MODERN MECHANICS
In Plain English

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WHERE EAST AND WEST MEET

The West is modern and progressive. The East still builds by the methods used at the Tower of Babel. The accompanying illustration shows an addition to the Grand Oriental Hotel at Colombo, Ceylon, under construction. Contract for the structural steel work was let to a European company which proceeded to erect it promptly and in the most modern style, using derricks and air hammers to expedite the work. As soon as the framework had progressed far enough, another contract was let to natives who proceeded to fill in the brickwork according to their own ideas. Bamboo scaffolds were erected, all tied together with ropes, and by means of bamboo ladders the bricks were carried up and leisurely put into place. The steel workers had forgotten all about the work before the natives had the brickwork finished. In the upper part of the photograph the steel framing can be seen going up in the modern way, while in the foreground a network of primitive bamboo holds sway. Kipling was right when he maintained that the East was not to be hustled.

The Ancient and the Modern Methods of Building Construction: In the Upper Left Hand Corner is seen the Structural Iron Work, and at the Right, the Native Bamboo Scaffolding.

Not only are the Oriental methods quite primitive as compared to those of the Western peoples, but at the same time they are usually the direct opposite of Occidental practice. And considering the crude machinery at their disposal, the Orientals deserve praise.

PRESENTING a collection of facts gathered from various sources, bearing on the efficacy of the German Zeppelins as well as the protective measures adopted by Great Britain to repel aerial attacks.

WHEN Louis Bleriot, the well-known French aviator, flew across the English Channel in one of his earlier monoplanes and landed near Dover, the feat was proclaimed as a great event in aeronautics. It was one of the first proofs of the practicability of the heavier-than-air machines for travelling from one point to another, over land and sea. But this same feat had another aspect of even greater importance, although perhaps not so conspicuous. For England it meant that the British fleet no longer was an insurmountable barrier against invasion by a hostile force. A new way was open—the air.

Since England's entrance into the European fracas an aerial attack on London by German airships has been a paramount threat. There have been persistent rumors of extensive preparations taking place in Germany for an invasion of England by an armada of Zeppelins, as well as an aerial attack on the British fleet. On the other hand, reports emanating from sources favorable to the Allied cause have indicated that adequate preparations were made to frustrate any attack by a German air fleet.

To vouch an opinion on aerial supremacy in absence of proofs is foolhardy, but the facts are interesting.

Dreadnaughts of the Skies

Everyone knows that a Zeppelin airship is a gigantic, cigar-shaped aluminum envelop containing seventeen or more gas bags that are held in place by a metal framework. Below the metal envelop are suspended the engine rooms and the quarters for the passengers. The earlier Zeppelins were some 550 feet in length and capable of speeds varying from 40 to 52 miles per hour. The cruising capacity was 1,200 miles, carrying 1½ tons of explosives, while altitudes up to 10,000 feet were attained.

A maze of mystery surrounds the actual number of Zeppelins in existence before the war and since August. According to a recognized and unbiased authority, Germany possessed twelve Zeppelins at the outbreak of hostilities, while another authority claims at least forty-five, adding, in the way of explanation, that the German government took every precaution to prevent the actual number of Zeppelins on hand from becoming common knowledge.

Irrespective of the foregoing controversy, it is a pretty well established fact that since the first of August the airship factories have been working day and night. One report has it that 1,000 workmen are employed at the Zeppelin works at Friedrichshafen, divided into day and night shifts. These men only assemble the airships, sections coming from all parts of Germany. There a Zeppelin can be assembled in three weeks. Another report states that the joint output of the works at Friedrichshafen and Potsdam is six machines per month. And aside from these two airship factories, there are several others in different sections of the country. If we are to give credence to these reports, there is not the slightest doubt that Germany has ample airships ready for instant use.

It is understood that within the past year a new and more powerful type of Zeppelin has been taking its place in the German aerial forces. A veil of secrecy prevents detailed descriptions of these monstrous air craft from reaching the outside world. These new machines, or super-Zeppelins as they have been styled, are of the same general design as former Zeppelins but highly improved in many respects, especially as regards their equipment for the purposes of warfare. As to their size, here is an interesting quotation from the letter of a correspondent to a British trade journal: "On November 5th the latest and most powerful Zeppelin ever built sailed north direct from the works (at Friedrichshafen) without any trials. It was 1,300 feet long, about 45 feet wide, and had three 800 horsepower motors, and had thirty officers and men aboard." It is hardly believable that this report is true, yet nevertheless it is typical of the many received from travellers returning from Germany.

To repel attacks by hostile aircraft, the super-Zeppelins are fitted with a number of guns, usually two-inch quick-firing pieces. Aside from those carried in the suspended cars, two or more of these guns are placed on top of the metal envelop; these being placed on platforms that are reached by means of a stairway passing through the envelop.

The one great handicap of the earlier Zeppelins, and for that matter all lighter-than-air craft, is said to be overcome in the super-Zeppelins. A German authority has recently made the statement that a newly discovered, non-inflammable, lighter-than-air gas now supplants hydrogen in the new airships. Furthermore, aluminum has been replaced by a new metal that possesses greater tensile strength yet is lighter in weight.

The one striking feature of the Zeppelin dreadnaughts is the suspended armored cage which they are said to carry several thousand feet below them, suspended on one or more steel cables. In the cage an observer can secure a better view of the ground below, while he can aim the bombs with greater accuracy

than would be possible from the decks of the airship itself, perhaps 2,000 or 3,000 feet above. Furthermore, it is often possible for the craft to conceal itself securely behind low hanging clouds while the man in the cage below is lower than the clouds and in full view of the landscape, yet presents but a poor mark to hostile fire.

Showers of Destruction

It is rumored that at least one Zeppelin took part in the rapid reduction of the fortress of Liége, Belgium. Early reports stated that the steel cupolas of the forts were shattered by the impact of aerial bombs, but the facts in the case are very vague. Even the Germans themselves prefer to give all the credit to their huge howitzers, hence the Liége aerial attack—if it ever did take place—proves nothing of moment for the Zeppelins.

It is in the bombardment of cities at night that the Zeppelins have really proven serious menaces. Take, for example, the attacks on Antwerp. The aerial dreadnaughts admittedly struck terror in the hearts of the unfortunate inhabitants. On several nights the airships passed over the city dropping bombs that scattered death and disaster wherever they struck. Yet the explosive bombs were those that caused the least destruction. The greatest menace proved to be the incendiary bombs that were dropped on various parts of the city and started large conflagrations in many quarters. These bombs were filled with petroleum which, on

becoming ignited at the moment of the bursting of the bomb, spread a torrent of flaming liquid in all directions and over a wide area. Water was of little use in extinguishing the burning oil.

Turning our attentions from land to sea, we find that the Germans have placed great faith in the success of their Zeppelins in attacking hostile warships from overhead. It is obvious that the force gained by a heavy bomb dropping several thousand feet is sufficient to cause it to pierce the decks of a battleship and explode with disastrous results in its very bowels. Of course, it is evident that careful marksmanship is required to hit a battleship with a bomb from a height of several thousand feet, but reports emanating from various sources have it that Zeppelins are often engaged in bomb dropping practice near Friedrichshafen—and practice eventually should make the men skillful. An airship flying at a height of several thousand feet would be beyond the effective range of the high angle guns of the battleships.

Coming to the subject of an attack on London, the German point of view is quite evident. Naturally, the most advantageous time for an aerial attack would be at night or in foggy weather. In the former instance the fleet would leave its base during the day, arriving over London during the night. That it might deliver a surprise attack, the Zeppelin fleet would steer such a course as to reach the English coast unseen by British warships patrolling the North Sea. Probably twelve or more airships would partake in the raid, possibly—but very doubtfully—accompanied by numerous aeroplanes. The air fleet would suddenly appear over London, with engines muffled, followed by a downpour of explosive and incendiary bombs. If it were a clear night, searchlights mounted on housetops would soon discover the fleet and direct the firing of almost countless anti-aircraft guns. If the weather were foggy, the enemy would have to rely on its aerial forces to combat the invaders. But it is more than likely that the German airships would make off after the attack, since nothing more could be gained by remaining to face the enemy's reply. An aerial attack on London would have but little, if any, true military value. The effect would be but a moral one.

Aeroplanes, Guns and Aerial Mines

You are probably now of the opinion that the Zeppelins are mighty and invincible engines of war. But you must listen to the other fellow's argument, since thus far we have considered only the German views. After hearing the British side you can compare the two and draw your own conclusions.

To begin with, the English contend that the Zeppelins are too bulky to be of much use, presenting, as they do, a splendid mark for their artillery. The non-inflammable gas statement is considered a myth for many convincing reasons. As for the cage arrangement, the British authorities do not believe it to be practicable. They point out that such a cage would produce a tremendous pendulum motion, even in calm weather, with disastrous effects to the Zeppelin employing it.

Attention is directed to the fact that before the war the Zeppelins were by no means vehicles that could be depended upon for constant service in weather of all kinds. The Zeppelins were known to be fair weather craft exclusively. It is unbelievable that such impracticable craft could be transformed into reliable aerial vehicles in so short a period.

While anti-aircraft guns would undoubtedly serve to good advantage in repulsing Zeppelin attacks in most instances, if the enemy elected to remain, say, 10,000 feet in the air, these artillery pieces would be of little value. The most efficient weapon with which to combat the Zeppelin therefore resolves itself in the aeroplane. The British aeroplanes are swift, small and easily managed—and there are many of them for home defense. These machines are serviceable in almost all kinds of weather. They carry bombs of various kinds that could be used with good effect on Zeppelins, as well as machine guns. Travelling at upwards of 90 miles per hour, it is obvious that a gunner on board a Zeppelin would have a difficult task before him to hit an attacking aeroplane; the swifter craft being capable of rapidly manoeuvering to the most advantageous positions. The main effort of the aeroplanes would be to pass over the Zeppelin and drop bombs on its metallic envelop. Even allowing that the Zeppelins would be accompanied by German aeroplanes, the British claim that the higher speed of their machines would still rest the advantage with them.

Judging from the general tone of the British press the attitude of the English as regards a Zeppelin raid on their fleet is one of indifference. Little seriousness is placed in the German threats and ample confidence is had in the ability of the Royal navy to repel such an attack.

British authorities are inclined to believe the existence of a bomb that can pierce the decks of a modern dreadnaught, and precautions have been taken. The latest dreadnaughts are equipped with heavy armor on their decks. It has been suggested that a strong, wire rope netting, placed over the decks of older, unprotected ships, sloping down on both sides, would serve to deflect bombs from the ships into the water, or at least break the force of the falling bomb. After all, however, the battleship's safety lies in rapid manoeuvering so as to avoid being hit.

Since the latest Zeppelins must present a target that is quite as large as the average dreadnaught, it follows that when it has descended to a point where its intended victim is an easy target, it offers an equally good target to the guns of the ship. There is the suspended cage to contend with, but in all probabilities it would be swaying to such an extent that accurate bomb dropping would be impossible.

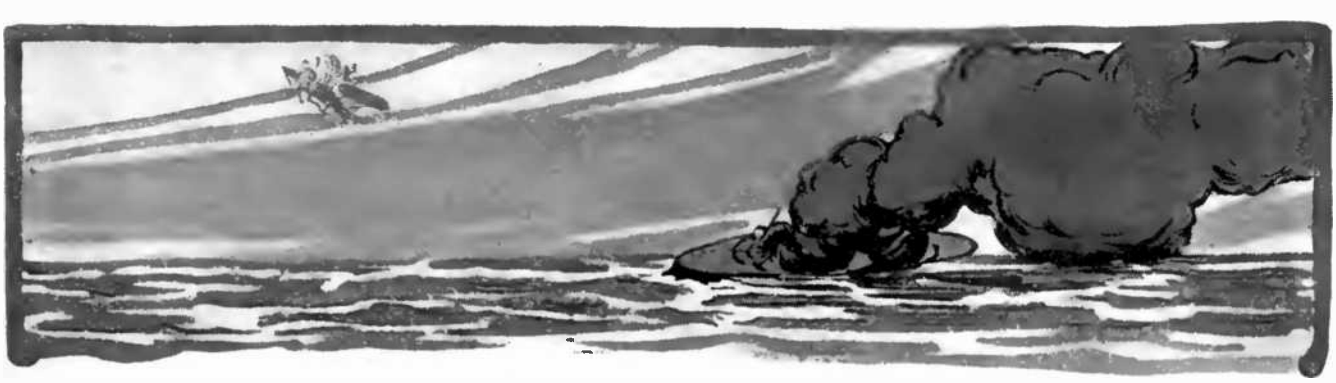
As in the land defense, on water the force below would depend on its own aircraft to repel attacks. The British navy today has the finest and most complete complement of seaplanes of any navy in the world, and any ships that were attacked would lose no time in sending these swift craft aloft to combat the enemy. And these facts are borne out by the recent engagement in Heligoland Bight between British cruisers and seaplanes, and German aeroplanes, Zeppelins and submarines. The Zeppelins partook in the battle but had to withdraw because of the effective fire from the high angle guns of the cruisers. Although the Zeppelins dropped several bombs, none made a hit. This failure was not due to poor marksmanship on the part of the airmen, but rather to the rapid movements of the cruisers to prevent being hit.

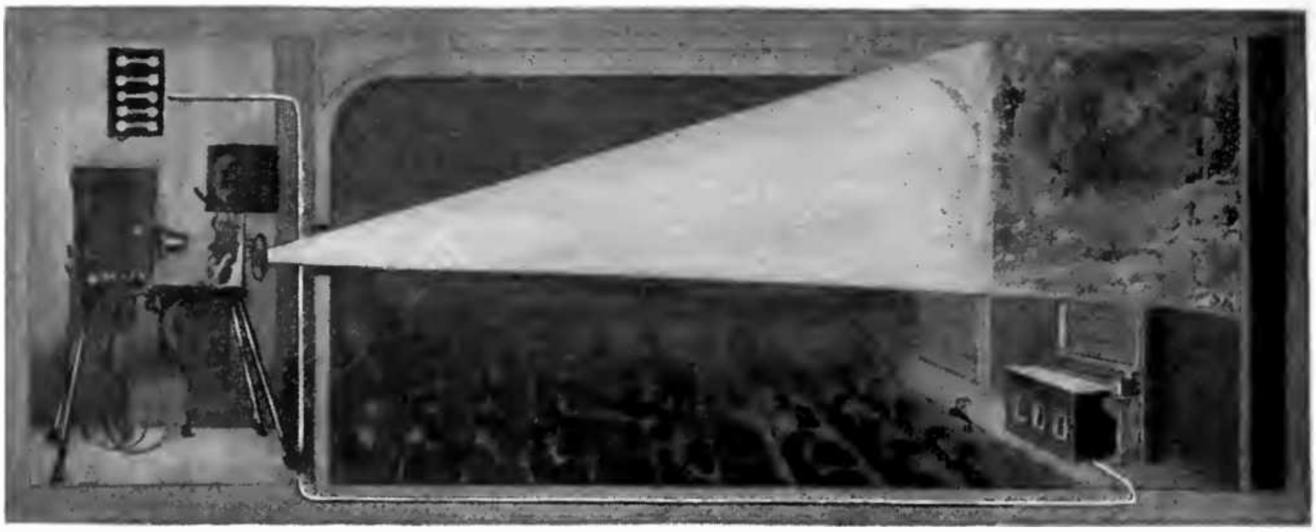
While the English authorities cannot give details as to the means they have taken to protect London from an aerial attack, a few of the actual, known precautions, as well as suggested ones, are of interest. It is known that machine guns and rapid firing guns have been placed on housetops and other vantage points, as well as searchlights that illuminate the sky every night. Fleets of swift and armed aeroplanes and their crews are in readiness at the aviation grounds. It is possible that armored motor boats are either now in use on the Thames River or would be available in time for an attack, these boats being equipped with high angle guns.

In time of fog, when the enemy would be most likely to attack, lookouts could be posted on the highest edifices the tops of which rise above the fog. In this connection it must be stated in way of explanation that London fogs often extend but a short distance above the earth. There has been suggested the use of captive balloons at various strategic points; the observers in these balloons being in constant touch with each other and with a central point by means of a telephone system. Thus, if the enemy were discovered approaching, the warning could be sent by telephone and the aeroplane fleets ordered out.

Perhaps the most valuable suggestion is that of employing aerial mine fields around London. The plan consists of placing captive mine baloons to form a screen against airships. Owing to the great size of the Zeppelins, it is believed that forty mines to the mile would be ample. The mines would be so constructed as to explode with great violence on contact. Four men could be detailed to supervise each ten balloons, and the mine field could be easily shifted as occasion demanded. Even if an airship did not come in actual contact with the mine proper, it is possible that propellers or other extending parts would become entangled in the mine cables, bringing the invaders to brief. At any rate, the knowledge of the existence of such a mine field would go a long way towards discouraging an air raid by a hostile air fleet.

The situation at the present moment has been cited in the foregoing. This is a war of surprises and predictions are difficult. Often they are never fulfilled, and more often they are ridiculed by astonishing and unthought of accomplishments. It therefore remains for you to consider the statements and draw your own conclusions.





By a Clever Application of Electric Current, a Piano Player can be Controlled by a Number of Pushbuttons Placed Within Reach of the Motion Picture Operator.

AN ELECTRICAL PIANO PLAYER

A new electrical piano-playing device has recently been perfected by Carl Brown, an inventor of Columbus, Ohio. The device is intended for use in motion picture houses in place of a pianist, thus eliminating the cost of hiring help for that purpose.

The player is placed in front of the usual piano and is controlled from a switchboard located in the operating booth. By pushing different buttons the picture operator can change the music to suit the character of the film appearing on the screen. Instantaneous changes from one selection to another, with change in tempo, are possible in order to keep pace with the rapid shifting of the scenes. In fact, it is claimed that the electrical piano player will keep its music in better harmony with the pictures than the average pianist.

Briefly, the piano player consists of a number of electro-magnets placed in a row and actuating armatures that are connected to a series of fingers overhanging any piano keyboard in front of which the device may be placed. Five trackers are also included with music containers below them. Each container has a capacity of 10 to 12 musical selections similar to the usual perforated paper rolls and made up into endless rolls. Instead of the regulation holes in the trackers, electrical contact pins are inserted. A metallic brush rides on the music paper directly over the tracker pins, making contact with the pins and actuating the magnets whenever a perforation comes in line.

BRIDGE SPANS A FOREST

Near North Vancouver, B. C., there is a remarkable suspension bridge that is more than 400 feet in length. This bridge, which is used to cross a ravine, is 220 feet from the bottom of the forested depression. The structure is entirely unsupported except at the ends. As one walks along this suspension bridge, the effect of looking down on the tops of tall trees is said to resemble that of looking from an aeroplane.

Remarkable Bridge.

A NOVEL WATER MAIN AND ITS LAYING

THE Fifth Borough of Greater New York is the Borough of Richmond, which occupies Staten Island. In years past much fault has been found with the local water supply because of its alkaline content. To overcome this, the engineers of the metropolis planned to link Staten Island with the great aqueduct leading from the Catskill Mountains. The difficult part of the problem lay in effecting this junction between the Brooklyn terminal of the aqueduct and the mains of Staten Island.

An Unusually Clever Engineering Undertaking: Assembling the Sections of a Water Supply Main and Lowering them to the Bottom of New York Harbor.

There is a point between Staten Island and the Brooklyn shore called The Narrows, through which nearly all of the ocean shipping passes, and this same bottle-neck to the harbor basin constitutes the prime passageway for the out-bound city sewage. The swiftness of the tidal currents, the deep deposit of silt and the presence of drainage refuse, combined with the traffic circumstances, hampered the engineers in finding a satisfactory solution. As the connecting main was to have a diameter of only three feet it was not practicable nor economical to think of driving a tunnel of that limited width, and it was manifestly clear that the pipe would have to be laid from the surface, inasmuch as a diver could not work in the current-swept waters nor be able to see in their muddy depths so as to seal the sections as they were laid.

The engineers of the Board of Water Supply finally evolved a type of flexible

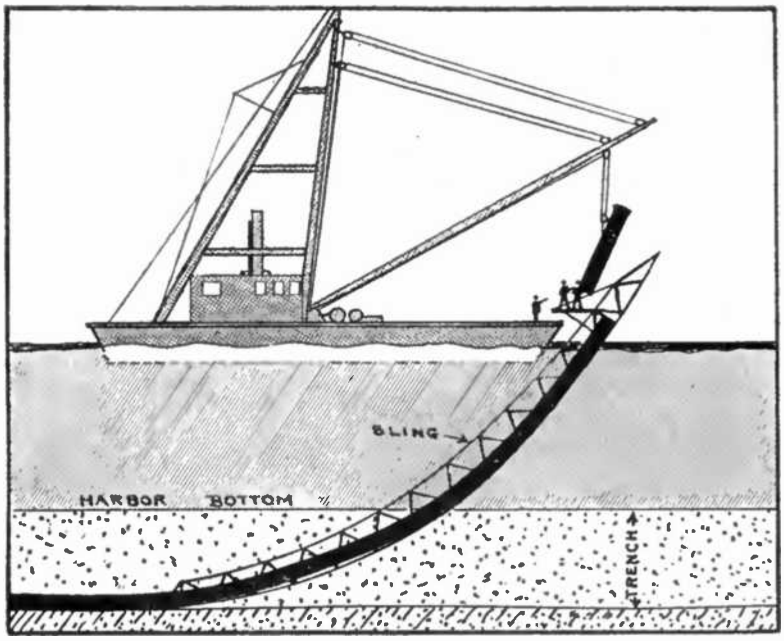


Diagram of the Method Used in Laying Water Main.

joint. By means of a cradle or sling, each section is made up above the surface of the water, and as the main is thus lengthened, the pipe sinks bottomward and rests in a trench dredged deep enough to shield the main—when the excavation is filled—from the anchors of ships. It has taken the city engineers many months to develop a satisfactory joint and their success blazes the way for kindred operations where conditions make it necessary to do the work speedily, to obstruct the channelway for the briefest possible while, and to insure success in the way of water-tightness without having recourse to metal-packed joint, that could be made certainly watertight with a limit of flexure of ten degrees. The arrangement is on the order of a hollow ball-and-socket the costly and the uncertain work of divers. This is probably the first time that this method of laying underwater pipes has been used.

MAKING THE CITY BEAUTIFUL

The Old-time Practice of Using Poles for Supporting Overhead Electric Wires.

The two accompanying views show concretely the effect in making the city beautiful of the removal of telegraph and trolley wire poles from the main streets. The telegraph and high power electric wires are strung through the alleys while the supports for the trolley wire are anchored in the walls of buildings. The views were taken at the intersection of State and Commercial streets, Salem, Oregon, before and after the wires and poles were removed.

A Modern Street Scene, Showing the Elimination of Poles and Overhead Wires.

Over the Sands With the Meter Man

BY C. A. DOUGLASS

The Meter Tester's Runabout Used for Covering the Distances that Must be Traveled.

A Collection of Scenes Such as are Constantly Witnessed by a Meter Tester in Southern California.

THE meter tester's life in some parts of the west can hardly be called monotonous and as evidence of this, the writer offers the accompanying pictures taken while employed as meter tester by a light and power company serving 45,000 square miles in the San Joaquin Valley of California.

It may be said, as an introduction, that much of the agriculture of this valley is fostered by irrigation; the water employed being handled by electric pumps. To test the meters that measure this consumption of current requires travel over considerable distances.

A substantial runabout serves to carry the meter tester and assistant. They are equipped for a week's outing, each being supplied with a suit case of clothing. Shovel and pick, and block and tackle are included in the outfit, for there is danger of getting stuck in the sand or mud. Tools and instruments are carried in special cases to withstand rough usage, but by far the most important of all is the water bag. When picture No. 1 was taken the thermometer stood at 127 degrees in the shade. On such torrid days the water bag is indispensable. The cattle in picture No. 2 are apparently feeding. However, such is not the case; picture No. 3 plainly showing what happens to cattle relying for food entirely upon the vegetation found on these barren wastes. Water in this region is practically unknown unless supplied from wells.

Picture No. 4 shows what the "good cows" that come home nights eat—and they get lots of it. This is an alfalfa field almost ready for the fourth cutting of the season. It has an electric pumping plant for supplying water from wells for irrigation. These wells range from 30 to 200 feet in depth, the water being raised by electrically-

An Elaborate Real Estate Office which will Eventually be the Center of a Thriving Town.


Two Views of the Sites Formerly Occupied by Hydro-electric plants that were Destroyed by Spring Freshets.

operated pumps. The motors in nearly all cases are directly connected and range in capacity from five to 100 horsepower. The power in all cases is measured by a standard make of integrating watt-hour meter connected in the circuit at all times, although the rate for power in this particular section, used for pumping, etc., is about $50.00 per horsepower per annum, based on the indicated horsepower at various times.

Picture No. 5 is a view of the beginning of a Californian town in that section A real estate syndicate is its godfather. This place lies in a great agricultural district and will eventually be a thriving little town.

Picture No. 6 shows the site of a former hydro-electric plant, the ruins of which can be seen in the river bed, the plant having been destroyed by a spring freshet. This dam is on the Merced River, 18 miles south of El Portal, the entrance to the world-famous Yosemite National Park. Picture No. 7 is the former site of another small hydro-electric plant. This plant was destroyed at the same time as the one shown in view No. 6. Its location is Merced Falls, also on the Merced River. The next view is of the famous Mt. Gains gold mine. This is a 20 stamp mill operated entirely by electricity. This mine is located sixteen miles from the nearest railroad point, and the road to it is the worst I have ever gone over in an automobile. My assistant driving and viewing the scenery at the same time came very near being the "finish" of the two of us on this trip.

The Mt. Gains Gold Mine which is Entirely Operated by Electricity.

Picture No. 9 shows an irrigating canal. The water in this canal is lifted into it by electrically-operated pumps. In this instance, two 200-horsepower motors driving 60-inch centrifugal pumps, are used. The water is taken out when desired with smaller pumps that are also electrically-driven. This canal in question is owned by a private concern and the water is used exclusively on their ranches. Electricity is again called upon at the barns and ranch houses for driving feed choppers, cream separators, churns, etc.

In view No. 10 is seen a small reservoir in which the water that is not needed for immediate use is stored. The electrically-driven pumps operate 24 hours per day without interruption during the irrigating season, which is from May to November in this section.

Picture No. 11 gives an idea of the method used in transporting baled alfalfa hay from the ranches to the railroad for shipment to the markets. This train of three wagons is drawn by fourteen mules, the entire train being driven with one line.

The next picture shows the type of transformer and switching stations used.

Here the voltage is stepped down from 60,000 to 10,000 for distribution to the pumping plants. The transformers, as will be noted, are outside. The building contains only the automatic oil switches.

The cost of testing the electric meters on the consumer's premises, requiring an automobile to cover the large territory, is approximately $15.00 per day. This figure, of course, allows a fair wage for the tester and his helper. However, if one doesn't wish to work and work hard, he had best not go out for this class of meter testing. While it will most likely appeal to those with inclinations for adventure, it is a very trying task.

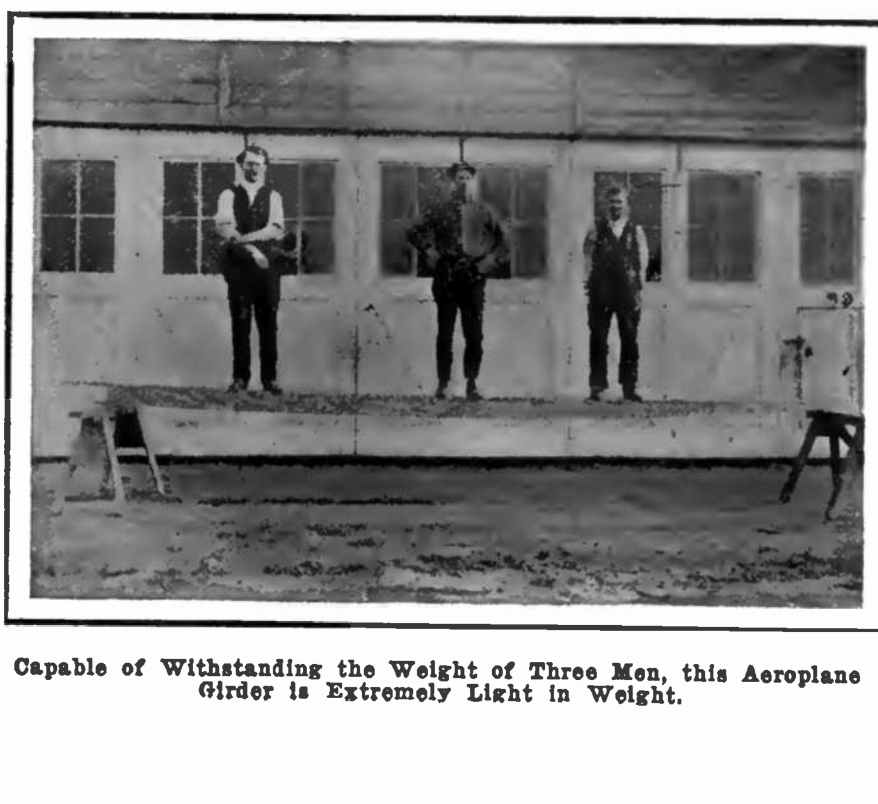
Various Views of Farming Activities in Southern California. Electricity is Employed in Every Possible Way to Make the Work of the Farmer a Pleasure Rather Than a Task.

THE LIGHTEST EVER BUILT

The three men as seen in the illustration are supported by the lightest structural member ever built. Their combined weight, which totals five hundred pounds, deflects the girder but one inch from the horizontal. It is 22 feet in length and tapers from six by six at the larger end to six by two and one-half inches at the smaller.

The entire girder weighs but fourteen and a half pounds, which is truly remarkable, and was accomplished through the aid of engineering mathematics in the hands of a mechanical engineer who has been experimenting and lending his skill and knowledge to the furtherance of the science of aeronautics in many ways.

The girder may be described as a lattice girder. It is built up of wood with a cloth cover to protect it from the



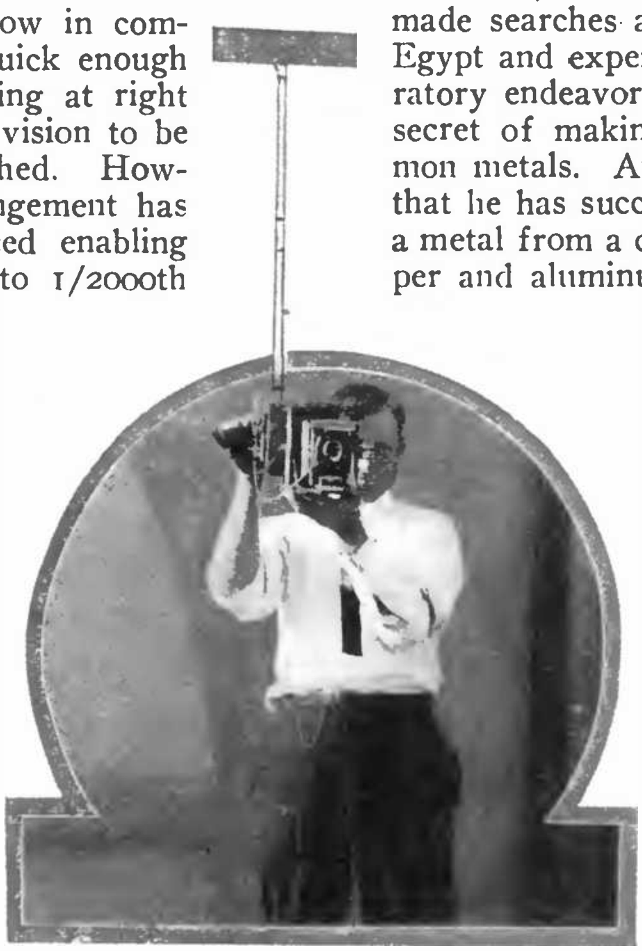
Capable of Withstanding the Weight of Three Men, this Aeroplane Girder is Extremely Light in Weight.

action of moisture; and has twenty panels. To reduce its weight, holes are bored in the material wherever possible.

ELECTRICALLY OPERATED HIGH SPEED FLASHLIGHT ATTACHMENT

Most photographers find to their dismay sooner or later that the fastest of flashlight powders cannot be depended upon to explode quicker than about 1/30th of a second. This speed, which is very slow as compared to fast instantaneous shutters now in common use, is scarcely quick enough to enable objects moving at right angles to the camera's vision to be successfully photographed. However, a flashlight arrangement has recently been introduced enabling exposures of 1/100th to 1/2000th second to be taken with a comparatively slow flash.

In principle, the operation of this device consists of electrically igniting the flash and immediately afterwards releasing the shutter of the camera at the instant that the flash has attained its maximum brilliancy. When not in use, the entire mechanism of the attachment, including battery, can be carried in the pocket. It can be used in conjunction with any camera.



On Pressing the Shutter Release Button of the Camera, the Flashlight Charge is Electrically Ignited.

WIRELESS STATIONS

Germany has seventeen wireless stations in operation, eight of which are on lightships. France has eighteen stations. Russia has twenty-eight wireless stations. In Austria-Hungary there are four important radio stations. The range of most of these stations is carefully concealed by the governments.

SYNTHETIC GOLD MADE FROM COPPER AND ALUMINUM

Since the dawn of history it has been the dream of chemists to change various common metals into pure gold. In fact, the ancients are said to have possessed a secret process for changing baser metals into gold and to-day there is a door of synthetic gold in a Berlin museum that was brought from the excavated ruins at Herculaneum.

For thirty-two years a certain Lewis C. Smith, of New York City, has made searches among the ruins of Egypt and experiments in his laboratory endeavoring to discover the secret of making gold from common metals. At last he announces that he has succeeded in producing a metal from a combination of copper and aluminum, as well as several other special ingredients the nature of which he will not divulge. He calls the metal "Dirigold" and states that it may be melted fifty times over without losing its color. It is said to possess the malleability, texture and homogeneity of pure gold. Furthermore, salt water has no effect whatsoever on Dirigold. Nitric acid affects it slightly more than gold. Otherwise, the new metal is to all intents and purposes pure gold, yet it costs less than plated silver.

A log raft containing one million feet of cedar, said to be the largest ever floated on the Pacific, recently made the trip from British Columbia to Puget Sound. It was 100 feet long and 70 feet wide; it stood 15 feet out of the water and 20 feet under.

A White Spot Painted on the Street Pavement Aids in Enforcing Traffic Regulations.

WHEEL MARKS ON THAT SPOT MEAN A FINE

If a motorist leaves the mark of his tires on the white spot in street intersections of Pomona, California, it means a fine. Passing on the wrong side of the disc means a lecture from the magistrate and a larger fine. The idea is to eliminate corner cutting and the white spot is painted on all of the street crossings in or near the business district of the city. The local traffic officers claim that it reduces congestion and confusion.

PRIMITIVE WATER POWER DEVELOPMENT

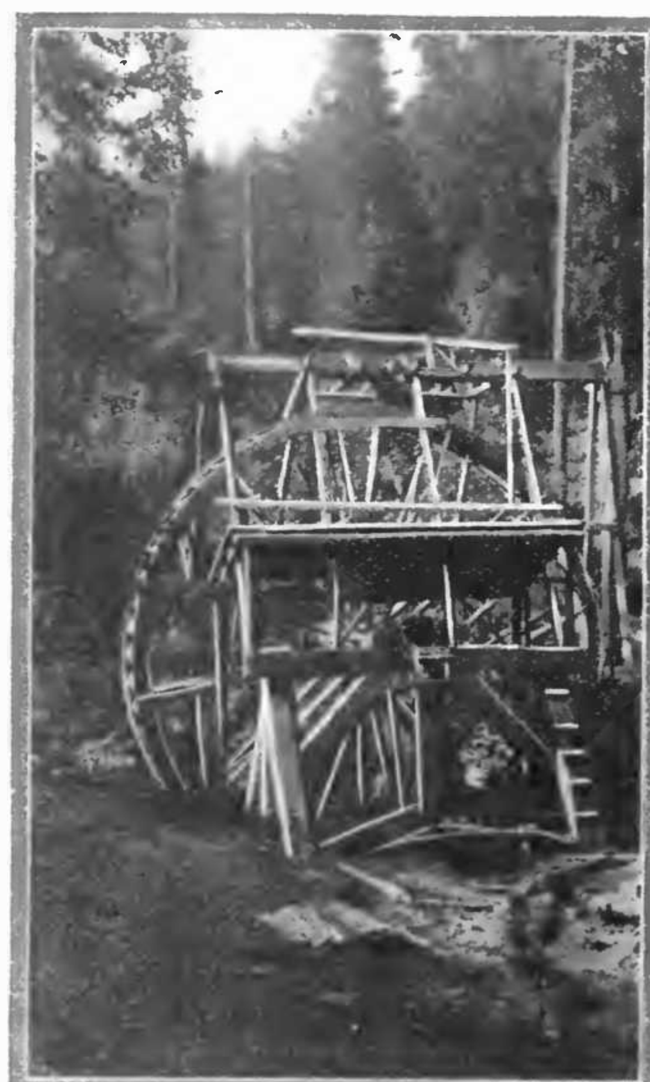
The development of water power was not always the highly finished process it is now. The accompanying view shows a large overshot water wheel, made by an early Californian miner to provide power for running his ore grinding machine. This wheel received water from a sluice at the top and was moved by the weight of the water descending in the buckets on the wheel rim. It was crude and wasteful of power, but it did the work for which it was built.

YARD AND POUND

The British standards of weight and measure, the pound and the yard, respectively, are made the subjects of an interesting ceremony which, every twenty years, occurs at the Palace of Westminster.

Immured in the wall seat of the blank window, on the right-hand side of the second landing of the public staircase leading from the lower waiting hall of the House of Commons up to the committee rooms, are the Parliamentary copies of the imperial standards of weight and measure. They were deposited in this place in the year 1853, soon after the new Palace of Westminster had been opened. They consist of the standard yard measure, made of an alloy of copper, tin and zinc, and the standard pound weight, made of platinum.

The imperial standard yard and pound, composed of similar metals to the copies, are preserved in the Standards Department, where they are kept in a specially made fireproof iron safe, secured by two locks. These measures are protected most carefully against



A Water Wheel Built by a Californian Miner to Drive an Ore Grinding Machine.

the effects of atmospheric corrosion and attrition. The yard rests upon eight equidistant rollers in a compound lever frame, so arranged as to equalize the pressure at the several points of support, while reducing its flexure to a minimum. The pound is wrapped in filter paper and inserted in a light silver gilt case, which is placed in a solid bronze box, the lid of the box being secured by four screws.

There are five Parliamentary copies of the standard, one at the Palace of Westminster, as described, and others at the Royal Mint, the Royal Observatory at Greenwich, the rooms of the Royal Society, and the Standards office. The four last named are compared with each other once in every ten years, and once in every twenty years with the imperial standards, when, also, the copies of the Palace of Westminster are compared.

The ceremony is conducted under the auspices of the Speaker of the House of Commons, assisted by ministers and officials of the Standards Department. The ceremony is quite an impressive and dignified one as it rightly should be.

DIGGING UP NEW YORK'S COLONIAL PAST

Digging for Colonial relics is an unusual hobby. Yet every Sunday two New Yorkers are at work on the side of a hill in the Inwood section of Manhattan Island. They are digging on the site of a British encampment of the Revolutionary War period, and have found many articles such as regimental buttons, old bottles, dishes, belt buckles, lead bullets and flints for muskets.

RICE SACKS NOW SUBSTITUTE CINDERS ON RUNNING TRACK

Owing to the scarcity of cinders in California, as well as the impossibility of getting them in large quantities without shipping them all the way from the State of Washington, Walter Christie, the track coach at the University of California, hit upon the novel expedient of using rice sacks as a substitute for them.

Christie experimented on a small track with different numbers of layers of these Japanese sacks woven from rice-straw, which are used in shipping rice in bulk to California from the Orient for the Chinese and Japanese in the state. He found that four layers of rice sacks, with two inches of dirt or sand, then two inches of clay and cinders, and finally on top of the whole, two inches of the best cinders procurable mixed with a small amount of clay, gave the best results in springiness combined with a firm surface.

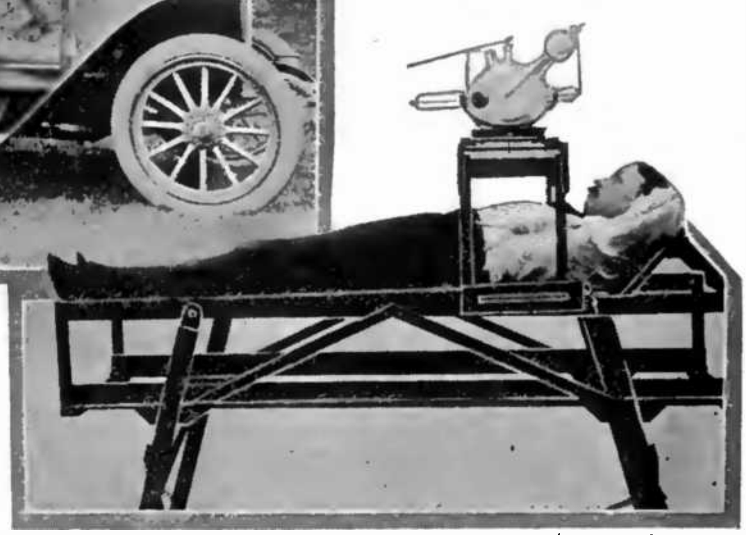
Photo. Rockwell Feature Service

Cinders are Being Replaced by Rice Sacks in Building the New Race Track of the University of California.

The new oval of the university is to be built upon this plan at a cost of $25,000 for excavation and construction work, which is paid from the funds of the Associated Students, an organization of university students interested in all college activities, including athletics and a co-operative store run for the benefit of the students. Over 127 four-horse wagon loads of these rice sacks have been obtained from a nearby sulphur works, which used them for packing glass sulphur bottles, and the enormous mound of sacks has been temporarily stored under a eucalyptus grove near the old running track, where they occupy a space about one hundred feet square.

The X-Ray on the Firing Line

FOR every death-dealing machine that the war inventors-of-the-offense create, the war inventors-of-the-defense must evolve a military or a surgical antidote. Zeppelins are destroyed by the horn-tipped Pathé bomb, trailed from French aeroplanes; invincible dreadnaughts are crumpled under the stealthy blows of submarines guided by aeroplanes; aeroplanes, themselves, disintegrate before the recently perfected Federston vortex gun, which hurls a whirling, shrieking ring of air with crushing force to a height of over five thousand feet. The long range siege gun



A French Automobile Ambulance that Carries a Complete X-Ray Equipment. An X-Ray Examination Right on the Battlefield is Often the Means of Saving a Soldier's Life Because of the Knowledge Gained by the Surgeons.

has not yet found an adequate military counter-invention, but the X-ray ambulance, the latest contribution of surgical-military science, is accomplishing a great deal towards alleviating its carnage.

A French army officer, Major Busquet by name, has recently perfected a compact X-ray machine for use on the battlefield. It comprises a photographic dark room, an electric generating plant and the various pieces of laboratory apparatus necessary for making a thorough X-ray examination.

The complete equipment is contained in a staunchly built motor car, resembling a field ambulance. The color is a durable gray; while a bright red cross is blazed in either side over the legend *Radiologie*—"X-ray Ambulance." On the roof is clamped a folded tent, while at the side of the driver a collapsible operating table is strapped securely in place.

In action, the *Radiologie* is certainly interesting. When not in use it is stationed at one of the field hospital bases; and the instant that an emergency call comes in either by telephone, telegraph, wireless or courier, the officer in charge of the *Radiologie* is given orders to proceed *vitement!* to the scene of trouble. The motor is started and the machine vanishes with a roar in a swirl of dust, bowling and pounding over an uneven road—often no road at all—on its errand of mercy. It would seem that this rough handling would be ruinous to the fragile X-ray bulbs, but an ingenious method of packing absorbs the shock and renders it entirely harmless.

As the *Radiologie* nears the section of the firing line to which it is destined, a protected route, if available, will be carefully picked out and followed. If it is necessary to cross shell- and bullet-swept clearings, the flag of the Red Cross—a crimson cross on a white field—will be raised, so that the *Radiologie* will not be mistaken for an ammunition automobile and shelled by the enemy. A single high power bullet or the smallest fragment of a shrapnel projected through practically any part of the enclosed room at the rear of the car would permanently disable the delicate apparatus.

When the X-ray ambulance arrives at its destination, the tent is erected, the operating table is unpacked and unfolded, and the wounded man is placed upon it. An adjustable framework, supporting the X-ray bulb, is attached to the table top after the patient has become reposed. The ingenious construction of the frame provides a flexible adjusting arrangement so that any part of the body may be conveniently brought within range of the rays and the photograph made without difficulty.

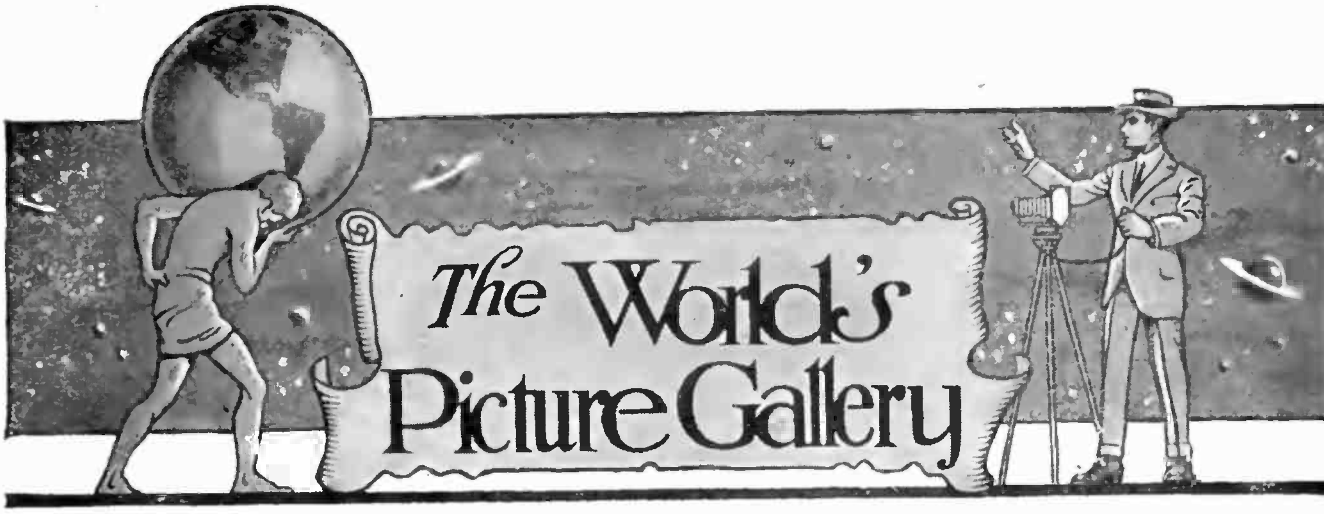
While the frame and bulb are being adjusted and the plate is put in place for the photograph, assistants are making various preparations with the generating mechanism. Besides supplying the current to the induction coil, which is used for producing the enormous voltage required for operating an X-ray bulb, other wires are led to the tent for illuminating purposes. The generating plant consists of a dynamo geared directly to the car motor and used for charging a large storage battery, so that current is at all times available whether the car is running or stopped.

After these preliminaries are attended to, and the sensitized plate for photographing the wound is fastened in position, the roentgenologist gives a low command; there is a momentary sizzling and crackling as the thousands of volts of pent-up electricity hiss violently along the insulated wires—and the exposed plate is hustled into the developing solution. *Voila!* Within ten minutes the surgeon who will perform the operation knows precisely the nature of the wound; knows to the fraction of an inch the location of a bullet, of shell fragments or splintered bones. The painful and dangerous preliminary probing is happily obviated. The patient's chances for recovery are several hundred per cent. greater than if the old method had been employed.

The ingenuity displayed in the design of the various parts of the X-ray ambulance is amazing. The rear compartment of the car furnishes a commodious dark room for developing the X-ray pictures—a room which for actual convenience and for completeness of photographic appointments can hardly be surpassed in the most thoroughly equipped of commercial studios. Cupboards full of variously labeled developing chemicals are placed within easy reach, while water tanks and large developing trays are to be found in their logical places. An electric ruby lamp, fed by the regular generating equipment, furnishes the necessary light for the developing process.

Just how successful the X-ray car will ultimately prove to be is, of course, a matter that the capriciousness of the war itself can alone determine. The first several weeks of its employment by the surgical service of the French army were singularly successful; and there is no reason to believe that it will not continue to perform valuable services during the remainder of the struggle.

Probably the most striking feature of the *Radiologie* is its ability for performing night service. On the roof a powerful searchlight is mounted, and levers manipulated by the driver direct the shaft of light, so that battlefields, after night has fallen and the firing has ceased, can be carefully explored for wounded soldiers whose injuries might be more easily cared for if an X-ray examination were given.



A VIEW of the Pedro Miguel Locks of the Panama Canal at night. These locks are illuminated by powerful electric lamps mounted on ornamental posts. By virtue of the efficient lighting system installed throughout the entire length of the canal, it is possible for vessels to pass through the water way at night as well as during daylight. The illumination of the locks is an important aid in the guarding of these important sections of the great canal.

Photo. by Underwood & Underwood.

A remarkable view of the funeral of Lord Roberts in France. The services were held in a French hotel, a portion of which was temporarily converted into a chapel. Lord Roberts, one of England's greatest military men, died while with the British army in France. His death was sudden and unexpected, the result of a cold contracted on the battlefield and that rapidly developed into pneumonia. He died on November 14th.

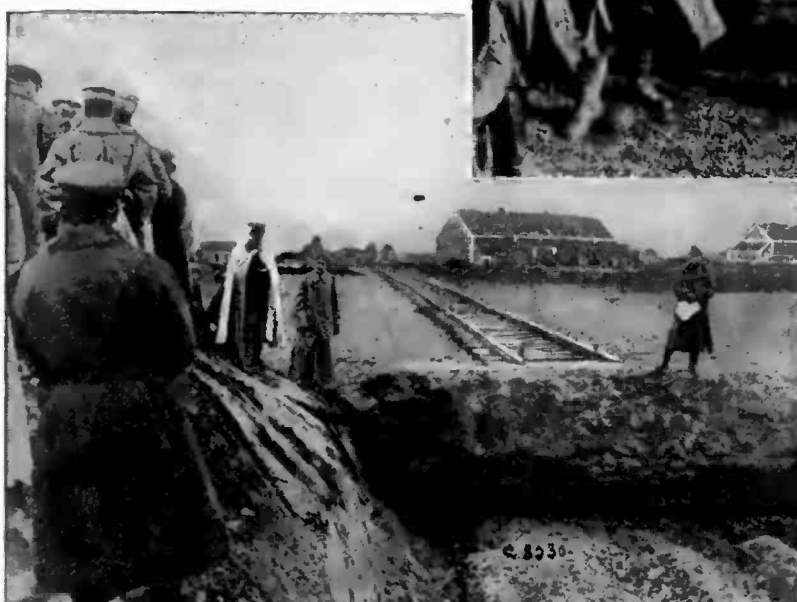
Above: A hastily constructed shelter used by English soldiers now fighting on the Franco-Belgian frontier. With the intense cold of winter to contend with, the soldiers of the Allied armies are resorting to every conceivable means of shelter. In some instances great ingenuity is displayed.

Above: the ruins of the Cathedral at Nieuport, Belgium, following the bombardment of the town by German guns. This town, which has been the center of severe fighting, is now reported to be a mass of ruins.

At the right. Brussels, the capital of Belgium now occupied by Germans, is the scene of soldiers in many different garbs. A typical street scene such as the one shown, discloses German marines, German infantrymen, German Red Cross attendants, and Belgian Civic Guards.

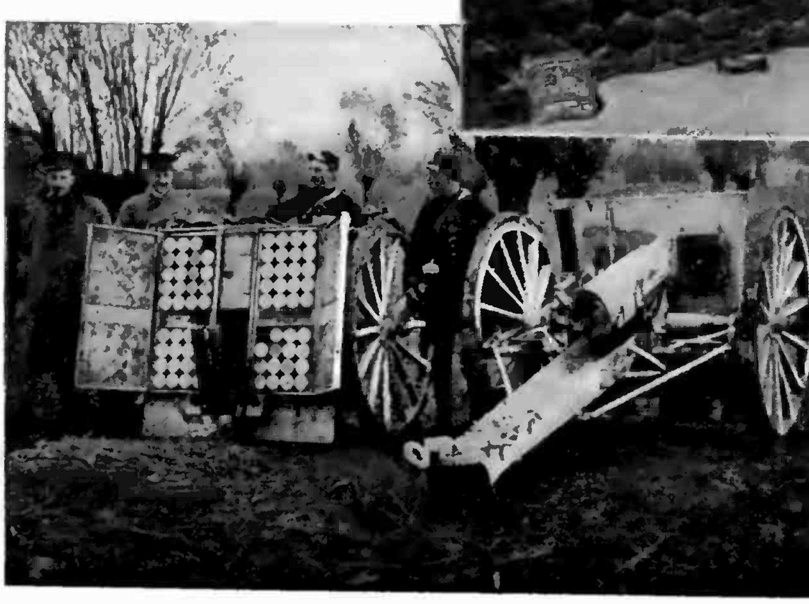
Photos. Copyrighted International News Service.

A group of French soldiers attached to the aviation corps. In this view, taken in the Flanders region, the men are at work changing the Gnome rotary engine on a military biplane. The aviators are supplied with all the spare parts necessary, including new engines, in order to keep this important arm of the army in the most efficient state.



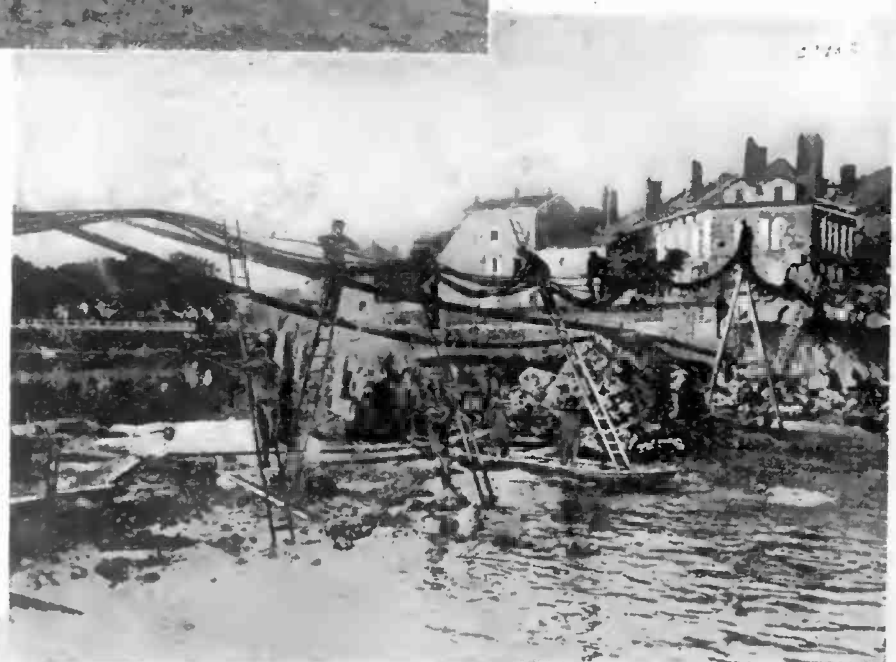
A deserted gun ditch and railroad track used by the Germans in operating their huge 42-centimetre howitzers. These huge ordnance pieces require a special foundation to withstand the tremendous recoil.

Piles of ammunition and provisions stored by the Japanese army for use during its attack on Tsingtau and the occupation of Shantung. The Japanese army moved with remarkable precision and carefully prepared for their successful attack on the German possession in China.



A close view of one of the French 75-millimetre field guns and its ammunition caisson. These guns are of approximately 3-inch calibre and are noted for the rapidity with which they can be served. The shells fired by these guns explode about ten feet above the ground and shower shrapnel downward with telling effect. The Russians are using French 75-millimetre field pieces of an earlier model.

Wounded Indian troopers who took part in the Battle of Flanders. This view is worthy of note, since it bears out the interesting fact that more than half of the wounded in the Allied armies have been hit by shrapnel and usually in the left hand.



Destruction and reconstruction are two of the most important duties assigned to the engineering corps of both sides in the fighting in the West. Here are seen several German military engineers rebuilding a bridge over the Aisne River in France, which was destroyed by the retiring French troops.

A ruined French village along the Aisne River, laid waste by German shells. From an American point of view, it appears that more private property has been destroyed in the European war than actual military defenses. It would seem that the soldiers avenge themselves by destroying the homes of the non-combatants.

Photos. Copyrighted International News Service.

Posters and signs of all kinds figure conspicuously in the recruiting campaign in England. A typical example of this means of inducing the eligible men to join the British army now fighting on the Continent is presented in this view of the Carleton Hotel in London.

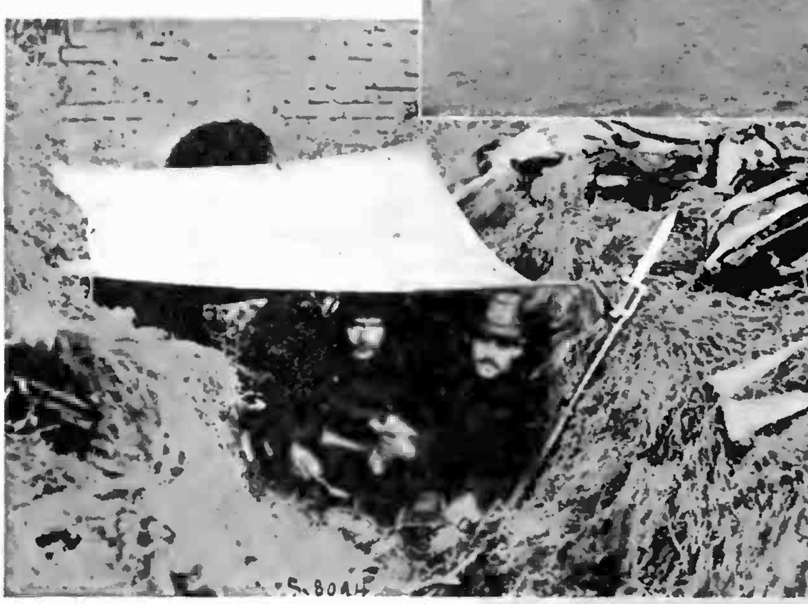
"One must live," or what happened to a chicken when it met a Turco. While the soldiers of the Allies are well fed, according to reports, they cannot be blamed for occasionally enjoying a chicken dinner when luck is with them in finding a stray fowl.

British soldiers searching a house between Nieuport and Dixmunde, as a result of having received notice that Germans were concealed there. Spying on both sides is indulged in to a great extent. Although the penalty for those who are caught is death, there are many constantly offering their services on both sides.

Photos. Copyrighted International News Service.

A scene at a British reinforcement camp in France. An armed sentry is guarding the tubs of water to prevent troopers using it for washing or shaving. Water has to be brought a considerable distance, and for that reason its use is confined to the most urgent requirements.

In the Harbor of Papeete, Tahiti: Captured German steamer sunk by German cruisers during attack on French Colony. The steamer was the war prize of a French cruiser.



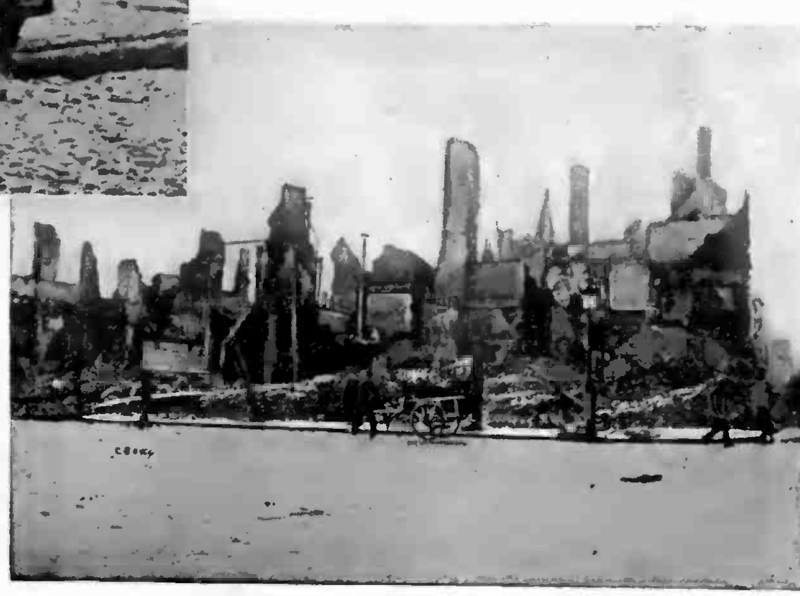
Belgian soldiers entrenched near Ypres. To protect themselves against the cold the soldiers make use of scraps of sheet iron, straw, old pieces of wood, and canvas sheets. In this instance the men have been fortunate enough to secure a piece of canvas which they have stretched over the trench.

When the sea was called to the aid of the Allies: A view in Flanders, showing how the country has been flooded to hamper the Germans. It is said that many Germans were drowned and that they lost numerous cannons and supplies when the Belgians let in the water from the sea.

An Indian trooper at rest between engagements in Flanders. He is smoking a hookah in the British camp near Ypres. The Indian troops have rendered good service on the battlefields in France and Belgium, and with the Winter weather setting in it is of interest to speculate as to how they will fare, since they are unaccustomed to cold.

A scene in a pass in the Carpathian Mountains, where Austrian soldiers are guarding the railroads. It is important for the Austrians to remain in control of the mountain passes in order to prevent the invasion of Hungary by the Russians.

Red Cross aides of the French army attending to a wounded soldier in a ruined church at Nieuport. Efficient medical service on both sides has lessened the terrible cost in human lives to a great degree.



Effect of German bombardment on the town of Ypres. This town has been the center of probably the hottest fighting in Flanders. In attempting to break through the Allies line in Belgium in a great drive towards Dunkirk and Calais, French coast cities on the English Channel, the Germans displayed marvellous courage and persistency, but failed because of the staying power of their opponents.

A bivouac of Senegalese troops outside Nieuport, Belgium. These are French colored troops brought from the colonies in Africa. These soldiers are said to be fearless of death and formidable opponents in battle.

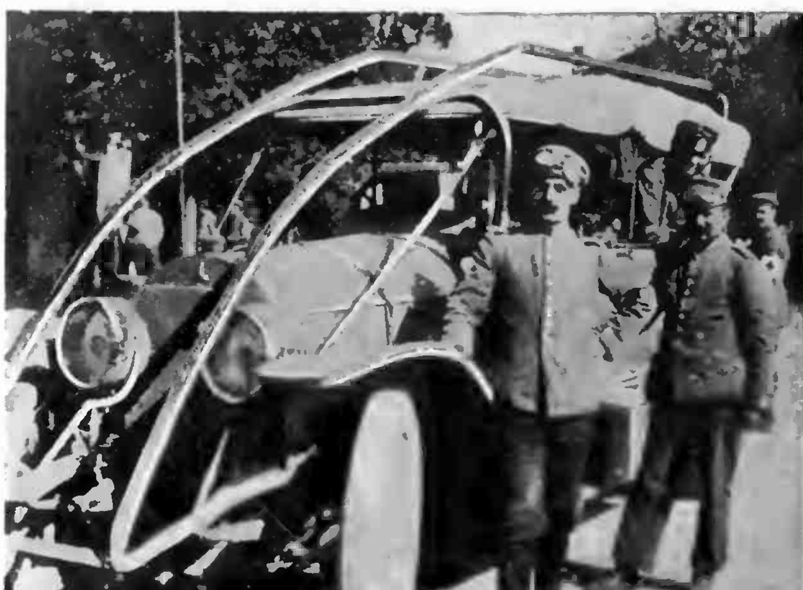
The horrors of war in the East are similar to those in the West. In this view peasants are seen returning to their homes only to find them a mass of ruins after the passage of Russian and German armies through this section.

Above: Shattered bridge of the armored liner "Carmania" after her engagement with the German steamer "Trafalgar," which was sunk.

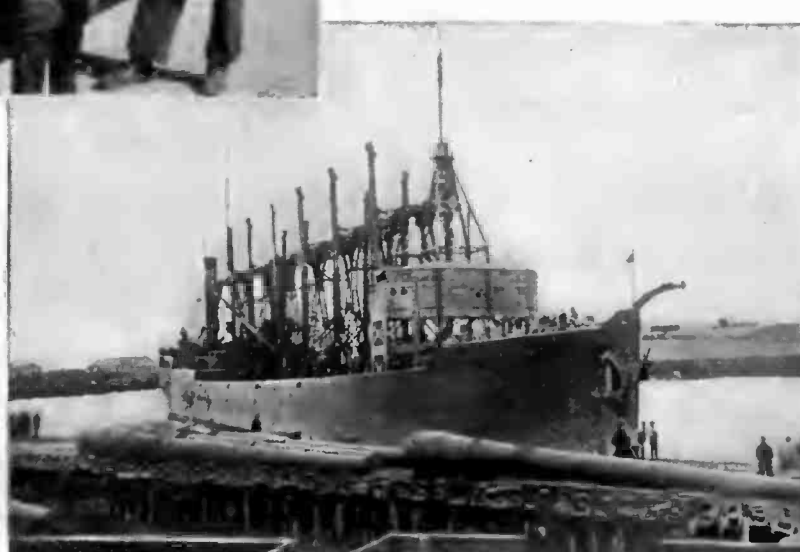
At the right: The lookout of officers commanding an armored train. From this vantage point the officers direct the fire and report results.

Above: Two of the mortars abandoned by the Germans and brought into Purvyse by the British and Belgian soldiers.

At the right: One of the armored light cars of the British army. Cars of this kind can travel over 40 miles per hour and can carry eight men and driver.



An instance of German preparedness: The motor car used by the German Crown Prince and its special iron framework for cutting wire fences. Little details, such as the fitting of angle iron frames on the automobiles of the officers, were solved and prepared for when the German army began its invasion of Belgian and French territory, to a degree that has claimed the admiration of the entire world.

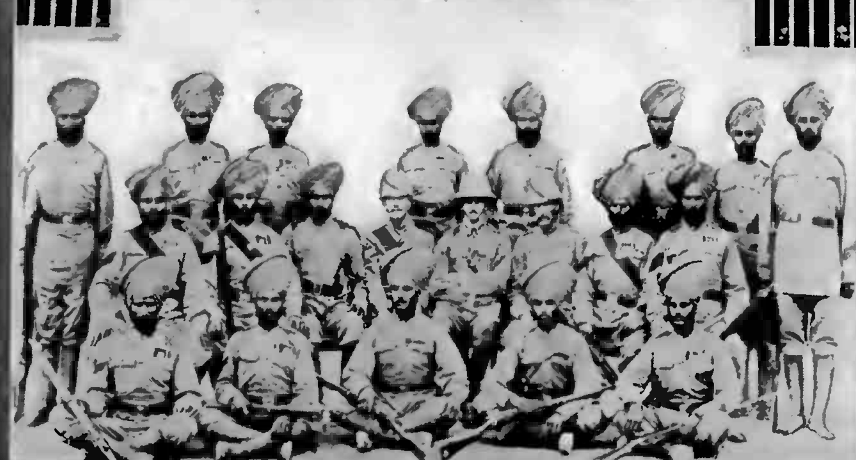


The American "Christmas Ship" arriving in England: The U. S. collier "Jason" at Devonport, England, with its load of millions of Christmas presents for the unfortunates of Europe. In the foreground may be seen some of the guns intended for British warships.

ENGLAND'S INDIAN TROOPS

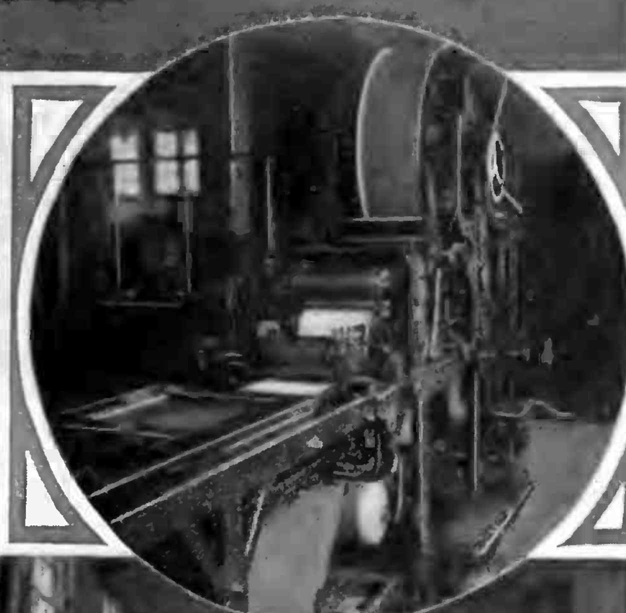
Not the least remarkable event in the European conflict has been the bringing of Indian troops from their native land to France. In the Hindu contingent now at the front, almost every portion of India is represented: there are Gurkhas from the Himilayan foothills, Sikhs from the northern plain of the Indus, Marathas from the mountains of Central India, the Rajputs who inhabit the western desert, and the Bengal and Madras infantrymen. The Indian troops are excellent fighters, and with them war is considered a sacred undertaking when the cause is a righteous one.

Photos. by Janet M. Cummings.

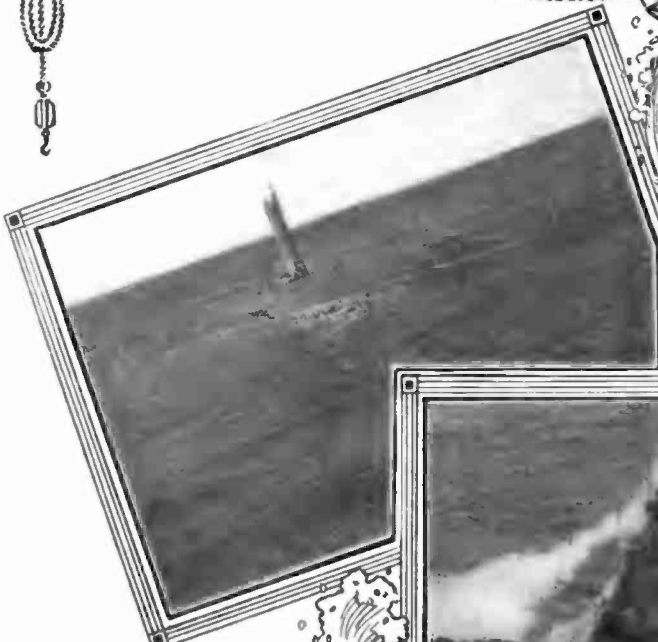


Various views in the Government Printing Office at Washington, D. C., where United States paper currency, postage stamps, and Government publications are printed. One of the unique features of the printing office is the playground roof used by employees. In the other views may be seen the method of destroying old paper currency, women workers in the bindery, stamp printing machine, applying glue on postage stamps, and engravers at work.

Photos. Copyrighted International News Service.



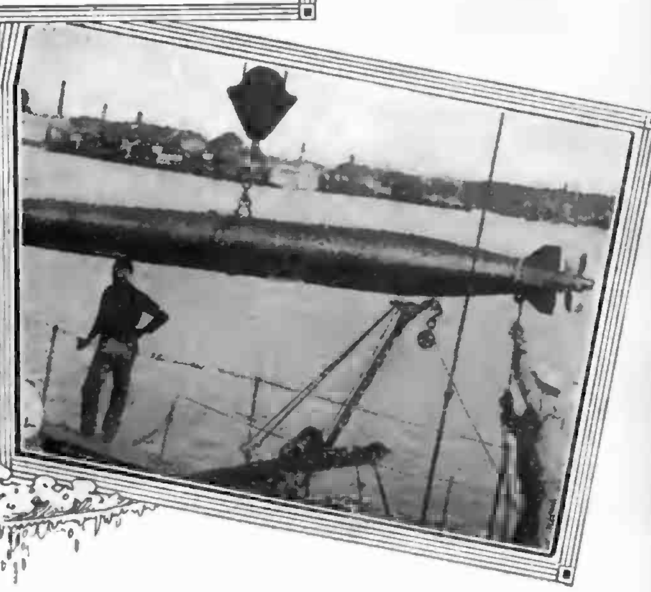
UNDER-SEA FIGHTERS



THIS remarkable series of photographs of two of the newest and most powerful submarine vessels in the United States Navy was taken during recent maneuvers off the coast of Massachusetts. In the several views may be seen the K5 and K6 running awash or on the surface, and preparing for a plunge beneath the waters; the crews of the two boats entering through the

Interesting Views of the K5 and K6, two of the newest and most powerful of Uncle Sam's submarine flotilla.

Photos (C) International News Service.

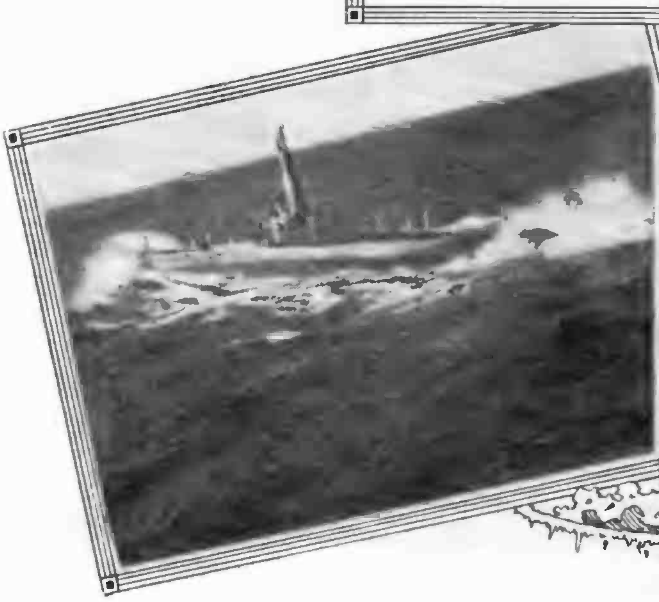


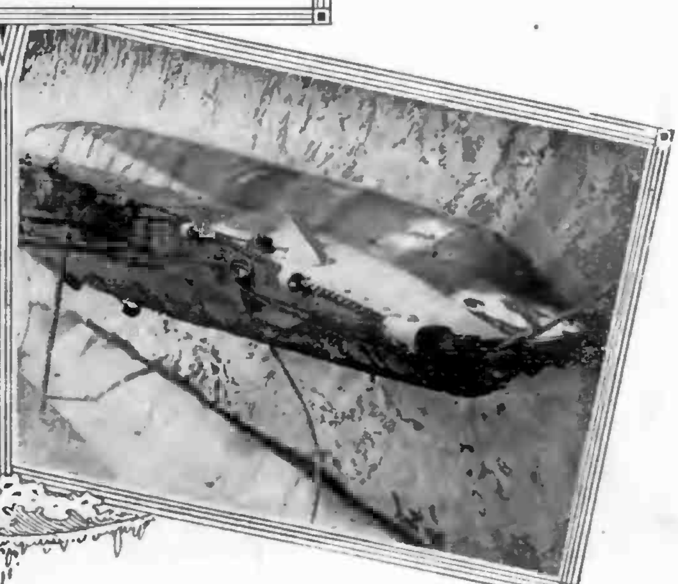
# of UNCLE SAM'S NAVY

hatches; a scene on the deck of one of the boats showing the conning tower in which the navigator stands; a view of one of the deadly torpedoes as it is being lowered into the submarine; and pictures taken from the observation turret of the K5 and showing the appearance of the bow and stern of the craft as she tears through the water at a high rate of speed, on the surface.

United States Submarines, K5 and K6, in a series of manoeuvres off the Massachusetts coast.

Photos (C) International News Service.





A reproduction from a photograph of a mountain ram's horn that was found imbedded in the stump of a tree. This curious combination was found in the mountains near Salt Lake City, Utah, and no satisfactory explanation has been given as to how the ram's horn became imbedded in the tree trunk.

Chinese peasants and their crude dwelling. This man and his wife are considered well off in China. They own the home, the furnishings and enough to eat — sometimes.

A popular child actor who appears in Vitagraph productions. Here Bobby Connelly is seen in a film play entitled "Just Bear Facts," with two cubs.

Largest grapevine in the world growing in California, measures nine feet in circumference and covers one-quarter acre of ground. It annually bears from six to eight tons. It was planted in 1842.

Taking Pictures on the Firing Line

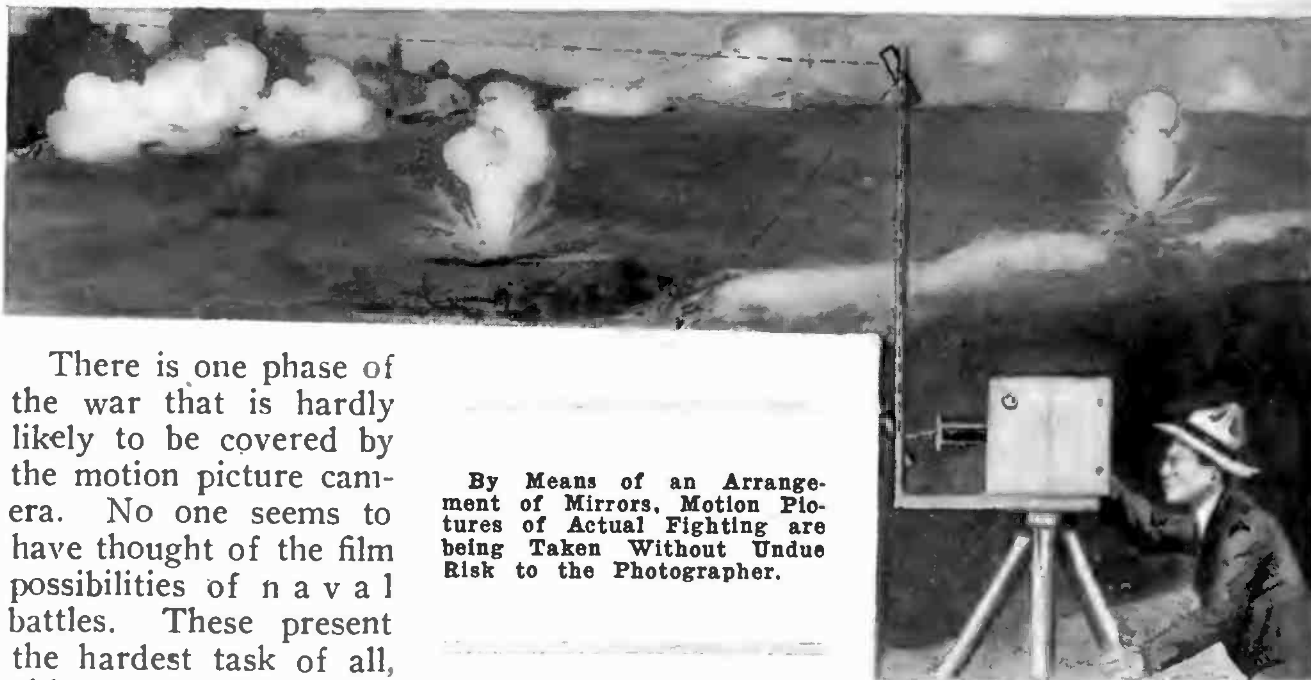
By Ernest A. Dench

THE present war is the hardest proposition that has yet confronted the motion picture camera man. Yet in the face of the seemingly impossible obstacles that have been placed in the way, some camera men have succeeded in surmounting the difficulties and have secured excellent pictures of active engagements. One evidence of success in this direction is presented in the film known as "The Defense of Alost," in which scenes of desperate fighting and carnage are much in evidence. The daring camera man who filmed this engagement was sheltered in the doorway of a house and had only just left his post when the adjoining house was blown up by a German shell. As it was, the camera man was wounded and blood poisoning afterwards set in. This is one of the few instances where fighting has been filmed at close quarters.

The most difficult problem of the camera man's work is when the fighting occurs over large, exposed areas. First of all, in such instances it is most difficult to approach within a convenient distance of the actual scenes of fighting, since the authorities are exceedingly strict and to venture in the direct firing line is to court death. Some of the operators have been equipped with the Aeroscope camera, which contains no heavy tripod. This hand motion picture camera has a wide range of vision and its light weight greatly simplifies carrying it to various parts of the battlefield. Others who adhere to the ordinary, cumbersome film camera will in all probabilities be obliged to conduct their operations from trenches. Both the operator and the camera will be below the surface of the ground, thus protecting both from rifle bullets and shells. One device that is now being used consists of two fixed mirrors that are attached to the camera to serve a double purpose; not only does the device reflect all the action that is taking place in the distance on the lens of the camera, but the operator is also enabled to see what is transpiring.

A much safer method than the one before mentioned is to photograph the battle scenes overhead from a balloon or airship. One enterprising camera man has already secured permission to do this.

Even after the pictures have been successfully obtained there is still a greater power to reckon with—the censor. Many film men have had their films ruined because of the censor insisting on an inspection before the strips were even developed. To avoid such losses as these, some operators often resort to smuggling, risky as that practice is.



By Means of an Arrangement of Mirrors, Motion Pictures of Actual Fighting are being Taken Without Undue Risk to the Photographer.

There is one phase of the war that is hardly likely to be covered by the motion picture camera. No one seems to have thought of the film possibilities of naval battles. These present the hardest task of all, although it is probably quite practicable to record the action from a dirigible. Of course, official permission may have been applied for but not granted.

FILMING THE WONDERS OF YELLOWSTONE PARK

Carl Louis Gregory, who is the underwater photographer of "Thirty Leagues Under the Sea," is whipping the 20,000 feet of film he took at Yellowstone Park for the Thanhouser-Mutual Company into shape for early release. Mr. Gregory is the first motion picture photographer to receive a permit from the Government to take the views.

ACTRESS'S REALISM FOOLS LIFE GUARD

A life guard at Playa del Rey, near Venice, Cal., spoiled a scene in the Reliance-Mutual newspaper drama, "The Floating Call." featuring attractive Irene Hunt in the rôle of the sob sister.

Miss Hunt jumped into the lagoon from the bridge. Director Fred A. Kelsey, with his camera man and other members of the company. stood on the lagoon bank. Miss Hunt, although an expert swimmer, at Kelsey's direction began going through all the evolutions of a drowning person. A life guard was patrolling the beach about a block away. He saw Miss Hunt plunge into the water and immediately started for her at full speed. The life guard cleared the bridge rail, dove head first into the water, seized Miss Hunt and started to swim ashore with her.

He then observed the director and camera man and apologized for spoiling the scene. The life guard said he thought Miss Hunt was trying to commit suicide. The scene was retaken, with the life guard an interested onlooker.

PATHE FRERES TO TAKE MOTION PICTURES OF WAR

It has been formally announced that Pathe Freres have been appointed official cinematographers to the French Government in connection with the war. This much sought for concession will give Pathe a tremendous advantage in the matter of securing authentic and historically valuable pictures of the world's greatest conflict, since it is evident that the prejudice which has existed against the motion picture camera anywhere near the firing line will to some degree be lessened when the cameraman bears his official government commission.

The statement made some time ago to the effect that a branch of Pathe Freres would film the German campaign has been denied.

"REEL" PERSONALITY

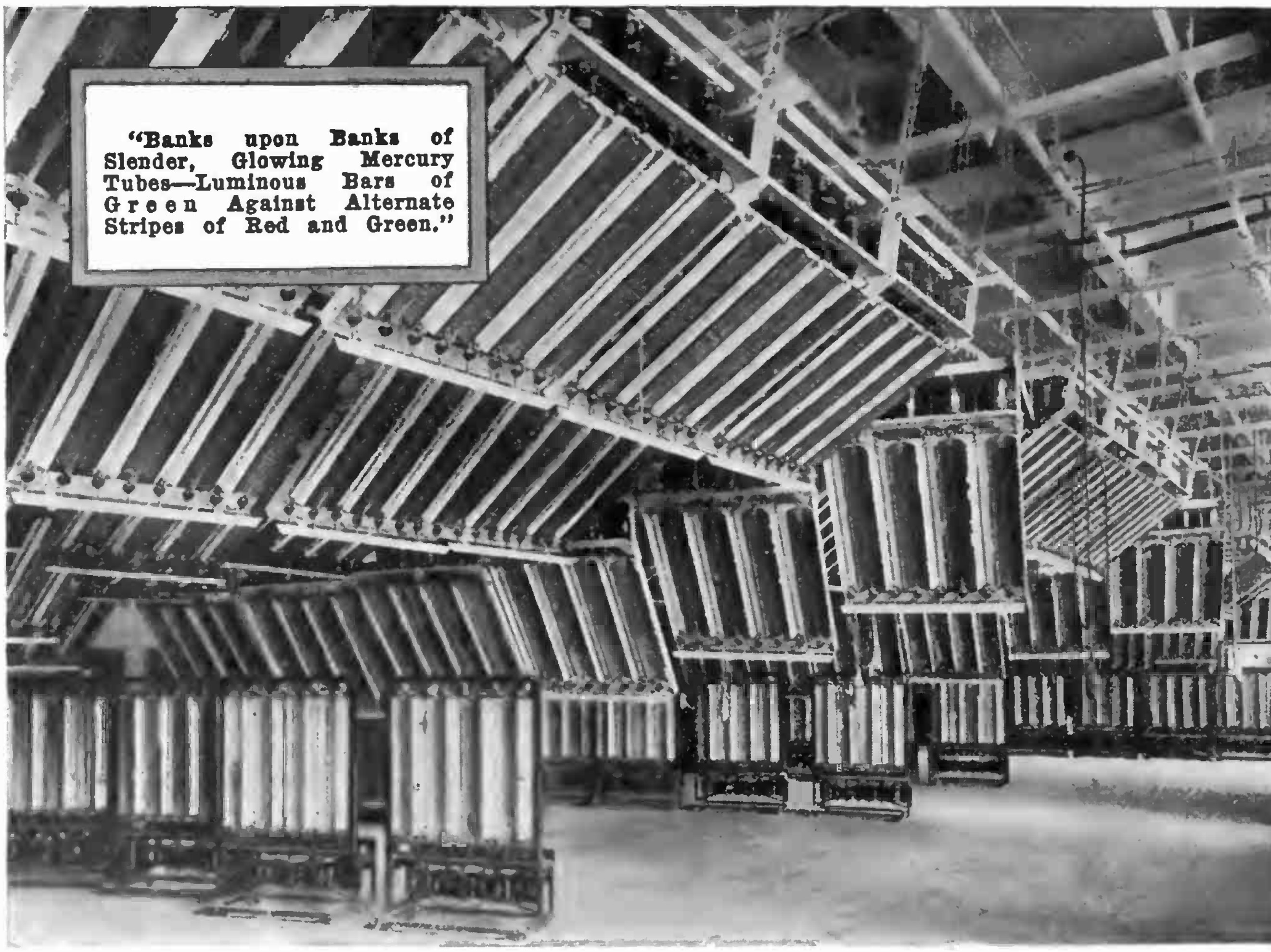
By Geo. F. Worts.

Artistic Temperament Has Fled Before a New Ideal in the Production of Modern Moving Pictures. "Studio" has been Supplanted by "Factory." The Ivy-Clad Sun Dial has Relinquished its Place to the Time Clock. Hustle and Bustle are Displanting Dreams and Desuetude. Heartless Competition Forced Efficiency into the Movies—and Efficiency is Making Over a Lifeless, Haphazard Experiment into a Highly Organized Industry.

THE glamour of the movies is like the glamour of the stage: it can only be appreciated by those on the other side of the footlights. Making moving pictures on the large scale that some producers do nowadays—several plays a week—necessitates rigid systematizing in every department. Acting is merely a cog in the machine, a single step in the manufacture of a world-wide necessity.

There is nothing romantic connected with a modern moving picture studio, unless it is the romance of business itself. I mean that artistic temperament simply does not exist there; that the photo-play on the screen is so utterly different from the photo-play in the making that it is often quite a disappointment to peek behind the scenes.

Viewed in a cold, critical light, moving pictures, made in the tremendous quantity that they are nowadays, are slowly



"Banks upon Banks of Slender, Glowing Mercury Tubes—Luminous Bars of Green Against Alternate Stripes of Red and Green."

but surely seeking the plane of the canning industry. The idea of "Canned Movies" may grate against your sense of the artistic; yet there is nothing shocking about it at all. If movies were not turned out on the canning industry scale, there would be no movies. The Biograph Company manufactures between two million and five million feet of finished film a week—enough to encircle the world once or twice every year. Obviously there is no room for temperament before or behind the camera.

Artistic Temperament Minus Temperament

The afternoon that I got my first glimpse of the Biograph studio in action, I was disappointed. After I had examined things more closely I had a decided change of mind.

Banks upon banks of slender, glowing mercury tubes—luminous bars of green against alternate stripes of red and green—poured a ghastly, bold light into a drawing room in which there were two lovers. Their skin was a bleached green; their lips, a deathly gray; their smiles—hideous.

"How can they stand it!" I burst out.

"They get used to it," replied our guide. "In time, they look just as natural to one another under that light as under sunlight." We stood there for nearly half an hour before we realized the truth in this statement.

"We use the mercury arc lamp," he explained, "because it is more efficient. Perhaps the actors and actresses would appear a trifle more natural to each other at first under the ordinary arc; but the mercury lamp has wonderful photographic qualities; it is the most efficient light for the purpose we have ever found."

Covering the entire ceiling of the vast studio, thick clusters of the bright tubes cast down their chilly radiance—like the nearby aurora of an Arctic night.

Thousands for Realism

Four or five separate scenes were being photographed in different parts of the studio, each set surrounded by a high screen. The screen gives privacy to the actors, besides offering an opportunity for the director to concentrate his thoughts and efforts on the difficult task of filming a smooth-flowing, consistent narrative.

The limits to which the Biograph directors will go—are expected to go—in order to give the aspects of truthfulness and naturalness to their films, knows no bounds. These are no idle words. Expense is the last consideration. In fact, it's not a consideration at all.

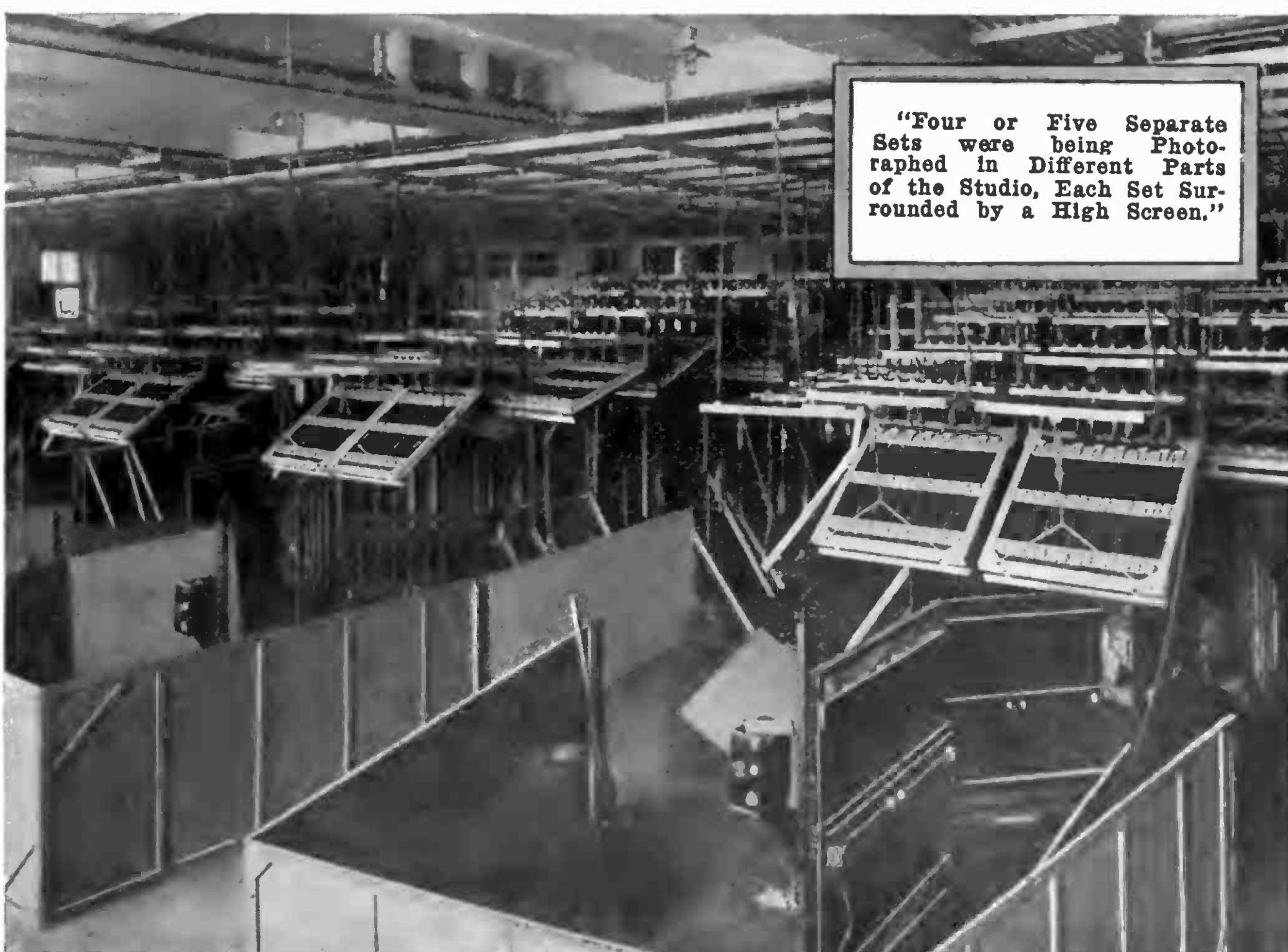
"The day of the faked picture is past," remarked one of the directors. "In Europe, scenery is not an object in any sort of a play. 'Get the acting and let the scenery go hang,' is their motto. Everything is sacrificed to temperament—to 'the art,' as they call it. But the conditions are different on this side of the water. Americans demand accuracy. Even in the cheapest melodrama, you can't get away with the same set for six different acts merely by shifting the position of a tree!"

Down in the property rooms we had seen a carpenter at work on an old, rustic well top. Dirty old boards had been used and stained musk to create realism in the picture in which the well would ultimately be used. Take away the business-like workbench in the background, let your mind wander a trifle, and you could very readily picture a little sunbonneted farmer maid with an oaken bucket on her arm standing beside the well in a green field!

Nothing is too good for realism at the Biograph factory. We inspected a prison set-up in the daylight studio, of which I will have more to say later, and it was so real that it was actually oppressive.

"Reminds me of the time I was arrested for speeding," observed my companion. "I didn't have enough money to pay the fine and the little home they gave me was just like this!"

The most striking illustrations of the extent to which Biograph directors will go in order to produce genuine atmosphere are shown in the ballroom scenes and the boudoirs of wealthy ladies. Whenever, for instance, you see a table



"Four or Five Separate Sets were being Photoraphed in Different Parts of the Studio, Each Set Surrounded by a High Screen."

in a Biograph picture that looks as if it were made of mahogany, you can rest assured that it is mahogany all the way through. The drawers of every bureau and dressing table we examined were lined with brocaded silk. Some of the more expensive sets are worth $3,000 or $4,000. Although the expensive furniture is usually rented, the rental bill will often amount to $500 or $600. Fashionable ball gowns, which must be made to order, cost from $400 to $1,000 apiece. To paraphrase the speech of a venerated statesman: "Thousands for realism, but not one cent for temperament!"

Blue Substitutes White

The Biograph Company has been in the moving picture field for more than eighteen years—longer than any other concern in the world—and they have worked out the countless little problems of picture taking to a fine science. One of the most interesting examples of this is illustrated in the use of clothing resembling white. I say *resembling white,* because the color white is rarely used before a Biograph camera. White displayed openly will cause, in photographic terms, *halation.* That is, a foggy blur about the white object in the picture. To avoid halation, the actors must wear pale blue shirts and neckties and the gowns, dresses and shirtwaists of all the actresses instead of white must be of this pale blue color. In the finished picture the blue appears as a snowy white. Tablecloths and bed coverings are likewise tinted to avoid halation.

While we were watching a hospital ward scene in process of construction, a girl, dressed in the "purely blue" costume of a Red Cross nurse passed by smiling.

"That's Miss Prescott," our friend informed us. "She has one of the sweetest dispositions of all the girls in the movies—on the stage or off."

We saw a number of famous moving picture players at the Biograph studio that afternoon. Most of them I recognized even in their "war paint," having seen them quite often in picture plays at the theatres; and I was fortunate enough to talk with a few. It seemed strange that a man whose gestures I and millions of others had become intimately familiar with by repeated observations at the

In this Room the Films are Assembled. In the Background are the Small Projecting Machines Used to Examine Finished Reels.

On These Wooden Frameworks the Wet Film is Wound and Then Revolved Until it is Thoroughly Dried. The Room is Heated at a Uniform Temperature to Expedite the Work.

movies, should be talking to me in flesh and blood and using these same familiar gestures.

Think of having literally millions of friends all of whom can claim an acquaintance "by sight!" And consider how embarrassing it must be to stroll down the street and, every block or two, after receiving a bold stare, hear someone excitedly whisper, "Oh, there's so-and-so, leading man for the Biograph!"—or Selig, or Vitagraph or Lubin, as the case may be.

Acres of Glass

On the top floor of the largest building of the Biograph group the daylight studio is located. It is an unbelievably large crystal-roofed room, lofty and as bright and airy as outdoors. Here, the enormous banquet and ball room scenes are produced. Perhaps I can emphasize its hugeness to best advantage by mentioning that a Democratic Constitutional convention, very accurately simulating the 1912 convention held at Baltimore, was produced not long ago. Speeches were given, political platforms announced; the smallest details were faithfully carried out.

"In some of our large productions," our guide informed, "we make use of a thousand or more men and women, for mob scenes and the like."

"Do you have any trouble securing them?" we inquired.

"Trouble! We used to advertise in the want-ad columns of the papers; and we have had lines of applicants extending almost all the way around the block. I should say we did have trouble! Now, we get all the supers we need through an employment agency down town. And you would be surprised to see the numbers of fine, capable looking chaps on the super list! There's something about suping for the movies they simply can't resist!"

Flickerless Movies

It is a physical impossibility for Biograph pictures to flicker. This result is brought about by the use of a camera of almost unbelievable weight, mounted on a tripod which, at least by its appearance, could support an elephant with ease! The cost of the Biograph camera would be difficult to estimate. It is of special design; and every mechanical or photographic device which would go toward making an absolutely perfect picture is there. Aside from the infinite pains which characterize every detail of its construction, perhaps the most ingenious feature is a mechanism which punches out sprocket holes as the picture is being taken. The film moves past the lens in little jerks, equal to the length of a single picture. When each successive unexposed portion is squarely opposite the aperture, a small punch automatically plunges through the rim on either side. The purpose is easily explained. When the finished film, the positive, as it is called, is run through the projecting camera in the theatre, each consecutive exposure as it is thrown on the screen will be exactly opposite the lens.

The Biograph camera is at least four times larger than the normal moving picture machine. Yet all that weight is there for a very definite purpose: camera solidarity means a steady picture. Hence the weightiness of the Biograph camera.

The Bigness of Little Things

You have been told a little about the mechanics of the moving picture stage. Now let us turn for a few, fleeting glimpses into the very interesting process of film treatment.

The first thing that would impress you would be the infinite pains which are taken in every one of the numerous steps of film finishing. A strip of the film of each scene is clipped from the negative before the set is destroyed to determine whether or not the exposure has been correct. Assuming that it has, the consecutive films are glued together in one continuous ribbon, and the picture is shown before a censory board comprising the managing director and the several directors who took part in making the play. The censory room is a veritable sanctum sanctorum and he who enters does so at his own risk. The picture is gone over thoroughly, stopped innumerable times, criticized, sections cut out, scenes rejected—sometimes the whole picture must be done over again.

Once a picture was made in one scene of which a girl went in and out of the house several times. It was a very important scene as it came at about the climax of the story. Of course, the interior of the house was staged in the indoor studio. The unfortunate part about it was that every time the girl left the room she wore a large black sombrero; but as she came out of the house, she had no hat on at all. The managing director exploded for about ten minutes and the scene was taken over again. Such occurrences as these are very rare, however.

A Gnome is Interviewed

Every work room in the Biograph factory is large, airy and comfortable. But you never lose sight of the fact that this is a factory with factory methods and efficiency ideals. A detail which did not escape us—it could not—was that every girl employed there (400 to 500), was well and attractively dressed.

"Their salaries are good because their work requires expertness," our escort advised us. "An efficiency engineer would need a microscope to find improvements for their methods."

The most interesting part of the entire establishment, to me, we found when we visited the printing room where the positives are printed. Thousands of miles of films are made each month for moving picture houses all over the world.

Our guide led us through a confusingly staggered hall—a series of "light breaks"—which prevent the outdoor light seeping in. Only a dim red glow can be used when raw films are handled as they are extremely sensitive.

Except for the sullen chatter of cushioned steel on steel, it might have been some quaint little Japanese tea house. Countless jack-o'lanterns groped with arms of dull, glowing crimson into the engulfing darkness. From out of the black shadows, the voice of a girl singing came mysteriously. This was gnomeland! A score of gnomes were busily at work.

As our eyes became accustomed to the crimson darkness, the low room seemed to expand, to broaden. The rows of shapeless bulks took on the definite forms of intricate, smooth-working machines. Between the rows of machines, on long tables, columns of neatly stacked tins spread out before us under square red lamps. Occasionally, a forewoman would come up with an armful of tins and carefully put them down beside the others. Or, she would flit back into the darkness bearing a fresh load.

Before every machine—there were probably forty of them—sat a girl operative, vigilantly watching an indicator or twisting a handle or knob. From metal tanks to her left, two ribbons flowed out and met under a masked light. This was the process of printing positives—the finished films which go out to the theatres. As the fresh yellow strip met the transparent-and-gray negative in a clicking steel frame, the masked light from above was flashed on and off automatically. Simultaneously, a perforating machine punched out holes in the edges of the new film for the sprocket wheels of the projecting machine to catch into.

Above: A Battery of Printing Machines that are Used in Printing the Positive Film. In the Oval: A View of a Large Film Assembling Room Where Many Girls are Employed in this Delicate Work.

After we had had the operation of one of the printers explained, I asked the girl who was operating it if the red light was not injurious to her eyes.

"Not at all," she replied. "Some of the girls have been working here for seven and eight years, and it hasn't affected their eyes at all."

"How about daylight when you have been working in here for several hours; does that hurt your eyes?"

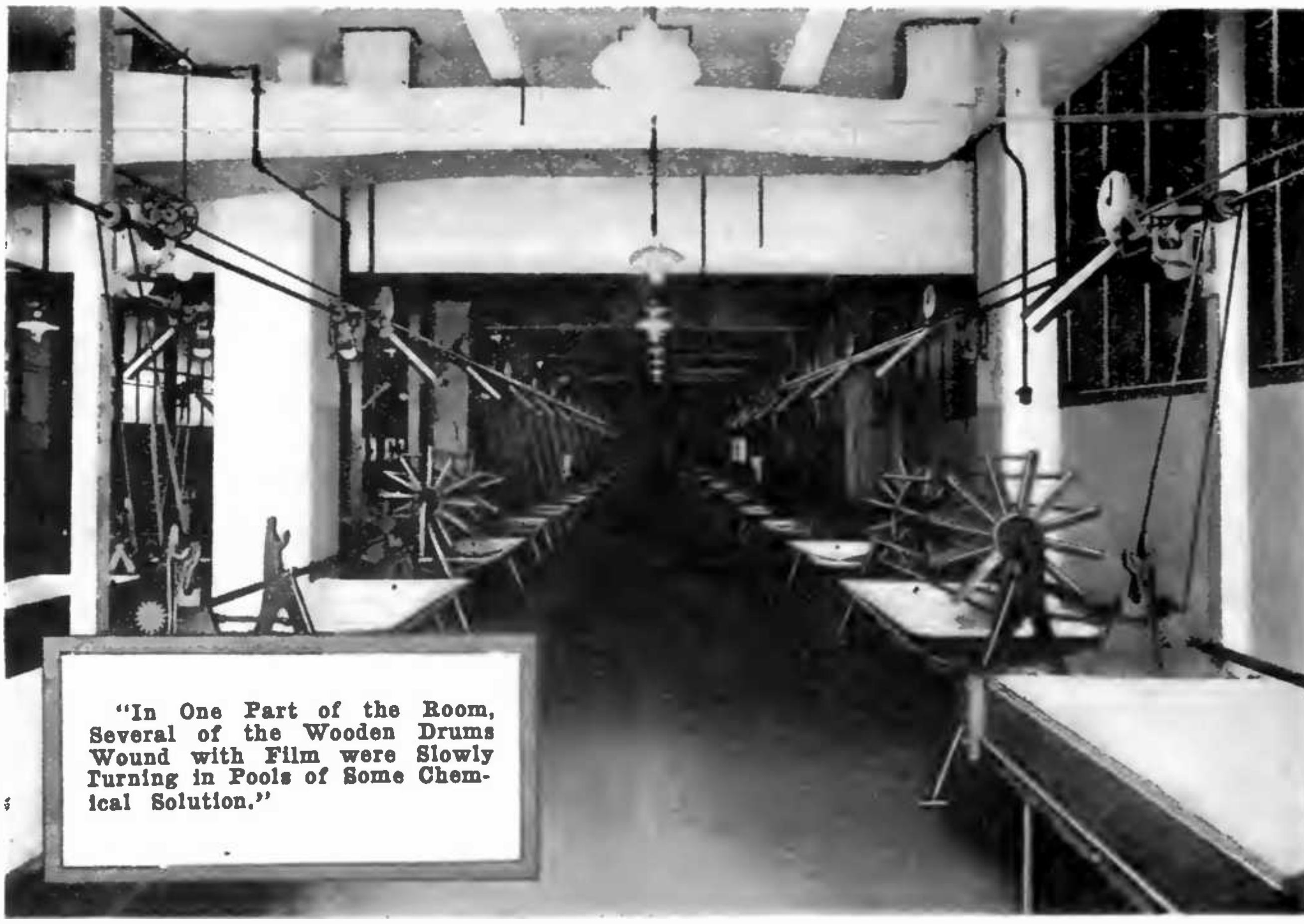
"Sometimes, but very rarely. We grow accustomed to it in a short while —a few days or a week at the most."

"How well can you see in this light?"

"Just as well as if it were daylight. I can distinguish the features of every girl in the room." She went on about her work, and we groped our way back to the daylight.

Railroad Semaphores and Cyanide Tanks

As we passed down the stairway of the developing building, we came opposite a window through which a knotted rope passed. An actor dressed as an Irish laborer, was gesticulating wildly to someone below. A man came out from a doorway and stopped us.



"In One Part of the Room, Several of the Wooden Drums Wound with Film were Slowly Turning in Pools of Some Chemical Solution."

"Wait a minute," he requested. "We're dropping a safe on a fellow's head, and you'll get in the picture if you walk past that window."

We waited while the *papier maché* safe slipped its noose and plunged down on the unfortunate below. Then we proceeded to the dark-rooms where the films are developed in great porcelain basins on revolving drum-like frames and on into the staining room where the films are colored for various ultimate effects —red for fire scenes and blue for moonlight and night pictures.

In one part of the room, several of the wooden drums wound with film were slowly turning in pools of some chemical solution. Above each tank, attached to an iron axle, was a semaphore arm, very similar to the semaphores in use on the railroads. Beside it was a large, white, enameled disc.

"The semaphore," explained the foreman in answer to our question, "prevents the film being left too long in the solution. When the process has gone far enough, a time apparatus causes the semaphore arm to fly up and attract the attention of the workman in charge. He knows then that the film is ready to be taken out and washed.

"This solution," he went on to say, "contains cyanide. If a film should be too dark, or 'thick' as we express it, it is run through a reducing bath of cyanide. If the film is 'thin'—too pale—we give it a bath in a mercurious solution to intensify it."

Back You Go!

The scenario department, which we next visited, presented the appearance of an editorial office in the flame of its busiest season. A spacious table in the centre was stacked high with pyramids of long, fat envelopes, stamped, ready for the mail.

"Those?" said a busy young lady, sealing and tossing an envelop on a groaning heap. "Why, they are rejected scenarios. We can only use one out of about every two hundred submitted. Everybody writes scenarios nowadays, you know. And they are nearly all worthless." We knew, for we had tried it ourselves.

"Policemen, school girls, grocery boys, rich ladies—all of them try their hand."

Six scenario editors were busy, reading and rejecting—reading and rejecting. And, contrary to general belief, every scenario received is conscientiously gone over. If it has the germ of an idea, it is set aside and re-read.

Writing acceptable scenarios is not so easy as some people believe.

In this rather limited space I have been able to do no more than touch upon a few of the most striking events in the career of a Biograph film. To go into any greater details would only bury the point that I have tried to bring out—the combined efforts of the workmen of every department to place Efficiency above all other considerations. The Biograph Company has been accused of absorbing the identity of its employees. I mean, for instance, that some persons criticize the fact that directors' and actors' names do not appear emblazoned on the screen at the theatres; that all letters on the company's stationery are signed merely by initial; that a person entering the Biograph studios is simply swallowed up and lost sight of. But that is an unjust criticism. The entire Biograph organization is a highly perfected efficiency machine—a solid, compact unity—the result of everybody's doing his and her level best.

It is an admirable policy with a single and obvious issue: the creation of a delightfully unique personality. And no one who has followed Biograph pictures for any length of time can doubt that they possess a charming and a lovable personality.

TWENTY TONS OF DYNAMITE EXPLODED FOR PICTURE

Twenty tons of dynamite was exploded to lend realism to a film production entitled "Nipped," a powerful story of Japan and the Mexican revolution, made under the direction of Thomas H. Ince.

The explosive was kept for over three weeks awaiting the time it would be employed. It was placed in various boxes that were isolated from each other by thick layers of cotton. The explosive magazine was constantly guarded by armed men. When the dynamite was finally employed its terrific explosion was recorded by eight cameras situated at vantage points. The force of the concussion was felt for a radius of many miles.

FOREIGN POLICE DOGS TAKE PART IN AMERICAN FILM

German police dogs are used in "The Center of the Web," a two reeler now in the making at the Thanhouser-Mutual studio in New Rochelle. These dogs only recently arrived in this country from Berlin, where they had been used successfully in the tracking and apprehension of criminals. Closely resembling wolves, the dogs made a queer looking pack as they awaited Director Harvey's bidding.

Heavy collars with sharp nails are used to discipline them. When a dog becomes unruly its collar is turned so that the nails quickly restore him to better temper and obedience.

The keepers of the dogs spoke to them in German, as they are not trained to commands in English. One of the dogs, however, understands directions given him in French. This animal was sold for $1,600, but represents such a splendid type of his breed that permission was given by the new owner to work him in the picture.

The ability of these dogs to follow the trail of human beings was demonstrated when two cats and several rabbits were turned loose near them. Not a dog even as much as looked askance. Their keeper explained that if they were trained to follow animal scents they might some time be led astray from the human trail they were following and thus fail in the one purpose for which they are intended—the hunting down of human malefactors.

By the Clever Application of a Curved Glass Window, This Display Appears to be Without a Glass Front.

AN INVISIBLE WINDOW

It is more than vexatious when a store has put in an especially elaborate window display to find that because the window glass is acting as a mirror, reflecting the sidewalk and the buildings across the street, passers-by cannot see the merchandise and figures in the window without flattening their noses against the glass. This is by no means an unusual situation, and nearly every window dresser has had to face it.

In efforts to find some means of overcoming the difficulty, backgrounds in various colors have been tried and wide awnings have been hung above the windows, but these are not very satisfactory or practical remedies. The reflections continue because they are caused by the refraction of light rays from the glossy surface of the glass itself. Nothing placed behind the glass can alter this.

By applying the simple scientific principles of optics a New York store has solved the problem. This store had an apparently useless window on a high-priced frontage—made useless by light reflections. Now the window is so free from glare and reflections that it instantly attracts attention; for, except on close examination, there does not appear to be any window at all, simply a show window open to the air. The eyes of people passing are so accustomed to more or less reflection from show windows that they are caught by the complete absence of reflection. Everyone instantly notices missing plate glass on the morning after a windstorm has blown in a show window.

The remedy for this window was found in a sheet of plate glass bent to such a curve as will reflect exterior rays downward to the inner non-reflecting surface of a barrier. Thus a shadow box is formed and permits a distinct view of the store interior and of the show window itself. Simply stated, the remedy really consists of the substitution of a curved plate-glass window for the ordinary flat glass. It is claimed also that the polarization of light entering the curved glass window—the shadow box window, as it is now called—emphasizes the color and texture of draperies, so that even at a distance of several feet their quality is shown to good advantage.

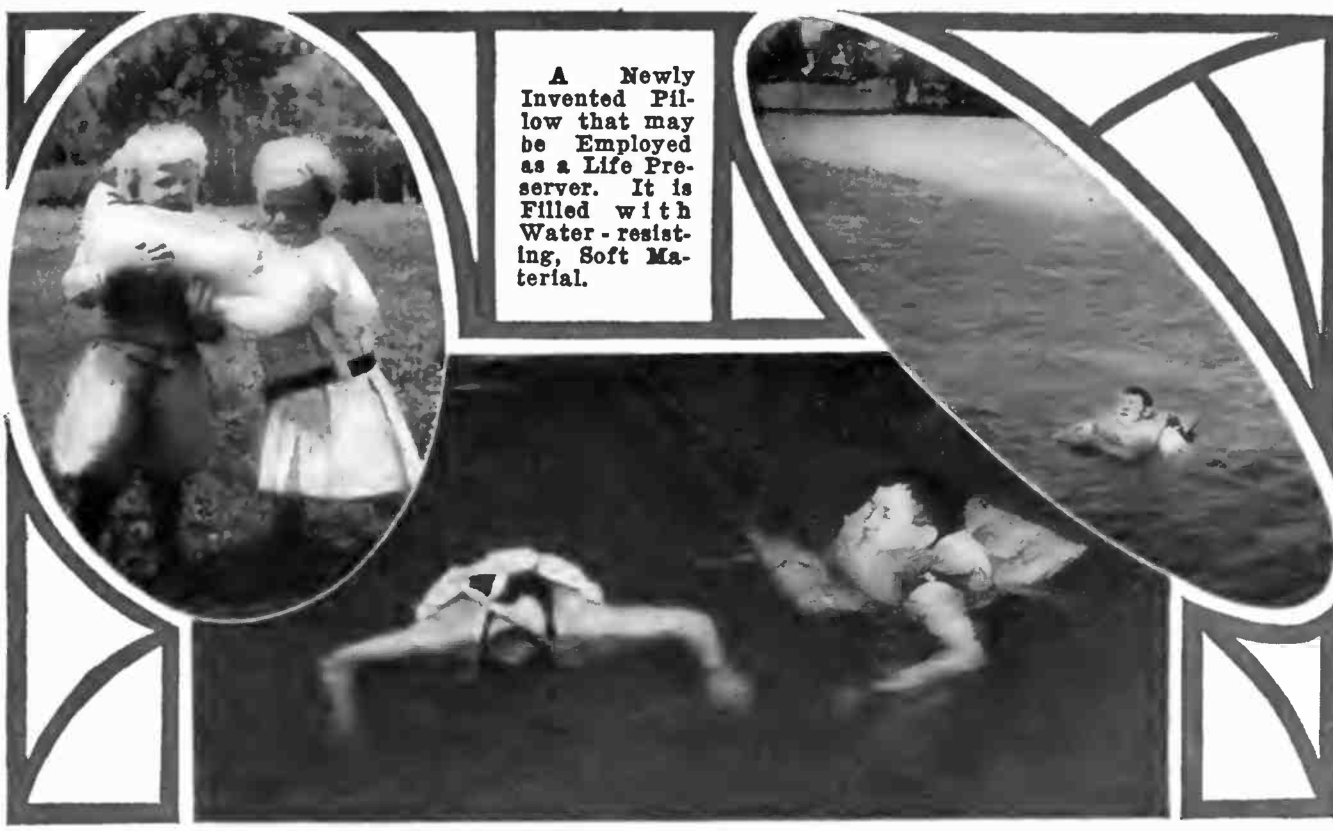
The new window is safe from accidental damages, both because of its strength, due to its curve, and because it is two to four feet back from a flat glass position, therefore putting it out of the way of most dangers.

The scheme might well be followed with profitable results by other progressive storekeepers.

A Typical Glass Front Showing the Reflection of the Building and an Automobile on the Opposite Side of the Street.

USING PILLOWS AND MATTRESSES AS LIFE PRESERVERS

A resident of Baltimore has recently demonstrated special pillows and mattresses for use on shipboard and which could be employed as life preservers and rafts. In a series of tests before Government authorities the inventor proved that his pillow could be placed about a person more readily and with less experience than the usual cork belts. Furthermore, he demonstrated how the pillow could be placed with equal ease on a two-year child as well as the largest person. The mattresses were likewise tested and proved to be very efficient life rafts capable of holding several people. Both the pillows and mattresses are filled with a water-resisting material that is unaffected even when placed in water for long periods; its floating powers being permanent.



A Newly Invented Pillow that may be Employed as a Life Preserver. It is Filled with Water-resisting, Soft Material.

ALUMINUM AS AN ELECTRIC CONDUCTOR

More or less success has attended the employment for some years past of aluminum for telegraph and telephone wires. Simple joints for the ends of the wires have been devised. Owing to its large volume, the wind resistance of aluminum wire is quite considerable, and for the same reason a good deal of insulating material is required, if it is to be coated.

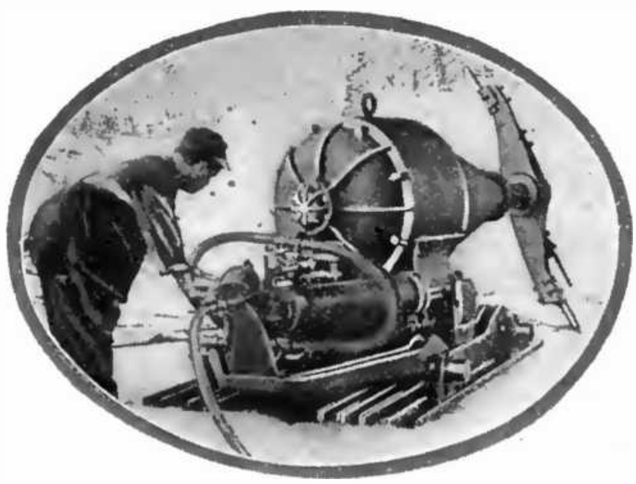
WOOD PRESERVATION

Recent experiments by Government experts have revealed an unexpected source of trouble in the process of sterilizing wood by the injection of preservative liquids. It is customary to remove the bark from a stick of timber before it is subjected to creosoting, but it has been supposed that thin layers of the inner bark left unremoved would do no harm. Now it is found that such layers, no matter how thin, almost absolutely prevent the penetration of the liquid. In any case, the preservative usually fails to penetrate the center of the stick, but forms an exterior antiseptic zone, which answers the purpose if there are no gaps in it. But if such gaps exist, owing to the presence of thin layers of bark, the teredo finds an entrance through them and carries on its work of destruction in the interior of the timber supposed to have been protected.

CARRYING COAL BY PIPE LINE

The proposal to pipe a mixture of pulverized coal and water, as oil is now piped, is not new. But it has been limited in the past to the coal dust produced in ordinary processes of mining and which is often washed. It has never been carried out commercially—at least on any considerable and practical scale.

Two New York inventors now propose to mine all coal in the form of dust with a special machine, mixing it at once with water and handling it thereafter by means of pumps and piping. At its destination the coal is to be separated from the water and dried, after which it is ready for all purposes for which lump coal is now employed in such tremendous quantities.



A Rotary Cutter, Driven by an Electric Motor, Used for Cutting Coal.

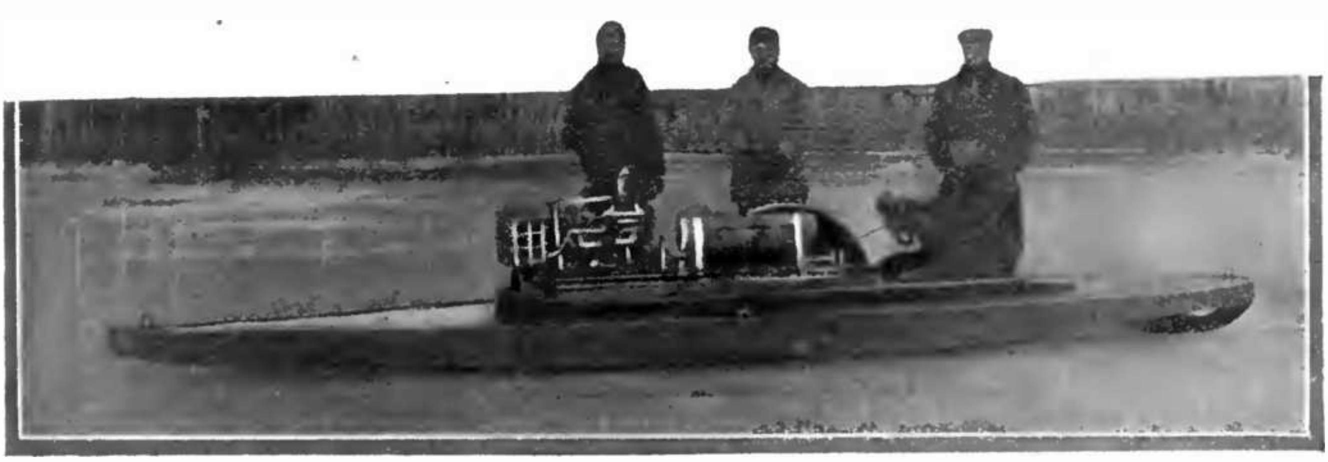
The mining machine is entirely automatic in operation. It advances by a simple hydraulic feed mechanism that propels it along the floor into the face of the seam. Rotary cutters on the shaft of the driving motor cut the coal much in the same manner as a circular saw cuts wood. A hose meanwhile directs a powerful stream of water against the face of the coal, all coal dust being washed away and the tools kept cool. The water laden with coal dust runs to the nearest sump and from there it is pumped to any desired destination for consumption.

MAGNETISM AND PETROLEUM

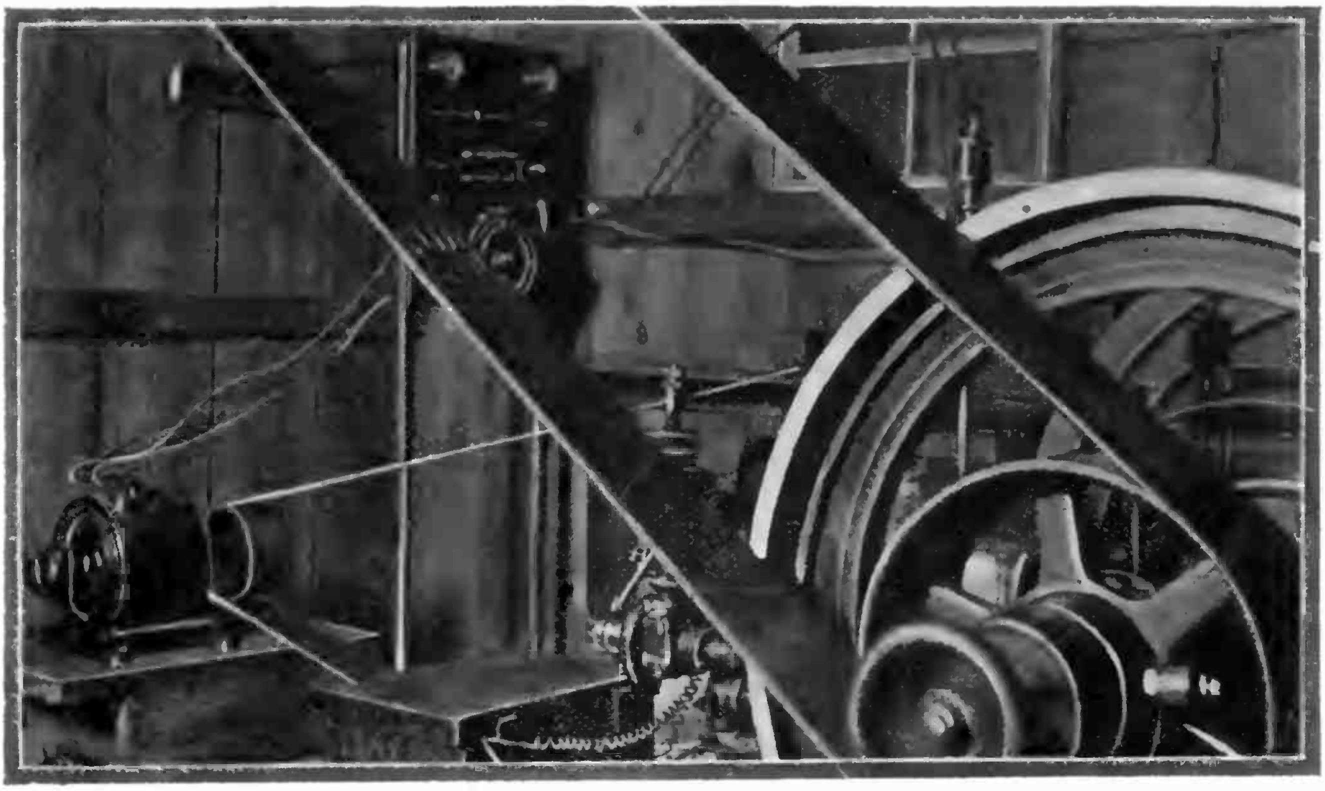
A distinguished English authority, in discussing the possibility that petroleum may be derived from carbides of iron or other metals, points out that Bauer's map of magnetic declination in the United States "proves that petroleum is intimately associated with magnetic disturbances similar to those arising from the neighborhood of minerals possessing sensible magnetic attraction," and he adds that henceforth no geological theory of petroleum will be acceptable which does not explain this association. If these conclusions are confirmed, a new and important sphere of usefulness in magnetic surveys will be opened.

BOAT THAT TRAVELS ON LAND, ICE AND WATER

An innovation in marine architecture is presented in a recently invented boat that is so constructed as to be available for water, ice and land travel. When



This Vehicle is Capable of Travel on Land, Ice or Water, Without Alterations of Any Kind.



An Electric Power Plant Employed on a Large Plantation in Texas for Furnishing Light and Power. It is Typical of Private Plants Throughout the Country.

employed on water it is operated much in the same manner as the ordinary boat, but when used on ice it is propelled by a steel wheel that digs into the slippery surface and pushes the boat forward. On land a set of wheels are brought into play and driven by suitable shafting. The four horsepower engine that is shown in the illustration performs the work of propulsion in the three spheres of usefulness.

ELECTRIC LIGHT PLANT ON PLANTATION

The employment of electricity is rapidly extending in rural districts. Not only does it furnish illumination in the farm houses and barns, but it is being employed to a greater extent each year for driving the machinery of the farm and plantation. And even where electric current is not available, small power plants are being installed to meet the demand.

In the accompanying illustration appears a typical lighting plant installed on a large plantation in Texas. The generator is connected to storage cells that accumulate current during working moments and furnish current after the plant is shut down. The current is used for illuminating the residences on the plantation, the office, and power house, and for furnishing power to a cotton gin.

OLD RIFLE CARTRIDGES FURNISH BRASS

Brass recovered from old cartridges picked up on the fields of the many battles in Mexico during the past year, is a business that is tempting many junk men. Tons of the scrap ammunition have been recovered around Zacatecas and Torreon. While most of the scrap is being sent to Mexican foundries, a considerable volume has been shipped to American destinations via El Paso.

The business, while considered lucrative, has its dangers, and in Mexican foundries where brass has been secured from spent ammunition, numerous accidents have occurred. In a foundry at Torreon the explosion of a cap in a supposed old cannon cartridge resulted in the loss of an eye to an employee.

The illustration shows a half ton of the material in a foundry located at Torreon. The large shells are heavy field cannon charges about 3 inches in diameter. The

A Batch of Spent Cartridge Shells Gathered on a Mexican Battlefield, Ready to be Melted at a Foundry.

smaller ones are mostly cartridges from Mauser guns. The shrapnel in the center is fully intact and with its brass point it represents a lucky find.

The waste of ammunition in some battles will be appreciated when one takes a trip through some Mexican brass foundry and sees tons of this material. In a number of locations where brass foundries exist, the Revolutionists took charge of the equipment and secured brass enough from this source to aid in making ammunition for their cannons. The brass gathered from this source is not used alone, but is made up with other material. Empty Mauser cartridges run about 93 to the kilogramme, or 93,000 to the metric ton.

GERMAN SUBSTITUTE FOR RUBBER

German chemists have worked out what they claim to be a practicable substitute for India rubber. They use as a basis the oil of the soja bean. Two parts of this oil are treated with one part of nitric acid, and the result is an emulsion. This emulsion is heated to the boiling-point of water, when it becomes converted into a uniform, gummy mass. Upon being washed in water, this mass is dissolved into dilute ammonia water (five per cent.), and from this solution a precipitate is obtained by neutralizing with some dilute acid. This precipitate is again washed with water and heated to about 112 degrees Fahrenheit. The final product is an elastic substance very similar to India rubber and is capable of being vulcanized.

USES OF FELDSPAR

The exploitation of the many feldspar deposits of the United States is all the time increasing, owing to the extensive use of this mineral in the manufacture of pottery, enamelware, enamel brick and electric ware. It is also used for binding together the materials of emery or carborundum wheels as well as to some extent in the manufacture of opalescent glass and artificial teeth. It is also useful in the preparation of scouring soaps and window-washes, because being slightly softer than glass, it is not liable, like the quartz contained in some soaps, to abrade the surface. Feldspar employed in pottery must be nearly free from iron-bearing minerals.

DRAWS TRADE WITH RAILROAD SIGNAL

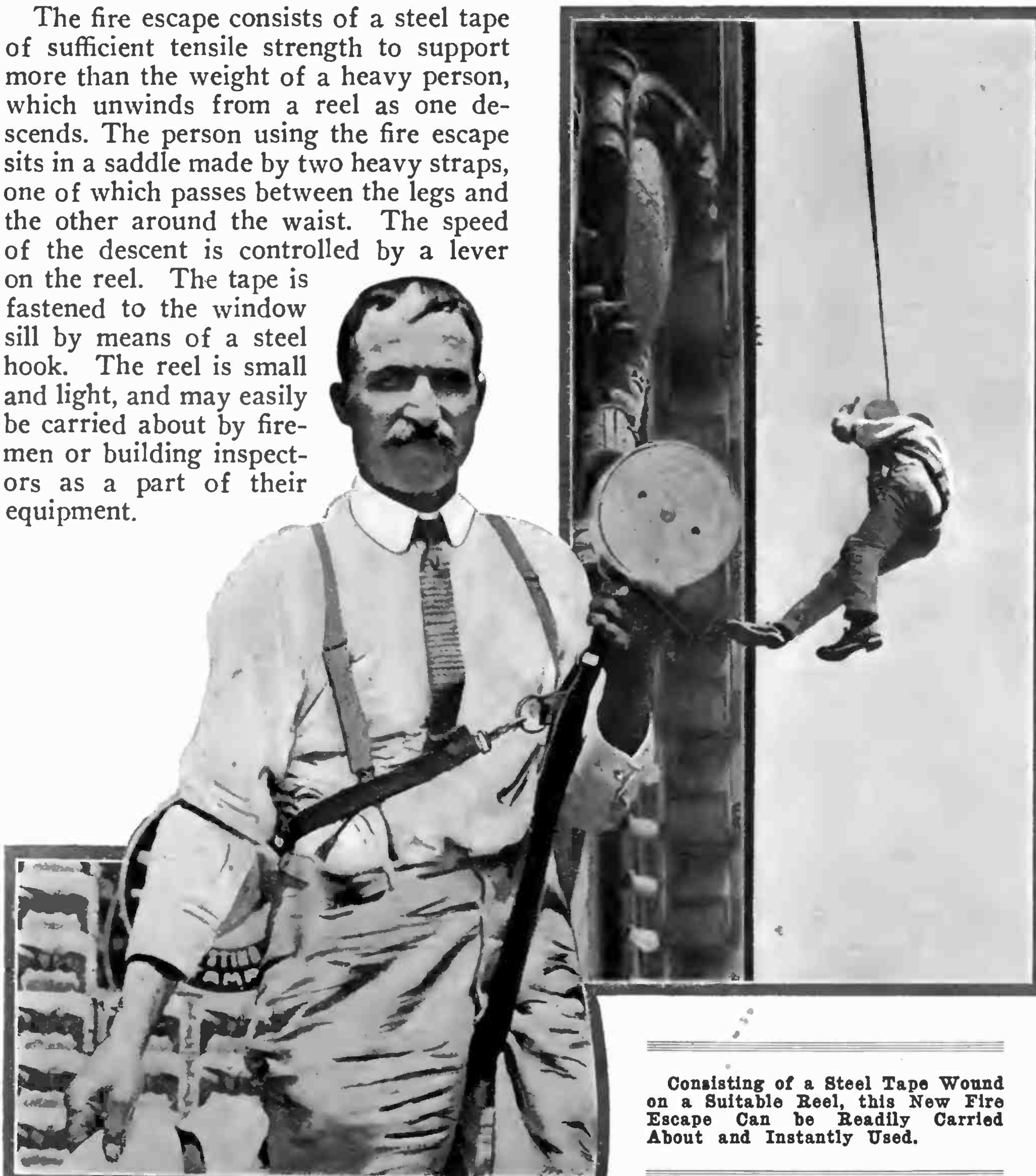
The semaphore that is used as a stop signal for railroads was initiated in the device of a Californian storekeeper who placed a small electric model before his door. The arm reading "STOP" operated by a small motor, and colored lights, red and green, flashed as the arm moved up and down. Curiosity over the novelty brought many customers.

A Clever Scheme for Attracting Trade.

FIRE ESCAPE OF NEW DESIGN

Peter Vescoci startled noonday crowds in Indianapolis when he let himself down to the side walk from the thirteenth story of the Odd Fellows' building to demonstrate a new kind of fire escape. He made the descent without any trouble.

The fire escape consists of a steel tape of sufficient tensile strength to support more than the weight of a heavy person, which unwinds from a reel as one descends. The person using the fire escape sits in a saddle made by two heavy straps, one of which passes between the legs and the other around the waist. The speed of the descent is controlled by a lever on the reel. The tape is fastened to the window sill by means of a steel hook. The reel is small and light, and may easily be carried about by firemen or building inspectors as a part of their equipment.



Consisting of a Steel Tape Wound on a Suitable Reel, this New Fire Escape Can be Readily Carried About and Instantly Used.

GOLD MINING IN THE HEART OF A CITY

The business of gold mining has been so long associated with the wilderness that mining for gold in the heart of a city is rather exceptional. In the city of Edmonton, Northern Canada, however, since the outbreak of war, placer mining on the banks of the Saskatchewan River, which runs through the main portion of the place, has been taken up by large numbers of men. The bars of the Saskatchewan River were worked at various times in the last fifty years and as late as the year 1900 men washed from three to ten dollars a day. Of recent years, however, work on the rivers

A Miner's Equipment for Mining Gold Along the Banks of the Saskatchewan River.

bars has been given up. With the outbreak of war and the possibilities of slack times throwing men out of employment, the city council suddenly remembered the possibilities of the mining industry which offered returns right in their midst. A large number of old mining men who had settled in Edmonton after the Klondike rush of '98, offered to act as instructors in the mining of gold from the river bed. The precious metal here obtainable is a fine flour gold and has to be separated from the earth and stones by being put through a "grizzly." The "grizzly" is a wooden contrivance containing in its makeup a sluice box and riffles on a smaller scale than those used in mining coarser gold. A number of these "grizzlies." made out of a few pieces of lumber, some wire bars and a piece of blanket, were built by the veteran mining men and instructions given to those who were willing to go to work on the river. As a result some two hundred men are now mining within sight and sound of the city's main streets. One miner recently weighed in a seventy-five-dollar poke of gold as a result of a week's work. The average, however, is from one to three dollars per day.

PRESCRIPTION ON THE WALLS

Directions for keeping healthy and for avoiding tuberculosis are placed on the walls and billboards in many parts of the United States. These free prescriptions are in the form of eight-foot posters and are carefully prepared by physicians of repute who are endeavoring to stamp out consumption by an educational campaign. About a dozen designs are used, each with a brief direction and a picture to make its argument more comprehensive. Funds for the work are also secured by appeals on billboards, and every Christmas thousands of dollars for use in extending this educational work are secured through the sale of special poster stamps that are familiar to everyone.

Posters of the Kind Illustrated are Proving Effective Agents in the War Against Consumption.

WHEN WILL THE SEA BE MADE SAFE?

By Walter S. Hiatt.

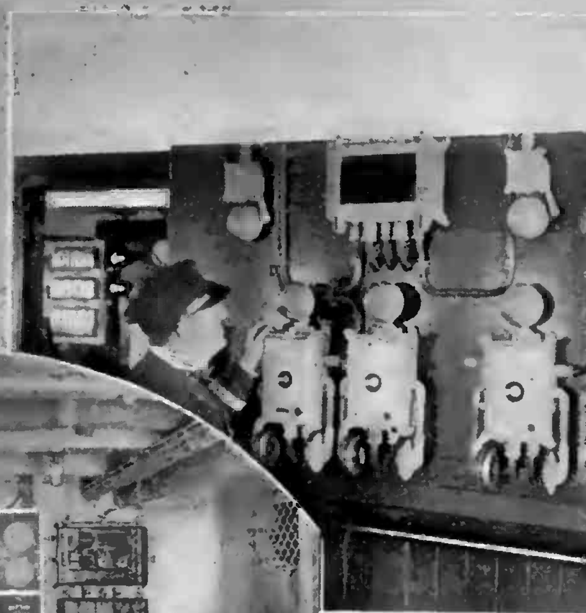
IF an ounce of prevention is worth a pound on land, it is worth a ton on water.

A hundred years of progress on the sea—sail, steam, speed, and safety—have not yet produced more than comparative safety. The steamship *Titanic* was described as the acme of sea safety, and yet since that fateful night of April 14, 1912, there have been more notable sea disasters than at any other period of the world's history, barring ships destroyed in war time. Not a week passes but the sea takes a huge toll in life and property. Five hundred thousand dollars in money and 7,500 lives has become the average annual loss.

Therefore, never before have there been so many and varied efforts to rob the sea of its dangers; never so many mechanical inventions applied to this end. The big floating cities that are the larger liners, with their 5,000 passengers and fifteen millions of dollars in values, must be protected at any cost. Consequently their bridges and their decks and their masts are being armed with electric searchlights, electric devices for launching boats, gyroscope compasses, double masthead lookouts, new fire-fighting devices, motor life boats, various underwater signalling apparatus and expensive wireless sets. Every human and mechanical equipment of promise is being adopted. More officers are in charge of ships, the United States has established an ice patrol in the Atlantic, and international regulations for the navigation of ships have been fixed. Many of the larger ships have been fitted with double skins, or bodies, in addition to the water-tight compartments which should prevent sinking in case of collision. Previous to her maiden voyage last spring the *Vaterland* was even taken out to sea, her seacocks opened and water let flow in until she was one third filled, this daring test being made to find out if her steel compartments would hold in an actual collision.

But has the last word been spoken in sea safety devices?

Fire and collision are the two great modern hazards of the sea, and no finite mind can foresee when a combination of causes will produce one or the other of these dangers. For instance, the collision in 1912 of the United States cruiser *Colorado* and the steamer *Cleveland* in the harbor of Honolulu came because the pilot of the *Cleveland* was stricken and died on her bridge. No invention



Above: The Wireless Room of the S. S. "Imperator". Three Different Sets are Used on this Steamer, an Emergency Set, Short Distance Set, and Long Distance Set.

At the Left: The Gyro Compass of the "Imperator". Above: Special Telephone Apparatus that Places Officers in Touch with the Crew in all Parts of the Ship.

of mechanics could avail in such event.

Nor can invention avail when natural laws conspire to lead ships to their doom. Thus, lately, the giant *Olympic* and the smaller *Philadelphia* passed each other in broad day a few hundred miles out of New York. The ships were so close that the voice of a man shouting on either could have been heard on the other. The *Philadelphia* saluted her sister by blowing her whistle three times. The *Olympic* answered the salute. The bridge officer of the *Philadelphia* saw the steam swarming from the *Olympic's* whistle. Yet he heard no sound. Why? Because his vessel was in a sound vacuum. Sound at sea does not travel on level surfaces, but skips like a rock on a pond. Had it been a dark or foggy night, a collision might have occurred. When the *Empress of Ireland* was rammed and sunk lately by the *Storstad* in the St. Lawrence River, because of a confusion of signals, one or the other vessel may have been in such a sound vacuum.

The ratio of the fire to the collision hazard is as one to three. Fires at sea annually destroy a hundred millions in property. The word "fire" accounts for many of the mysteries of lost ships. Only in the last few months has adequate fire protection been found for ships. The old way was to fight a fire with a water hose on deck and the steam pipe in the hold. But a hold fire is tenacious because it may be discovered late and because it is impossible to reach it directly, as was the case with the *Volturno*, burnt a year ago. Steam not only dampens and ruins the cargo, but it feeds oxygen to the flame.

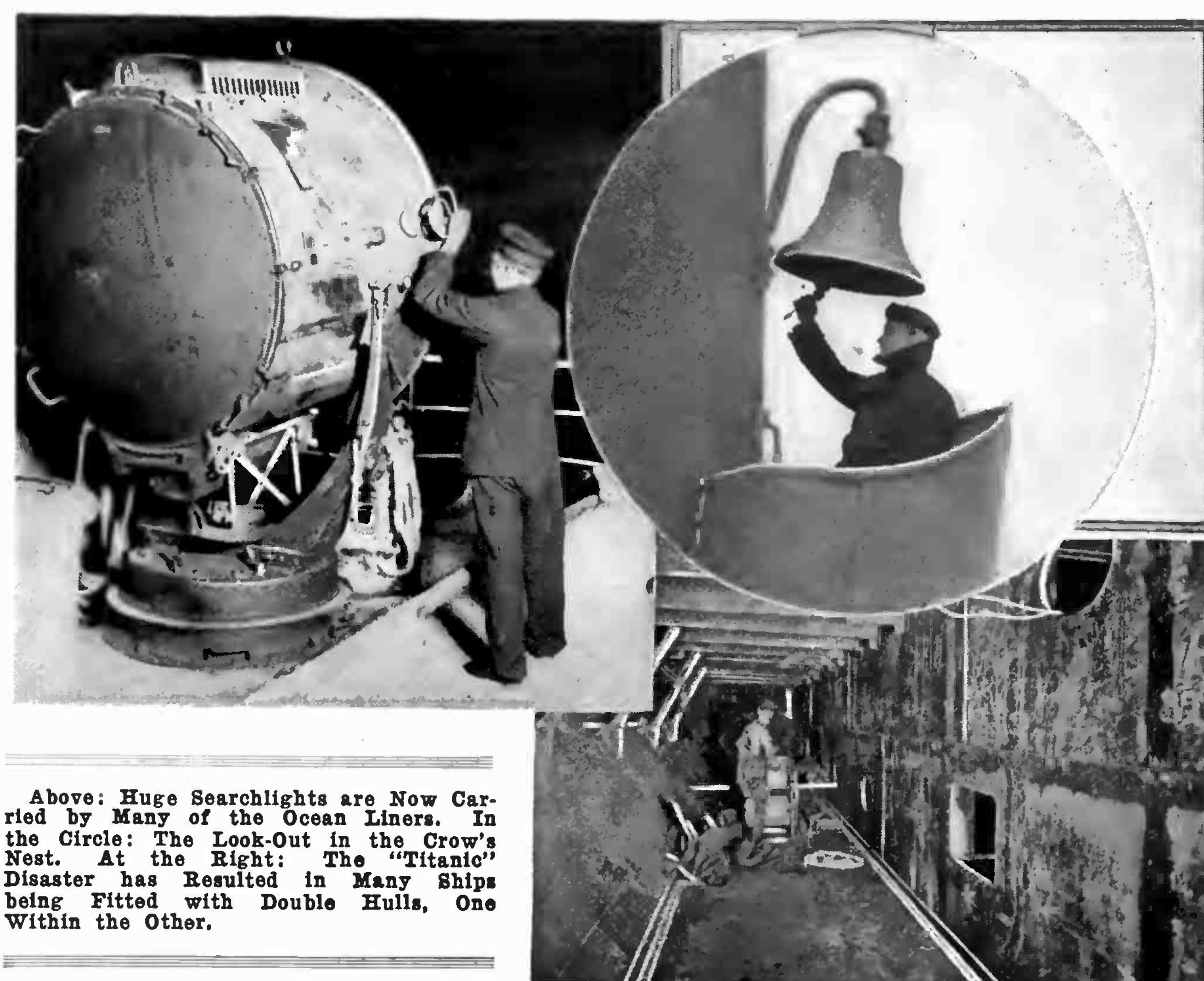
So when the big *Imperator* was nearly burned at her dock in Hoboken, N. J., a year ago, her owners set to work to permanently reduce the fire hazard. The result was the rebuilding of the ship until she is now practically fireproof. Automatic water sprinklers were placed throughout her superstructure, the steam pipes were replaced by carbonic acid gas pipes leading to every hold from the bridge so that gas could be pumped therein to smother the fire. In addition, an automatic fire alarm system was put in operation and a dozen trained firemen placed in charge of all fire work. When cotton and other cargo ships adopt the gas system, then the fire demon will have been reasonably conquered at sea.

The inventions to prevent collisions are legion, as here is involved the navigation of the ship. None of them seems sure. Witness this July the collision of the passenger liner *Zeeland* in broad daylight on the roomy high seas with the freighter *Missouri.* Why? Nobody knows. Some claim that when two large bodies are near each other, they are irresistibly attracted to each other and hence drawn together. Officially, it was explained that the helm of the *Missouri* refused to obey her helmsman. It was under like circumstances that the *Republic* was sunk by an Italian ship in the Atlantic some years ago.

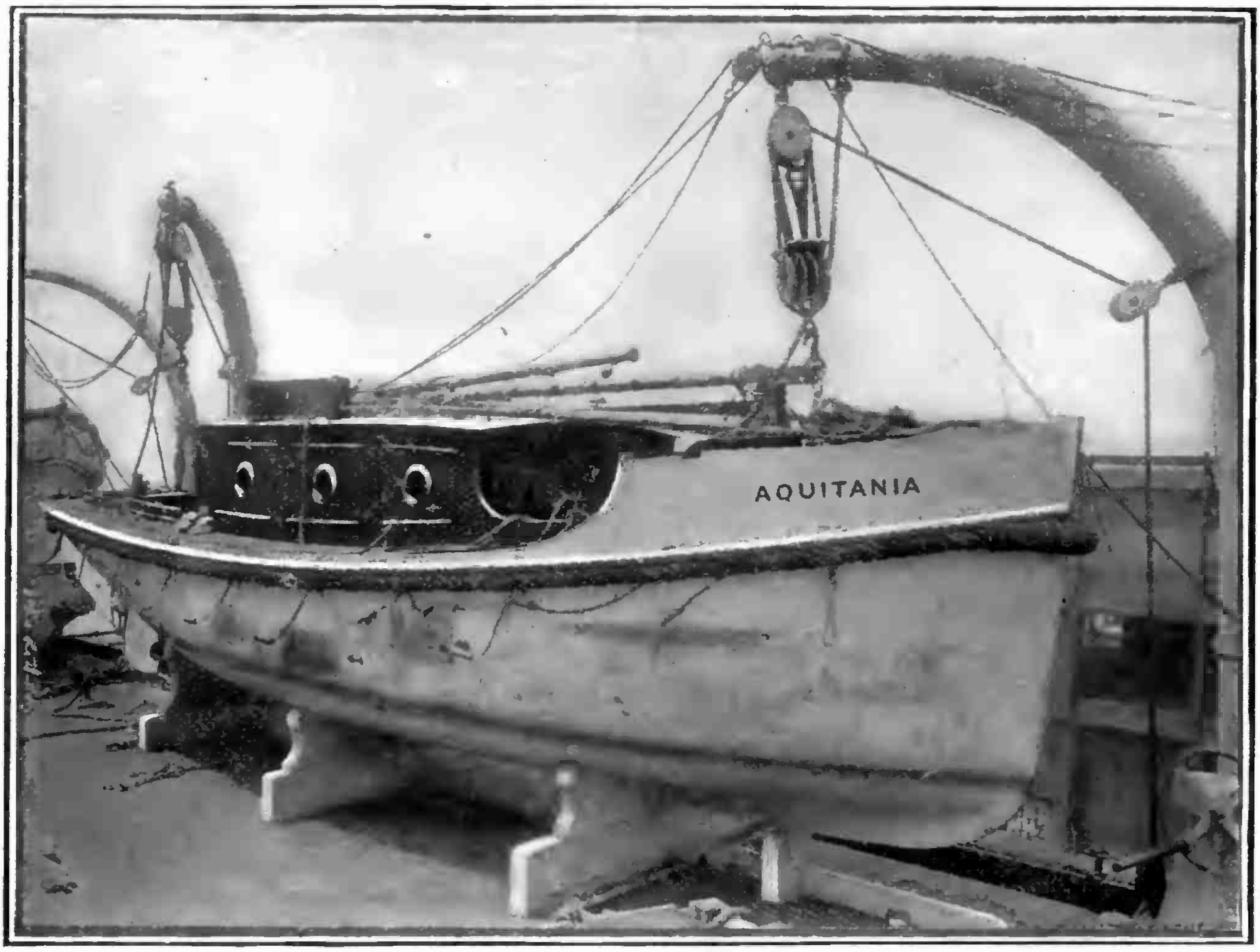
With ships becoming more numerous, the danger of collision is greater. A round 100,000 number will cover all the vessels above fifty tons in the world, including those for war and pleasure and commerce. But the majority of these vessels are always on the move. There are 500,000 different voyages made in the North Atlantic alone in a given year. The lights of a half dozen vessels were in sight when the *Titanic* sunk. On a dark night these vessels are invisible one to the other. Hence the value of wireless, of searchlights, of underwater signals, and double lookouts.

The ice patrol maintained in the North Atlantic not only warns ships by wireless of the presence of bad ice, but it also destroys the derelicts which the Gulf Stream carries into the ship lanes. This coming winter will see the first international ice patrol maintained there.

In case a vessel is in collision, then, she may call aid by wireless. If she has a



Above: Huge Searchlights are Now Carried by Many of the Ocean Liners. In the Circle: The Look-Out in the Crow's Nest. At the Right: The "Titanic" Disaster has Resulted in Many Ships being Fitted with Double Hulls, One Within the Other.



A Power Life Boat of the Steamer "Aquitania", Fitted with Every Requisite for Spending Several Days at Sea in Case of Disaster to the Mother Ship.

double skin and transverse bulkheads, it is not likely she will sink. If she does sink before aid comes, then she has a number of carefully equipped lifeboats to which crew and passengers can go. These lifeboats are much better equipped than a few years ago. Several of the larger ships even have big motor boats, fitted with wireless, that can scour the seas for aid or else tow the oared boats. The launching of these boats has never been an easy task in a high sea, but the crews are now compelled by law to exercise when in port, and the launching has become a much simpler matter.

All in all the man who can invent a combination of devices that will definitely make the sea safe will not only reap a reward in fortune but also in lasting honor.

ILLUMINATING OIL FROM NUTS

From the Philippines comes the report of an oil bearing nut of commercial value, primarily in manufacturing, but also as an illuminating oil. Tradition shows that before the advent of petroleum the natives of the islands used the oil from the *Amoora* as a luminant. Since the importation of coal oil the vegetable oil has fallen into disuse and the only traces of its use are the old implements with which it was manufactured, still in the possession of the older inhabitants.

The nut comes from a large tree bearing brown, pear-shaped fruit, the kernels, or seeds, bearing over 45 per cent. oil. The method of extraction is simply one of drying, grating and pressing, the resulting oil being thick and dark.

As the oil does not dry well it is not adapted for use with paints, but in the manufacture of soaps it is an excellent substitute for cocoanut oil. Extensive experiments are being conducted with the oil for illuminating purposes by the Philippine Bureau of Science. The abundance of the seed promises a valuable and paying industry for the islands in case the further experiments bear out the results of those already made.

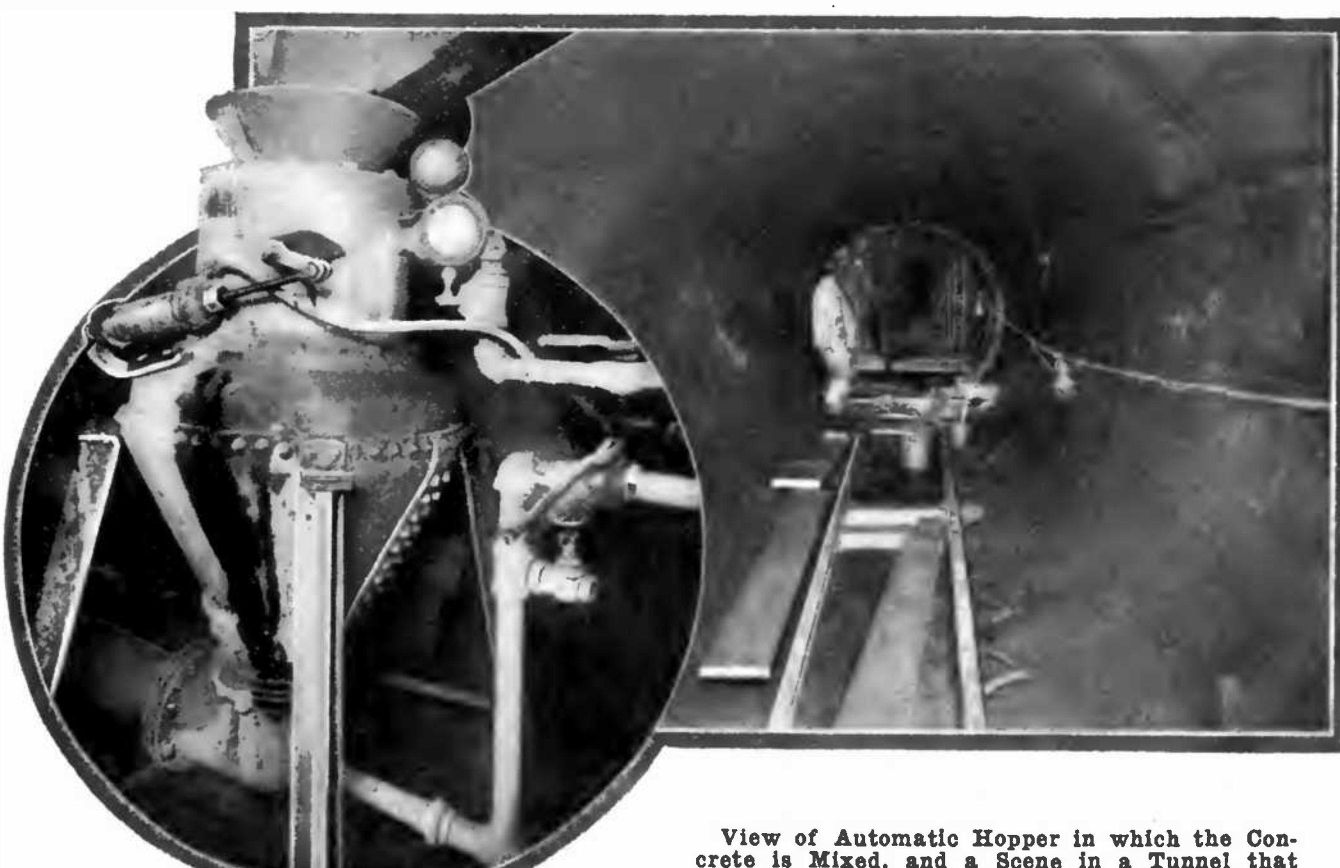
USING COMPRESSED AIR FOR LINING TUNNELS WITH CONCRETE

All tunnel linings in the recent waterworks improvements at St. Louis, Mo., were placed by the new compressed air or pneumatic system that deposits a stream of concrete behind mounted steel forms.

The system consists briefly of the following: A portable mold 36 feet long is mounted on a steel platform. At its sides angle pieces are bent upwards to support the crown. Its sides or "wings" can be turned or swung in by special arrangement, while the upper part of the form may be lowered by means of jacks underneath the platform. This design permits of readily changing the position of the mold as the work of lining a tunnel progresses.

A suspended pipe feeds concrete into the form and it is applied in varying thicknesses according to the requirements. Stone for the concrete is furnished at the top of the shaft while the water is supplied through a suitable piping.

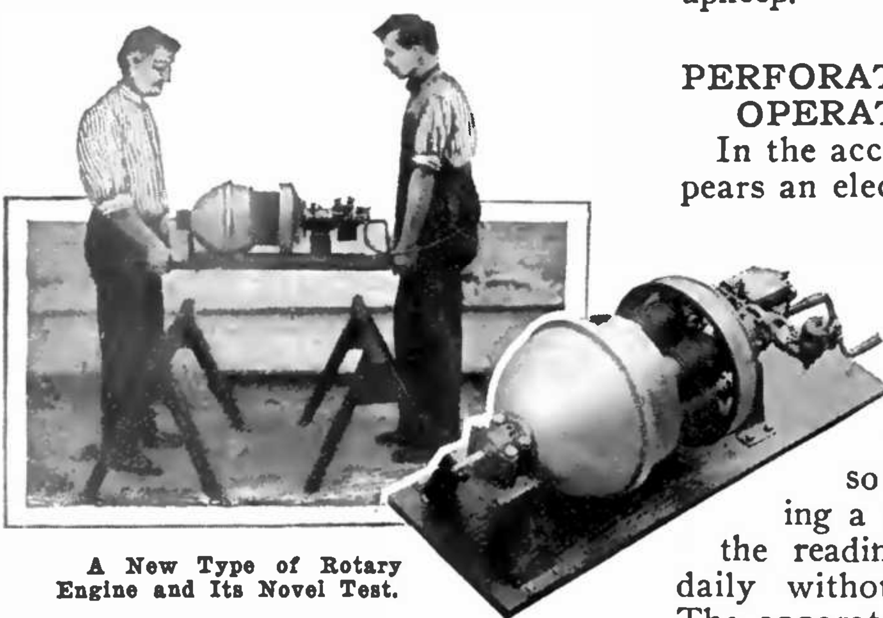
On work where a considerable length of tunnel is to be lined, two forms are employed in order to reduce the length of time required.



View of Automatic Hopper in which the Concrete is Mixed, and a Scene in a Tunnel that is being Lined with Concrete applied by Machinery.

INTERESTING TEST FOR VIBRATION

In order to show clearly how little vibration resulted from the operation of a gas engine, the machine was photographed while two men were holding it, the engine making 2,500 r. p. m., during the exposure of the plate. The fogged appearance of the left side of the photograph is due to the smoke issuing from the cylinders. The slightness of the vibration is shown by the clear detail in the picture, although the engine was held in the hands while running at this great speed. Incidentally the lightness of the engine is indicated, for while it devel-



A New Type of Rotary Engine and Its Novel Test.

ops 12 h. p. its weight is only 115 pounds. This is a five-cylinder rotary engine of the Macomber type, which is characterized by extreme simplicity of design. The view of the engine at rest shows its very compact form. Practically the entire engine revolves when it is in operation, and the motion helps both the air-cooling process and the lubrication which is arranged to take advantage of the centrifugal force. The flywheel is eliminated from this machine, together with many other parts essential to the reciprocating type of gas engine. The wiring, for instance, is reduced to 12 inches instead of many feet; the radiator, water pump, hose connections, etc., are done away with completely and the result is the reduction of both the first cost and upkeep.

PERFORATED PAPER ROLLS OPERATE ELECTRIC SIGN

In the accompanying illustration appears an electric sign of new and original design. The lettering on the sign is controlled and operated by a perforated paper roll similar to that used on a player piano. It is said that the sign mechanism is so flexible that, without changing a single electrical connection, the reading matter may be altered daily without the slightest trouble. The apparatus is operated by a small electric motor.

Absolute control is one of the prime features of this motograph sign. The mechanism is so arranged that from one to sixty words per minute can be flashed on the bulletin panel. The reading matter is introduced on the bulletin panel from the extreme right and disappears at the extreme left. By making certain perforations in the paper roll, trade marks can be shown as easily as regular lettering.

The sign shown in the illustration is now in use in Seattle, Wash., on a tall office building in the business section of that thriving city.

Perforated Paper Rolls Serve to Change the Lettering on This Attractive Electric Sign. From One to Sixty Words per Minute can be Flashed on the Bulletin Board.

Hobgoblins of the Insect World

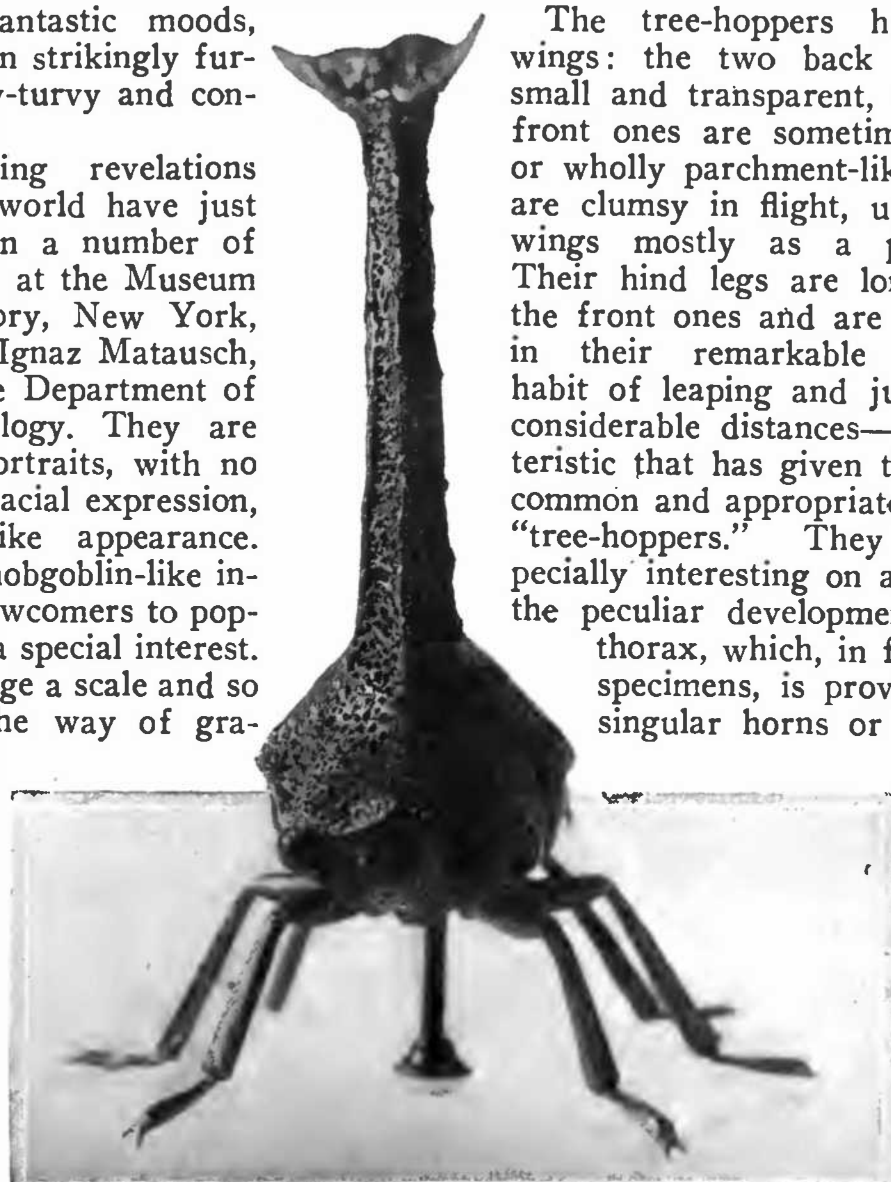
By Herbert Beardsley

AMONG the grotesque and remarkable creations of the insect world probably the least known are the peculiar and extraordinary formed creatures known as Tree-Hoppers. These bizarre and eccentric appearing little individuals, which fill one with amazement, are not apparitions from fairy land, but realities from Nature's inexhaustible treasure house of wonders. In the accompanying views a few realistic glimpses of these little known and curious shaped insects are shown for the first time to clear advantage. Nature has evidently devised and equipped them in one of her most rollicking and fantastic moods, for they have been strikingly furnished with topsy-turvy and contortionate bodies.

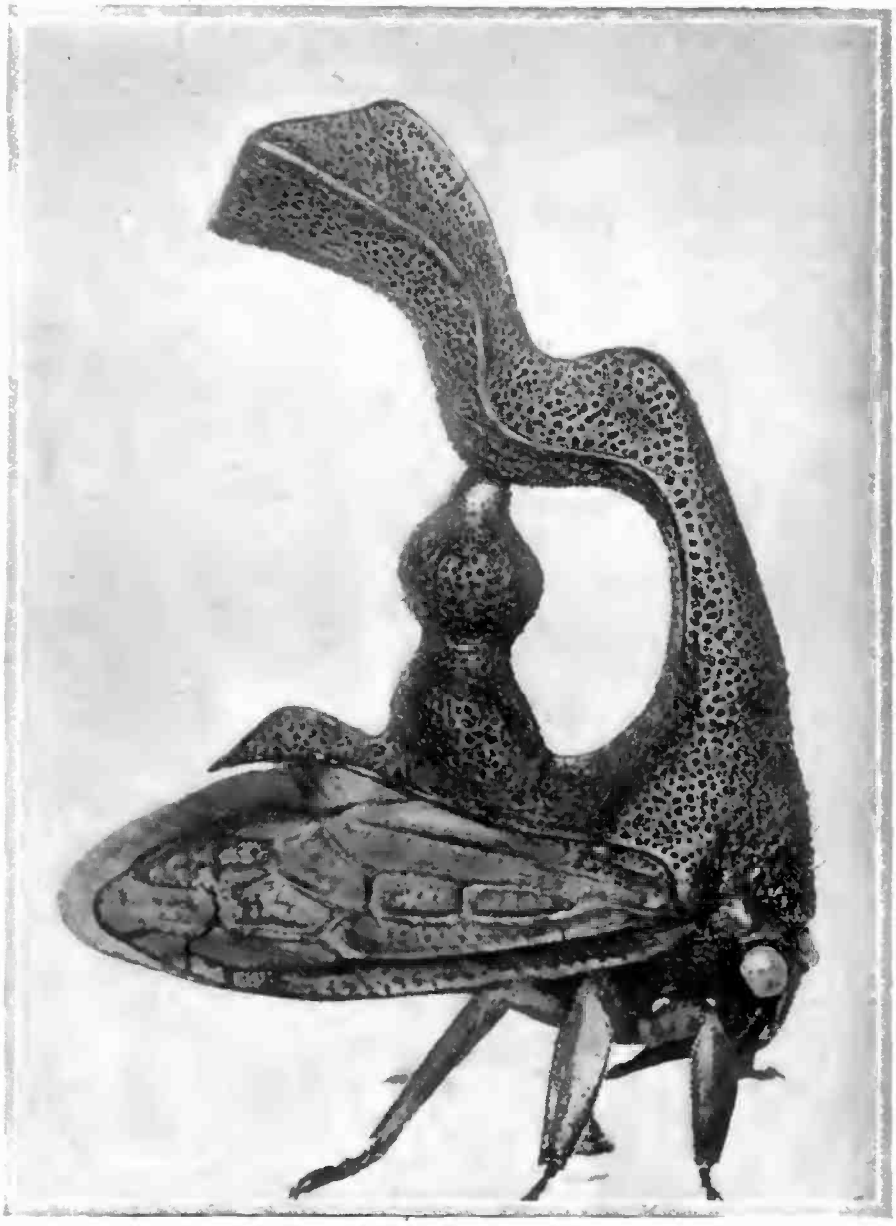
These surprising revelations from the insect world have just been portrayed in a number of large wax models at the Museum of Natural History, New York, executed by Mr. Ignaz Matausch, Preparator of the Department of Invertebrate Zoölogy. They are true magnified portraits, with no exaggeration of facial expression, shape, or life-like appearance. These droll and hobgoblin-like insects, veritable newcomers to popular eyes, are of a special interest. Nothing on so large a scale and so satisfactory in the way of graphically portraying the unsuspected and hidden wonders of form structure possessed by these tiny fantastic creatures, has hitherto been attempted in entomological work.

The tree-hoppers have sucking mouthpieces and live on the juice or sap of small trees and plants, which they extract from the stems by means of their sharp beaks that consist of several bristles inclosed in a fleshy jointed sheath. They are tiny, varying in size up to that of a lady bug. The tropical living types are gorgeously colored in many hues. They have four eyes: two large and protruding ones and two below, partly developed. Their two large eyes have a keen, droll look and the line that separates the head, in some instances, gives them the appearance of wearing spectacles.

The tree-hoppers have four wings: the two back ones are small and transparent, while the front ones are sometimes partly or wholly parchment-like. Some are clumsy in flight, using their wings mostly as a parachute. Their hind legs are longer than the front ones and are employed in their remarkable acrobatic habit of leaping and jumping to considerable distances—a characteristic that has given them their common and appropriate name of "tree-hoppers." They are especially interesting on account of the peculiar development of the thorax, which, in full-grown specimens, is provided with singular horns or protuber-



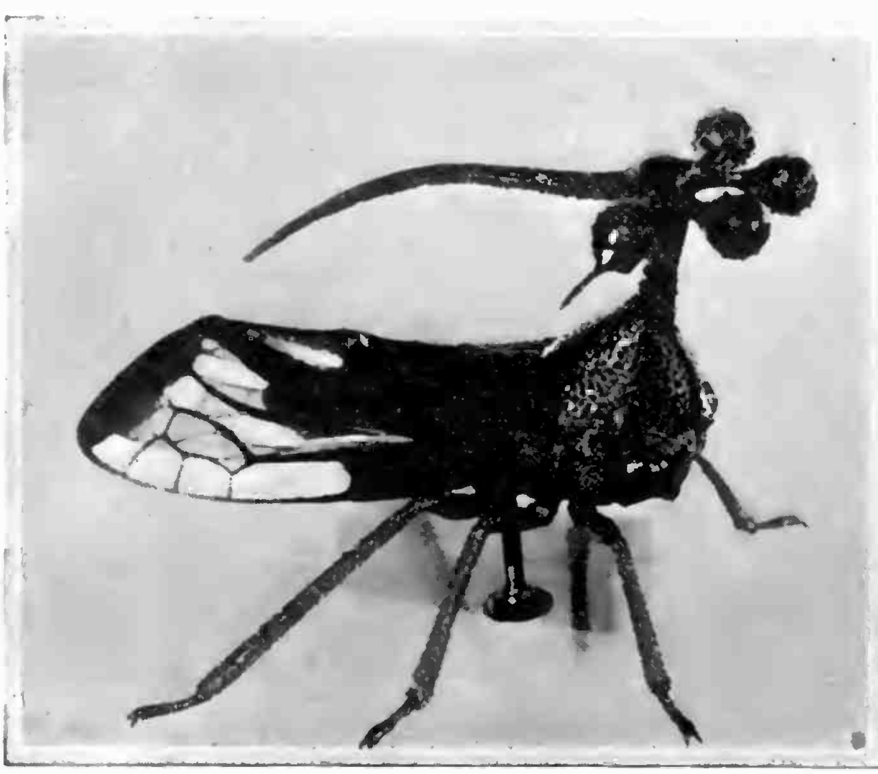
Front View of a Tree Hopper Model Made in Wax.



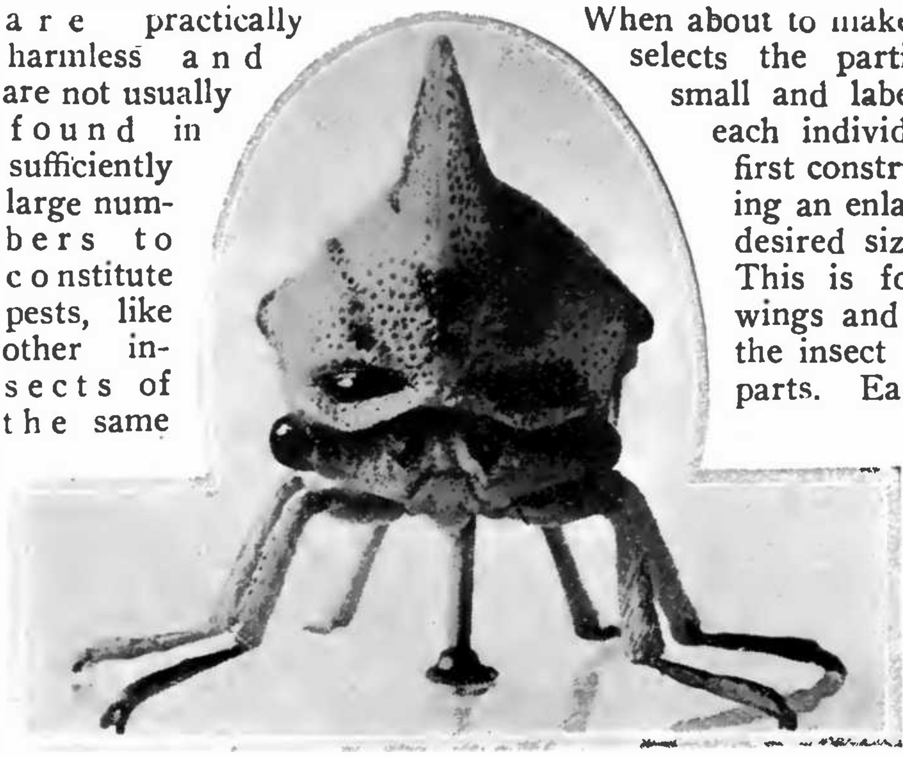
structure are not so clearly seen in tree-hoppers of temperate regions as they are in the species from the tropics of South and Central America, where they are often most surprisingly shaped and surpass anything known by their strange appearance.

Many of the tree-hoppers have mountain-like humps on their backs, the pro-thorax is prolonged backward, as a roof, over the body, often quite covering the entire insect. In some instances, the pro-thorax is an elevated night-cap. in others it is shaped like a Tam O'Shanter, and sometimes it has long horns, one on each side. Some possess a wonderful sword or blade-like appendage, having ball-like projections, which often are several times the size of the body and covered with long hairs. The little tree-hoppers

Two Wax Models of Tree Hoppers. These Species are Perhaps the Most Interesting of the Tree Hopper Family.



ances. These horns are often so freakish and extravagantly shaped that entomologists have hitherto been unable to account for their development and form. They remind one of some of the highly specialized horns and tusks of fossil reptiles and mammals. It is difficult to conceive of their being used by the insect in any way. These peculiar developments in



Front View of a Tree Hopper, showing the Eyes and Mouth.

are practically harmless and are not usually found in sufficiently large numbers to constitute pests, like other insects of the same order. Nearly all of the best specimens are obtained from various tropical parts of South and Central America, Mexico and India. The trapping of these hopping and wiry creatures, whose presence none but the experienced native collector can detect, is difficult, since many render themselves inconspicuous, owing to their small size, so as to escape detection and vigilance.

One of the most extraordinary and fantastically shaped tree-hopper comes from Sikim, India, and is distinguished by a long, curved, tusk-like continuation of the pro-thorax, extending the full length of the body. Probably the most wonderful and mysteriously shaped of all is the specimen from Brazil, with its long, dagger-like blade and four large spindle-shaped balls, two having long, pointed projections. For a droll and comic look with imitation spectacles, the Arizona specimen is decidedly amusing and unique.

The construction of the wax models of the tree-hoppers requires most patient, skillful drawing, painting and modeling When about to make a model, the preparator selects the particular specimen from a small and labelled wooden box, where each individual insect is kept. The first constructive step is that of making an enlarged scale drawing of the desired size of the intended model. This is followed by removing the wings and legs. Then the body of the insect is divided or split in two parts. Each of these separate dissected parts is measured, drawn to certain dimensions, and afterward worked up in clay to correct proportions, from which model plaster casts are made. These rough casts are next cleaned and assembled, forming only the general outline and crude exterior of the insect. This is followed by an application of the plastic material, a special wax preparation, which is worked up and modeled to the finest detail so that in measurement and shape it corresponds in every point with the finished sketch. The final process is that of painting.

A Species of Tree Hopper that has a Helmet-Shaped Body.

Home of a Settler in the Remotest Section of Southern Idaho, in which Extensive use is made of Electricity.

ELECTRICITY IN REMOTE DISTRICTS

It is surprising to notice the progressive spirit displayed by some settlers even in the most remote rural districts. In southern Idaho may be found numerous settlers who are employing electricity to light and heat their homes. The accompanying illustration is a typical home of a settler who employs electricity for heating and lighting, as well as for cooking. It is said by visitors to this house that the electrical equipment is quite up-to-date. In fact, there are few farms, or even city houses for that matter, so completely equipped. The Government is supplying power at reasonable rates and the settlers are not slow to realize its advantages.

ELECTRICITY TO BANISH ARCTIC NIGHT

The long gloom of the far north will soon be brightened by electricity. The shadows that have haunted the Arctic Circle for ages will be driven away by the blaze of twentieth century invention. Arc light will banish arctic night. All this, if the plans of the Right Rev. Peter Trimble Rowe, Protestant Episcopal Bishop of Alaska, do not go amiss.

Bishop Rowe returned to civilization, warmth and light last autumn with a deep-rooted conviction that it was time for man to get busy in the frozen north and turn on the electric lights. This conviction he confided to his brethren at the General Convention in New York, but his confidence was rewarded with a more or less audible titter. This snicker was subdued into a very respectful silence, however, when the prelate added that he had already arranged to supply electric light for Point Hope, one of the centres of the missions he has established in the Alaskan territory.

Point Hope, which for a considerable portion of the year is in continuous darkness, will soon have an electric plant. Already, Dr. J. W. Temple, of the engineering department of the University of Pennsylvania, is at work on the design, and Mr. Temple will personally supervise its construction.

The great windstorms which sweep all through the long winter night along the bleak Alaskan coast will be harnessed by windmills and made to produce the power. A certain amount of power, as well as light, will probably be generated.

ELECTRICAL WELDING OF STREET CAR RAILS

The man with the mask is melting a stick of the hardest kind of Bessemer steel down into the crack formed by the ends of the steel rails of manganese steel. He is employing the electric current secured from the overhead trolley wire and the rail. As the steel rod he holds is brought in contact with the rail, the ed by the intense heat of the current, at the rate of two inches a minute. As a result the two grades of steel in the rail and melted rod are combined together in a perfect weld. The rail is then ground off to smooth the joint former is melt- and the work is complete. The man wears a pair of heavy rubber gloves and dry shoes to prevent the 500-volt, 300-ampere current from passing through his arms and body to the ground. In order to protect his eyes, the man wears a mask fitted with orange-colored glass windows.

Workman Using an Electric Arc for Welding Street Car Rails.

It is said that rails may be welded by this process in less than five minutes and without the necessity of tearing up the pavement around the rails and stopping traffic. Hundreds of miles of street car rails in Cincinnati are being welded together by this simple process.

A Russian naval officer has just invented an electrically-operated machine for writing messages in cipher code, as well as deciphering the messages when they are received.

MISSOURI'S HIDDEN LAKE

This curious body of water lies in the heart of the Ozark Mountains. In Oregon County, Missouri, and Fulton County, Arkansas, are grouped Grand Gulf, Mammoth Spring and Spring River. Grand Gulf is the most extraordinary of the three. The shallow streams, about one-fourth of a mile distant from one another, flowing in the same direction over an elevated plateau, suddenly drop into cañons nearly five hundred feet deep. These two cañons form a junction half a mile below where they strike a mountain lying directly across their path. Now this mountain has been tunneled by the action of the water, and the natural bridge thus formed is no less a curiosity than the natural bridges of Virginia and Utah. It is almost equal to the former in size, while comparing favorably to both in point of beauty.

After passing through this mountain the united streams strike another mountain and tunnel it for several hundred feet. Then they spread out into an immense underground lake, the area of which is not exactly known. Many persons have entered the tunnel, but for the most part it is quite a mystery. No light can long exist over the bosom of this lake, which is a kind of reservoir that supplies Mammoth Spring with its sixty thousand cubic feet of water every minute.

The above Ornamental Object, as well as those appearing on the Opposite Page, have been Forged in Iron by an Expert Blacksmith. The Ordinary Tools found in a Blacksmith's Shop have been Employed in Making the Objects.

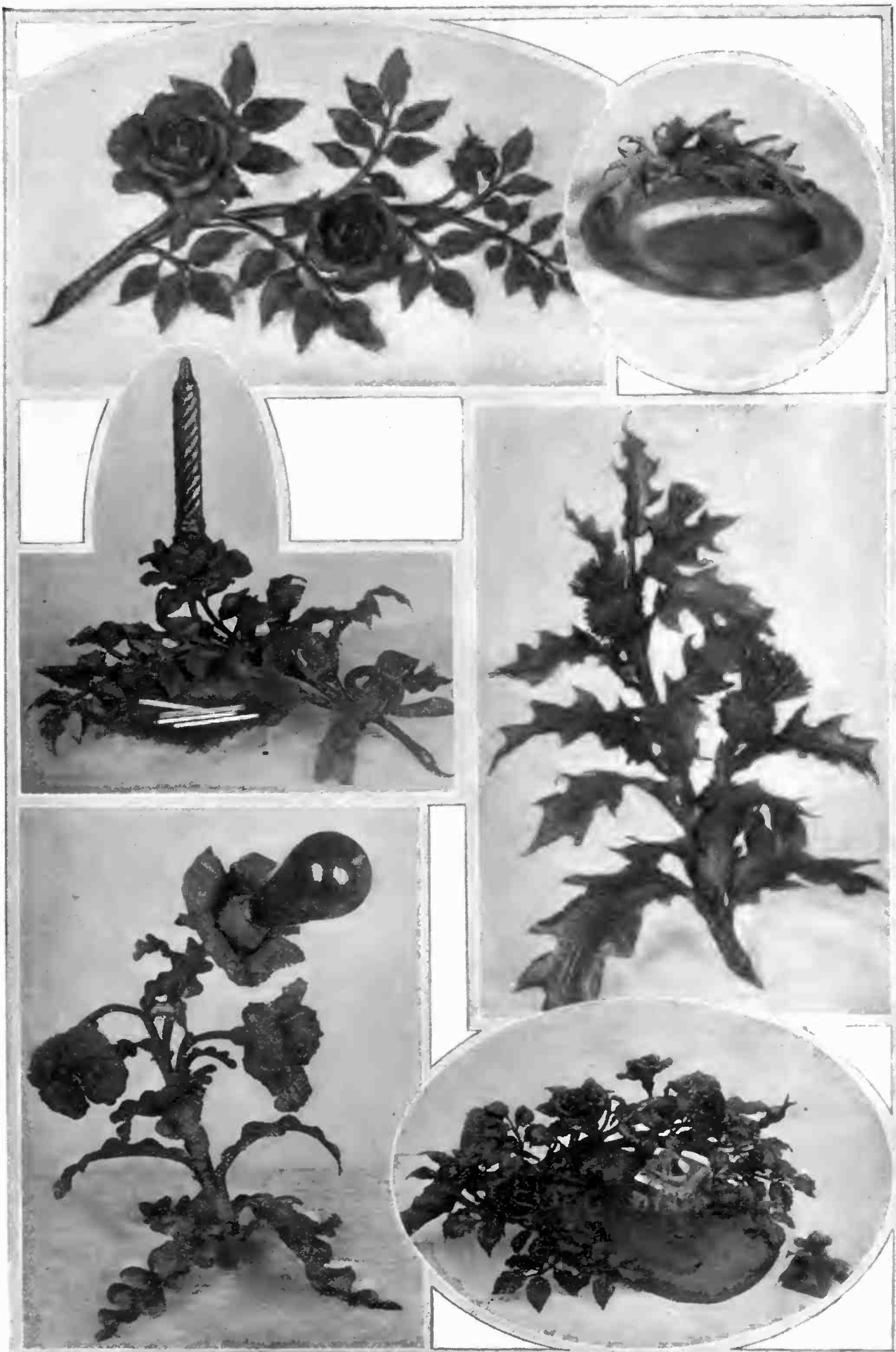
An American Wizard of the Forge

By Robert H. Moulton

WHEN a year or two ago someone ferreted out Louis Van Boeckel in a small hamlet in Belgium the art world wondered, for he had been making in an ordinary blacksmith shop, with crude tools, beautiful reproductions of flowers. To-day, much of his fine work is in the possession of the nobility in Belgium, and he has been awarded diplomas and medals at European exhibitions. A similar case has occurred in this country. There has been discovered recently, not more than forty minutes from the bustling, commercial centre of New York, a man whose skill in metal floriculture has been pronounced by critics to be superior even to that of the great Van Boeckel.

The American wizard of the forge is James Cran, of Plainfield, N. J., who not a great while ago was actually shoeing horses. All the beautiful pieces shown in the accompanying illustrations were actually made in his blacksmith shop. The only tools used were the ordinary hammer with cross peen, tongs of various sizes, pliers and one or two other simple implements, all of which were made by the smith himself.

Art critics who have seen his work agree that the welds are cleaner and neater than those made by Van Boeckel and that Cran has gone very much closer to nature in his work. Mr. Cran works entirely from memory, using no model. He studies his object closely, fixes it firmly in his mind and then begins work at the forge. When he began to do this kind of work he used ordinary chain iron; now he has adopted Swedish iron,



which is more elastic and malleable. Every piece illustrated was made in an ordinary forge.

It is an interesting sight to watch this smith make a rose. He first fashions the core and then forges the smaller petals, hammering out the ends flat and then placing them over an iron block containing holes of various sizes. By hammering them over these holes they are hollowed out until they resemble little spoons.

After hollowing out the four petals he grasps the iron rosebud in a pair of tongs, thrusts it into the fire and heats the stems. He takes it out of the fire and hammers the stems into a solid mass with the flat faced hammer. He forms the larger petals in the same manner and, after having thus made the complete rose, grasps it as in the beginning, with larger tongs, heats it again and finally places it, a red hot glowing mass, forming a beautiful representation of the genuine, natural flower, in a vise.

The smith then takes a device shaped somewhat like a screwdriver and opens the outermost petals first, then in a less degree the inner petals. By an artistic twist of the tweezers he gives these petals the natural looking curl. It is difficult to open out the petals without breaking them off, and to learn to do this required considerable patience and experience on the part of the smith.

It requires about 135 minutes to make a rose such as has been described. An attractive spray of leaves may be made in about half an hour.

All the different parts of the flowers are forged separately, and the veins or radial ribs of the leaves are produced by means of the cross peen of the hammer. The same instrument, when slightly tilted and when the blows are directed toward the outside of the leaf, produces the serrated edge of the leaf. The piece from which the leaf is made is first held in the tongs by the stem, heated and flattened on the anvil. The centre rib in the leaf is formed by having that part lap over the anvil's edge while the artist is flattening the leaf.

A rose branch thirteen inches high and made of ninety-four separate pieces, which required thirteen hours to make, excites the admiration of all who see it.

Mr. Cran began his apprenticeship as a blacksmith in Scotland when 18 years of age. But horse-shoeing, repairing plows, harrows and wagons grew monotonous after a few years, and Cran, in looking for something new in blacksmithing, had the good fortune to get employment from Mr. James Anderson, the famous maker of iron golf club heads, of Anstruther, Scotland. At this kind of work he soon became an expert and was successively employed by several of the best-known manufacturers of golf irons in Scotland.

In 1896 he came to the United States and was probably the first man to make a hand forged golf club in this country.

After a few years devoted to this work, he started out to follow machine blacksmithing, and to-day superintends the most intricate and exact work in forging the fine products of one of the largest machine tool concerns in the country.

It is in his leisure hours that he himself works at a small forge which he has fitted up in the rear of his home, molding into everlasting beauty wreaths of flowers that defy the winter's frost.

In parts of the West where trees are scarce, sage brush is used for fuel. In Nevada the large main stems are trimmed by Indians at $3 a cord and delivered to the user at about $6.50. Sage brush burns rapidly and is rather dirty, but produces good heat.

Those familiar with the eastern mistletoe only have no idea of the great losses due to this parasite in the forests of the West, where it counts next to fire and insects in the amount of damage done.

Virginia uses more wood for boxes and crates than any other state, followed by New York, Illinois, Massachusetts, and California, in the order named.

The Insurance of Arms

By Martin Wells

THE sudden precipitation of peaceful Europe into a trampled field of war, last August, has had the result of raising the important question in the United States as to whether the country is in any kind of shape to meet a possible aggression or enforce a just demand upon another power.

There is a great, natural advantage in the isolation of the United States, surrounded as it is on practically three sides by vast expanses of salt water and on the north by the practically unarmed colony of a friendly nation. This advantage has been dinned into the ears of the public, taught in our school books and generally accepted at a greater value than its worth; in addition, there is a strong sentiment throughout the country that when the time comes, a nation of a hundred million can surely arm and with the vastness of its numbers, eventually hurl an invader into the seas across which he came.

And upon what is this last belief founded? Upon past victories in every war in which the country has been engaged?

It is not a fair test. In all its history, the United States has never struck against the full weight of a great country. The revolution was won by the American farmers and colonists fighting only against what comparatively few troops England could spare from European fields. India held her attention; France held it and the guarding of a vast empire expanding held her forces at other points.

In the war of 1812, Wellington needed every man and every ship against the power of Bonaparte, and only a comparatively small force of the red coats marched into the United States. And yet, they took Washington and burned the capitol!

The Mexican war next engaged the armies of the country. The enemy had but a small force, poorly equipped, poorly armed and poorly led, and, as wars go, it was but a small war. Again, it is no test, the United States against Mexico.

The Spanish-American war found us opposed to the armies of a great country fast lapsing into obscurity from its past glories. And it found us grossly unprepared in men, and, what was more important, arms and munitions. Even our troops were compelled to use to a certain extent the deadly black powder which served to indicate the position of our troops to the Spanish fire. Spain was by no means a powerful foe.

To illustrate from another angle, the civil war was a great war, but it was between factions of our own people—and *neither* side was prepared. Had either the Union troops or the Confederates been ready, with ample store of weapons and equipment, despite the lack of training, that side would have been in a position to enforce its will at an early date.

Here is what lack of preparedness cost the whole country as a result of the civil war. The Union losses were 349,994 dead. Figures are not available for the other side, but it is easily safe to assume that 150,056 Confederates died in the war. These figures give a total of at least 500,000 American lives sacrificed upon the field of battle or incident to it.

At the average age of these young men who died that a united country might be firmly welded, it is safe to assume that they might have lived for twenty years—certainly that long on the average.

To be modest in our assumption, each of them would have done work to the value of at least $500 a year—very modest—a total for the twenty years they might have averaged, of $10,000 apiece. Multiply that by the 500,000 who might have lived, and the result is five billions of dollars.

In addition, the war cost the country

at least one million dollars a day to feed, clothe, arm, transport, pay, etc., the forces. This totals a little sum of $1,500,000,000. Added to the other sum, it reaches the staggering cost to the country of six and a half billion dollars, to say nothing of the distress and destruction from which part of the United States has never recovered.

Now this staggering cost was due to the fact that the Federal forces were not prepared for war. Had there been an efficient army susceptible of prompt expansion to a fair war strength, the South would have been overawed or a decisive victory early in the conflict would have ended it. Instead, it dragged along for four years, the first two being mainly given to preparing for war. At the first Bull Run it was a question as to which side would run first.

¶ Time was when the geographical isolation of the United States could be depended on for protection against aggressive European powers. Today, with the efficient battleships and transports in the hands of many European nations, the three thousand-odd miles of ocean expanse offers but a small obstacle in the way of an invasion.

But any possible foe of the country to-day is amply prepared.

The United States far tops the world to-day in wealth. It leads with one hundred and thirty billions, its next competitor, England, trailing along with eighty billions. France has sixty-five billions, Germany sixty, Russia forty, and so on down.

Our treasure house is not very well locked.

We are only supposing, of course, but let us suppose that some country, coming out of the present great war, finds itself with a magnificent army and navy and an empty treasury. And, right across the Atlantic, is the richest country in the world, practically undefended.

Could the navy stop him? The navy would get the first crack at him, for the seas must be kept clear for an enemy to maintain a line of communications for supplies and men from the home land.

The naval lessons of the European war to-day teach that ships of short range cannot compete with ones more modern. Admiral Craddock's ships plunged to the bed of the Chilean coast before the outranging of the German ships. The heavier guns enabled the Germans to keep out of the range of the English gunfire and batter their opponents almost at leisure. And the tables were turned off the Falkland Islands. Two British battle-cruisers added their weight to the lesser English ships and the German fleet was sunk by the same process—outranging.

To-day, the United States has eight dreadnaughts built and four building. A navy's strength is measured in terms of dreadnaughts, on the same principle of range and weight of gunfire. England, the leader, has twenty completed, with sixteen building; Germany, next in rank, owns thirteen built, with seven more nearing completion.

But the point is that lesser nations, possible foes, have a building programme under way which, within a comparatively short time, will relegate the United States to a lower place in the list. In lesser ships of vital importance, such as battle-cruisers, cruisers, destroyers and submarines, the navy of our country is sadly behind, as shown by the official records. And yet we have a sea coast far greater than that which any other country has to protect.

A foreign foe may not land troops in force in America until our navy is defeated. And, as dreadnaughts only count, it is seriously to be doubted if we could hold off the fleet.

If victory is denied our fleet, there

are a thousand points on the coast at which an enemy may land; say somewhere on the New England coast. The enemy would strike with the speed of lightning and it would be utterly impossible with the small regular force in the United States, augmented by the National Guard, to mobilize in time and in sufficient force to check the advance upon New York, for that city would surely be attacked from the land side.

With finance paramount in this country, it is not difficult to foresee the result of the capture of New York. From the narrow canyon of Wall street, terms of peace would be dictated—and they would probably be agreed to. And the price of peace would certainly be gold, running into the billions.

Rifles cannot be built in a day; nor field guns, equipment, air craft and the all-important ammunition. Roused by invasion, the men of the land would flock to the colors—but there would be nothing to place in their hands, because arms had not been provided beforehand.

The business man insures his life and his plant against fire. Each one would regard it as poor business to fail to do so. Yet, lulled to a false security, the American business man does not insist that the same precautions he takes individually be taken by the nation to preserve his honor, his business and his home!

There is a huge disparity between the stupendous cost of war and the cost of the relatively small insurance premium paid for preparedness—an efficient and ample navy, guns, equipment, ammunition and a trained nucleus of men, for expansion to war strength!

No man wishes war, if he has even the vaguest appreciation of its terrors, its sorrows and its awful price in blood, treasure and national humiliation for the vanquished. But the fact that it is not welcome will never prevent its coming. No one supposes that the masses of the European countries which are now plunged in war were willing that their families should be subjected to the affliction which must result to hundreds of thousands, nay, millions. And the nation is founded upon the home.

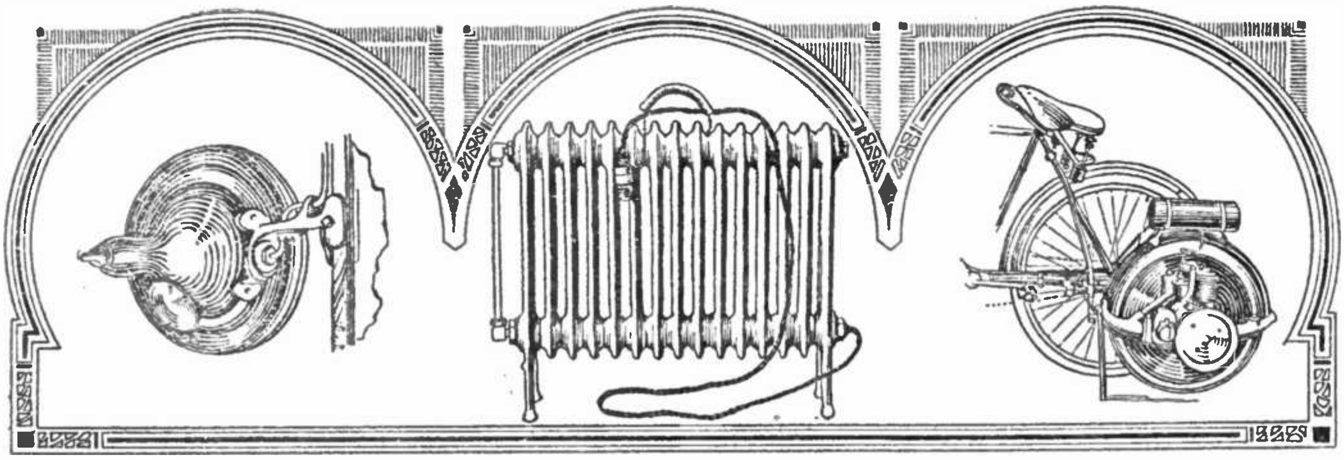
And, furthermore, no man can speak for a country, whether republic, monarchy or loose confederation. Each and every one, to give a just answer to the question, must think the matter out for himself.

War is practically unavoidable in the present scheme of world organization and policies. And, as each man nurses at least a spark of regard for the country which has borne him or is of his adoption, he is, underneath, jealous for its prestige and success. But regrets, after a defeat, are powerless to remove the sting.

¶ Military preparedness does not necessarily mean that a nation has military and conquering aspirations. Nor does it follow that a nation so prepared is more easily led into war with its neighboring powers, but quite on the contrary an efficient system of defense is no invitation for an attack.

An adequate appropriation for a navy, guns and equipment, can easily be spared—so much more easily than is the case with any other power. The correct sense of security which must result will do far more to increase prosperity by the very insurance against molestation and the ability to maintain principles of honor, than the comparatively small saving effected by an unsound niggardliness in the expenditure of national moneys, wherein an impotent force for defense is maintained. In case of defeat, the present force would be a dead loss.

Let each man think it out for himself—and act.



Mirror Searchlight. Steam-Electric Radiator. Motor Wheel for Bicycle.

Recent and Improved Devices

Mirror Searchlight

A combination of an electric searchlight and a diminishing mirror has recently been placed on the market. The device serves the double purpose of an adjustable searchlight at night and in the day time a mirror for making visible vehicles approaching from the rear. The illustration shows this device which comes equipped with all the necessary brackets and wiring attachments so that the lamp may be installed on a car in a few minutes' time. The switch is in the handle of the lamp so that the driver can turn the light on and off as desired without interfering with the other lights. The lamp can be prepared for emergency service by wiring it direct to the battery.

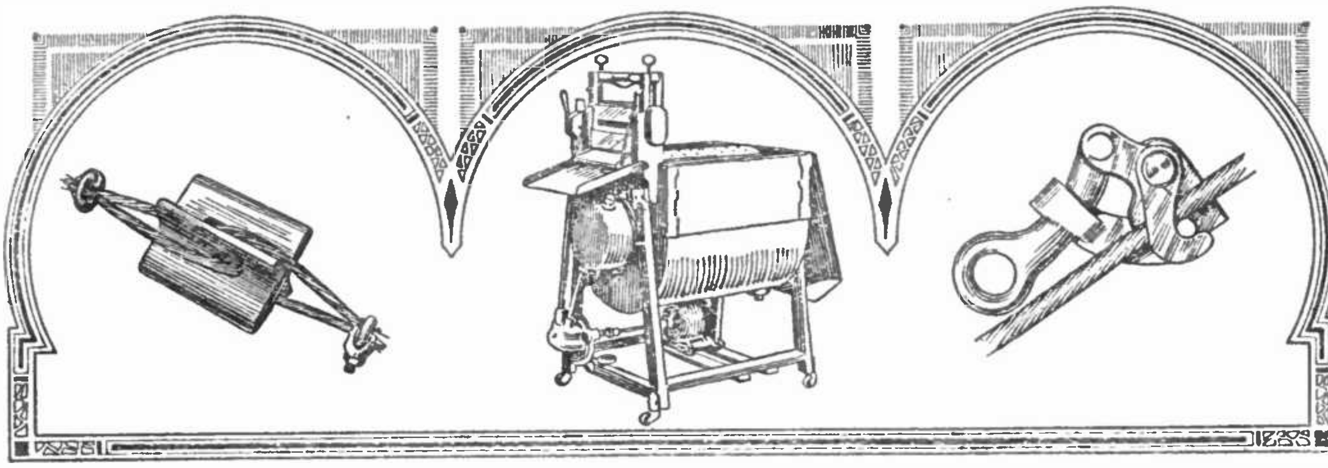
The lamp embodies many conveniences, among which may be mentioned an adjustable bracket which automatically locks at any angle desired, and a detachable back reflector so that the lamp bulb may be removed and replaced in the reflector without fingering or soiling the highly polished surface.

Steam-Electric Radiator

The electrical steam radiator is the latest contribution to the heating field. The device utilizes the heat radiating characteristics of the steam radiator and the steam is produced within the heating unit through a system which is simplicity itself. To all outward appearances, the device resembles an ordinary steam radiator. In the bottom water way of the radiator is placed a tube and within this tube is inserted another, some three-sixteenths of an inch smaller. A resistance coil, properly insulated, is inclosed within the smaller tube. In the radiator is placed a small quantity of water—from one and one-half to three quarts, according to the size of the radiator. The water reaches the inner tube containing the heating coil through an opening in the larger tube. As soon as the current is turned on, the thin film of water becomes heated and circulation commences.

Motor Wheel for Bicycle

The application of a gasoline motor to an ordinary bicycle is not new, but it is extremely doubtful if many of the attachments of this nature are of much practical value. As a rule the attachment involves some more or less serious and expensive change in the frame of the bicycle. The motor wheel illustrated herewith, on the other hand, is quite a departure from the conventional attachments of this nature as it comprises a complete power unit in itself and re-



Porcelain Strain Insulator. New Washing Machine. Improved Come-Along.

quires no changes whatever in the frame of the bicycle for its successful attachment and use. The power plant consists of a small gasoline motor mounted in a substantial frame which is carried on a rubber tired wheel that serves as the driver. Above the wheel is mounted the gasoline tank. A glance at the illustration will show that the device is entirely self-contained and that it is attached quite easily by means of clamps to the framework of the bicycle, of which, however, it is quite independent.

Porcelain Strain Insulator

A porcelain strain insulator that is said to be very good for antenna work is shown in the illustration. An important feature of the insulator is found in the fact that should it break, the wire will still be supported. The design is such, however, that a fracture of the insulator is highly improbable and its mechanical strength is of a high order. Another important feature is the extremely low electrostatic capacity of the insulator. It is made in three sizes, 3½. 5 and 6½ inches in length.

New Washing Machine

The aim in designing the electrically driven washing machine shown in the illustration was to insure absolute safety even to the most careless operator. There are no chains or belts to catch the fingers or clothes and every moving part is enclosed. The wringer is so arranged that it is impossible to get the fingers caught in the rolls, thus making accidents from this source impossible.

The machine is driven by a small motor which can run both washer and wringer at the same time. Two switches, one for the washer and the other for the wringer, control the operation of the machine.

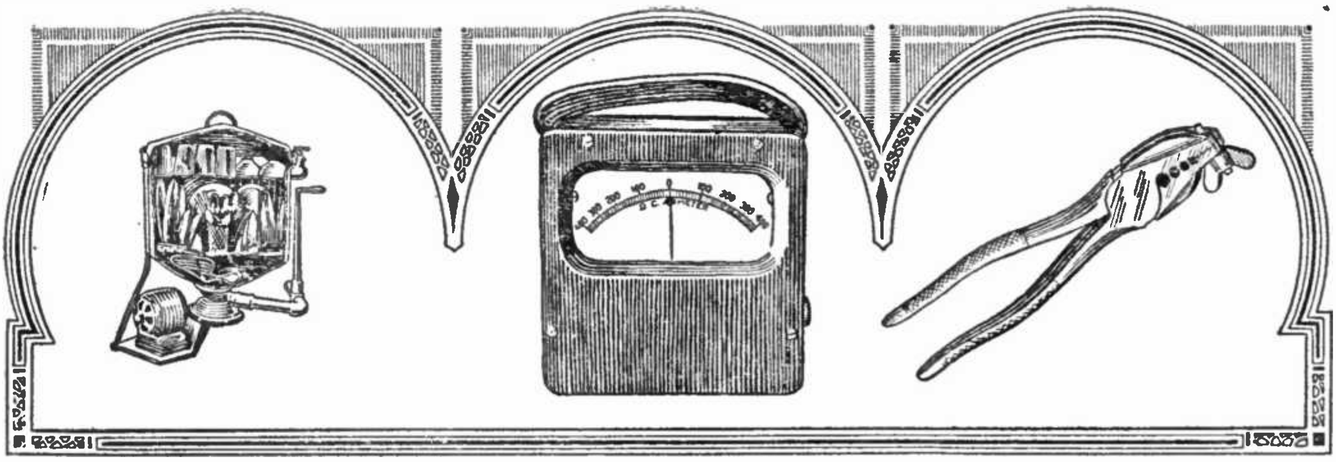
Ordinarily, the body of the machine is made of galvanized steel and the cylinder of maple, but if desired a copper body and cylinder can also be furnished. A special feature of the design is the limitation of the width so that the machine will pass through a 25-inch door.

Improved Come-Along

A new type of come-along or cable clamp has recently made its appearance on the market. This clamp presents several features of interest, among which is the fact that it can handle cable up to ¾ inch in diameter; in fact, the device is said to be the outgrowth of a demand for a clamp to accommodate a cable larger than ½ inch in diameter.

The body and handle of the clamp are of steel forging and the eccentric is of hardened tool steel. The most interesting feature of the construction is the addition of a swing latch which engages with the stud on the lower jaw, thus centralizing the pressure on the cross bolt which is made of turned steel of great strength.

A solution of ammonia and alcohol will serve to remove lacquer or varnish from metal.



Motor Driven Dishwasher. Cable Testing Ammeter. Wire Connecting Pliers.

Motor Driven Dishwasher

It is inevitable that the motor driven dishwasher will become as important an electric utility as the washing machine or vacuum cleaner. Many women who do their own work employ others to take care of the laundry or housecleaning, but nearly all do their own dishwashing three times a day.

The illustration shows the appearance of the internal construction of a new dishwasher that is designed to relieve the housewife of this disagreeable task. The dishes are placed in wire trays, the container partly filled with hot water and soap added. At the bottom of the container is a dasher which is rotated rapidly by a small electric motor and which forces the water up between and over the dishes, washing them thoroughly in a few minutes. The dishes are not merely sprayed but are swept by solid waves of hot water. Since the trays do not move, there is no danger of breaking the dishes. The bottom of the container is conical in shape so that drainage is perfect. The washer is supplied for wall mounting as shown or for portable use. It is manufactured in three sizes for home, restaurant and hotel use.

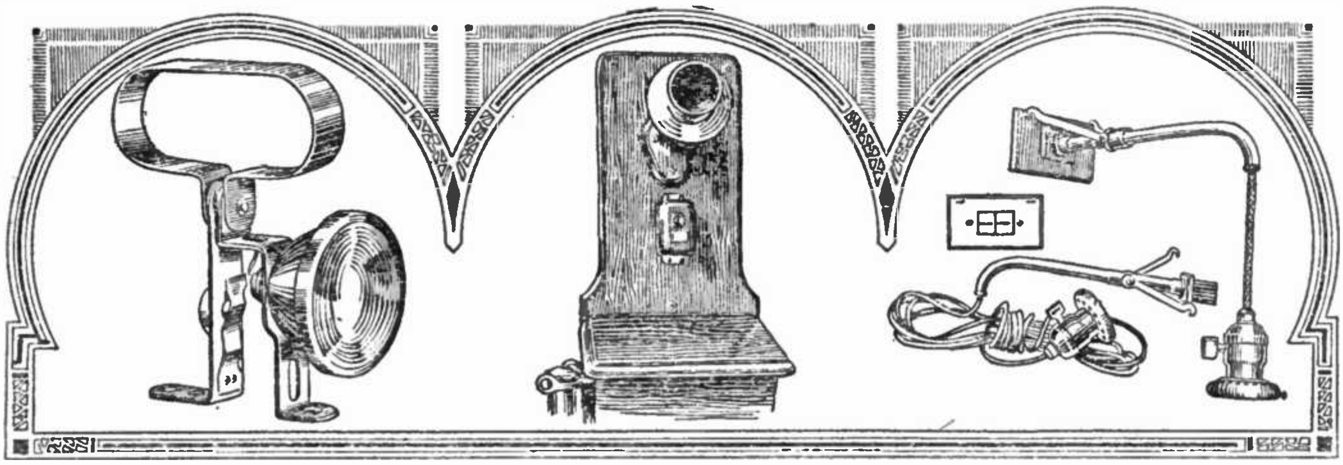
Cable Testing Ammeter

A new cable testing ammeter, designed to measure the current passing through a cable without either disturbing same or opening the circuit, has recently been introduced. This instrument, an illustration of which appears on this page, can be prepared for immediate use by removing the "U" shaped iron strap, placing the conductor within the loop of same and reinstalling the strap to the instrument terminals. When the key is pressed, the instrument will indicate the value of the current flowing in the enclosed conductor.

The instrument resembles in principle those of the D'Arsonval type excepting that the permanent magnet is displaced by the detachable iron loop and the moving coil circuit is energized by a small auxiliary battery. It will readily be seen that when the iron loop encloses a conductor carrying current, the flux in the magnetic circuit of the instrument will be proportional to the current flowing in the conductor and as the moving coil is energized by a separate current of constant value, the deflections of the pointer on the scale will be proportional to the current flowing in the enclosed conductor.

Wire Connecting Pliers

An interesting contribution to the field of electricians' tools is seen in the novel wire connector illustrated on this page. It will be noted that the connector resembles a pair of ordinary pliers of substantial design with the addition of a wing nut on a swivel bolt at the nose of the tool to hold the jaws tightly together after the twisted joint of wire has been inserted. This feature makes it necessary to use only one hand in gripping the wire even though it be of steel and quite heavy. In fact,



Hand Lamp Attachment.

Measured Service Meter for Telephone.

Ingenious Lighting Fixture.

the tool illustrated is fitted with holes to take wires of Nos. 8, 10, 12, and 14 gauge.

The connector is designed for use with any of the standard sleeve connectors so popular with linemen at the present day. Obviously it should prove a boon to the wireman and in examining the device, one is tempted to reiterate the old story, "Why has no one thought of it before?"

Hand Lamp Attachment for Dry Cell

Among the several attachments designed to convert a dry cell into a hand lantern, probably none is simpler in design and withal more effective than that illustrated herewith. The device is simplicity itself and it consists essentially of a frame and handle of metal strip so formed that it may be clamped to the top of a dry cell of standard size by means of the binding posts, thus accomplishing the double purpose of making the electrical connection and mechanical support at the same time. Attached to the frame is a reflector carrying a small tungsten lamp and a lens to direct the rays in the desired direction. A push button, also incorporated within the frame, enables the user to turn the light on and off at will.

Measured Service Meter for Telephone

As the result of several years of experimental work, the manager of an independent telephone company has produced a telephone service meter system which, in the opinion of a number of prominent telephone men, is both practical and of great merit. The device, which is intended to register the calls made from the instrument upon which it is installed, is in actual operation in a Pennsylvania city, and enables telephone subscribers to keep a check on their calls.

Ingenious Lighting Fixture

A lighting fixture intended for use in hotel sample rooms has recently been introduced on the market. The distinctive feature of the device is its portability and ease of attachment to various parts of the wall from which it is suspended on a bracket. As the illustration shows, the lamp socket is swung out from the wall at any point desired, and for its attachment the base of the supporting bracket is inserted in a wall pocket, any number of which may be located in various parts of a room. The device is very useful in the household in connection with reading lights over a bed, side table, etc.

Its most prominent use, however, is for the lighting of hotel sample rooms and its design is the result of a demand on the part of hotel managements for a ready means of properly lighting the bedrooms of hotels for the peculiar requirements of this class of work and at the same time to provide a fixture that can be removed quickly and easily without leaving any disfiguring marks on the walls of the room.

Recording a Plant's Emotions

By Basanta Koomar Roy

THROUGH the medium of the electric current a Hindu scientist has recently startled the world by proving that plants have temperaments and that in many ways they have the characteristics of human beings. The scientist, Jagadis Chunder Bose, professor in the Calentta University of India, is now lecturing before the various academies of science and in the leading American universities. Previous to this he has appeared before learned bodies in Europe.

Bose utilizes electricity to make plants express their feelings, or "speak," as it were. His researches in plant life have been classed by eminent scientists of Europe and America as something that may be favorably "compared with the works of the masters of the historic past."

Philosophy claims that life is one and that it permeates both the organic and inorganic worlds. The life in minerals, the life in plants, and the life in animals are identical. The difference is that of degree of development and expression, and not of kind. The philosophers' intuitive claim cannot always be accepted as true until science has proved it to be so. It is doubtful if any other man has proved this unity of life by accurate scientific methods to such a great extent as Dr. Bose.

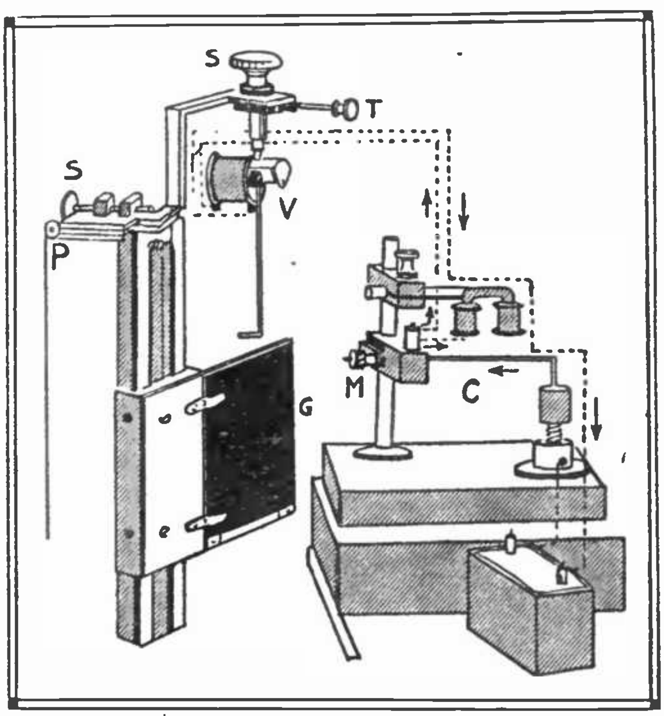
The eminent plant physiologists of Europe claimed that the response in plants was not a true excitation, but was a hydro-mechanical blow. Dr. Bose has conclusively proved the fundamental unity in the response of plant and animal. And it has been done by specially invented mechanical devices that make the plant itself prove it by writing on a plate the story of its own life.

Hit an animal and it feels the pain, trap an animal and it shows its displeasure and tries to escape, drug an animal and it is affected according to the property of the drug. Do plants react under similar circumstances? No, we are sure to say. "But wait a minute," says Dr. Bose, "don't jump to conclusions. It is risky. Look here, by my machines I have made the plant exhibit many of the activities which we have been accustomed to associate only with animal life."

Dr. Bose proves his statement by means of his unique machine called the "Resonant Recorder." A description of this machine may be quoted from Dr. Bose's Friday Evening Discourse delivered at the Royal Institution in May last: "The principle of my resonant recorder depends on sympathetic vibration. If the strings of two violins are exactly tuned, then a note sounded on one will cause the other to vibrate in sympathy. We may likewise tune the vibrating writer V, with a reed C. Suppose the reed and the writer are both tuned to vibrate a hundred times per second. When the reed is sounded the writer will also begin to vibrate in sympathy. In consequence of this the writer will no longer remain in continuous contact with the recording plate, but will deliver a succession of taps a hundred times in a second. The record will therefore consist of a series of dots, the distance between one dot and the next representing one-hundredth part of a second. With other recorders it is possible to measure still shorter intervals. It will now be understood how, by the device of the resonant recorder, we not only get rid of the error due to friction, but make the record itself measure time as short as may be desired. The extraordinary delicacy of this instrument will be understood when it is noted that by its means it is possible to record a time-interval as short as the thousandth part of the duration of a single beat of the heart."

By means of the recorder a plant automatically records how it is affected by cloud or sunshine, by rain, drought or drugs. The internal story, rather the mind, of a plant can never be studied by human vision, but it has been made visible by machines invented by human mind—the mind of a scientific man from mystic India.

Is the plant equally excitable at all hours of the day and night? When certain plants close their leaflets, it is poetically claimed that they have gone to sleep. But Dr. Bose claims that these "movements are brought about by variation of turgor and have nothing whatever to do with true sleep, for similar closure of leaflets takes place under precisely opposite condition of strong light." But by taking automatic records of its daily diary, the sleeping hours of the plants have been detected by Dr. Bose. Speaking before the Columbia University in early December, 1914, Dr. Bose claimed that plants were like extremely fashionable ladies that kept very late hours at night and fell asleep at the early hours of the morning. A plant makes up for its late hours by gradually waking up by noon. It remains in a condition of uniform sensibility all the afternoon.



"Resonant Recorder" Apparatus that is Employed to Record the Emotions of Plants.

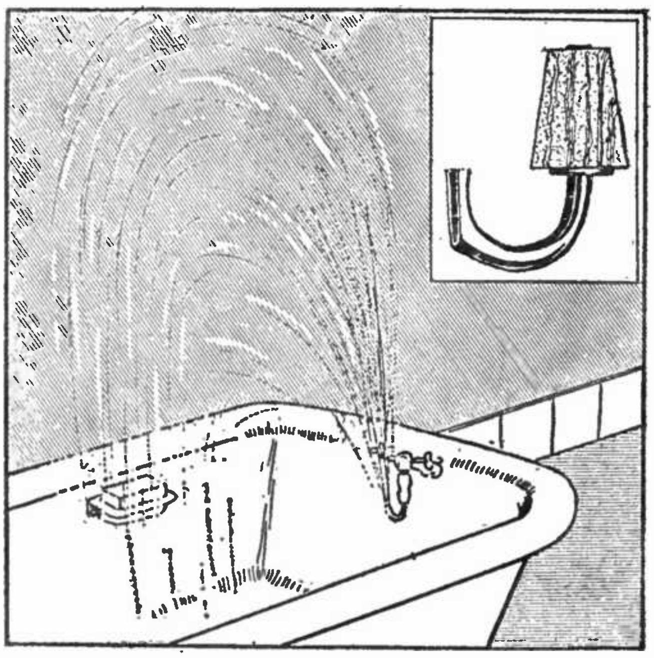
The plant, like the animal, is injuriously affected by impure air. It is a superstition to think that plants flourish in carbonic acid gas. Dr. Bose has taken records that go to prove that it is suffocated in carbonic acid gas, just as human beings are. The effect is, of course, modified in sunshine by "photosynthesis." Ozone makes the plant thrive, but renders it easily excitable. Sulphuretted hydrogen is fatally injurious to the plant. Chloroform has the same effect on the plant as on a human being. "The ludicrously unsteady gait," says Dr. Bose, "of the response of a plant under alcohol could be effectively exploited in a temperance lecture."

As in life, so in death, the plant shows similar signs of decreasing vitality, and then comes a moment in the life of the plant when it refuses to respond to excitation. As in man, so in the plant a spasm—the contractile spasm of death—passes through every fibre of its being. This spasm is accompanied by an electrical spasm as well. "In the script of the death recorder" (another of Dr. Bose's inventions) "the line that up to this point was being drawn, becomes suddenly reversed and then ends. This is the last answer of the plant." Thus the plant dies and long after this it begins to wither and show outward signs of death.

Thus Dr. Bose, who combines in his mental make up the ideals and the culture of both the East and West, proves the heart beats of the plant, with all its tales of joys and sorrows, of diseases, disappointments and death — conditions that affect the animal world from the cradle to the grave. The message of Dr. Bose's researches is: This world is pulsating with life—a life that is one and indivisible.

A SHOWER BATH SPRAY CARRIED IN THE VEST POCKET

A Californian named D. S. Rockwell, who makes his home in Berkeley, has been surprising his friends with a new kind of shower bath, one that may be carried in the vest pocket or in a lady's handbag. This useful and curious article is constructed of nickel-plated brass tubing and a cork. The tubing is bent something in the manner of a fishhook and inserted into the cork through a hole in the center, with a round plate to keep it from slipping. The tube is flattened at the end with a narrow slit about half an inch long cut in it. This slit is what causes the water to spray. Whenever the tired and dusty traveler desires to cool and refresh himself with a shower, he need not be discouraged by finding that there is no shower bath in the home he is visiting or the small-town hotel. The convenient little attachment is instantly fitted into any faucet in bath tub or lavatory, and the water turned on.

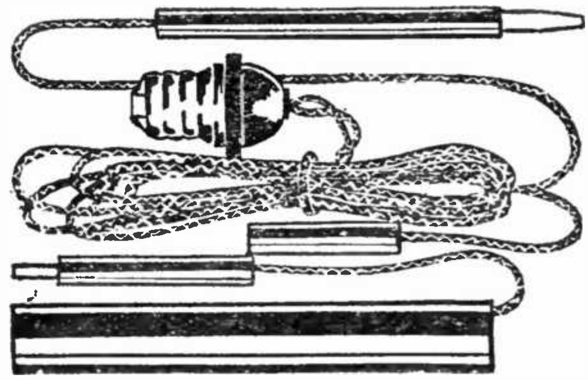


Simple Shower Bath Attachment that may be Carried in the Pocket.

A good sized spray is the result, and while not as powerful as the regular shower, it is delightful when the traveler is hot and fatigued from his journey, yet despises, as many Americans do, the tub so dear to the Englishman's heart. The cork is cut tapering to wedge into the faucet.

Handy Testing Outfit

In the accompanying illustration is shown a circuit tester of useful design. The outfit comprises an attachment plug, several feet of flexible cord, a connection case containing sockets in which plugs are inserted to form various connections, an incandescent lamp to serve as a signal, and a special contact piece in an insulated handle with which to make contact with the wire of the circuit to be tested. The incandescent bulb may also be used as a trouble lamp for



Different Parts of a Handy Circuit Tester.

use in places that would be inaccessible to the ordinary bulb.

Battery Table Lamp

There is a large demand from rural districts where electric current is not available for battery lamps of a practical design.

A table lamp designed for use with battery current has recently been placed upon the market. The lamp comprises a standard attached to a wide, decorated base. Through the base and standard a silk covered flexible wire runs down to the battery box which holds four dry cells. The small incandescent bulb is placed within a reflector of ingenious design which concentrates the rays of light in such a way as to increase the useful candlepower of the diminutive bulb. The complete unit is especially adapted for use as a reading or shaving lamp and a swivel joint makes it possible to turn the reflector in any direction.

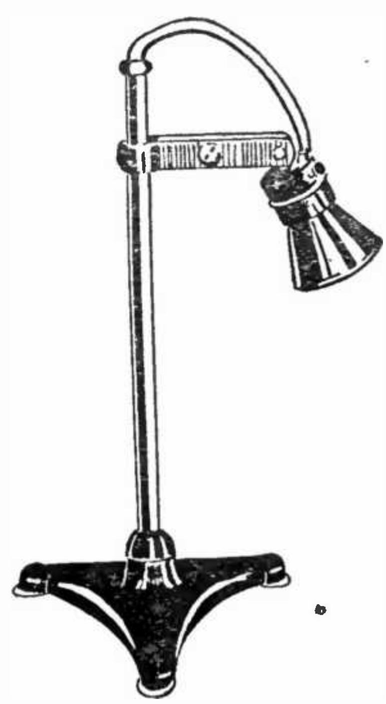


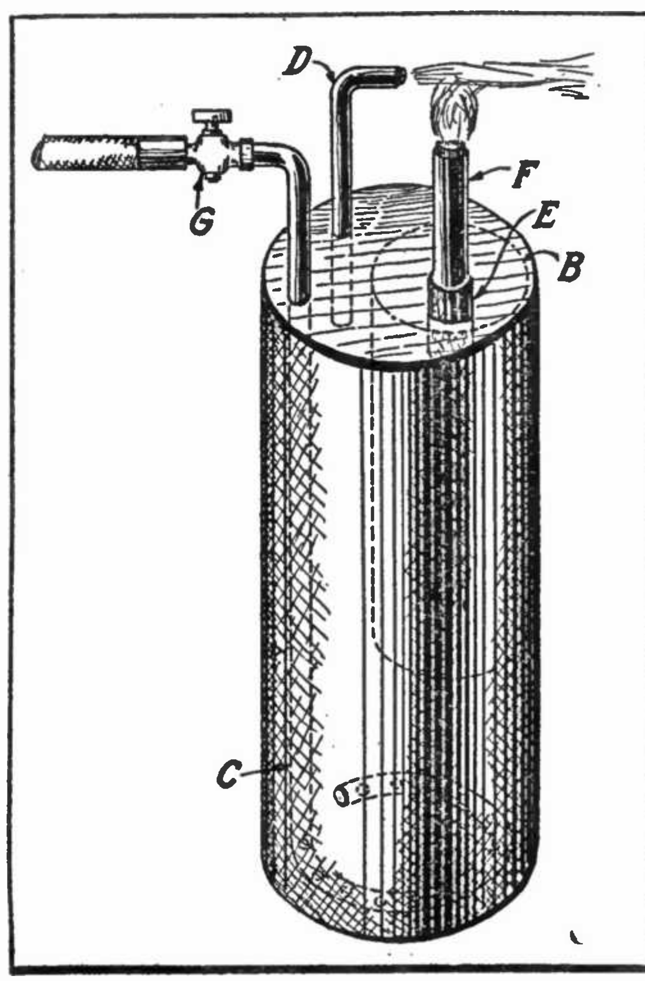
Table Lamp that is Operated from Dry Cells.

Electrician's Blow Torch

The drawing illustrates a blow torch that may be made by the amateur workman out of materials to be found in the average workshop. The torch consists essentially of a large receiver or cylinder for the air and within this cylinder a much smaller one, shown at *B* in the drawing, to hold the fuel which may be either alcohol or kerosene.

The outside cylinder is formed by rolling up a piece of sheet copper 7 x 11 inches and securing at the seam with solder. Heads of sheet copper are fitted to top and bottom. The bottom of the cylinder may be permanently closed as soon as the copper forming the wall has been bent to shape. The top of the cylinder, however, should be left open in order that the smaller cylinder *B*, together with the air inlet and outlet tubes *C* and *D*, may be fitted in place. The smaller cylinder is 2 inches in diameter and 3 inches long, closed at the bottom. The top of the small cylinder is soldered to the lid of the large cylinder after the wick holder *F* and its collar *E* have been secured in place. The collar *E* is a short piece of pipe about 1 inch in length and ¾ inch in diameter, while the piece *F* is about 3½ inches long and of a diameter that will permit it to slide through the collar *E*. The latter is soldered to the cover of the cylinder in order that the piece *F*, which carries a wick, may be removed quite readily to permit the fuel to be poured into the small cylinder. Care should be taken to see that there is no leak from the small can to the large one.

The air inlet *C* is a piece of ¼ inch copper tubing about 20 inches long and bent at one end into a circular form to add mechanical strength when it is fitted into the large cylinder, as shown by the dotted lines. After being passed through a hole in the top of the cylinder and carefully soldered in place, its upper end is to be bent to a right angle and the valve *G* screwed on the threaded end. The next operation is to insert and



fasten with solder the air jet *D* which is a piece of ¼ inch copper tubing bent to a right angle and plugged in its end with a short piece of rod of suitable diameter. A 1/32 inch hole drilled through the plug forms the jet. The torch may be completed by soldering the top of the cylinder in place.

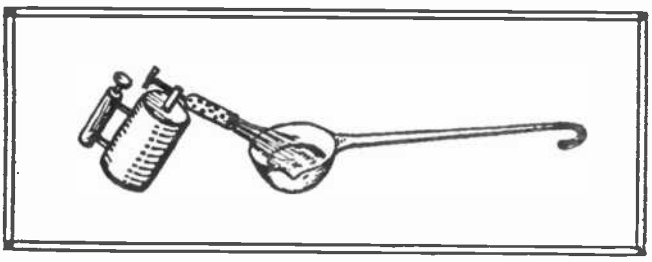
To operate the device the fuel chamber *B* is partly filled with alcohol or kerosene, preferably the former, the wick lighted and air pressure from the mouth applied to the rubber tubing attached to *G*. The torch will send out a hot blue flame from 2 to 4 inches in length, according to the value of the air pressure in the large cylinder.

Contributed by

CHAS. E. DIMICK.

To Melt Babbitt Quickly

If at any time the busy workman desires to melt a small quantity of babbitt, lead or other metals having a com-



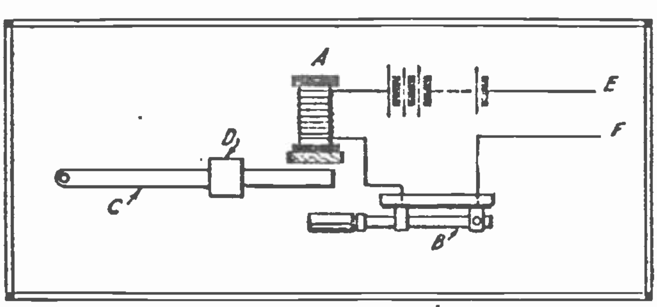
paratively low melting point, he will find that by employing the method suggested herewith, he will save both time and fuel. The amount of material it is desired to melt is placed in a ladle or other container and the flame of a gasoline torch forced directly upon the surface of the metal to be melted.

Contributed by

B. W. VERNE.

A Simple Circuit Breaker

This little circuit breaker is intended to automatically break the circuit in charging storage batteries when the



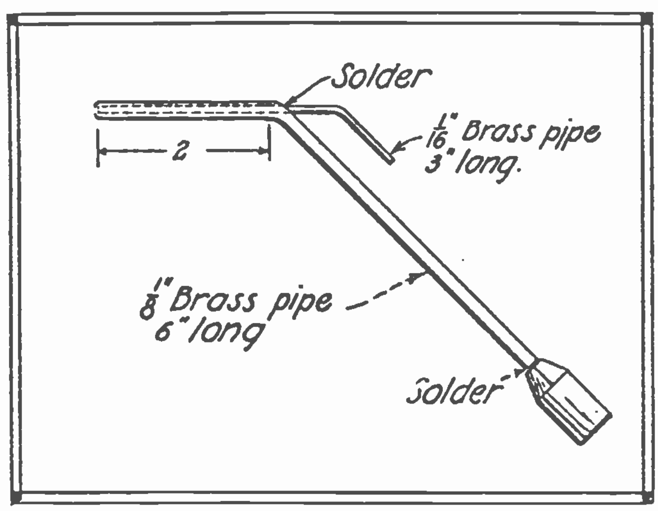
voltage of the dynamo falls below a predetermined point. The breaker consists of a small electromagnet *A* connected in series with battery, dynamo and a single pole knife switch, a pivoted bar *C* carrying a movable weight *D* and so arranged that when the proper amount of current is passing through the magnet *A*, the pivoted bar is held against the magnet. When the voltage lowers beyond a certain degree the magnet releases the bar which swings on its pivot and opens the switch *B*. By sliding the weight back and forth on the bar *C*, the breaker may be adjusted to operate on various values of current. As the magnet is placed in series with the circuit, its winding should be of comparatively coarse wire of low resistance.

Contributed by

A. H. WAYCHOFF.

A Blow Pipe

A very useful tool in the shop is the blow pipe, although this tool in its usual form is cumbersome and unwieldy for fine work. The blow pipe suggested in the present contribution has the advantage of being small and light, and it will enable the worker to direct a fine, hot



flame into places where previously only a jeweler's soldering iron could be used. The blow pipe is made entirely of small pieces of tubing that may be found in most workshops.

The first operation is to bend a 6 inch piece of ⅛ inch copper tubing to an angle of 45 degrees at a point 2 inches from one end. In the angle a hole is drilled to permit a piece of 1/16 inch brass tubing to be inserted as shown in the drawing. This small tubing may be found in a discarded gas burner of a certain type wherein it is used as a by-pass or pilot burner. The small tubing is soldered where it passes through the angle in the large tubing and at such a point where the end of the small tubing is just within that of the large. The tip of the large tubing should be spun over to partially close the opening as the drawing indicates.

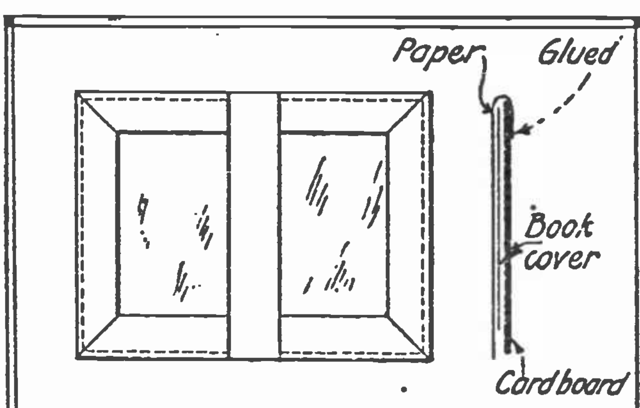
The gas supply is attached to the larger tubing by means of a rubber hose connection and the smaller tubing is likewise connected to a source of compressed air such as a sheet metal tank fed by a hand or foot bicycle pump. For the successful operation of this blow pipe a fairly good air pressure is required and the amount of air admitted to the blow pipe should be under fine control by means of a valve attached to the air tank.

Contributed by

GEORGE MENHINICK.

A Substantial Book Cover

A protecting cover for paper covered text books, such as are used by high school students, can be made by the average boy as shown in the drawing. Two pieces of heavy cardboard are cut to the size of the book cover and a piece of heavy brown wrapping paper is cut sufficiently large to entirely cover the binding of the book and permit the edges of the paper to be folded over and glued to the cardboard pieces, thus forming a double pocket. A book slipped within this cover may be used daily without having its binding soiled or stretched, and when the home-made cover becomes



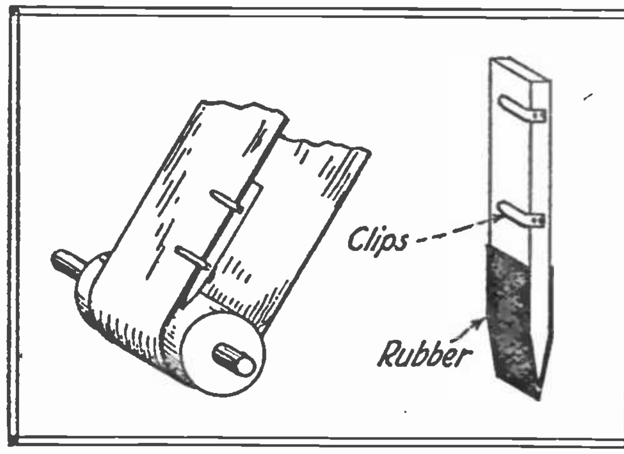
soiled a fresh one may be substituted, for it is the work of but a few minutes to make a new cover.

Contributed by

JOSEPH HATTENBERGER.

To Prevent Belt Motion

Have you ever stopped a machine in order to make some minor repairs and then had it suddenly start, either due



to the loose pulley binding or the belt lapping over on to the revolving pulley? In such a case the result is generally a bruise or a cut for the operator, and if the machine happens to be a planer the injuries may be of a severe nature.

A simple method to prevent accidents of this nature is to take a piece of hard wood about 1 foot long, 4 inches wide and 1½ inches thick, and bring one end down to a wedge shape, fastening clips on one edge and a piece of sheet rubber over the wedge-shaped end as shown in the illustration. In use the clips are slipped over the belt with the rubber-covered wedge fitting between pulley and belt. The slightest motion of the belt of course wedges the whole arrangement tightly.

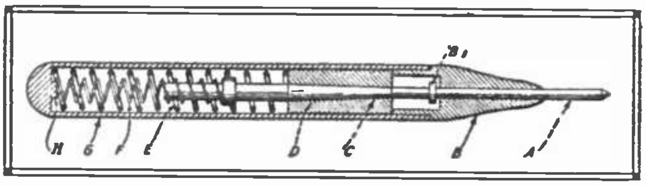
Contributed by

B. W. VERNE.

Automatic Prick Punch

The object of this punch is to obviate the necessity of using a hammer to make the impression. In use, the point of the punch is placed at the desired spot and by merely pressing down on the handle a blow is delivered within the latter, which forces the tip of the punch into the metal that is to be marked.

The shell of the punch *G*, is of ½ inch stubbs steel, 4 inches long and bored out to ⅜ inch inside diameter. The part shown at *H* is recessed to receive the end of the coil spring *F*. The piston or striking punch C is made in two parts and is joined at B^1 with a shoulder on its upper end to receive the spring F. The hammer D is a cylinder 1 inch long which slides freely in G. Through the



center of the cylinder D, is a taper hole that engages the taper part of C by friction. The nose B is turned to fit the internal bore of the cylinder G and is drilled to pass the shank of the punch A. The action of the punch is as follows: When pressure is applied to the point A, the part C with D is pushed against the spring E, and as D is held on C by the friction of the taper joint only, it is obvious that when the pressure of the spring E becomes too great the hammer D will be released striking the shoulder B^1 with considerable force causing the point to make an indentation in the metal against which it is placed. The spring F serves to push the plunger C back to its original position.

Contributed by

JAMES McINTYRE.

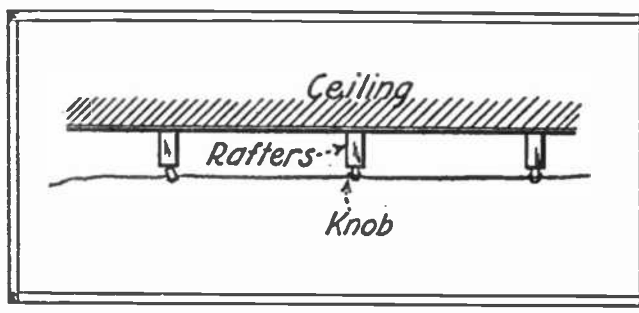
A Handy Tool Post

The tool post shown in the drawing will be found very useful, as it will enable one to use tools made from bar steel without dressing. By making linings for the tool post with different shapes of openings in them, the tools may be made from round, square, or flat stock, as the case may be. In this tool post the tool may be placed in any desired position or swung around throughout an entire circle to afford adjustments for various turning and boring operations. This tool post has been in use in the shops in which the contributor has been a foreman for a number of years, and it has proven very successful.

Contributed by W. C. DEIBERT.

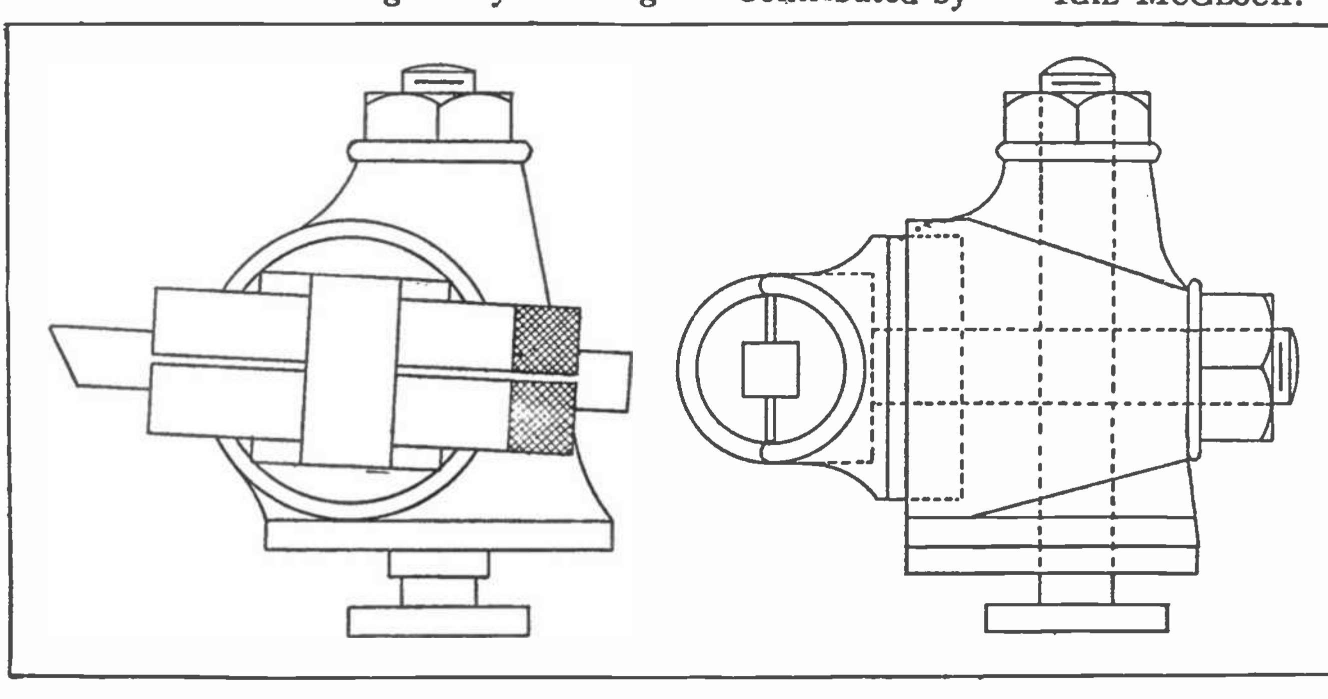
To Stretch Wires Taut

A suggestion for the wireman that may be applied while doing open work is offered in the accompanying illustration. The idea is to catch the wire on the knob, making it a trifle short of the finished distance and starting to drive the



nail at an angle. When the nail is finally driven home, it will straighten up the knob, stretching the wire tightly between rafters.

Contributed by RAE McGEOCH.

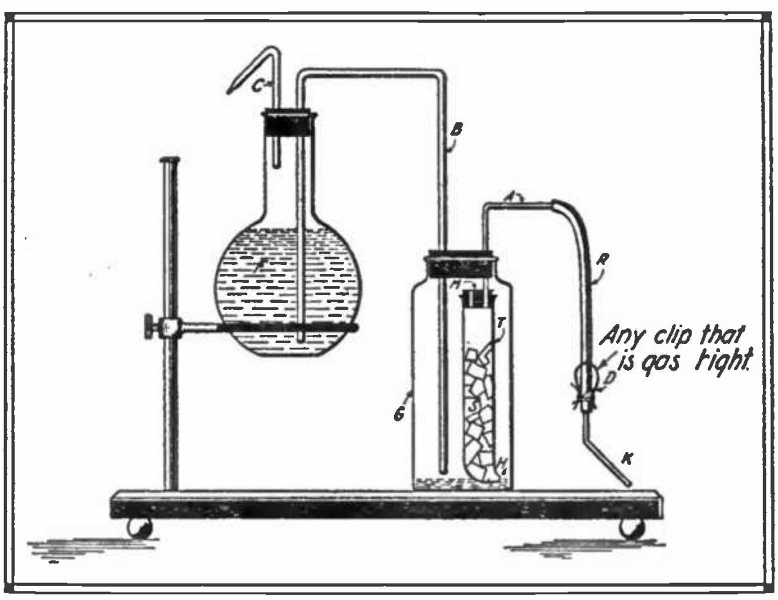


A HYDROGEN SULPHIDE GENERATOR

By E. C. Swetman

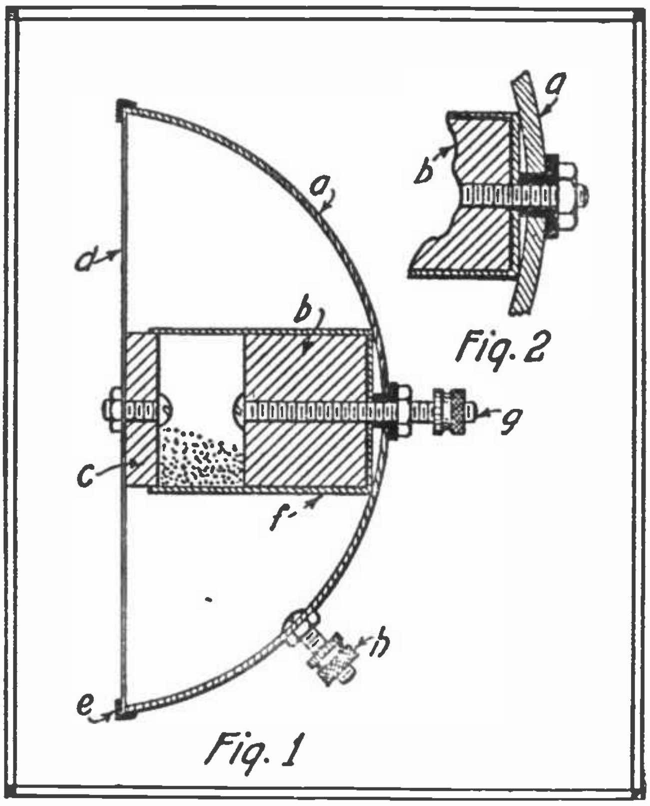
Students in advanced chemistry have frequent use for a good hydrogen sulphide generator when doing qualitative analysis. A Kipp generator is not always obtainable, and a temporarily constructed apparatus which requires attention each time the gas is used is inconvenient. The generator hereunder described supplies a stream of gas whenever desired, and ceases evolving the gas when it is not wanted.

The generator proper consists of a wide-mouthed bottle *G*, fitted with a two-hole rubber stopper. Inside the bottle is suspended, by means of the glass tube *A*, a large test tube *T*, which must be of soft glass so that a small hole may be blown in the bottom at *H* when it is held in a flame and softened. This test tube is also fitted with a two-hole rubber stopper. A florence flask *F* is supported so that the bottom is at least as high as is shown in the diagram. This flask is also fitted with a two-hole rubber stopper. A glass tube *B* connects the flask and the bottle, while a small piece of tube *C* provides an open air passage. Another glass tube *A* leads from the test tube and bottle, and is connected to some rubber tubing *R* to which is attached a clip *D* and a glass outlet *K*. All the connections about the generator must be tight so as to prevent the escape of gas. A little paraffin might be run around the connections and the large stopper to make the escape of gas impossible. A very thin coating will be found ample.



Set the generator in operation as follows: Fill the flask with dilute hydrochloric acid, leaving an air space which is connected to the outside air through *C*. Place some ferrous sulphide in the test tube and connect up the apparatus as shown in diagram. See that the clip *D* is open and apply pressure at *C* so that the acid will flow into the bottle. Once started, the acid will continue to flow on the siphon principle. As the acid fills the bottle, creeping up around the ferrous sulphide to which it gains access through the hole *H*, hydrogen sulphide is generated and forces the air from the bottle through the outlet *A*. When the gas itself is indicated at *K*, close the clip *D*, which prevents further escape of hydrogen sulphide. The gas continues to be evolved in *T*, increasing the pressure in the bottle, and driving back the acid through *B* into the florence flask, until the acid is no longer in contact with the ferrous sulphide. Then the evolution ceases till the clip *D* is opened again, relieving the pressure in the generator and allowing the acid to siphon over and come into contact with the ferrous sulphide, generating more hydrogen sulphide gas.

To insure the proper working of the apparatus, a small space should be left at *M* between the rubber stoppers. Also the test tube should not come closer than ½ inch from the bottom of the bottle. This is to allow for any gas that may be generated after the surface of the acid has left the ferrous sulphide, as otherwise some gas might be forced over through *B*, thus disturbing the siphon action the next time gas would be required.



A Home-made Telephone Transmitter

A telephone transmitter of simple but effective design is suggested in the drawing. The materials needed for its construction are: The gong from an old electric bell, two round carbon buttons obtained by slicing off a round battery carbon by means of a hack saw, three battery binding posts and a piece of thin tin large enough to cover the open end of the bell.

A hole is drilled in the carbon button, *b*, large enough to insert one of the binding posts. A piece of paper is put on the back of the button to insulate it from the bell. The binding post *g* is also insulated from the bell as shown in the enlarged view, Fig. 2. After this button has been bolted to the bell a piece of paper is rolled into a tube as shown at *f* and slipped over the button *b*. A binding post is fastened to the bell as shown at *h*. The diaphragm *d* is cut out of thin tin and the carbon button *c* fastened to it. The carbon grains indicated by the dots in the drawing can be made by pounding a piece of carbon into small bits. The granulated carbon should be sifted through a sieve and only the pieces about the size of a pin head should be used.

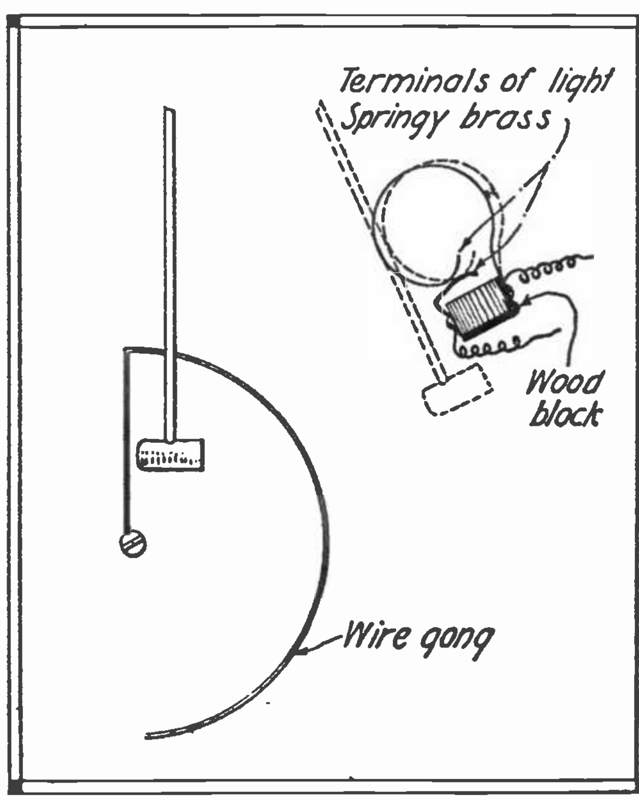
To assemble the transmitter, place a small quantity of the carbon grains in the paper tube *f* and then put on the diaphragm, making sure that the button *c* slips into the tube. The diaphragm is then held in place by soldering three or four small pieces of tin to the edge of the bell and then bending them over the diaphragm. The transmitter may be used without a mouth piece if desired or this finishing touch may be added through the exercise of a little ingenuity.

Contributed by

E. R. THOMAS.

Wiring a Clock

The contributor had occasion to wire up a clock in the house so that the hours would be struck in his room. This had to be done without damaging the clock in any way and without interfering with the striking mechanism. It was observed that every time the clock struck, the clapper would recede just before striking the gong. This action was employed to connect the circuit in the manner shown by the appended diagram. Two pieces of very light, springy copper were attached to a small piece of wood and a drop of glue fixed the whole affair to the back of the clock. A glance at the drawing will show that when the hammer is raised before striking the gong it touches the terminal of springy brass, causing



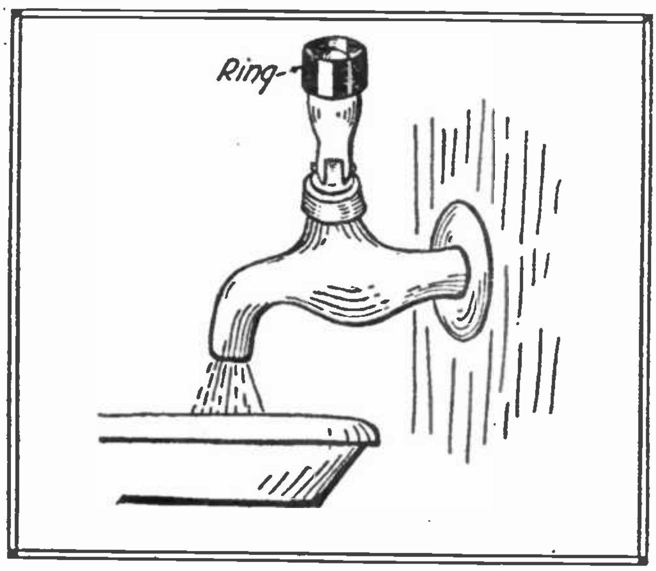
the latter to make contact with the second terminal secured to the wooden block.

Contributed by

E. C. SWETMAN.

Handy Faucet Attachment

Many tubs and basins are equipped with self-closing faucets and if a person desires to let a quantity of water flow, it is necessary to stand and press the thumb springs. The little attachment illustrated makes it possible to grip the thumb pieces of a faucet in such a manner that the water will flow until the device is removed. It is made from a short piece of pipe slightly flattened so that it will slip over the thumb pieces as they are pressed together.



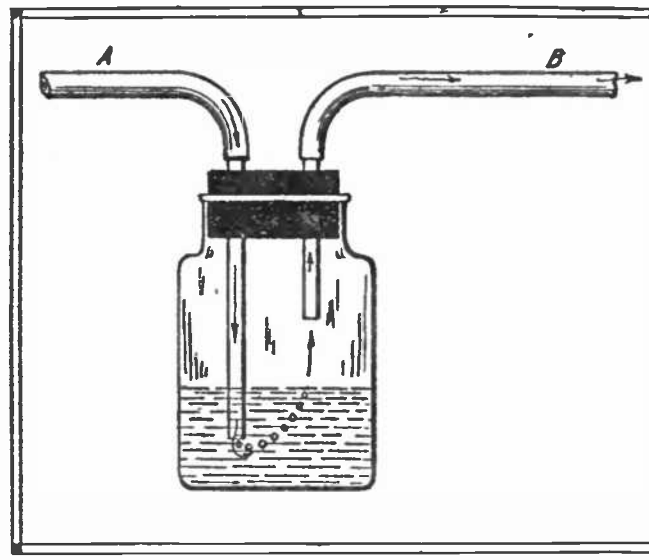
Contributed by

B. W. VERNE.

Preventing Gas Explosions

Acetylene and other gas explosions are sometimes caused by the flame following the gas in the tubing back to the generator or tank. In order to prevent this, a device known as a wash bottle is sometimes used between the source of gas supply and the burner. Referring to the illustration, the tubing *A* is connected to the generator or tank, while *B* leads to the burner.

The wash bottle itself is merely a wide mouthed glass bottle having a perfectly air and gas tight stopper, preferably of rubber, through which are passed two pieces of glass tubing, one reaching nearly to the bottom of the bottle, while the other extends but a short distance below the neck. To prepare the bottle for use it is half filled with water. It is obvious that the gas in flowing down the tube *A* will have to pass up through the water in a series of bubbles before it can escape through the tube *B*. The water thus acts as a check valve, preventing fire from getting back into the main tube leading from the source of gas supply.

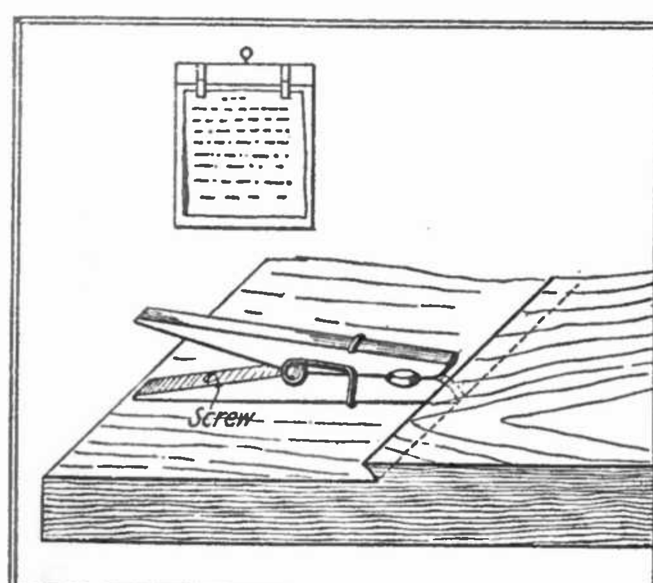


Contributed by

CHAS. I. REID.

Improvised Letter File

Given a pair of spring clothes pins, two small wood screws, a piece of light wood the size of a sheet of stationery,



and a small screweye, the amateur workman can assemble a letter file or clip that will give highly satisfactory service for a long continued period of time. The scheme is outlined in the drawing and the reader will note that the clothes pins are set into a recess. This, however, is not at all essential and to save time the builder may merely fasten the clips to the surface of the board.

Contributed by

B. W. VERNE.

A Handy Clamp

A clamp that may be used to hold work in any desired position is shown in the illustration. The part *D* is to be gripped in the jaws of a vise, and, by loosening the set screw *I*, the clamp may be tilted to any desired angle, while an adjustment laterally may be effected by turning the clamp on the pivot at *H*. The clamp proper is in reality a parallel jaw vise and the merits of this tool are too well known to require further comment. The entire tool is built up from bar steel and the dimensions of the various parts are optional with the builder.

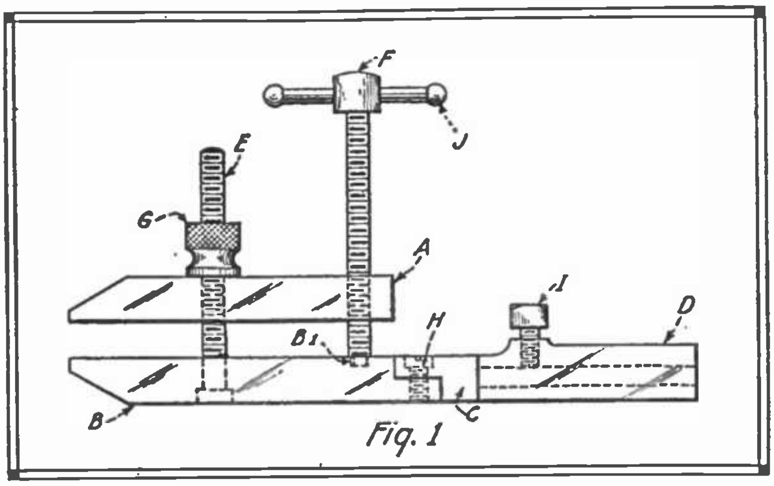


Fig. 1

In the clamp made by the contributor the jaws *A* and *B* are ⅝ inch square tool steel, hardened and drawn. The jaw *A* is 4½ inches long and it contains two holes 5/16 inch in diameter, one of which is tapped for the screw *F* to work in. The other hole is a clearance fit for the screw *E*. The jaw *B* is 5⅛ inches long and is counterbored at one end for half its thickness to engage with the counterbored part *C* held by the fillister head screw *H*. *C* in turn is turned down to 5/16 inch to fit in the hole in *D*. The screw *E* is made a driving fit in the jaw *D* and is 3½ inches long. It is threaded for a distance of 2½ inches. The knurled nut *G* is ¾ inch in diameter and hardened. The screw *F* is 3½ inches long under the shoulder, while the latter is ½ inch thick and ⅝ inch in diameter. Through the center of the shoulder is passed a piece of 3/16 inch rod 2 inches long and fitted with ball ends. The end of the screw is turned to 3/16 inch in diameter to work in a hole at B^1.

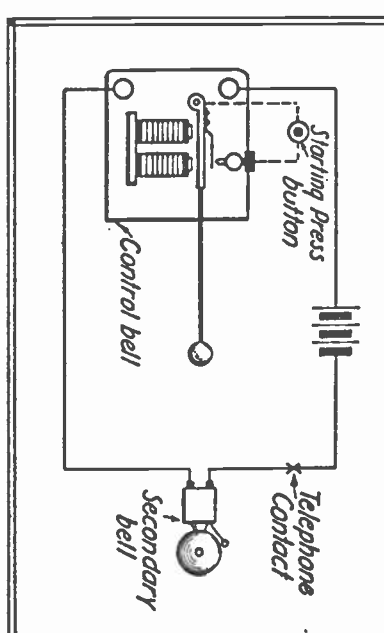
Contributed by

JAMES McINTYRE.

Automatic Call Bell

Having to call a neighbor to the telephone, the difficulty arose in that the contributor sometimes neglected to attend to the call, resulting in complaints. The call bell was therefore arranged in such a manner that once started ringing it continued until the act of answering the telephone disconnected the bell.

The diagram shows how this was accomplished. The control bell is of the ordinary vibrating type with a long pendulum the contact terminals of which are arranged to be out of contact until the pendulum is put in motion by pressing the starting button. The secondary bell, in the neighbor's house, is connected as a single stroke gong so that it merely repeats each slow stroke of the control bell, this characteristic action distinguishing a telephone call from other uses to which the neighbor puts



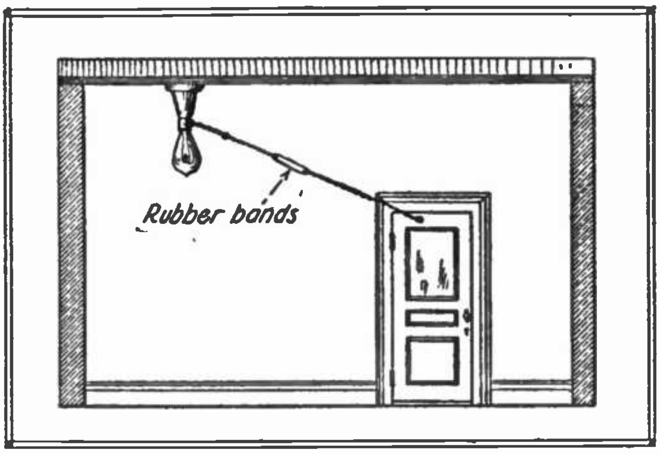
his bell. On starting the bell by pressing the button in the contributor's house, the bell continues to ring until the neighbor by answering the telephone breaks the bell circuit.

Contributed by

EDWIN O. CATFORD.

Opening Door Turns on Light

An arrangement by means of which a light is turned on when a person opens the door to a room and turned off when the door opens and closes on the departure of the person, is suggested in the accompanying sketch. From the pull chain of a socket within the room to a screw-eye fastened on the top part of the door is connected a cord with a number



of small rubber bands attached. The proper location of the screw-eye can readily be determined by experiments and this point will be found near the hinged edge of the door as the required length of movement is quite short. If a hook is placed on the end of the cord where it is attached to the pull chain, the device can be disconnected during the day.

Contributed by

ELBERT N. TODD.

Metal Moulding Knockouts

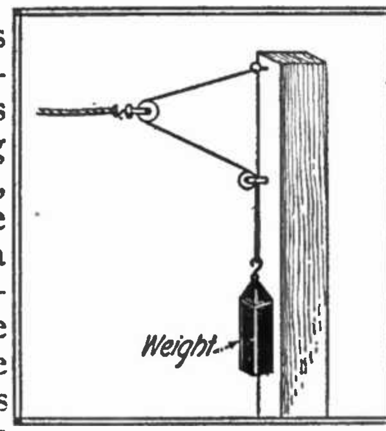
The round knockouts in the bases of metal moulding boxes are sometimes very hard to remove. A simple and easy way to do this is to place the knockout directly over the hole in a roll of tape and strike a sharp blow with a ball peen hammer or a hammer and screw driver.

Contributed by

B. OLSEN.

To Take Up Slack in Clothes Line

The employment of the device shown in the sketch will result in a clothes line that is always neat and taut and one under which clothes props are unnecessary. As the drawing clearly shows, the device consists of a weight attached to the ends of a line which forms a continuous



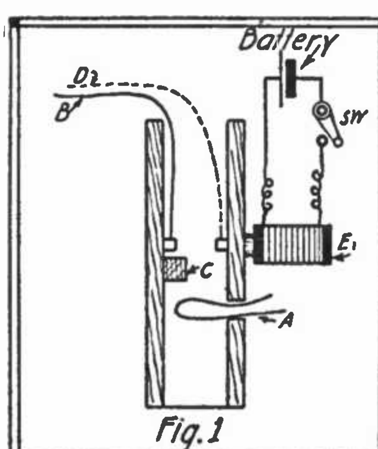
loop through a pulley attached to the clothes pole, on up through a screw eye attached to the upper part of the pole, through a pulley fastened to the end of the clothes line, and thence back to the original pulley on the pole and down to the weight. A glance at the drawing will show that the device will take up the slack within wide limits.

Contributed by

B. W. VERNE.

A Wiring Hint

The sketch shows how a wiring difficulty was overcome. A switch was required at *A* and the block *C* prevented the wire from going down inside the partition. After repeated trials without success, the idea suggested in the drawing was employed. A small piece of iron was fastened to the end of

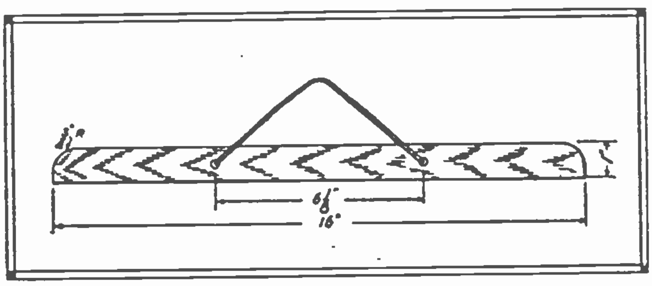


a string *B* and an electromagnet *E* placed against the partition as shown in the drawing. Through the hole, where the switch was to be fastened, a loop of wire was run so that the iron weight held against the wall by the magnet could be guided down through the loop. This accomplished, it was obviously a simple matter to draw the wire down after it had been attached to the cord.

Contributed by
GEORGE L. MACLEAN.

A Coat Hanger

As shown in the illustration, a serviceable coat hanger can be made by rounding off the ends of a piece of 1 inch

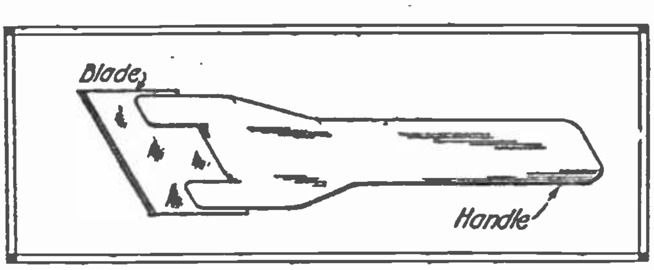


square wood, 16 inches long and securing a short piece of rope or heavy cord at points a few inches on either side of the center. Such a hanger can be made in a few minutes' time out of material to be found in nearly any house and it will prove serviceable and effective notwithstanding its simplicity.

Contributed by
OSCAR WILHELM.

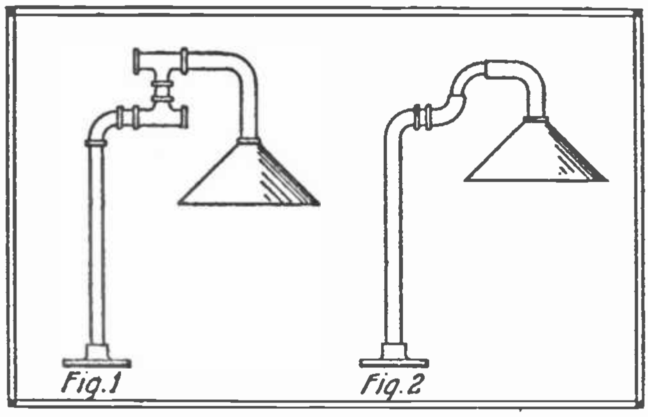
Removing Adhesive Labels from Windows

Papers, placards and labels stuck on windows with glue or paste usually re-



quire considerable scraping with a putty knife for their removal. The little instrument shown in the sketch, however, may be used to accomplish this work very easily and quickly. As the drawing clearly shows, the device is merely a safety razor blade held in a handle of sheet iron.

Contributed by
B. W. VERNE.



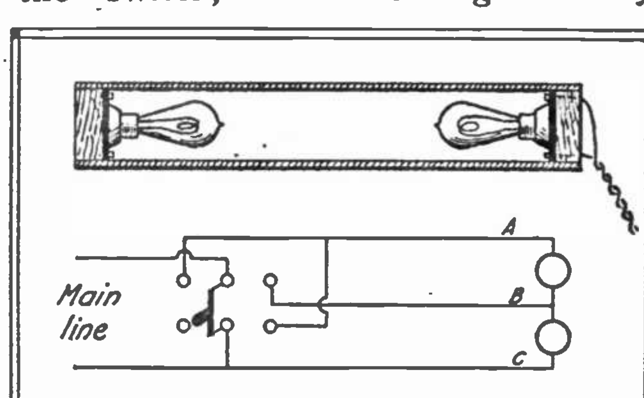
Bench Lamp from Pipe Fittings

The drawings Figs. 1 and 2 show how a handy bench lamp can be made out of a few pipe fittings. The fixture may be adjusted in many directions to meet the requirements of the user. A flange or crowfoot attached to the bottom of the standard will provide a substantial support for the lamp. The construction is so clearly shown in the drawings that further description is quite unnecessary.

Contributed by
GEORGE L. MACLEAN.

Electric Foot Warmer

A simple electric foot warmer offering a superior substitute for a hot water bottle and which takes the place of the more expensive heaters now on the market, is shown in the accompanying sketch. Two 16-candle power incandescent lamps are held in receptacles in the end of a tin tube about 2½ inches in diameter and 15 inches long. A handy diagram of connections is shown in the drawing. By wiring the lamps up according to this diagram it is possible to join them either in series or in multiple by simple movement of the switch, thus affording a ready



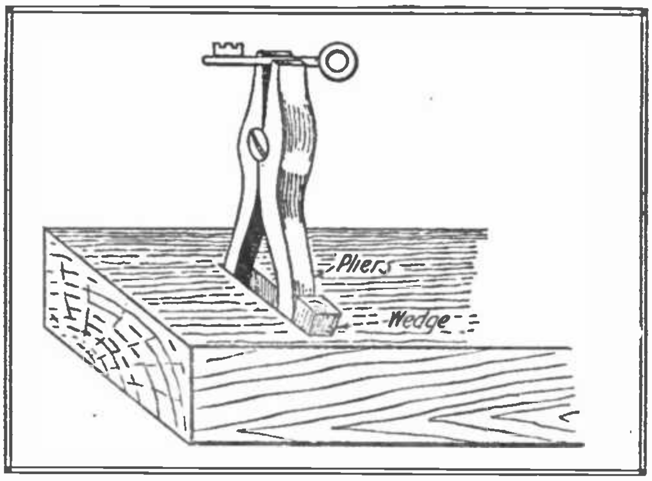
means of regulating the amount of heat liberated within the tube. The complete heater should be covered with a woolen jacket.

Contributed by

MAXWELL SNAVELY.

Pliers as Bench Vise

In the illustration is shown how a pair of pliers may be utilized as a substitute for a bench vise by cutting a slot through



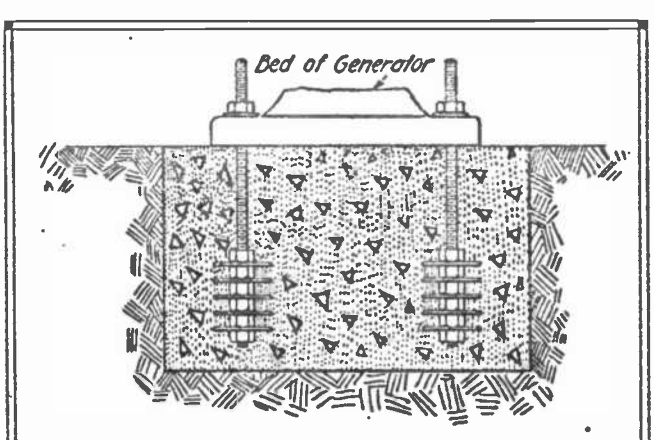
the bench, inserting the handles of the pliers and drawing up with a small wedge of wood. This improvised vise will hold articles to be repaired or filed with surprising rigidity.

Contributed by

B. W. VERNE.

Substitute for Anchor Bolt

While on a recent contract the contributor was confronted with the problem



of devising a substitute for anchor bolts strong enough to hold the bed of a generator down to a foundation of concrete. The problem was met by threading long bolts to the head and placing on them alternately washers and nuts, as shown in the sketch. This arrangement was found to be altogether satisfactory in use.

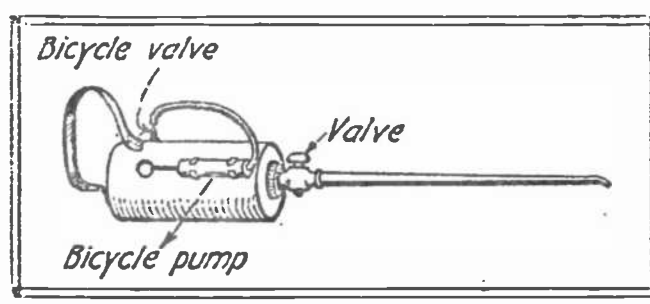
Contributed by

JOHN H. HARDY.

Auto Engine Cleaner

When cleaning the engine of an automobile, the device shown in the illustration will prove to be of material assistance. The materials needed for its construction are: A large oil can with a long spout, a small petcock, a tubular bicycle pump, a tire valve, four pieces of tin and a soldering outfit.

The first step is to remove the handle and spout from the can, cutting the spout into two pieces and soldering the petcock between them, after which the spout is replaced on the can. Four legs are fashioned out of the tin and soldered to the pump, which is then secured with solder to the body of the oil can. The pump should be soldered



well to the front in order that the plunger may be moved back and forth without striking the handle of the can. The reader will note that the handle is affixed to the bottom of the can when it is replaced. A hole is next punched in the rear of the can and the bicycle valve soldered therein. The outlet of the pump is connected with the valve by means of the hose supplied with the pump, after which the cleaner is finished.

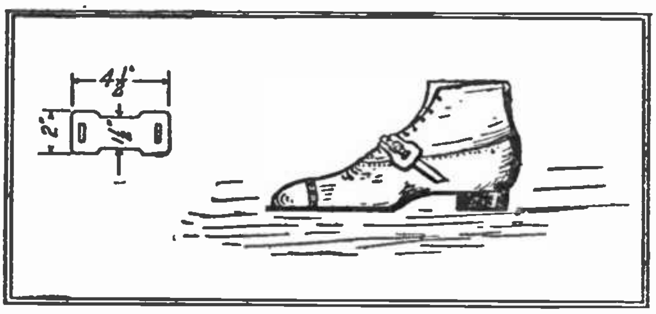
To operate the device, fill the can with gasoline and establish an air pressure inside the can by means of the pump. Open the petcock and out comes a spray of gasoline which can be regulated to the desired degree through an adjustment of the petcock.

Contributed by

WILLIAM D. LONG.

To Prevent Skate Strap from Pinching

A shield to prevent the strap of a skate from pinching the foot is shown in the illustration. In addition to this it



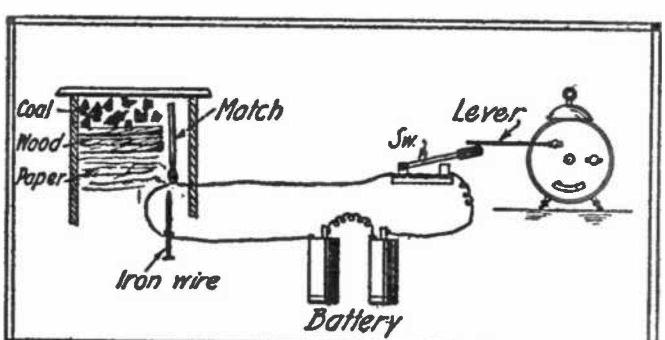
acts as a support for the instep. The device is made in duplicate from a piece of leather and cut to the shape and dimensions shown in the drawing. The reader will note that the buckle of the skate strap comes on the top of the piece of leather which acts as an effective shield.

Contributed by

GLENN G. FOGLESONG.

To Automatically Start a Fire

The contributor suggests a combination of time switch, electric circuit, match and kindling by means of which



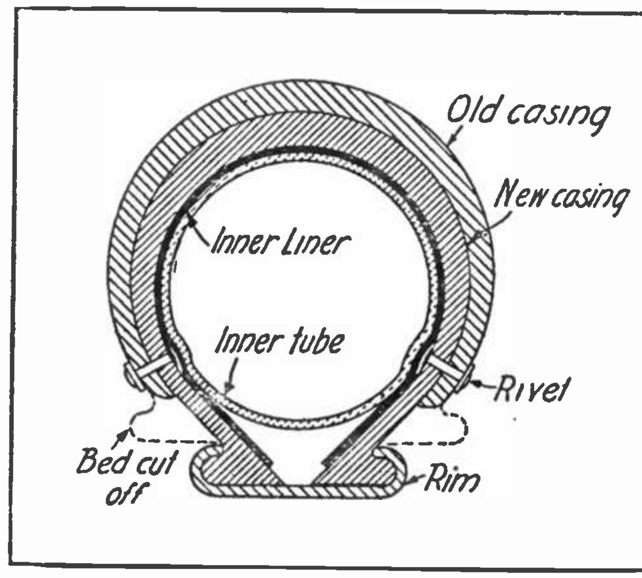
a fire may be started in the kitchen range, for instance, at any desired time during the day or night. It will be noted in the illustration that a piece of fine iron wire is made a part of the circuit through a battery and switch; the latter being closed at a predetermined time by the alarm clock. When the switch is closed the iron wire becomes red hot and lights the match, which in turn sets fire to the kindling in the stove.

Contributed by

JOHN R. WARR.

Reinforcing Auto Tires

Here is a way to make your tires last longer. When a casing gets so old that there is constant danger of a blow out, cut off the beads as indicated by dotted lines, and rivet it onto another casing. To protect the inner tube from chafing against the heads of the rivets a small layer of "tire dough" may be placed over the heads. An inner liner should also be used to further protect the tube. Copper rivets with very flat



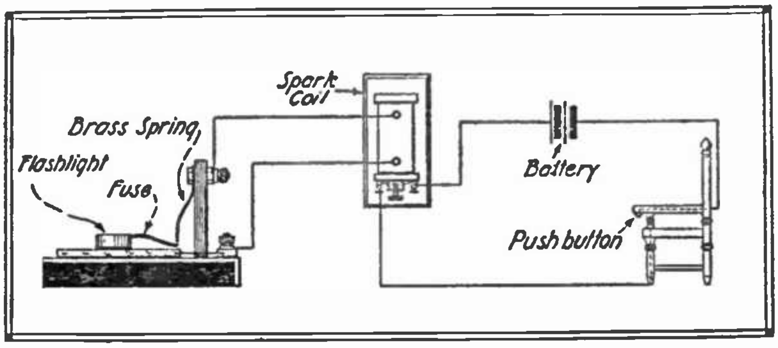
heads are used. A 30 x 3 protector casing may be used on a 30 x 3 or 30 x 3½ casing. A tire protected by this method will give several thousand miles more service.

Contributed by

FRANK G. CAMPBELL.

Device for Flashlight Photography

This device will enable the operator to take his own photograph by flashlight on the mere pressure of a button. The discharging apparatus comprises a battery, push button and spark coil connected in a circuit with a flash pan the construction of which is clearly shown in the drawing. The flash pan

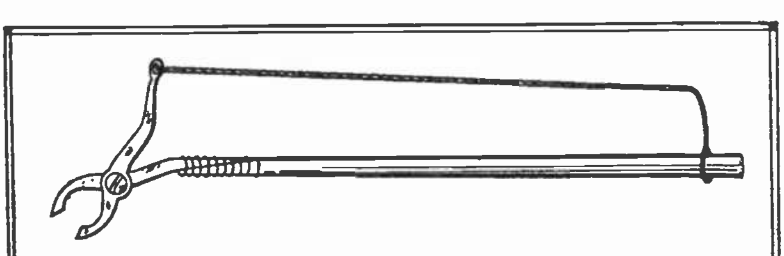


consists of a plate of metal mounted on a base of wood and connected to one terminal of the spark coil, while the other terminal leads to a piece of brass strip fastened to an upright on the base of the flash pan and so adjusted that a short gap is maintained between the metal pan and the brass strip. The flashlight cartridge is laid upon the pan with its fuse inserted in the gap at which a spark takes place when the push button is pressed. The push button is conveniently placed under the arm of the chair in which the operator seats himself when the photograph is to be taken. The camera is set up and focused on the chair. The shutter is opened, the fuse of the flashlight cartridge is dipped in alcohol and the cartridge placed on the flashpan, and when all is in readiness for the exposure to be made the photographer presses the button.

Contributed by CHAS. FICK.

To Remove Articles from a Shop Window

Shopkeepers having a large display of mixed articles in the store window frequently have occasion to remove some article that may be quite beyond reach from the rear of the window. The old method was to use a hook attached to a pole, but this method is not altogether satisfactory. The device illustrated in the accompanying sketch was made from a cheap pair of pliers, a pole of suitable length and light metal rod. The pliers are to be bent as shown, one of the handles wired to the end of the pole, while the other is pivoted to the end of the metal rod as shown in the drawing. By means of this device, any article may be removed from the front part of the window without the slightest difficulty.

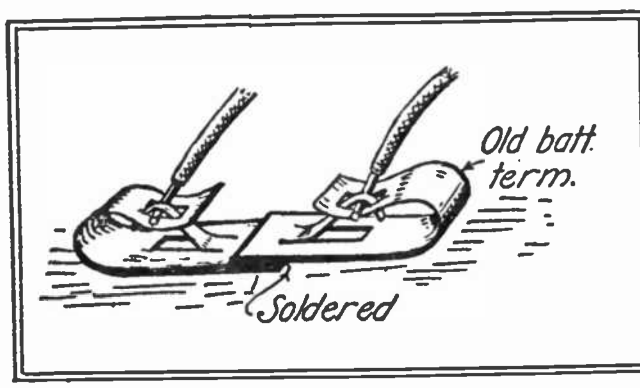


Contributed by

B. W. VERNE.

Wire Connector

A handy connector can be made in a few minutes by soldering two of the spring binding posts used on dry cells together as shown in the illustration. Such a connector will enable the experimenter to quickly make and break a temporary connection without the unsatisfactory method of twisting wires together.



Contributed by

JACOB LIEBMAN.

Reel for Clothes Line

With this device one can wind up the clothes line quickly and neatly on a reel instead of winding in a ball or around the arm, thus keeping it from getting tangled and dirty. The device consists of a reel proper that revolves on a spindle forming a continuation of the handle *A* in Fig. 1. The latter is gripped in the left hand, the clothes line looped over the screw *I*, in the end of the reel and the spool revolved by turning the handle *B* with the right hand.

In Fig. 2 the reader will note the details and dimensions of the component parts of the device. The ends of the reel, *E* and *F*, are discs of ½ inch wood turned to a diameter of 6½ inches and drilled through the center with a ⅞ inch bit. The slot *H* is cut in one disc while the hole near the edge of the other disc is bored with a ⅝ inch bit. In the same disc the screw *I* is placed in position near the center hole.

The spindle with its handle *A* is turned from a piece of 1⅜ inch dowel rod to the dimensions given in the drawing. The washer *J* is to slip over the end of the spindle after the reel has been placed in position. A cotter pin is then inserted through the hole in the end of the spindle to retain the washer. The handle *B* is self-explanatory in the drawing, as is also the core of the reel *C*. *D* is a piece of spring brass placed over the slot *H* in the end of the reel to retain the end of the clothes line after the latter has been wound on the reel. The reel may be painted any color desired, or simply varnished.

Contributed by

PHILIP G. CARLSTEDT.

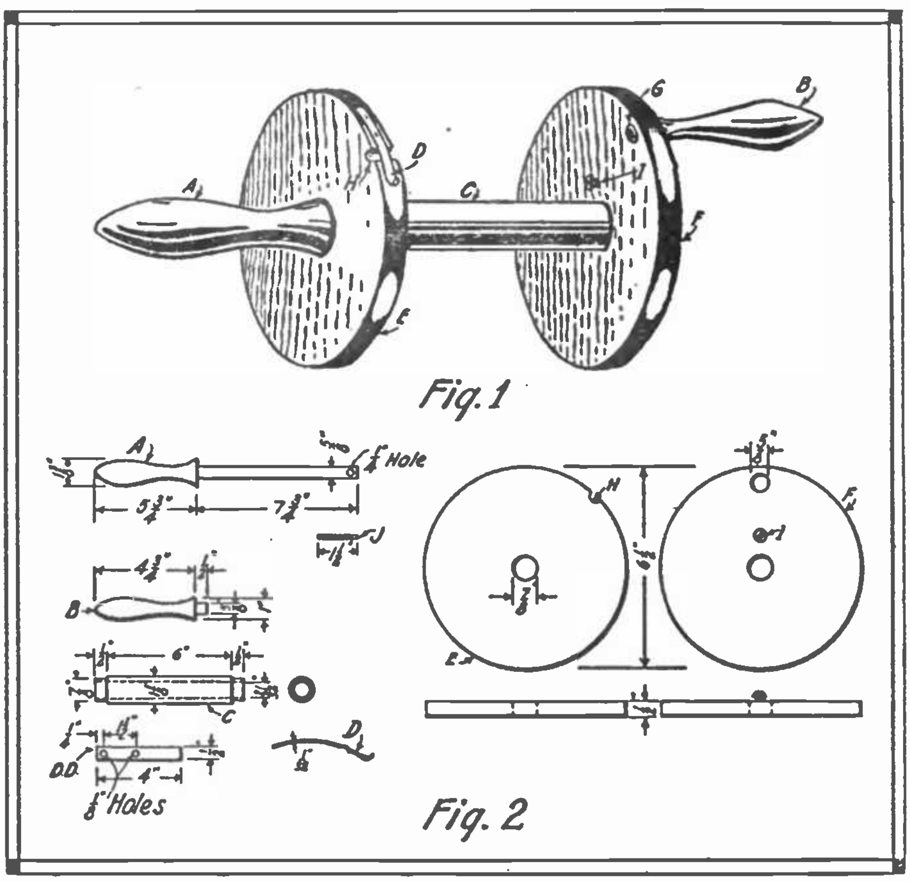


Fig. 1

Fig. 2

A Duplicator for the Camera

The simple addition to the camera shown in the drawing will afford endless pleasure and amusement to the photographic enthusiast. By means of this device, one may take two poses of the same person on one plate. For instance, a man may be shown shaking hands with himself.

The device is simplicity itself. It is necessary only to have a piece of cardboard or tin, a thumbtack and a cheap box camera. The first operation is to cut the cardboard or tin into the shape of a triangle, the width of which near the base is just sufficient to cover the lens opening. A clearly defined line is to be drawn down the front of the camera case, crossing the lens at its opening center. The triangle is then to be pivoted with the thumbtack at the top of the camera case as shown in Fig. 1 and tested to see that the lens is completely covered when the triangular piece is perpendicular.

If this is found to be the case, the piece *A* may be pushed to one side until its edge is perfectly perpendicular, as in Fig. 2, and a mark placed on the camera case at this point. The piece *A* is then to be pushed to the opposite side until its other edge is perpendicular and a mark placed as before. These marks are indicated by *C* and *D* in Fig. 3.

To take the picture, the camera is placed upon a tripod or other firm support and an imaginary line drawn as shown in one side of the center line and the shutter *A* on the camera moved to uncover the lens on the same side. The exposure is then made in the usual way. The subject is next moved to the opposite side of the imaginary line and the piece *A* on the camera reversed to cor-

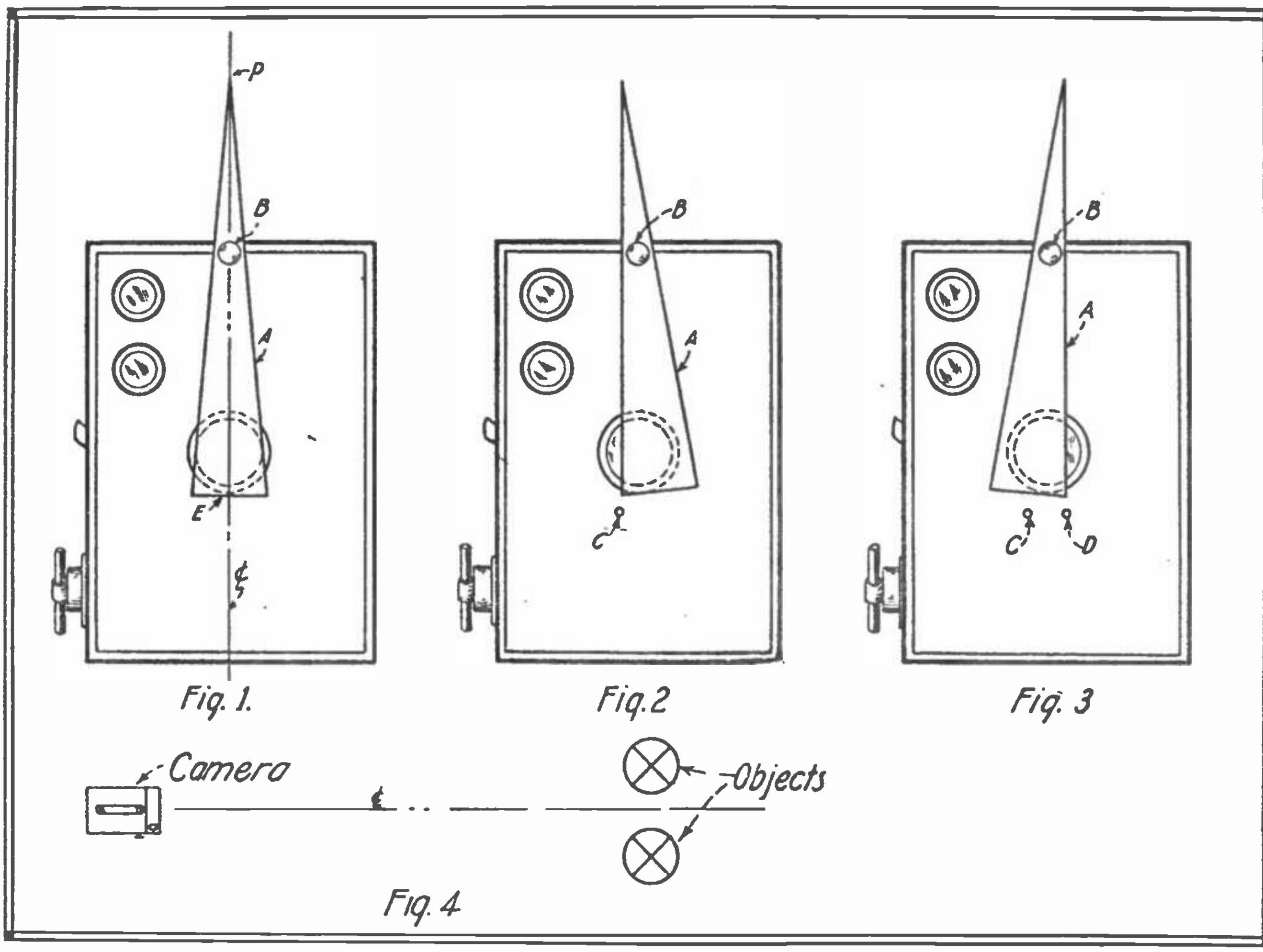


Fig. 1. Fig. 2 Fig. 3

Fig. 4

respond. The second exposure is made and the plate or film developed. In the event that the picture shows an overlap or an unexposed portion between the two halves, it indicates that the length of the triangular piece *A* is not just right. If the defect is an overlap, the piece should be lengthened to broaden the angle of the sides; if the pictures do not meet, the piece should be shortened.

Contributed by

ARTHUR A. BELIVEAU.

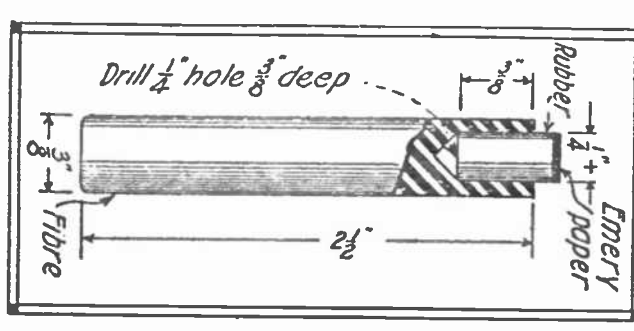
Novel Curling Tool

The tool shown in the drawing will be welcomed by many amateur mechanics who work with brass. The tool will enable one to produce the curling or mottling so often seen as a finish on the brass parts of high-grade instruments.

The tool is made by drilling a hole in the end of a piece of fibre rod, inserting and cementing a short cylinder of gum or springy rubber in the hole and finally cementing a piece of No. 1 G emery paper to the end of the rubber. This latter operation may be performed with the aid of a little sealing wax, but it is preferable to use a cement adapted to rubber and paper. The emery paper is to be trimmed accurately to the edge of the rubber when the cement is hard.

The tool is to be inserted in the chuck of a high speed drill press, speed lathe, or polishing head and the work brought against the rapidly revolving tip of emery paper, shifting the metal until its surface is quite covered with the mottling.

The advantage of the rubber cushion is found in the fact that even though the work is not held perfectly flat against the abrasive, the springiness of the rubber will compensate the difference. Another point in favor of the cushion is the



fact that, owing to the smaller amount of friction between tool and work, the emery paper will last longer than if a solid backing were used.

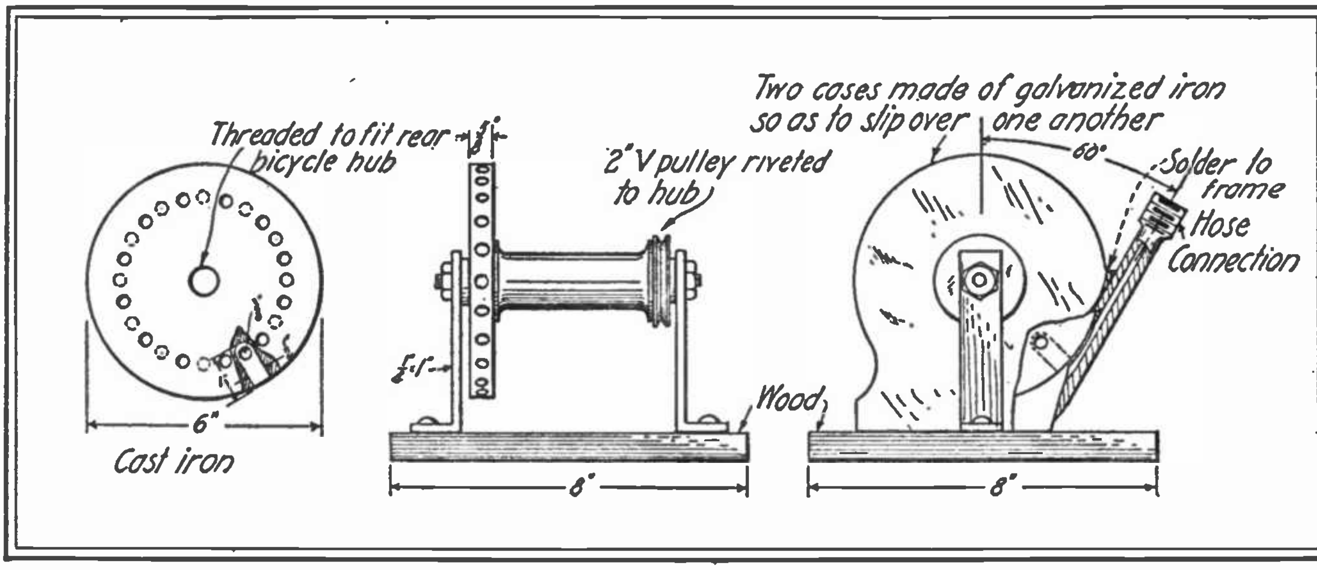
Contributed by

P. J. Hoffman.

Water Motor

The details of a water motor, capable of developing about ¼ H. P. on a water pressure of 60 pounds, are given in the accompanying drawings. The rotor is made up of an iron casting in the form of a disc having holes drilled radially in its periphery and secured to an old bicycle hub. The rotating member is mounted between bearings and covered with a jacket of galvanized iron which carries the nozzle. The exhaust water escapes through a hole in the base which may be of wood.

The construction is so clearly shown in the drawings that no further description is necessary, particularly as the design is offered mainly as a suggestion, in the working out of which the builder is expected to use his ingenuity.



Contributed by

Franklin E. Taylor.

AN ELECTRIC TIME SWITCH

By Harry Brock

The electric time switch described in this article can be used in connection with a burglar or fire alarm or for automatic time signalling. In fact, the limitation of its many uses is due to the fact that nothing heavier than a comparatively small battery current can be handled by the light contacts of the device, although this objection might be overcome through the employment of an auxiliary relay to take care of the main current. The time switch consists of a cylinder revolved by clockwork and so arranged that it may be adjusted to switch the circuit in and out at a predetermined time.

For the revolving mechanism, the works of a discarded clock may well be used. The movement should be removed from the clock case and fitted into two grooved pieces of wood *A A* in the drawing of the completed device. The reason for the V-shaped cut is to make room for any wheels which protrude beyond the framework. The pieces *A A* are nailed to a baseboard about 11 x 7 x ½ inches.

For the revolving cylinder, a piece of fibre tube 5 or 6 inches long and from 2½ to 3 inches in diameter will be required. A cylindrical phonograph record will answer the purpose. Two pieces of

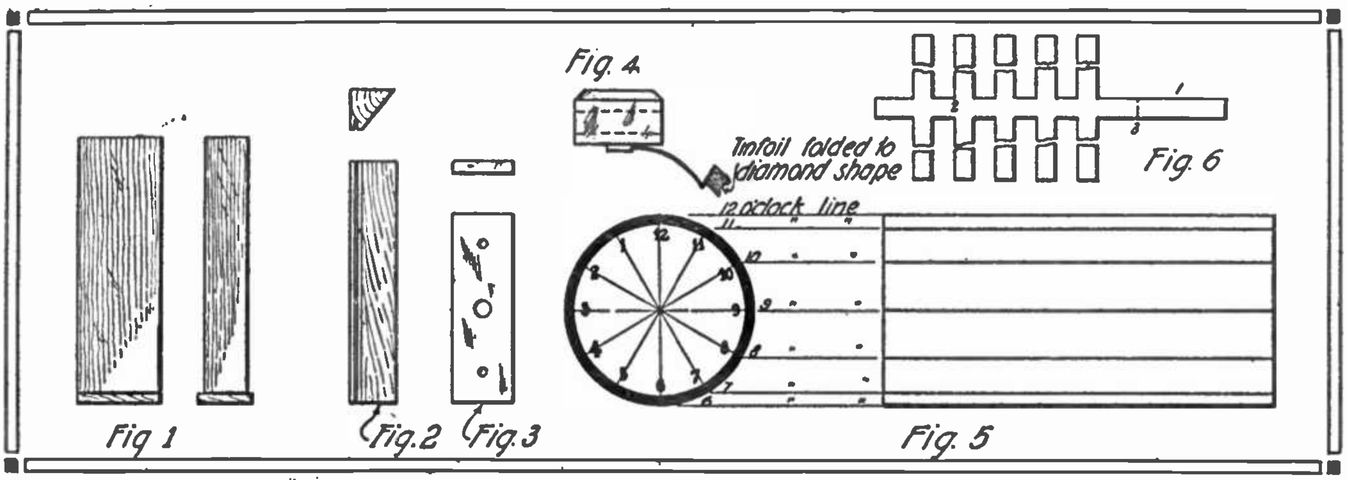


Fig 1 Fig. 2 Fig. 3 Fig. 5

wood should be cut or turned to fit the ends of the cylinder nicely and these heads, G^1 G^2, should have a thickness of at least ½ inch.

To the little tube that originally held the hour hand of the clock is soldered a piece of brass cut 2 by ½ inches, 3/16 inch thick and drilled as shown in Fig. 3. The face and the minute hand of the clock should be removed, the latter being retained for future use.

After marking, drilling and cutting the slot or recess in G^1 where F fits into it, the piece G should be glued into the end of the cylinder.

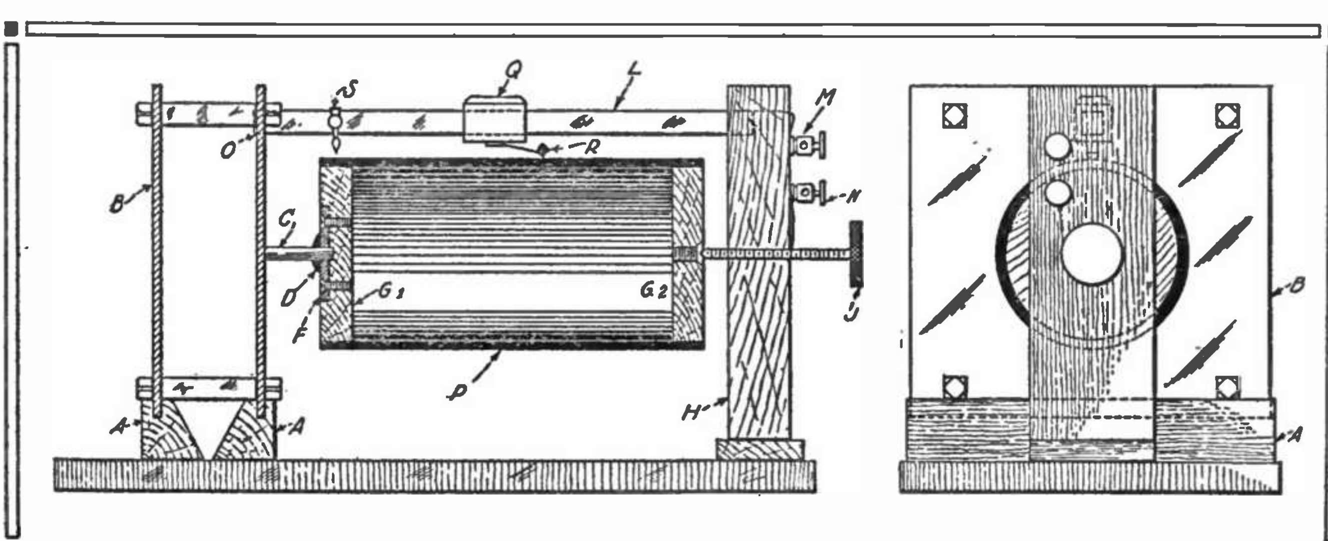
The support H is cut from some hard wood. Place this near the mounted works B and measure up the exact distance that the hour tube C is from the top of the baseboard and drill a hole accurately to fit screw J. This step is to get the dead centre for the revolving cylinder.

The screw forming the bearing which turns on J is made by drilling a small hole about 3/16 inch deep in the head of an ordinary iron wood screw. Drill a hole in G^2 to admit screw, then glue this head into the remaining open end of the cylinder.

Procure a tuning coil slider rod and slider; the former being long enough to reach from point O to support H. The contact portion of the slider should be in the form of a brush as shown in Fig. 4.

Drill a hole at point O on the frame of the clockwork, a little smaller than the diagonal dimension of the slider rod. File the hole square with a triangular file. Bore and chisel a similar hole ¼ inch deep in the support H.

This much accomplished, the more delicate portion of the work is arrived at. Draw the dial of a clock on the end of the cylinder G^2. This should be done with a 30 degree triangle and the utmost accuracy is essential to good results later. Scratch fine lines with a knife point



throughout the entire length of the cylinder. These lines should be at perfect right angles to the end of the cylinder; a try-square being an efficient aid in securing this result.

Get a piece of medium weight tinfoil about 2½ inches wider than the cylinder and cut it so that it comes together neatly when wrapped about the cylinder. Proceed to cut it as in Fig. 6, making as many sectors as there are combinations desired. The ends of the sectors must meet when they come around the cylinder. Glue this piece of tinfoil on the cylinder so that the rib 2, Fig. 6, travels along the 3 o'clock line. While the glue is still damp, secure a razor blade and treat each sector as follows:

Let us assume that one combination is to be 9 P. M. to 7 A. M., *i. e.*, we wish to make the circuit at 9 P. M., and break it at 7 A. M. The sector is cut off at the seven o'clock line, and at the nine o'clock line, in order that a break may occur in the continuity of the ring of tinfoil. Care should be taken to make the sector cuts accurately.

The numbers on the end piece must run in the opposite direction to those on a clock dial for the reason that it is the cylinder, and therefore the numbers, that revolves.

The slider rod is next to be placed in position and secured with a bit of solder applied at point *O*. Take the minute hand of the original clock and solder it to the slider rod at the point *S*. Cut off the projecting portion and bend the pointer so that if a line were drawn from the contact point on the brush (Fig. 4) to the pointer *S*, it would be perfectly parallel to the time lines scratched on the cylinder. This pointer is used to set the apparatus to standard time.

The completion of the assembly is now in sight. Screw the plate *F* to the cylinder end G^1. Bend over the projecting lug of tinfoil *I*, Fig. 6, and make a hole large enough to let the screw in end G^2 of cylinder pass through it. Drive the screw home and adjust the pivot screw *J* upon which the cylinder turns. Test by turning the setting screw at the back of the works to determine whether the cylinder revolves accurately on its bearings.

Connect the screw *J* to the binding post *N* with a wire and likewise connect slider rod with binding post *M*.

To set the clock, let us assume that it is 8 P. M. and that we wish to use the 9. P. M.—7 A. M. combination, for example. The cylinder is revolved until the little pointer *S* points directly down to the 8 o'clock line. The clock switch should be set that way in the beginning to get it accurately adjusted and regularly wound to keep it going. If it is necessary to set the clock at a point between the even hours, say at half past six, the pointer should be placed at a point half way between the six and seven lines. If the quarter hour is essential, the pointer should be adjusted in proportion, just as it is on a regular clock.

The apparatus is, of course, connected in series with the circuit it is intended to control.

ELECTRICITY AND FIRES

Contrary to the prevailing opinion among persons with a slight knowledge of electricity, recent figures indicate that there are less conflagrations due to electric current than many other causes.

There were nearly 5,000 fires reported in Chicago during 1913. The records show that less than one per cent. could be laid to electricity. Only one fire was caused by lightning. Careless use of matches caused 164 fires in 135 days; stoves, chimneys and flues caused over 300; 52 fires were incendiary; spontaneous combustion caused 51; 46 were due to carelessness in handling gasoline; thawing water pipes caused 43; explosions of gas, 38; and oil lamps, 35.

Thus it would seem that those who are prone to say the fire was caused by "crossed wires" when they can think of no other reason, are striking wide of the truth. It is but another piece of evidence in favor of man's most faithful servant.

THE HOME CRAFTSMAN

A CRAFTSMAN CEDAR CHEST

Describing the Construction of a Paneled Cedar Chest With Suggestions for the Design of Others

By Ralph F. Windoes
Instructor in Manual Training, Davenport High School, Davenport, Iowa.

Illustrations from drawings made by the author.

RED cedar—the peer among chest woods—can be found growing all over our entire country. From the Atlantic to the Pacific—from Florida to Minnesota—this beautiful and fragrant wood grows. In most places it sparsely covers extensive areas (cedar brakes), and does not attain any great size, but in the southern states, especially on the west coast of Florida, it is highly prized as a commercial product since there it grows to a suitable size for lumber. One of its most important uses has been in the making of lead pencils, as it whittles easily and is very light. Its consumption in the pencil industry alone is several million feet a year—hence the rapid depletion of the supply.

Although these cedar facts are interesting, we are more concerned just at present in its use as a cabinet wood, and especially in chest construction. An ideal chest wood must be light, as chests are handled a great deal, it must be firm and strong for the same reason, and it must present an attractive appearance. The cedar fills this list completely and has the added attraction that no other wood possesses—its aroma, combined with its moth-repelling qualities. Moths shun the red cedar wood as other insects shun the pennyroyal herb, and costly furs or woolen goods placed in a cedar chest are moth-proof for ages. Its aroma is so fragrant that the articles may be taken out of the chest, worn at once, and not have a repulsive smell such as that left by the ordinary moth ball. Altogether, then, the red cedar wood made into a chest produces a very pleasing article of furniture, and one that should be in every home.

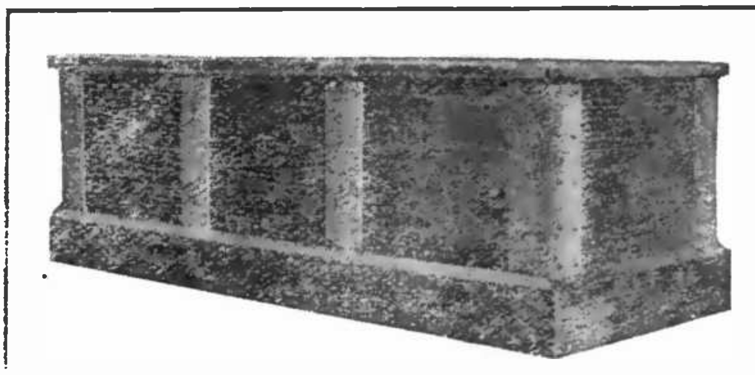


Fig. 1.—An Attractive Cedar Chest made by High School Boy under the Direction of the Author.

In this article the author offers complete working drawings for a paneled chest, as well as suggestions for the design of several others. The description will apply to the one detailed, but any one of the others can be worked up acceptably without difficulty.

In the first place, it is not always necessary to decorate a cedar chest with copper embellishments. Some styles demand it while others abhor it, and the craftsman must be guided by his own sense of the ugly and beautiful when planning his own. The photographic illustration accompanying the working drawing shows a chest that would have been much more pleasing if the copper strips had been omitted altogether, since they tend to efface the stiles of the panels and give them an "all rail" appearance. If the craftsman who intends to follow this design will bear this in mind and produce corners that do not show a bad crack where joined, he will find that he has a much better looking chest if he leaves the copper off. With this particular chest, the box was fastened with flat head screws and the corners were added to cover these heads.

A study of the working drawing will reveal the following pieces in the list of stock:

2 pcs.	3/8" x	13 " x	36 ",	side panels.
2 pcs.	3/8" x	13 " x	13 ",	end panels.
4 pcs.	3/4" x	2½" x	38 ",	side rails.
4 pcs.	3/4" x	2½" x	15 ",	end rails.
4 pcs.	3/4" x	2½" x	18 ",	side stiles.
4 pcs.	3/4" x	1¾" x	18 ",	end stiles.
1 pc.	3/4" x	20 " x	42 ",	top cover.
1 pc.	3/4" x	16½" x	38½",	bottom.
1 pc.	3/4" x	2 " x	38 ",	feet.
2 pcs.	1½" x	1½" x	17¾",	corner blocks.

This stock should be *sand papered* at the mill to exact dimension, thereby saving the craftsman additional hours of labor which would of necessity be spent in "cleaning up" the wood by hand.

Let us begin the construction by making the panels. A study of the detail will show that the rails are tenoned into the stiles. Cut the mortises in the latter first, laying them out very carefully and comparing them side by side before doing any cutting. They will be made 3/8" wide, 1½" long, and 1¾" deep, as the detail shows.* As they open on the top it will be a little easier to clean them out than they would be if entirely blind. Next, lay out the tenons that fit into them, and cut them carefully with perfectly square, sharp shoulders. The drawing shows that the panels are let into the rails and stiles to a depth of ½", and at their exact centers. These panel grooves can be cut out with a router plane or a combination plane, while if a power saw is handy they may be cleaned out with the dado head.

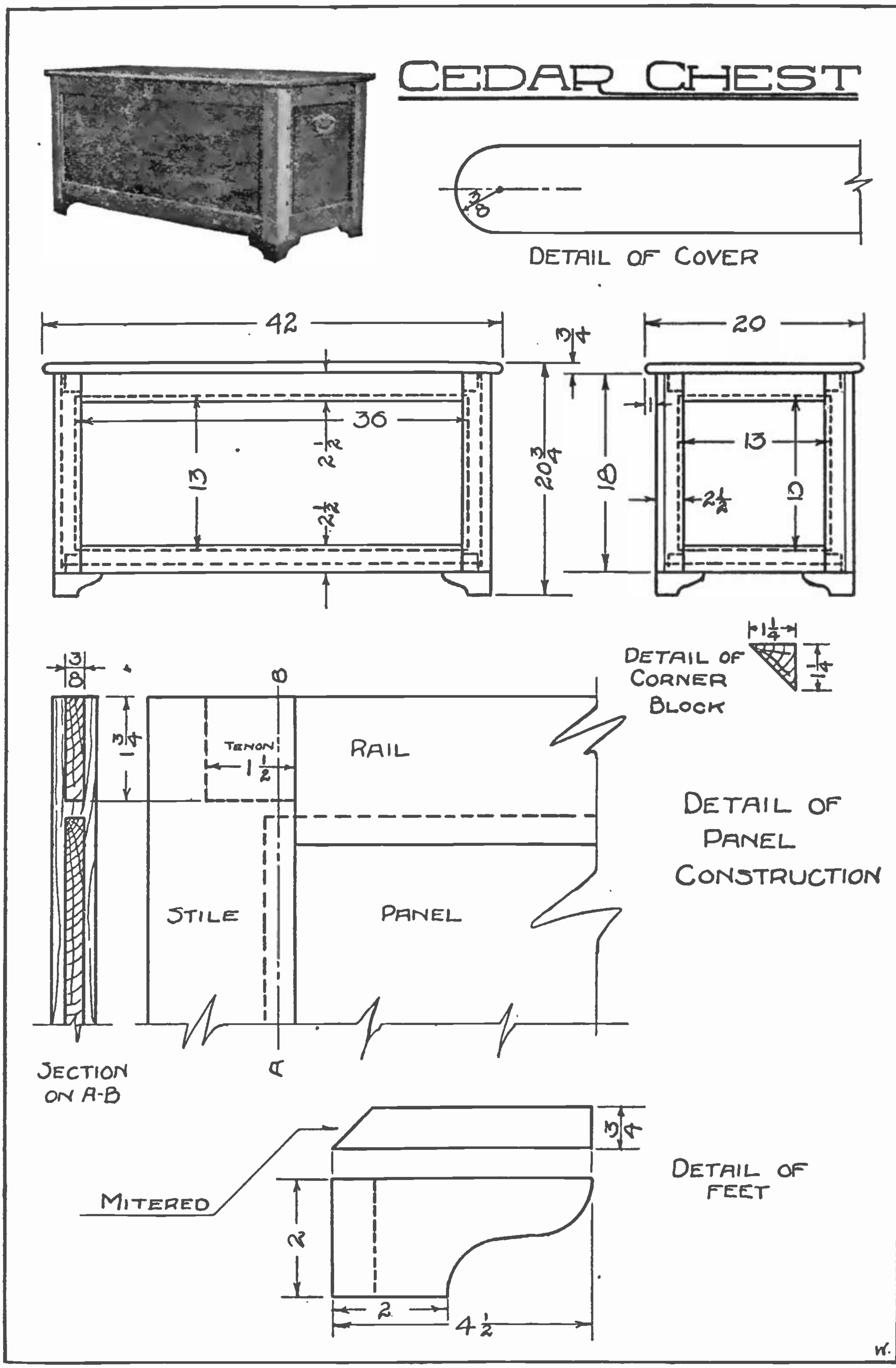
When these parts have been carefully fitted, glue and clamp them together. It is not wise to put any glue along the edges of the panels, as they shrink and swell with variations in the weather and if held by glue at these points they might force out the rails or crack them open.

When the glue has dried and all that is on the outside has been carefully cleaned off and sand papered, these pieces will be ready to assemble. Decide upon the method of fastening you intend to use. If you insist upon using the copper corners, the best method is by means of countersunk flat head screws, 1¾" No. 9. If you do not care for the metal corners, glue and nail with finishing nails, the heads of which may be set and filled with a mahogany paste filler which will show but little after the finish has been applied. The bottom is also fastened with nails in the same manner. The top cover has a rounded edge and is hinged with two brass hinges on its under-side. It is checked from falling back when opened by means of a desk support or a piece of brass chain. In each corner glue a triangular corner block, made by ripping the two square pieces on a diagonal of each. (Notice the detail.)

The feet are mitered for each corner and are nailed into place, as the detail plainly shows. The addition of casters or polished steel slides completes the construction.

As the description seems a trifle condensed, a few words of caution may

* If the craftsman does not know the correct method of laying out and cutting mortise and tenon joints, he should refer to an article of this series that appeared in the January number of MODERN MECHANICS.


CEDAR CHEST
DETAIL OF COVER
42
36
20
13
18
$20\frac{3}{4}$
DETAIL OF CORNER BLOCK
TENON
RAIL
STILE
PANEL
DETAIL OF PANEL CONSTRUCTION
SECTION ON A-B
MITERED
DETAIL OF FEET
$4\frac{1}{2}$

serve the amateur well. In the first place, strive to obtain good corner joints so that the copper strips will not be necessary. Good joints cannot be obtained unless the edges of the ends are perfectly straight and square, so try your utmost to accomplish this. Be very sure, also, that when the box is nailed together, the corners form right angles. If they have a tendency to spring after the clamps have been removed, the square cornered bottom will probably straighten them out if it fits snug. The feet should be carefully mitered and the end grain of the miter should be given a glue size before the final gluing and nailing. By "glue size" we mean the placing of a thin coat of glue on the end grain and allowing it to harden before giving it the final coat. If casters are used, glue and nail a block about 1½" square and 2" long on the inside of each corner into which fasten the caster.

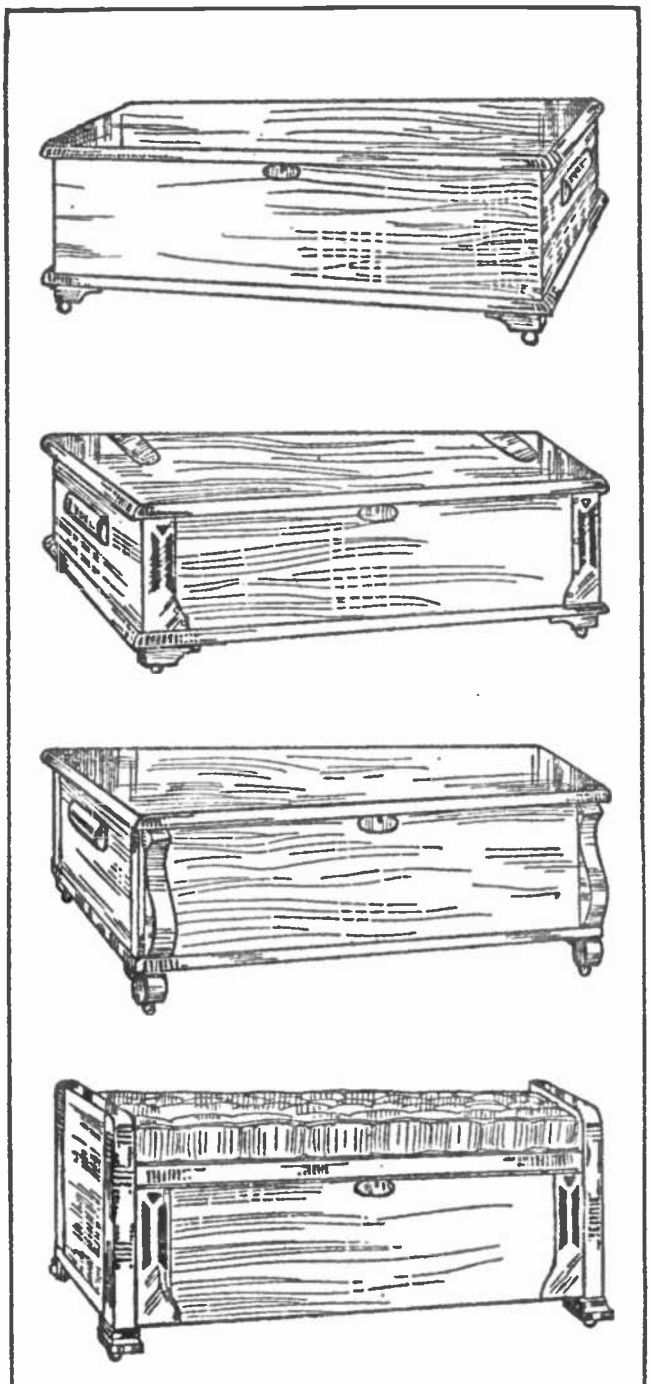


Fig. 2.—Four Suggestions for a Cedar Chest.

To bend the metal corners to right angles, place them between two pieces of hardwood held in the vise so that one-half of each strip is even with the top of the pieces of wood. This half may then be driven over flat with a mallet.

Some craftsmen may prefer the chest with the straight sides to the paneled chest that we have described, hence we have illustrated a few designs that may assist him in his planning. In Fig. 1 we have a photograph of a chest made complete, including the gluing up of all stock from narrow boards, by an eighth grade boy in the Davenport, Iowa, schools. It has copper corners and bands, and a mitered base—a good design, yet massive.

In Fig. 2 will be found four suggestions. At the top is a simple design very similar to the chest described but with straight sides instead of panels. The bottom is the same size as the top and is screwed up into the box. Below is illustrated the same chest with the addition of copper corners and hinge plates. The designs are sawed from the metal with a small jeweler's saw frame. The next shows an elaborate chest with scrolled pieces nailed at the corners, giving it a heavy effect, otherwise the box has the same construction as the other designs. Lastly is a good design for the experienced craftsman to undertake. The heavy square corner posts are tenoned onto the end pieces and the sides. The top is set down from the ends and a tufted cushion is made for the cover.

Regarding the finish: Apply nothing to the inside of the box as you will want the cedar smell to remain unrestrained, but the outside should be given a rubbed varnish finish. First, apply a coat of white shellac. After twenty-four hours, rub it down smooth with No. 00 sand paper or steel wool, and give it another coat of the same. After waiting another twenty-four hours rub it down again, and apply a coat of some *high grade* rubbing varnish, carefully following the directions on the can regarding the temperature, etc. When this coat has thoroughly dried—it may take two or three days—rub it down smooth with pumice stone and water, and wipe off clean. Give it another coat of the varnish—a flowing coat—and when this has hardened perfectly rub it down with pumice stone and oil. If carefully done, this should give a good finish. Of course, the copper embellishments are not placed until the piece has been finished in this manner. The copper may be polished with pumice and water, and given two coats of banana oil to effectively prevent it from tarnishing.

THE FLEXIBILITY OF THE INDUCTION MOTOR

By E. E. George

FEW of the users of induction motors are aware of some of the interesting characteristics of this type of apparatus.

It is not generally known by the experimenter that the induction motor, whether of the slip-ring or cage-wound type, may be used as a generator under certain conditions, chief of which is that it must be loaded onto a live circuit, as the motor will have no field or magnetism unless the line onto which it is loaded has another source of power sufficient to excite the motor field at all times. As a rule, any line that will run an induction motor at no load, will, with proper adjustment of generator voltage if necessary, permit an induction motor to be loaded onto it. The motor must be run slightly overspeed. For instance, an induction motor running idle at 1,800 R. P. M. which might give 5 horsepower at 1,760 and 10 horsepower at 1,720, would give back 5 horsepower to the line if run by some external source of power at 1,840 and 10 horsepower at 1,880 R. P. M. This relation does not hold true exactly, due to motor losses.

In case of a central station breakdown, where part of the synchronous generating equipment is disabled, induction generators could be used temporarily to carry most of the load.

The slip-ring induction motor is often used as a frequency converter, although it may also be used for transforming voltage and phases. The frequency of the current in the rotor of an induction motor equals the stator frequency multiplied by a fraction whose numerator is the synchronous speed of the motor minus the actual speed, and whose denominator is the synchronous speed. Speed in the direction the motor tends to run is considered positive, and speed backward is considered negative. Thus it is readily seen that any desired frequency of alternating current may be produced by driving the motor at the proper speed. The ratio of rotor voltage to stator voltage depends upon the speed, frequency and winding, but the rotor voltage is usually 110 at zero speed. Practically all polyphase motors have three-phase rotors. Thus, a two-phase slip-ring motor makes a good device for obtaining three-phase current from two-phase lines, or *vice-versa*. The motor may be driven by a direct current motor, by an induction or synchronous motor off the same source of power, by some external source of energy, or by an induction or synchronous motor operating off of the new frequency produced.

This latter device is called the interlocked frequency changer because of the definite ratio of the two frequencies, depending only on the synchronous speeds and pulley ratio of the two motors. It is used where one has but two motors available for the frequency transformation, one suited to each frequency.

The squirrel-cage type motor can also be used as a phase converter. Single phase current may be drawn off of two lines of a polyphase circuit without unbalancing the circuit greatly. The motion of the rotor tends to divide the single phase load among all the phases. A modification of this device has proved very valuable in single-phase railway work. A three-phase motor, after being started in any way, can be connected onto a single-phase line and three-phase current can be taken off of its terminals. The experimenter will find this a very valuable device for obtaining polyphase current from a single-phase supply.

Anyone who is thinking of installing a large number of single-phase motors with their costly and complicated starting devices, will find it far cheaper and very convenient to use one large three-phase motor, keeping it running idle on the line at all times, and loading the small three-phase motors onto three lines from its terminals. The large motor will need to be started but seldom, and never under load, so it may be started by hand or with a split-phase device.

ELECTRICAL RESISTANCES AT VERY LOW TEMPERATURES

It may be remembered that some time ago Professor H. Kammerlingh Onnes, of the University of Leyden, made some very interesting discoveries regarding the decrease of electrical resistance in a conductor at very low temperatures. In a note recently presented to the French Academy of Sciences he relates his further experiences in following the same line of experiments. In studying the resistances of metals at the very low temperatures which can be obtained with liquid helium, Prof. Onnes calculated that the resistance of mercury would still be easy to measure at 4.25 degrees above the absolute zero (—268.75° C.), but that it would continue to diminish with lower temperatures in such a way as to become negligible at —271°. Recent experiments have verified these calculations as to the diminution of resistance with decreasing temperatures, and at the same time they have brought to light the unexpected fact that the electrical resistance disappears very suddenly. Mercury at 4.19° Kelvin (which is the name given to these temperatures above the absolute zero) passes without any warning into a new condition, which is characterized by an extreme mobility of the electricity. This state, in which currents can be maintained in a conductor without appreciable electromotive force, has been called the "superconductor condition."

The time of persistance of a current once established in a circuit and abandoned to itself without electromotive force is extremely short in ordinary cases; for superconductor circuits, however, it may become so great that the currents are practically permanent.

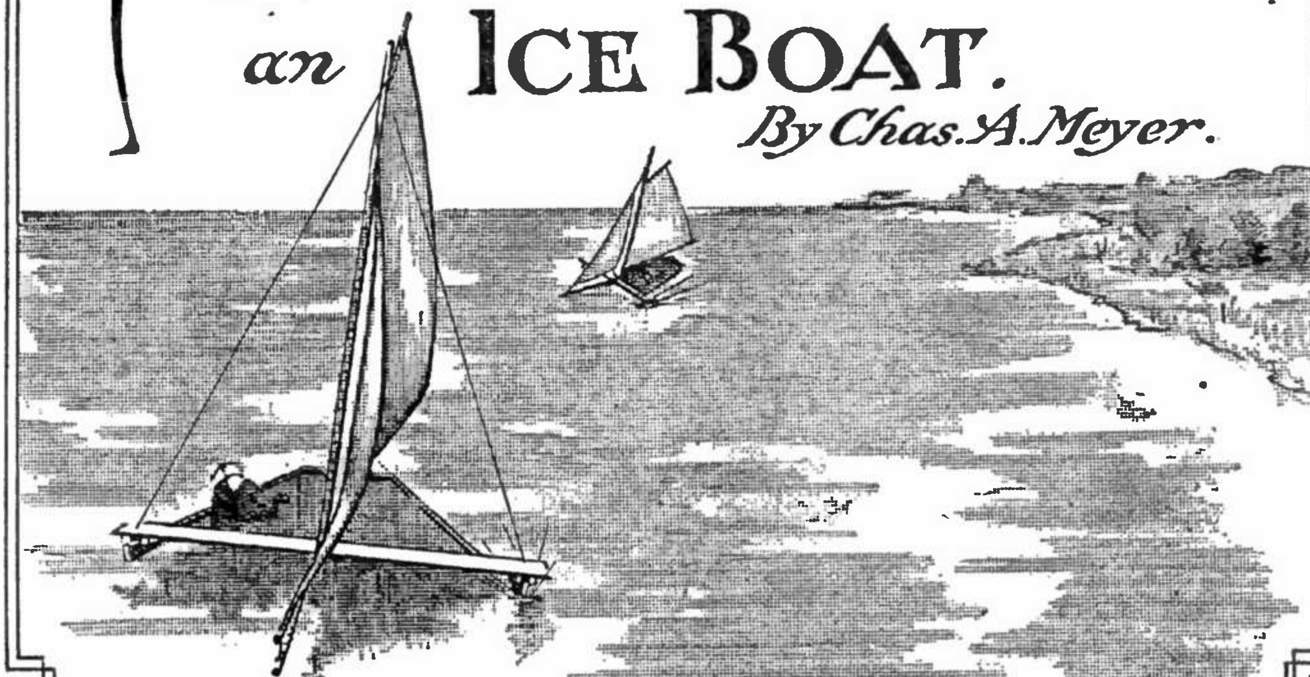
In his communication to the Academy the Professor gives an account of the various experiments which have led to these additions to our electrical knowledge.—J. H. Blakey.

The buildings of the Panama-Pacific International Exposition are being painted by means of improved air brushes. Electric current is employed to heat the varnish applied over the paint, so that it may flow more freely through the orifices of the air brush.

In operation, the airbrush utilizes the principle of an atomizer, the paint or varnish being drawn up through a tube, at the end of which is a nozzle.

How to Make and Sail an Ice Boat.

By Chas. A. Meyer.



OF all winter sports ice boating is the most exciting. The sensation of flying over the ice with the speed of the wind and the sting of the frosty air and bits of ice in one's face, accompanied by the cracking of the sails, is perhaps more exhilarating than that offered by any other form of sport.

On some rivers and lakes where the surrounding country is too level for coasting or skiing, ice yachting is the chief winter sport. Such is the case on the North Shrewsbury River in New Jersey. Sometimes, when the ice is good, the entire river about the towns of Red Bank and Fair Haven is dotted with these craft which appear like so many large white gulls with wings outstretched.

The yachts vary greatly in size, ranging from the small one-passenger affairs to the great boats which carry a dozen or more people at the same time. The boat described below is capable of accommodating two or three persons when there is a good breeze.

Fig. 1 is a side view of the craft complete. In Fig. 2, which is a detailed plan of the body, the backbone, marked *A*, is a 3 x 4 inch piece of timber tapered slightly at one end. The runner-plank, *B*, is a 2 x 8 inch plank. The side rails, *C, C*, are 1½ x 4 inch strips set edgewise. Almost any kind of boards may serve as the flooring, *D*. The runners, *E, E*, are loosely bolted between the runner blocks, *F, F, F, F*. *P* is a hole, one inch square and one inch deep, cut into the backbone to hold the mast. Another hole, *G*, ⅞ inch in diameter, is bored through the backbone to hold the tiller post.

RUNNERS

The two front runners are cut from hard wood two inches thick. The size and shape can be found in Figs. 1 and 3. Through each runner, equidistant from the ends and one inch down from the top, there is a hole one-half inch in diameter. Along the bottom of the runners make a V-shaped groove one-quarter inch deep. The third runner, which acts as a rudder, is cut from hard wood 1½ inches thick and is 14 inches long. The shape and width are the same as those of the other two runners.

Three runner irons must be made as follows: Procure some square iron rod ¼ or 5/16 inch on a side. Select a piece

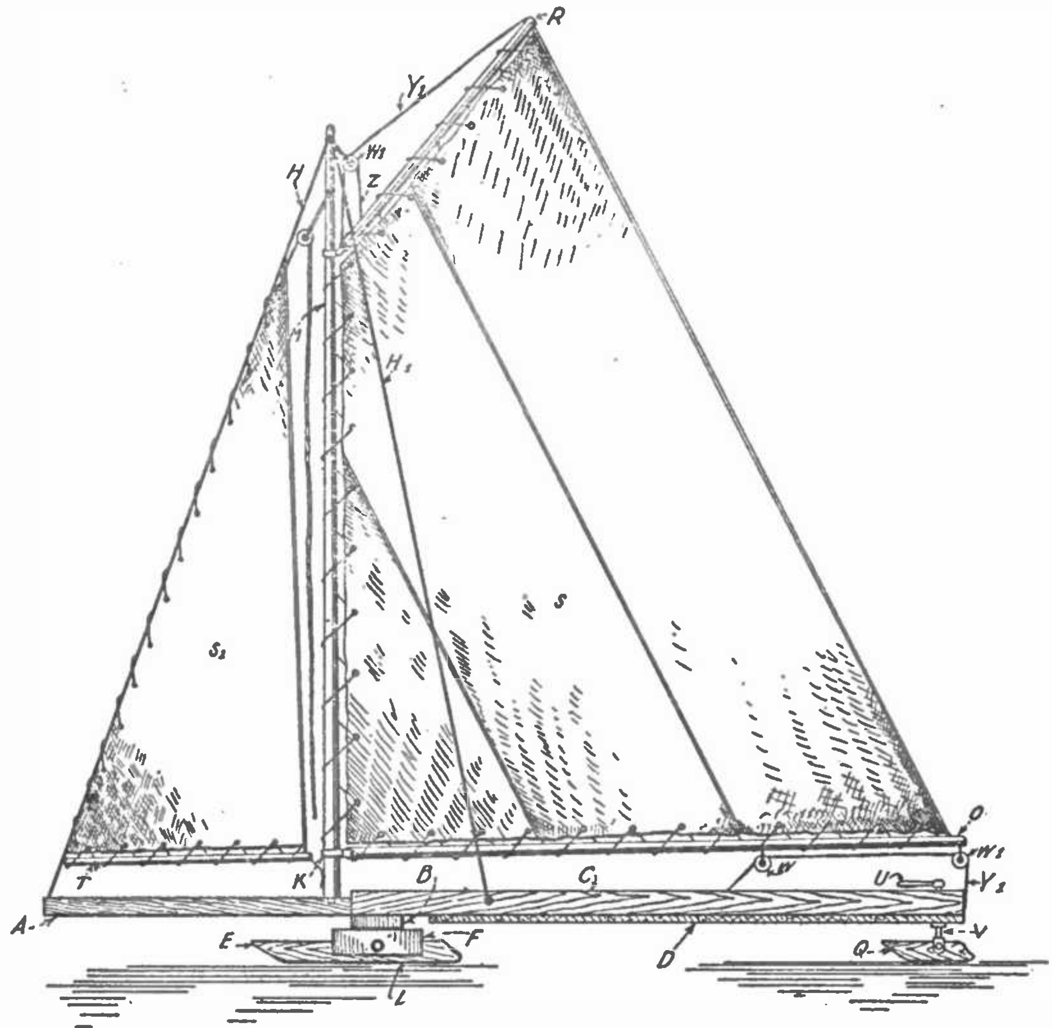


FIG. 1

just as long as the runner to which the iron is to be fitted. Bend it edgewise so that it will run along the bottom of the runner and up the curved part at front and rear for a space of two inches. Then flatten each end of the rod a little and drill holes through the flattened part to take wood screws.

When all three irons have been made fit them into the grooves in the runners and screw them firmly in place with long, stout screws. Sharpen with a file the edge which will bear upon the ice.

RUNNER BLOCKS

Four runner blocks, *F*, Fig. 3, will be needed. These parts are cut from hard wood and are 14 x 4 x 2 inches. Three-quarters of an inch below the center of each block there is a hole, *N*, ½ inch in diameter.

TILLER POST AND HANDLE

These parts must be made by a blacksmith. The shape and size may be seen from Fig. 4. The tiller consists of a round iron rod ¾ inch in diameter, split at one end and drilled so that the rudder may be bolted between the prongs. Just above the split part there is a flange which prevents the tiller post from slipping up through the hole in the backbone. The top of the rod is made square for a space of one inch. Two small holes, ⅛ inch in diameter, are drilled through the square part, the first one ¼ inch from the top, and the other a trifle below the point where the rod changes from round to square.

The tiller handle is a round iron rod the same thickness as the post. It is flattened at one end and has a square hole made through it which is just large enough to fit snugly over the tiller post.

MAST AND SPARS

The mast is a round stick of spruce or pine 2½ inches thick at the bottom and gradually tapered to 1¾ inches at the top. It must be cut down square at the bottom to fit into the hole in the backbone. The boom, *O,* Figs. 1 and 5, made of the same material as the mast, is 2 inches in diameter throughout the whole length. The jib-boom, *T,* and the gaff, *R,* are round sticks 1½ inches thick.

ASSEMBLING THE PARTS

Place the backbone over the runner-plank and at right angles to it in the position shown in Fig. 2 and bolt the two firmly together. Fasten the cross-piece, *X,* to the rear end of the backbone with screws. Secure the side rails to the runner-plank with bolts and to the cross-piece with nails or screws. Screw the flooring to the under side of the side rails and backbone, and drill a hole directly under the hole, *G.*

Bolt the rudder between the prongs of the tiller post and push the latter up through the hole, *G.* Then fit the tiller handle over the tiller post and secure it in place with two pins thrust through the two holes in the top of the post.

Bolt two runner blocks to each end of the runner-plank as in Figs. 2 and 3, with just enough space between them to allow the runners to fit in loosely. Be sure that the two pairs of blocks are exactly parallel or the boat will not run well. Now place the runners between the blocks so that the holes in each come opposite, and run a 7-inch bolt through both. This arrangement allows the runners to move up and down when any roughness in the ice is encountered.

Place the mast in the hole, *P,* and secure it in place with three heavy wire stays, *H* and *H′,* Fig. 1. (Only two are

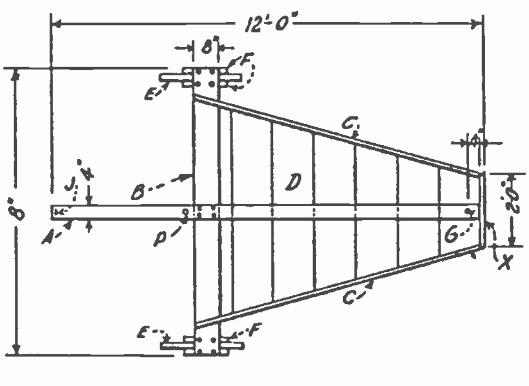


FIG. 2

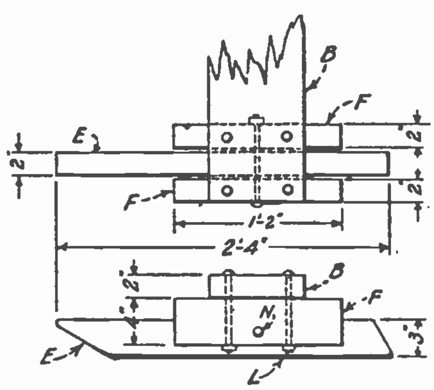


FIG. 3

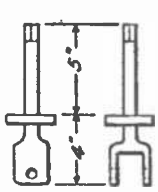


FIG. 4

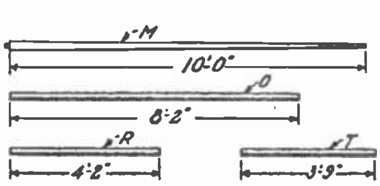


FIG. 5

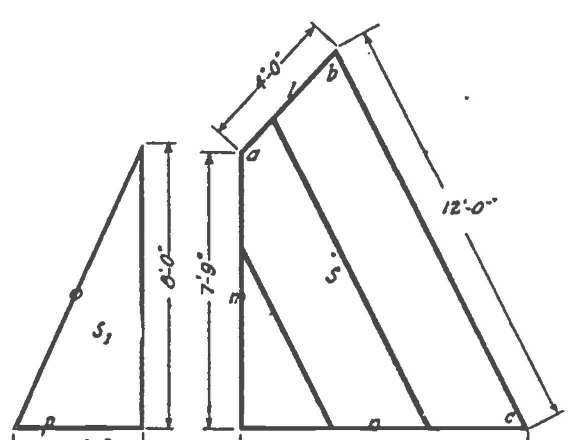


FIG. 6

shown in the sketch.) One of these stays is brought down to an eyebolt in the tip of the backbone and the other two to eyebolts in the side rails. The boom and gaff are fastened to the mast with rings of copper or brass wire, made large enough to slide freely up and down. Two ropes, *Y'* and *Z*, tied to the gaff, are brought through the pulley *W'*, and wound around a cleat on the backbone. These ropes make it possible to hoist the mainsail up or down at will.

SAILS

The mainsail *S*, and the jib, *S'*, are made from yard-wide stripe of canvas or sail cloth of any kind. In looking at the plans, Fig. 6, it might at first seem a simple matter to map out the sails. But such is not the case. The simplest way to accomplish the task is as follows: Select a large room with a bare floor on which to work. Draw on the floor a straight chalk line 8 feet long. At one end of this line and perpendicular to it draw another line 7 feet 9 inches long. The lines may be made perpendicular by using a large steel square or by drawing the plan in the corner of a square room. Now fasten a few feet of twine to a piece of chalk. Make a loop in the twine at a distance of four feet from the chalk. Drive a nail at point *a*, Fig. 6, and loop the string over it. Then, handling the chalk like a pair of compasses, draw an arc through point *b*. Change the position of the nail to point *c*, and, using twelve feet of twine, make another arc cutting the first at point *b*. Join points *a*, *b* and *c* with two straight lines and the plan of the mainsail is complete. For the jib, start by drawing a straight line 3 feet, 8 inches long. At one end of this line and perpendicular to it draw a line 8 feet long. Connect the extremities of these lines with a third line, thus forming a right angle triangle, and the plan of the jib is finished. Now it will be found a simple matter to cut the sails to the proper shape by laying the strips of cloth down over the chalk plans. Be sure to have the strips run as in the illustration or the sails will not hang well. All seams must be double stitched with strong thread. A hem one inch wide should be made along all edges of both sails and eyelets worked in, about one every foot, on the sides *l*, *m*, and *n* of the mainsail, and on the sides *o* and *p* of the jib.

PUTTING ON THE SAILS.

When the sails have been completed hoist the gaff to within about two feet of the top of the mast and fasten it there. Then lace the mainsail to the mast, boom and gaff with quarter inch rope of a good quality. Lace jib to the front wire stay and to the jib-boom as shown in Fig. 1. A length of rope tied to the end of the jib-boom and wound on a cleat will allow more or less sail to be "let out." Another rope, *K*, fastened to the top of the jib and run over a pulley, *W*, allows this sail to be hoisted up and lowered. The rope controlling the swing of the mainsail is rigged as follows: Fasten it to an eyebolt in the rear cross-piece, *X*, Fig. 2. From there bring it over two pulleys, *W*, *W*, on the boom, and finally tie it to a cleat on the backbone.

The appearance of the boat will be greatly improved if the body, runner blocks and runners are painted some attractive color which will show up well against the ice. The mast and spars would look well if shellaced or varnished with some waterproof preparation.

HOW TO SAIL THE YACHT.

When the craft is on the ice always turn it toward the direction from which the wind is blowing and turn the tiller crosswise before hoisting sail. For ordinary sailing both sails should be regulated by the ropes controlling them so that they can swing about a foot to either side. When the sails have been hoisted take the tiller in one hand and push the boat around sideways to the wind. Then straighten out the tiller and run along a few steps till the craft is fully under way. An ice boat should be handled about the same as an ordinary sail boat. To stop, "throw the boat up into the wind"; that is, point it in the direction from which the breeze is blowing.

The cost of electrical cooking has been reduced more than 40 per cent. by the introduction of the so-called "fireless electric cooker."

DESIGN FOR A SMALL DYNAMO

Description of the Construction of a 30-Watt Generator of Simple Yet Efficient Design

By Chas. F. Fraasa, Jr.

Illustrations from drawings made by the author.

THE following design is for a small direct current dynamo following the best practice in small dynamo construction, embodying as it does, a laminated slotted drum armature; built up, mica-insulated commutator; cast steel field magnet, giving increased efficiency; and a reasonable speed. The capacity of the machine operating at a normal speed of 2,500 r.p.m. is 30 watts. The design gives winding data for 15 volts 2 amperes as a dynamo. The machine will operate equally well as a motor, but at a lower speed. Fig. 1 shows the completed machine.

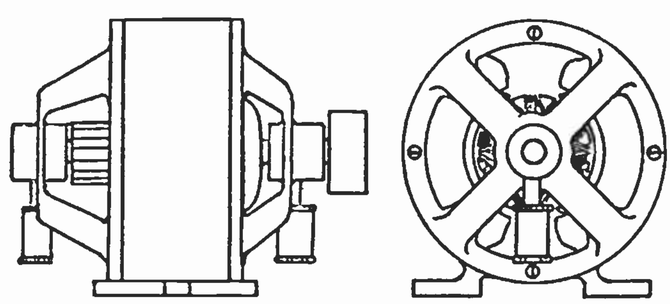


Fig. 1.—Side and End Views of 30-Watt Generator as it Appears when Completed.

The dynamo is easily constructed. All the machine work may be done on a lathe of 7-inch swing. Directions are given for making the patterns so that the builder may make them himself, and cut down the cost of the castings.

The patterns are built up to the proper thickness from a number of thicknesses of white pine, and secured together by pattern maker's glue. Patterns to be turned are glued to a disc of one inch pine fastened to the lathe face plate with screws. A piece of heavy paper should be glued between the pattern and the disc to facilitate the removal of the pattern. The patterns should be given a slight draft from the parting line, that is, the parts of the pattern should be thicker at the parting line, so that the pattern may be removed from the mould without tearing the sand. Holes of large diameter in proportion to their length will form their own cores. Holes of small diameter in proportion to their length, such as the holes in the bearing hubs, will have to be cored out. When the pattern has been turned to shape it is finished by sand papering it with No. 0 sand paper and given a coat of shellac. This will raise the grain of the wood. Sand paper again, and apply another coat of shellac. The patterns are almost too small to make any practical allowance for shrinkage, but 1/8 inch must be allowed all dimensions for machining.

The yoke and the magnet cores of the field magnet are cast separate so that the field coils may be wound on a form, and then placed on the poles, when they are secured to the yoke by means of machine screws. Fig. 2 dimensions the finished yoke casting. The pattern divides along the line *A—B*. The two parts of the pattern are secured together while turning by means of four 3/16 inch dowel pins. These dowel pins are glued in one of the parts of the pattern, and fit snugly in holes in the other part. These pins should remain in the patterns, as they are used by the moulder to locate the two parts of the pattern in the mould. Remember that the dimensions given in the illustrations are finished dimensions, and to add 1/8 inch to each dimension where it is to be machined. The recess *C* is not turned in the pattern, but in the finished casting.

The two pole pieces and magnet cores are cast together as in Fig. 3, and machined to fit the yoke ring, when the

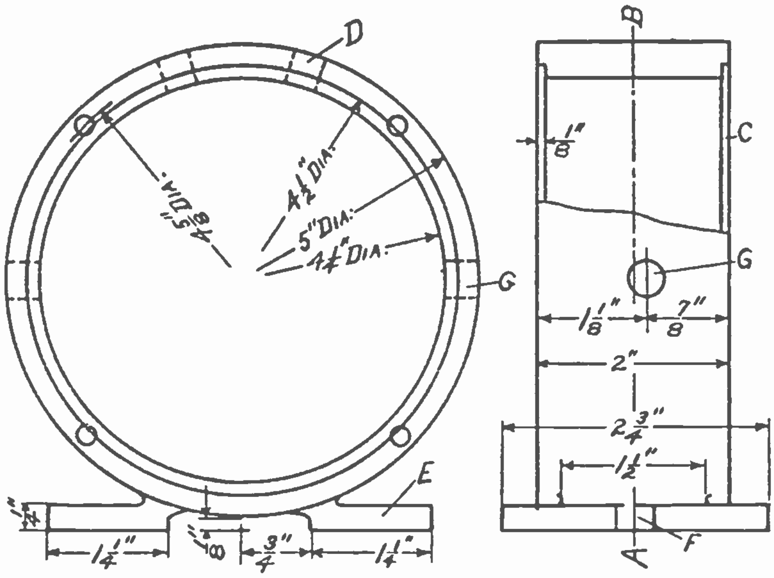


Fig. 2.—Dimensions of the Finished Yoke Casting.

material *B* between the pole tips is cut away. Fig. 3 gives the finished dimensions. In the pattern, make the cores ⅞ inch long, and the armature 2⅛ inches in diameter.

The housings are illustrated in Figs. 4 and 5. A pattern will be required for each. The pattern is built up to the required thickness and turned inside and outside. Drill a hole in each of the windows, and cut along the lines of the arms with a coping saw. The windows are then trimmed to shape with a sharp knife. The flange *A* is not turned in the pattern but in the finished casting. It will therefore be necessary to make the ring *B* ⅜ inch thick. Turn the core prints *A*, Fig. 5, from some pine, and mount one in each end of the housing hub, gluing it in a ¼ inch hole drilled in the centre of the hub. The parting line of the mould is the inside of the housing, so draft will accordingly be made on the arms and the hub.

The brush holder pattern, Fig. 7, is so simple as to require no explanation. The hole *A* cores itself, and should be given a slight draft to the surface *B*.

The yoke and the pole pieces are to be cast from a good quality of steel. The housings and the brush holder may be made of cast iron.

When you get your castings from the foundry, they should be cleaned before you attempt to machine them. With a piece of emery cloth, clean all the sand and scales off of the castings and grind off any rough, irregular spots.

Mount the yoke ring, Fig. 2, in the lathe, and bore it out to 4¼ inches in diameter. Face the end and turn a recess *C*, 4½ inches in diameter, and 1/16 inch deep. Then clamp a block of iron to the face plate and turn up a supplementary face plate to snugly fit the recess in the yoke ring, and clamp the yoke ring to it. The other end may now be faced and the recess turned. Drill two 5/16 inch holes *D* in the top of the yoke ring casting for the terminal binding posts. The base lugs *E* should be finished by grinding to shape. The bottom surfaces should be in line, so that the machine will stand level. A ⅜ inch hole *F* is drilled in each lug and then cut open with a hack saw to form a slot ⅜ inches wide and ¾ inches long. This slot is for the bolts which hold the machine down. The holes *G* for the cap screws

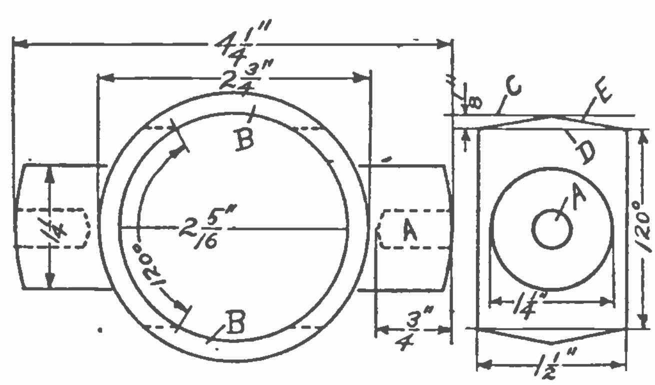


Fig. 3.—Casting for Two Pole Pieces and Magnet Cores.

which hold the magnet cores in place are drilled ⅜ inch in diameter. Be careful to locate these exactly as indicated in the illustration, as upon this depends the uniformity of the air gap, and the centering of the armature between the bearings. If the holes are too far to one end, the armature will pull to that end and rub against the bearing.

The casting of the pole cores is chucked in the lathe and the core ends are turned down to a diameter of 4¼ inches. The armature tunnel is bored out to 2 5/16 inches in diameter, and the

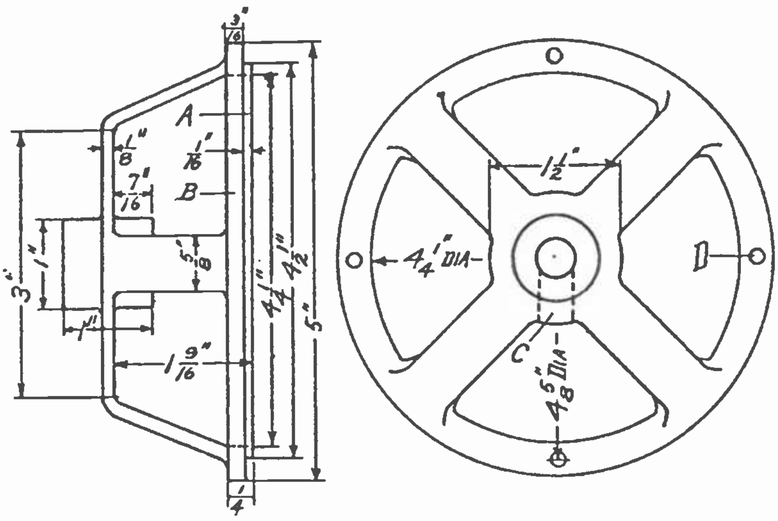


Fig. 4.—A Housing as it Appears When Finished.

ends faced off so that the poles will be 1½ inches wide. The hole *A* in each of the pole cores is drilled with a 9/32 inch drill in the center of the pole, and tapped ⅜ inch, 18 threads per inch. In the armature tunnel, locate the center of each pole. With the dividers set at 1 5/32 inches between points, scratch a mark on each side of the center. Then set the divider for 1 9/32 inches, and scratch another mark. Through these marks on each pole face, scratch parallel lines *C* and *D*, Fig 3, and from the center of the line *C* draw the lines *E* to the ends of the lines *D*. This will give the pole face the shape, Fig. 3. For mounting the pole pieces in the yoke ring, procure two ⅜ inch cap screws one inch long.

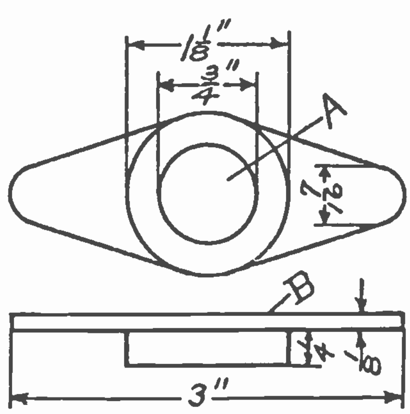


Fig. 7.—Pattern for Brush Holder.

Chuck the housing and bore the bearing hub out to 9/16 inch in diameter. Mount the housing on a mandrel, bracing it well, and face off the hubs. The flange *A*, Fig. 4, is then turned 4½ inches in diameter and faced off so that it will be 1/16 inch thick. This flange should make a snug fit in the recess turned in the yoke ring. The hole *C* is drilled ¼ inch, and tapped 5/16 inch, 18 threads per inch for the grease cup which lubricates the bearing. To drill the holes *D*, fit the housings to the yoke ring, and drill a 3/16 inch hole through the housing at the points located. Then continue with a No. 29 drill into the yoke ring and tap for a 3/16 inch 24-thread per inch screw. Drilling in this way will insure the alignment of the holes in the housing and the yoke ring. The bearing is a piece of brass or phosphor bronze one inch long, 5/16 inch internal, and 9/16 inch external diameter. This is bored out and mounted on a mandrel and turned down to a snug fit in the housing. The bushing is driven in place, and a ⅛ inch hole is drilled through it from the center of the hole *C*, Fig. 4. The bearing is then reamed out with a 5/16 inch reamer. The commutator end housing should have the inside hub turned down to ⅞ inch in diameter for the brush holder.

A grease cup dimensioned in Fig. 6 consists of a tube *A* one inch long, having its ends threaded internally to receive the two caps *B* and *C*. The caps *B* and *C* are turned from brass rod, and threaded to fit the tube *A*. The *C* cap has a ⅛ inch hole drilled through it for the wick *D*, which lubricates the bearing. A coil of brass wire *E* is bound to the wick

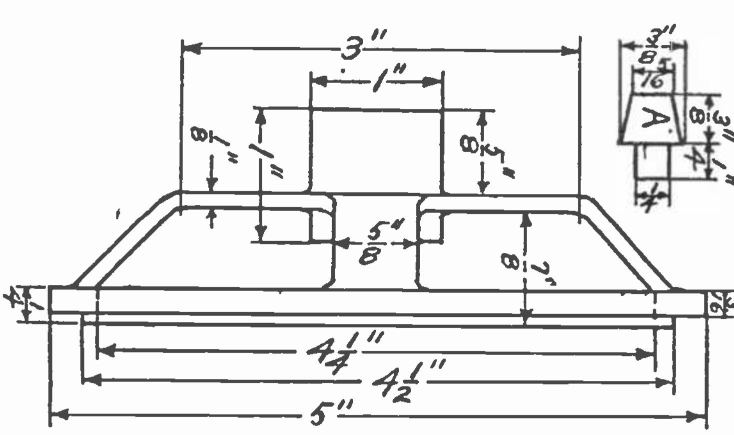


Fig. 5.—Construction of Pattern for Housings.

D to force it against the shaft, thus providing a constant supply of oil to the shaft.

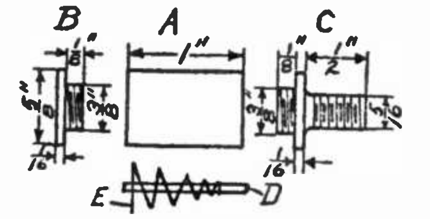


Fig. 6.—Parts of a Grease Cup.

This concludes the description of the machine work on the generator.

In the March issue of MODERN MECHANICS, the author will cover in detail the winding of the field magnet and armature of the 30-watt generator, together with a description of the assembly of the machine and suggestions for an appropriate and attractive method of finishing it.

HOW PINS ARE MADE

The making of such a common and everyday commodity as a pin involves quite a number of steps from the raw material to the finished product. But every operation is performed by machinery so that the cost of pins is remarkably low.

The first step in the manufacturing of pins is when a pair of jaws seizes the end of a brass wire which is wound on a spool and draws out a length corresponding to the size of the pin. The wire runs on steel posts, which serve to straighten it. The wire is then caught by two clamps and a cutter clips off enough wire to make one pin. A small length of wire is left projecting to make the head. The latter is formed by three rapid blows from a hammer which moves forward one-twentieth of an inch after each blow.

The pins then drop from the clamp and run down an incline beneath, in which are grooves large enough to admit a shank, but which will not permit the head to pass through. As the pins move down the inclined plane, the points come in contact with a revolving cylinder beneath. This cylinder, the surface of which is like a file, comes in contact with the pins on only one side as they move down the grooves. This causes them to turn around so that the revolving file sharpens them eventually on all sides. The pins next drop from the grooves into receptacles and are cleaned from grease by being dipped into an alkaline solution.

The process that follows is the tinning of the pins. This is accomplished by placing in a pan a layer of finely ground tin, then a layer of pins, another layer of tin, and so on until the pan is filled. A solution of bitartrate of potash is then poured in. The application of heat makes the solution of tin with which the pins are coated.

The pins are then polished by placing them in barrels and revolving them rapidly. The friction thus produced highly polishes the pins in a short time.

Pins are papered by an ingenious little machine which saves a great deal of labor. It is nothing more than a steel box under which is a sliding frame that seizes the paper and crimps it into divisions as wide as the length of the pins. The bottom of the box is made of little square steel bars spaced at such a distance apart as to allow the shanks but not the heads of the pins to pass through. The bars are kept in motion, thus shaking down the pins until a row is formed, when they are clamped in place by the bars. A fold of paper is pushed up against them until they are pressed into place. This process is repeated until the paper is filled, when a new one takes its place.

THE MYSTERIOUS CAGE

By G·C·HINES

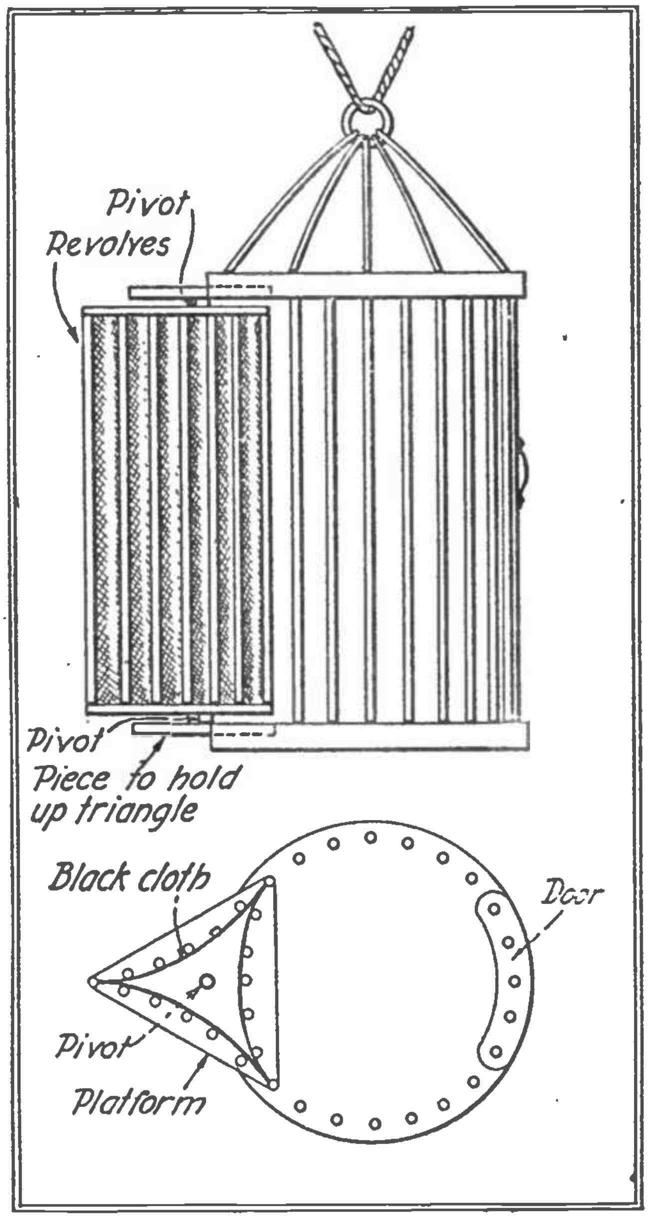
THE illusion about to be described is in all probability a familiar one to a great many readers. In offering this experiment the performer first calls attention to a large iron cage suspended in mid air. The cage is about 4 feet in diameter and 8 feet high. The performer's assistant, a young girl of about 10 years of age, enters the cage by means of a stepladder and two wing-shaped curtains are then let down until they just cover the front of the cage. Within two or three seconds the curtains are raised and the girl is seen to have grown into a young lady. The curtains are again let down and when raised for the second time the young lady is seen to have changed into an old lady. To prove that the effect is not accomplished by means of a change of make-up and costume, the curtains are lowered and when raised again, all three of the assistants are seen standing inside of the cage. A ladder is placed in position and the assistants descend.

In view of the fact that the cage is off the floor and at least 10 feet away from the back curtain, and also that the audience can see through the cage, thus proving that the other two assistants are not concealed therein, this illusion is a most effective one. The secret of its production is a simple one and it is through the time-worn method of using a special back drop that the illusion is performed.

The cage is made as shown in the illustration and is about 8 feet in height to the top of the dome. In the back of the cage the bars are removed for a space of about 3 feet and in the middle of this space in both top and bottom of the cage are placed metal brackets in which pivots are secured. Two pieces of wood are then cut into triangles each side of which is slightly less than 3 feet in length. Bars are then placed in curves on these boards as shown in the drawing. The reader will note that the radius of these curves is the same as that of the cage itself; the bars set into the triangles, therefore serve to complete the cage.

A back drop, preferably of black velvet, is placed across the rear stage and pieces of the same material as this drop are fastened along the inside of the bars of the triangles as shown in the figure. Thus we have a structure with three platforms and this affair is to be located so as to revolve freely on the pivots secured in the top and base of the cage.

Assuming that the cage has been suspended over the stage and that the drop is in position, the performer is ready to attempt his experiment. The young lady assistant is located on one of the platforms in the rear while the old lady occupies the remaining platform. The audience will, of course, be unable to distinguish between the black material backing up the bars on the triangular platform and the material forming the back drop. Thus it will appear as though a clear view through the bars of the cage were to be had. The child is



Details of Apparatus for Producing the Mysterious Cage Illusion.

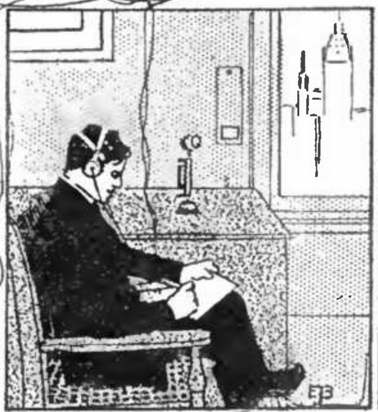
permitted to enter the cage and the curtain let down. The child then steps upon the platform which is revolved, thus bringing the young lady into the cage. The curtain is raised to show the young lady and then lowered to effect the change into the old lady. When it is desired to bring all three assistants into the cage for the finale, the platform is revolved until the three assistants have taken their places.

USE OF GOLD IN CERAMICS

Gold is used on pottery either for gilding or as a coloring agent in glazes. Its value for gilding lies in its resistance to oxidation and the fineness of the layer which can be produced, for which reason it is not an expensive stain. The aid of a flux is employed in application, and mercurous oxide is found to reduce the amount of gold required. The following mixture is recommended:

Fifteen parts of black mercurous oxide, 2.5 parts of basic bismuth nitrate, and 0.3 parts of melted borax; the addition of three parts of silver carbonate to this composition producing a greenish tint. After firing in the muffler the gold has a matt surface and must be polished with bloodstone or agate. A cheaper process, which does not require polishing after the burn, is the use of "Glanzgold" or "Meissen gold," a preparation of gold solution with an organic medium such as turpentine, lavender oil and a balsam or resin. As a coloring agent in glazes, gold produces shades from violet to purple and red, of which the best known is purple of Cassurs, a lake of precipitated gold with metallic hydroxide, preferably that of tin, which was formerly regarded as a definite compound. The presence of ammonia or alum in the stannous chloride solution produces shades from dark to rose purple, and the tint may be further modified by the substitution of antimony or magnesia for tin. Choice of flux materially influences the color. Various recipes are given which contain lead oxide, borax or felspar, and kaolin may be used as a base for the lake. In lead glazes one part powder will produce a deep red glaze, and in leadless glazes, one in 10,000. An underglaze stain can be produced from 50 parts of pegmatite, 50 of alumina and one of gold chloride. Gold may be applied under a glaze on places previously moistened with gum tragacanth solution.

A Berlin professor estimates the commercial value of electricity represented by a single flash of lightning lasting for one-thousandth of a second, at 29 cents. If this energy could be conserved and rendered commercially available, it would serve to light the average six or seven room cottage for nearly a week.



HOW to MAKE a MICRO-DETECTAPHONE

By Fred H. Fries

DESCRIBING the Construction of a Micro-Detectaphone of Simple Yet Efficient Design that May be Used for the Same Purposes as the Commercial Type Employed by Detectives.

ALMOST all amateur experimenters have around their radio station an old telephone receiver and possibly some of them have an old transmitter, but there are few who have a sensitive microphone. In the following the author has endeavored to describe a microphone that he has used for some time and which is so sensitive that he can hear a train leaving a station seven squares away from his home, as well as hear people talking in the house next door.

To commence with, you first construct the wire frame *B*, which is made by taking a piece of No. 8 B & S gauge wire, 19½ inches long. Measuring 7½ inches from one end, bend the wire at right angles. Then measure 4½ inches from the first bend and again bend at right angles, resulting in the frame *B*. Next construct diaphragm *D*, which is a piece of No. 24 B & S gauge tin, 4⅛ by 4¾ inches. Now cut two pieces of spring copper *C*, either No. 34 or 36 B & S gauge, and have them 2¾ inches long by 3/16 inch wide. Take diaphragm *D* and solder strips *C C* to it, also to frame *B*, (see sketch). Next construct the adjustable contact point *G*, which is another piece of No. 34 spring copper 4 inches long and ½ inch wide, having three holes in it and bent as per enlarged sketch. *I* is a piece of No. 1 lead pencil cut in the manner shown and inserted in the two holes made in the copper strip *G*. Construct the adjusting screw *E*, which is a copper pillar ½ inch in diameter and 2 inches high, with a hole drilled in it and then tapped out to receive a threaded rod. This rod may be any size, but ⅛ inch rod was the size used by the author. The manner in which the copper pillar *E* and the adjustable contact *G* are fastened to the base, *A*, is clearly shown in the sketch. In order to fasten wire frame *B* into place, measure 4½ inches on the base and then make two holes a trifle smaller than the wire and force the wire ends into the holes.

After the parts are assembled and the wire is run on the underside of the base to binding posts *F F* at the edge, as shown in the sketch, take the instrument and set it on a perfectly level place and see where the carbon point *I* touches and mark it on the tin. Now cut a small piece of carbon *H*, a ½ inch square by ⅛ thick and glue it on the diaphragm *D* at the point where carbon point *I* touches.

The micro-detectaphone is then ready for service, and by looking at the hook-

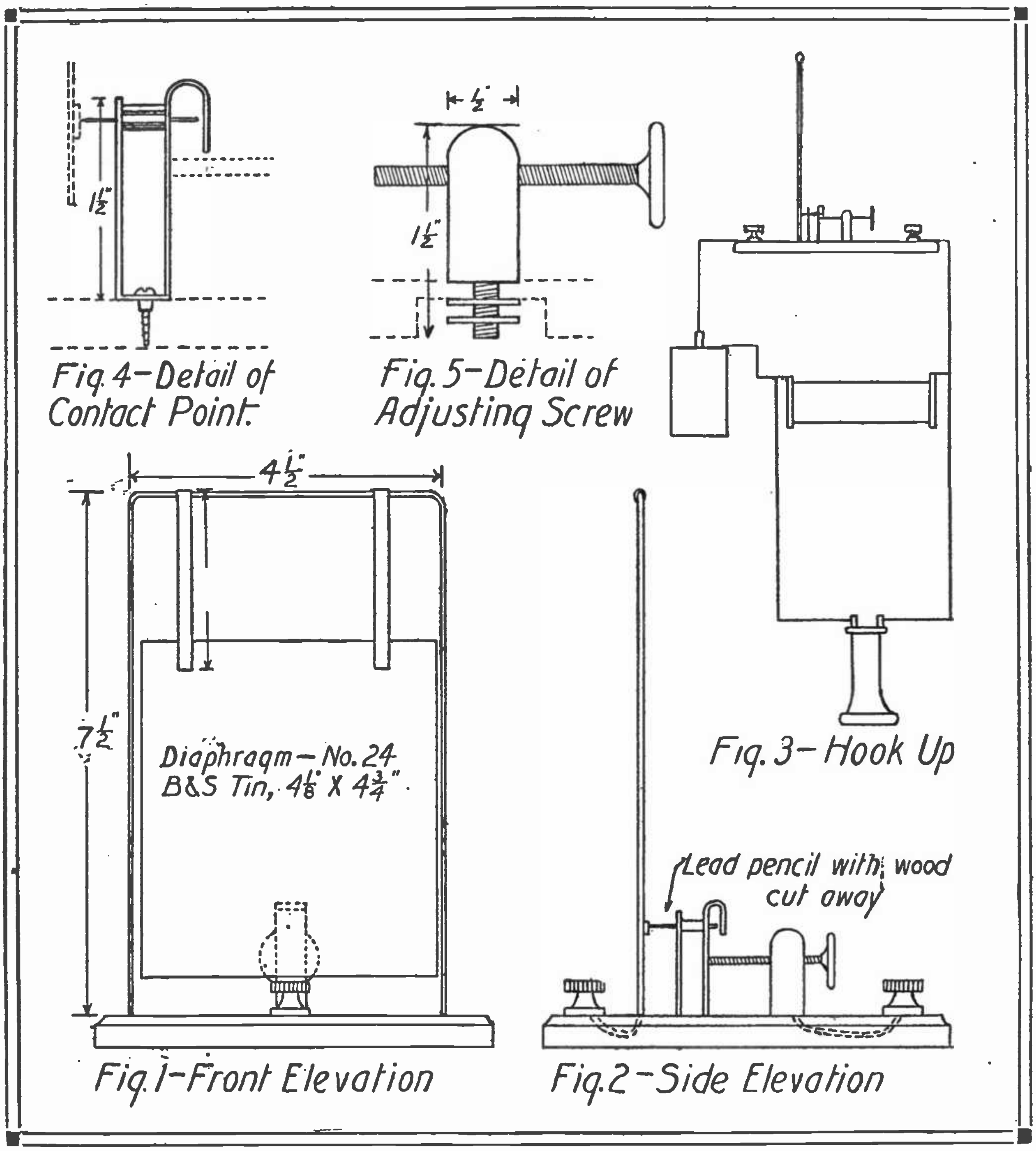


Fig. 4—Detail of Contact Point

Fig. 5—Detail of Adjusting Screw

Fig. 3—Hook Up

Fig. 1—Front Elevation

Fig. 2—Side Elevation

up you can see how to run the wiring. *A* is the instrument, *B* is the battery, *C* is an ordinary telephone induction coil, and *D* an ordinary telephone receiver. It will be seen that the receiver is connected to the secondary side of the induction coil. With a little practice it will be possible to adjust the device to render it as sensitive as most dictagraphs on the market at present.

If you enjoy MODERN MECHANICS, tell others; if not, tell us.

ELECTRICAL ILLUMINATING HINTS

Recently, an illuminating engineer of the General Electric Company gave the following helpful rules:

Dust lamp globes and shades as often as furniture, or at least once a week.

Keep a supply of unused lamps of various sizes in the house. Don't wait until the lamps are broken or burned out, to secure new ones.

Always replace a burned out lamp with one of the same wattage.

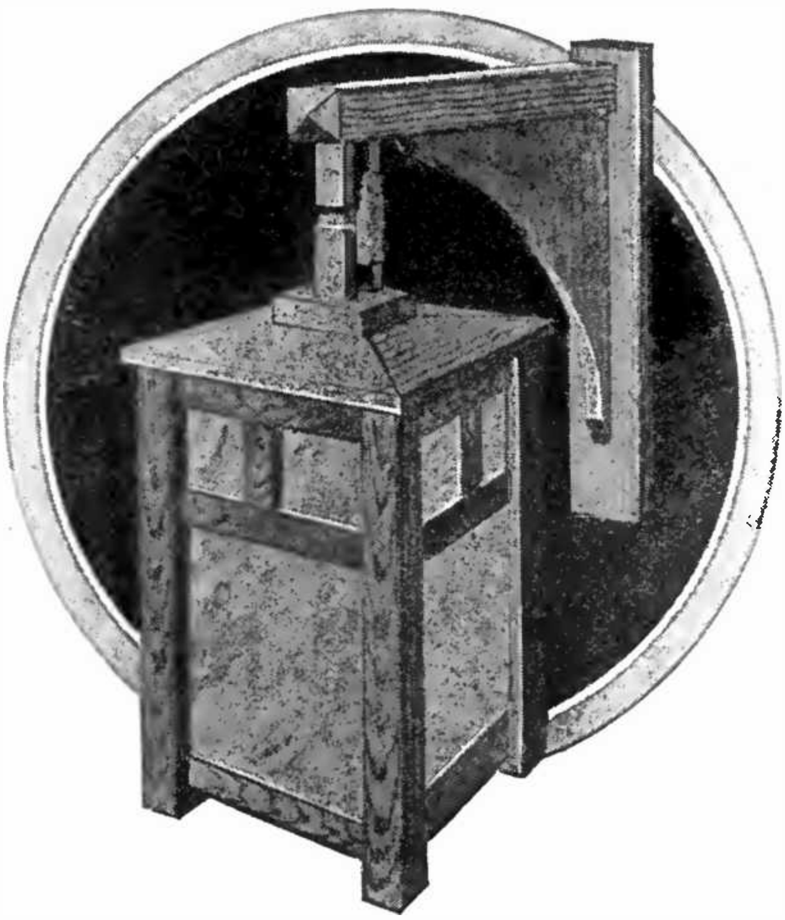
For the Handy Man

Edited by Thomas Stanley Curtis

A Wall Lamp in Wood and Artglass*

OF the many different types of artcraft lamps suitable for amateur construction, probably none is more useful than the wall bracket design providing it be made of moderate size and of simple design. By the latter is meant a design comparatively free from ornamentation. It is believed that the lamp illustrated in the wash drawing on this page combines both of these features in a design that is at once dignified, unobtrusive and artistic. Its appearance in the daytime is quite as pleasing as at night when it is lighted.

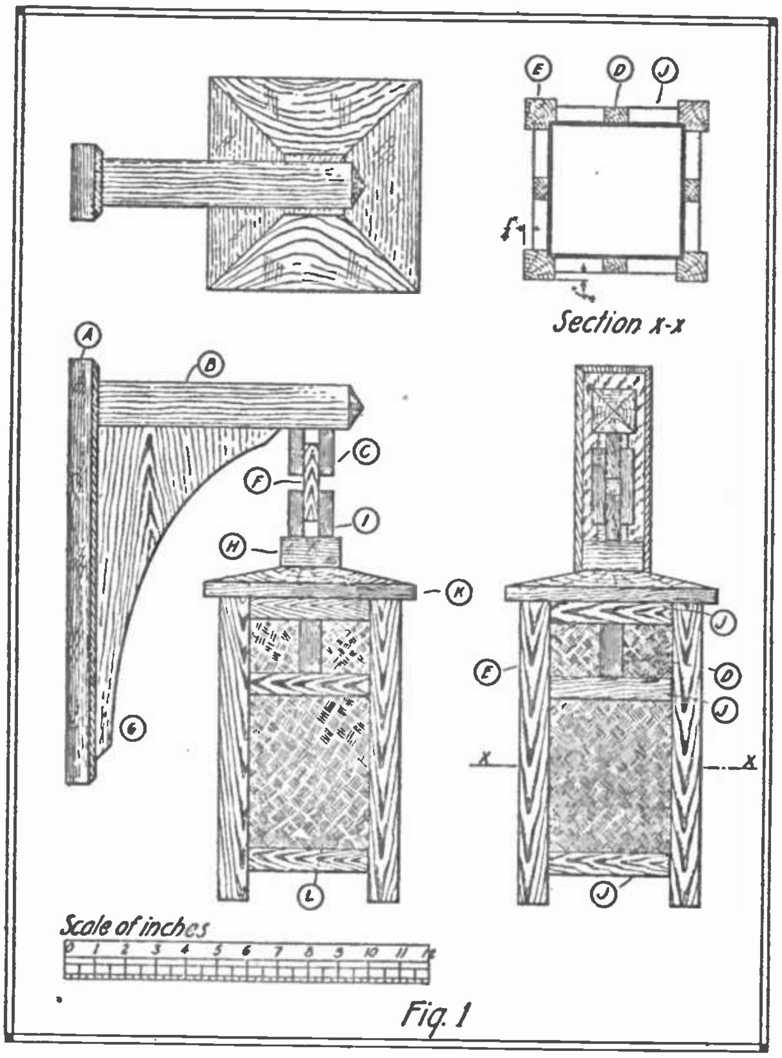
In Fig. 1 the reader will see line drawings that show the plan and side and end elevations of the completed lamp, as well as a section through the body of the lamp to show the method of securing the artglass panels in position. The dimensions are not given in these drawings as their presence would serve only to confuse. Instead, the scale of the drawings is to be seen in the lower left hand corner of the plate and by cutting this scale out of the page and pasting it on a piece of thin cardboard, the reader may take at a glance the dimensions of any part in the assembled views by using the scale as a rule and reading the dimensions in inches.



View of Completed Lamp.

The exact dimensions of the various pieces from which the lamp is made up are given in the detailed drawing, Fig. 2. The number of pieces of each size required is also to be seen under each drawing. The summary of this drawing is given in the bill of materials which follows and it is necessary only to add that the wood referred to is oak unless the individual worker prefers some other stock, to match the finish of a certain room, for instance. Oak is very practical as it can be stained to a variety of shades and it takes a nice finish. The stock should be ordered cut to size unless the builder is well equipped with tools and does not object to the extra

* This article is one of a series dealing with the construction of lamps in many different designs that has appeared in the November, December and January issues of this publication.



Showing Front, Side and Top Views of Completed Lamp.

labor involved. At any rate, the material should be ordered planed to the thickness required in the finished piece.

(A) 1 piece wood 1″ x 2½″ x 14″.
(B) 1 piece wood 1½″ x 1½″ x 9¼″.
(C) 2 pieces wood ½″ x ½″ x 1½″.
(C) 1 piece wood ½″ x ½″ x 1½″.
(D) 4 pieces wood ½″ x ¾″ x 1¾″.
(E) 4 pieces wood 1″ x 1″ x 10″.
(F) 2 pieces wood ½″ x ½″ x 2½″.
(F) 2 pieces wood ½″ x ½″ x ½″.
(G) 1 piece wood 1″ x 6″ x 11″.
(H) 1 piece wood 1″ x 2″ x 2″.
(I) 2 pieces wood ½″ x ½″ x 1½″.
(I) 1 piece wood ½″ x ½″ x ½″.
(J) 12 pieces wood ½″ x ¾″ x 4″.
(K) 1 piece wood 1″ x 7″ x 7″.
(L) 4 pieces artglass 4⅜″ x 8⅛.″

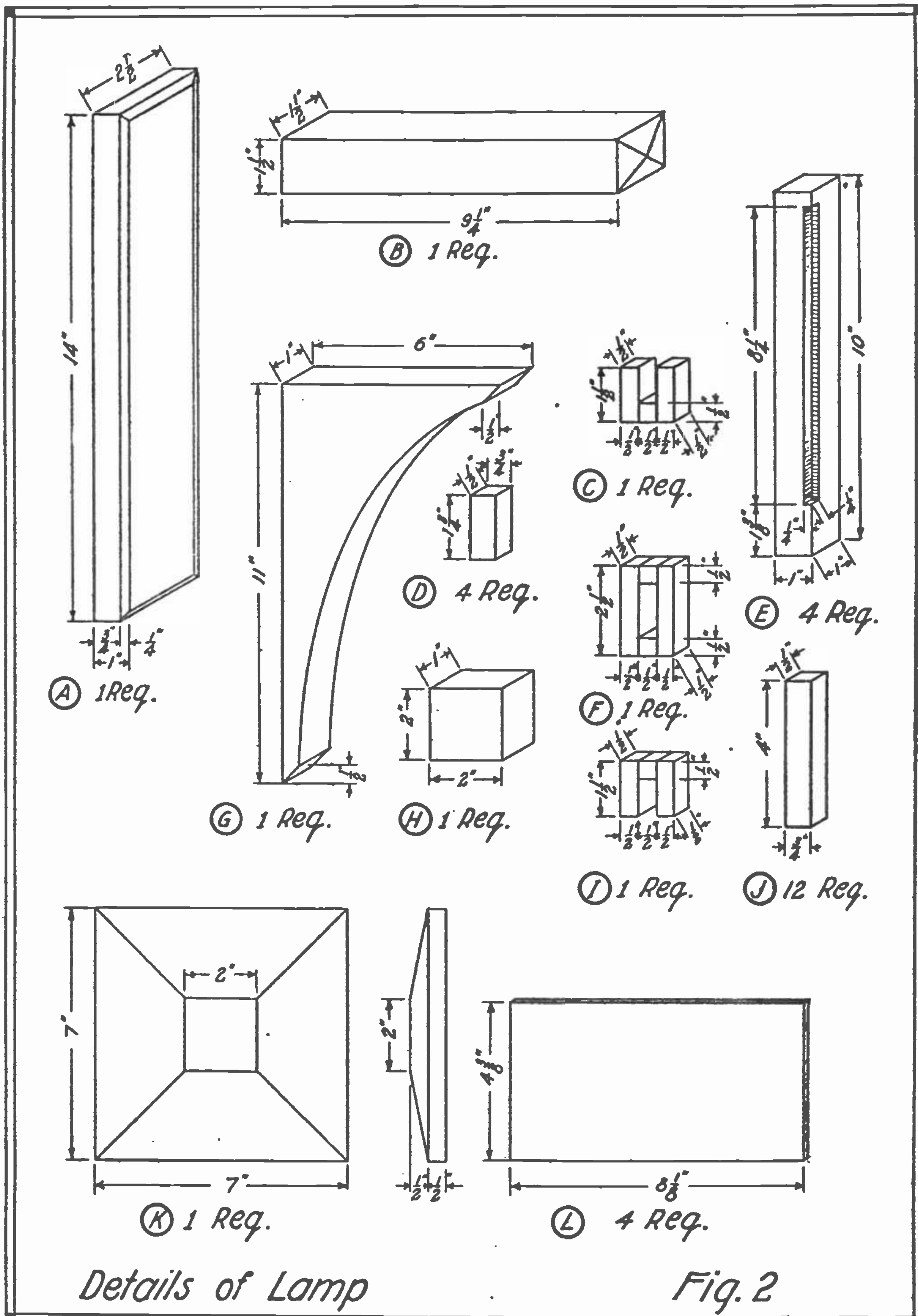
In the above bill of materials the reader will note several repetitions and in preparing the order for the mill, the total number of pieces of each size required should be specified.

It is believed that few words of explanation are necessary in order that the average reader may clearly understand the construction and assembly of the lamp. The first piece to consider is the back board *A* upon which the lamp is supported. This piece should be cut accurately to size, the bevel planed on the edges, and the whole piece sandpapered with a piece of very fine paper. To this piece the arm *B* is attached after it is finished up in like manner. The assembling may be done with flat head wood screws and slender wire finishing nails supplemented with glue carefully applied, but it is preferable to use dowels if the task of placing them is not beyond the ability of the worker. In the case of the back board and arm, *A* and *B*, respectively, the use of screws is quite admissible and in fact advisable as the heads are concealed when the lamp is attached to the wall.

The bracket piece *G* is cut to shape by means of a pattern maker's or compass saw and the surface and edge nicely finished with sandpaper. The bracket is then to be located beneath the arm *B* to which it is secured with dowels. The attachment to the back board may be accomplished with screws from the back.

The construction of the links of the chain is clearly shown in the detailed drawings, Fig. 2, and indicated by *C, F* and *I*. The reader will note that the links are built up of separate pieces of ½ inch square stock. The assembly is preferably with dowels and glue, although slender nails may be substituted for the dowels. The small nail holes are easily filled and concealed by means of paste wood filler worked up with stain to the color of the finish that is placed on the wood.

Before fastening the upper link to the arm, the latter should have a ¼ inch hole drilled through its center from the back and extending to a point midway between the pieces of the upper link. A hole to meet the first one is then drilled up from beneath in order that the flex-



Showing Dimensions of the Parts of the Lamp.

ible wire to carry current to the lamp may be passed through the arm, coming out between the pieces of the link through which it passes on its way down through the top of the lamp.

Next in order is the block *H* to which the lower link is attached. This block is secured to the top of the lamp, which is a solid piece of wood, broadly beveled as shown at *K*. To the top the worker will fasten the corner posts *E*, first cutting the section of ¼ inch stock away from each as shown in *E*, to provide a support for the artglass sides of the lamp. The function of the cuts is shown in the sectional view in Fig. 1. The spreaders *J* and the decorative pieces *D* are next prepared and fitted in their respective places preferably with glue and small dowels.

The pieces of artglass *L* should be ordered cut to the exact size as it is difficult for the amateur workman to secure a clean edge on this glass without the skill and tools of the professional. Each sheet of glass is to be placed in the lamp by holding the glass diagonally in the opening through the bottom of the lamp. When the glass is in its place, a few small brads tapped into the corner posts will secure it. The bottom of the lamp may be left quite open or it may be closed with a square piece of artglass.

The incandescent bulb is held in a receptacle secured to the top of the lamp *K* in a manner that is obvious to the worker.

The color of the glass and the finish of the woodwork are, of course, optional with the builder and there is little to be said other than to suggest a color scheme harmonious with the interior decorations of the room in which the lamp is to be used. The woodwork should be stained and preferably waxed or else treated to a rubbed shellac finish to be in keeping with the rugged, simple outlines of the design.

AN ELECTRIC SPY SYSTEM FOR FACTORIES

Electrical engineers have shown much interest in the suggestion of an electric spy system. By this is meant the application of electricity and suitable recorders in order that a record of the work performed by machines and employees would be available at the end of each day.

The scheme has been tried in a cement mill and it is now possible for the management to secure accurate information regarding the operation of every machine. It is impossible to conceal delays from the recording devices.

A suggestion has been made for employing such a system in a factory, so that it will keep a record of the time at which the machinery was started in the morning, the operation or failure to operate of every machine, and even the opening and closing of the various doors, from room to room, up till the blowing of the whistle at night.

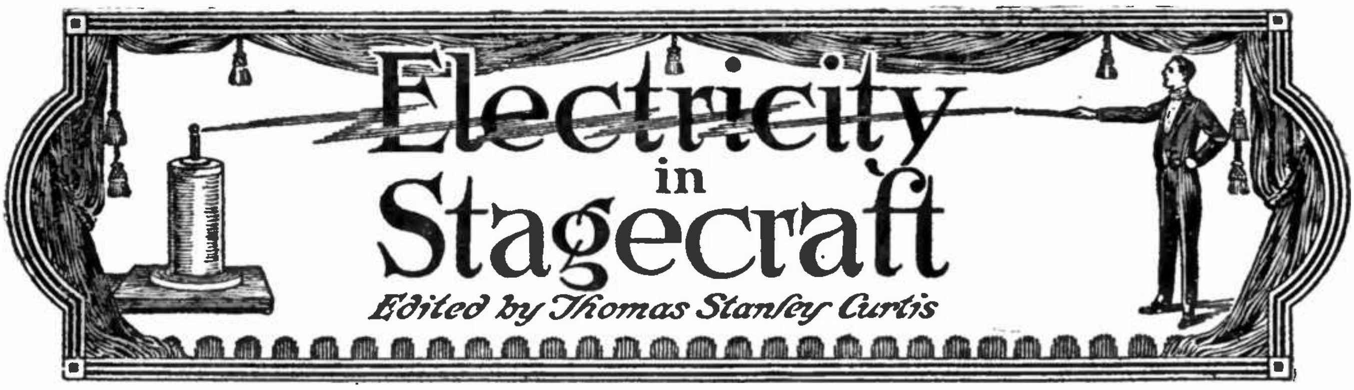
The idea of an electric spy system seems to have originated from the use of recorders in power houses that keep a permanent record of breakdowns, heavy loads and other conditions.

INTERESTING FACTS CONCERNING BIG GERMAN GUNS

Frederick A. Talbot, a well-known writer in many fields, gives many interesting facts regarding the big German guns in a recent article appearing in the English *World's Work*.

According to Mr. Talbot, the German army is equipped with 10.5, 28 and 42 centimetre guns, which in English measurements are regarded as 4¼, 11, and 17 inch weapons. Contrary to the prevailing opinion the fortresses of Liége, Namur and Antwerp were for the most part reduced by the 28-centimetre type of gun. It is stated that the larger siege weapons had been built with the intention of using them against the fortifications of Paris.

The 28-centimetre gun is quite mobile, being mounted on a large gun truck fitted with caterpillar wheels.



Apparatus for a Spectacular Vaudeville Act*

ASSUMING that the apparatus described in the past five numbers of this magazine has been built according to instructions, the builder will be interested to connect up and test his outfit. The connections are simple, as the accompanying drawing indicates, and it is only in some few particulars that the author need supplement with further explanation.

A switchboard is highly desirable but not at all essential to the successful operation of the apparatus. One may be made quite simply and without the expenditure of much time or money. A pilot lamp, to enable the operator to see the control switches in the dark; a 50 ampere double pole, single throw knife switch to control the transformer circuit; and a small snap or knife switch for the spark gap motor circuit, will complete the equipment of such a simple board. This adjunct to the outfit may be made quite elaborate, if desired, just for the theatrical effect it may have if placed upon the stage. In this event, the board, which may be of wood treated with a fireproofing compound, should be finished eventually in a dead black to simulate slate. The switch equipment may be supplemented with fuses, imitation bus bars and additional lights. An ammeter and a voltmeter will not only add to the appearance, but will also be of practical service in the operation of the apparatus.

The transformer requires a current of from 40 to 50 amperes at full load and the leads from the stage pocket must necessarily be of heavy cable. The stage cable used in connection with motion picture arcs is admirably adapted to this purpose and the outfit should include from 50 to 100 feet of this cable.

Connection between the transformer secondary and the rotary spark gap electrodes may be made with the high tension cable used in the ignition circuit of automobiles. This cable is to be fitted with substantial lugs as in use it will have to be connected and disconnected a great many times.

The oscillation circuit comprising spark gap, condenser and primary of oscillation or high frequency transformer should be connected with the special cable described in the October number in which a description of the connecting lugs for the primary of the oscillation transformer also appears.

The ground connection shown in the diagram is of the utmost importance as without it the high voltage surge back through the transformer wires will be almost sure to puncture the insulation of the transformer. To further protect the latter and to safeguard the house wiring, a protective condenser should be connected across the transformer primary at the point where the line wires are connected. This condenser is made by joining two 2-mfd. telephone condensers in series across the line and grounding the neutral point or wire that connects the two.

For the sake of simplicity, the spark gap is shown as a stationary one rather

* This article is one of a series that has appeared in every issue of this publication from September, 1914, to date.

than a rotary. The connections are, of course, the same for the two.

When all has been connected up, the spark gap electrodes may be adjusted to the point where they just miss the rotating member and the gap motor started. For this first test, the primary clip of the oscillation transformer may be placed on the center turn to permit of variation in either direction as required to establish resonance. The main switch may next be closed and the ball discharger at the top of the oscillation transformer should send forth long streamers of fire with a terrific crackling noise. An adjustment of the clip on the primary from one turn to another, and a variation in the length of the spark gap, will soon enable the operator to obtain resonance. This point is indicated by the longest streamers. At its maximum efficiency the coil will send forth a spark that will dart a distance of more than five feet to a wire attached to the ground and brought near the discharge terminal. A strange feature of this experiment is the fact that the secondary cylinder is but 50 inches high and, rather than dart downwards, striking the primary of the coil, the spark will break down a far greater distance in a horizontal plane and still farther if the ground connection is placed overhead. This is a peculiarity of high frequency discharges.

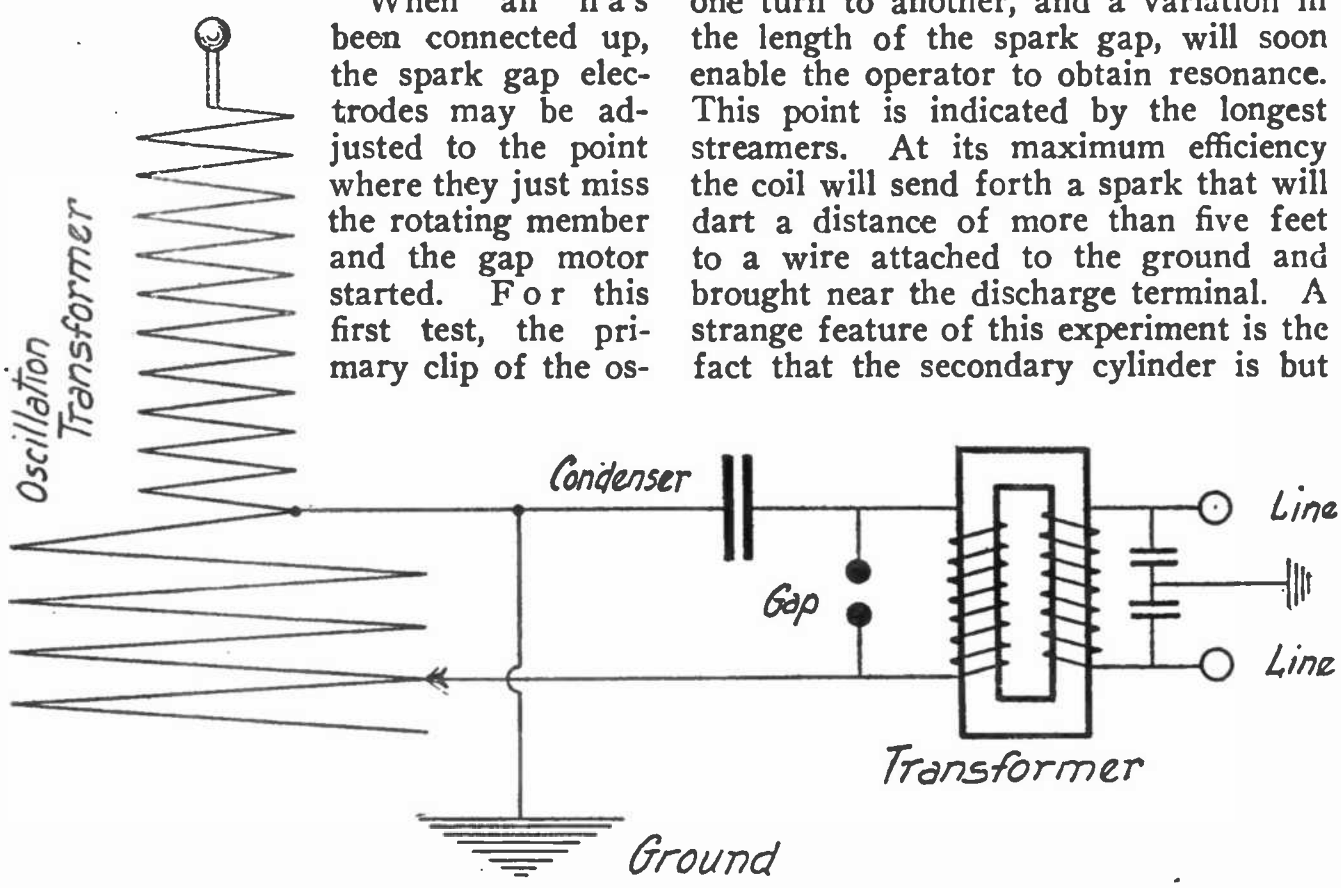


Diagram of Connections of the Apparatus

NEW BUSHING FOR BX

The Code requires that the armor of cables be fastened in outlet boxes, junction boxes and cabinets so as to secure good electrical connections. A new connector for BX, called the Jiffy bushing, is designed to do this. Metal fingers turned back from the bushing are compressed in the hole when the outside combination lock nut and spring washer are set tight with a pair of pliers, forming a secure connection.

A recent invention is in the form of an electrically-operated camera that may be used for photographing oil wells. When tools become broken the camera may be lowered into the well and a photograph obtained of the extent of the damage.

Practical Electro Therapy

Edited by Thomas Stanley Curtis

A Summary of Previous Articles

IT is intended in this number to give a general summary of the ground covered in the past five issues of the magazine; this summary serving as an introduction to the series which is to follow. In treating this subject, the reader is assumed to be a layman who knows next to nothing of electricity and its applications. For this reason, the author has attempted to make clear the nature of the various currents used in electro therapy and as simply as possible to show how they are applied, before taking up the real work of the department which will be to show the inner workings of electro-medical apparatus that is now on the market and in the offices of physicians throughout the country, if not the world.

It is believed that the average physician will obtain better results and greater satisfaction from his apparatus if he knows the why and wherefore of it; how it works; why certain things happen; where breakdowns are likely to occur and, what is more important, not so much how to repair such breakdowns but how to prevent them through intelligent handling. This knowledge will bring with it a feeling of confidence that is sure to be transmitted to the patient during treatment and if there is anything in the psychological effect in the practise of medicine, this is a point not to be overlooked.

We have learned that there are two primary forms of electric current; the direct, which flows in but one direction through a conductor; and the alternating, which flows first in one direction and then in the reverse, alternating its direction of flow perhaps many times a second.

We have seen that both alternating and direct currents may be retarded in their flow by means of resistance; this resistance acting as a valve in a pipe, cutting off the flow in proportion to the size of its opening.

We have learned that the direct current may be of two varieties: one the continuously flowing current that never fluctuates in its strength or value from one second to another, while the second form of direct current is known as a pulsating current. This current, while it flows always in one direction, changes its value or strength periodically perhaps many times a second, thus giving it a wavy or pulsating form.

The alternating current, we have seen, may be of two varieties known as the high frequency and the low frequency current. The term frequency referring to the periodicity or number of complete reversals of the current per second. This frequency is stated in terms of so many cycles per second.

We have learned that the pressure of the electric current is designated by the term *volt* while its volume is known in terms of *amperes*. The resistance to the flow of current is measured in *ohms*.

We have seen that the alternating and the pulsating direct types of current have the peculiar property of inducing a sympathetic current in wires in close proximity to those in which the fluctuating current may be flowing and further that this property, known by the term induction, is utilized in many ways in

(*Continued on page 263*)

High Frequency Current Scores a Success

Interesting Results Obtained by an Experimenter in the Miami River Valley.

A MOST interesting report on electro-culture experiments was made recently by Mr. T. C. Martin at a convention of electrical men and from this report it may be deduced that, of all the processes by means of which plant life may be stimulated, the one employing the high frequency current as its fundamental principle is the most successful by far.

The experiments mentioned by Mr. Martin were carried out at the Moraine Farm, a few miles south of Dayton, Ohio, and located in the celebrated Miami River Valley. The experiments were promoted by F. M. Tait, formerly president of the National Electric Lamp Association, and were in the immediate charge of Dr. Herbert G. Dorsey, whose work in this line has long been worthy of note.

In preliminary tests, according to Mr. Martin's report, says *The Philadelphia Inquirer,* small plots were marked off for exposure to different kinds of electrification. To insure that the soil of one plot was not better than that of another, top earth was collected, mixed and sifted and then was laid to the uniform depth of seven inches over the entire area. To quote further:

> In the soil of Plot No. 1 was buried a wire screen. Over the plot was a network of wire, stretched about 15 inches from the ground. Connecting the network above the ground and the screen below were several wire antenna. The screen was connected to one terminal of a Tesla coil and the network to the other. A transformer stepped a 110-volt alternating current up to 5,000 volts, charging a condenser of tinfoil and glass plates, which discharged through a primary of the coil. About 130 atts were operated for an hour each morning and evening.
>
> Plot No. 2 was illuminated by a 100-watt tungsten lamp with a ruby bulb. The light was turned on for three hours daily beginning at sundown. Plot No. 3 was illuminated the same way, except that a mercury vapor lamp was used. No. 4 had no artificial stimulation of any kind, being intended as a comparison between electrically excited plant growth and that of natural conditions.
>
> In Plot No. 5 was buried a wire network connected to the terminal of a 110-volt direct current. The positive terminal was attached to a small sprinkling can with a carbon electrode in its center. The can being filled, the water was subjected to electrolysis for several minutes. The plot was then sprinkled from the can, the theory being that the current might flow from the can, through the streams of water to the soil.
>
> Plots Nos. 6 and 7 were sub-divided into four individual boxes, two feet square, separated by porcelain insulators and arranged with carbon electrodes at each end. To these electrodes were applied both direct and alternating currents.
>
> After radish and lettuce seed had been planted and germination had begun, the various methods of electrification were tried with extreme care. The result of the experiments showed that the plants in Plot No. 1 grew in every instance far more rapidly than those in the other beds and more than double the normal growth as shown in the unelectrified bed.

The comparative results obtained with the various processes may be noted in the table which follows, and it is interesting to observe that the high frequency current from the Tesla coil takes the lead from the standpoint of weight of the edible portion of both radishes and lettuce grown under its influence:

Radishes (ten plants selected at random):	Plot 1 Telsa Coil	Plot 2 Ruby Light	Plot 3 Mercury Vapor	Plot 4 Normal	Plot 5 Elec. Spkg.
Total plant weight, grams	265.70	137.80	109.50	180.00	78.50
Edible portion, grams	139.50	57.40	40.90	79.40	31.00
Edible portion, per cent	51.15	41.65	37.34	44.11	39.49
Tops and leaves, grams	120.50	75.70	65.90	95.00	41.50
Tops and leaves, per cent	43.35	54.92	60.18	52.77	55.66
Roots, grams	9.30	4.70	3.20	5.60	6.00
Roots, per cent	3.50	3.43	2.48	3.12	4.85
Lettuce (ten plants selected at random)	67.00	52.60	56.60	46.10	31.30
Edible portion, grams	60.70	57.30	50.20	41.80	28.20
Edible portion, per cent	90.59	89.92	88.85	90.67	92.10
Roots, grams	6.30	5.30	6.30	4.30	3.10
Roots, per cent	9.41	10.08	11.15	9.33	7.99

Encouraged by these preliminary experiments, the workers started the research on a larger scale with a two-acre plot of ground. The details of the layout and an outline of the apparatus used will be reported in the March issue of Modern Mechanics. Following this report, the complete specifications for the construction of high frequency apparatus suitable for the cultivation of a two-acre plot will be given in order that interested readers may conduct similar experiments should they be interested to that extent in this subject.

THE HAMILTON RADIO ASSOCIATION

The Hamilton Radio Association held its first meeting on December 1st. One of the features of the meeting was the election of officers, as follows: President, Hughes Beeler; vice-president, Arthur Letherby; secretary, S. D. Doron; treasurer, Cecil Hopkins, and chief operator, S. W. Doron.

Plans for the ensuing year were discussed and many important suggestions were offered. At this meeting 30 members were present and it was reported that the number of stations of members in operation totaled 41.

It is said that the Hamilton Radio Association has the most powerful station in that section of the country, at their disposal. The range is well over 500 miles. The average power of other stations in the city is ¼ kw.

The association will be pleased to hear from other clubs and organizations interested in radio communication. All correspondence should be addressed to the secretary at 329 N. C. street, Hamilton, Ohio.

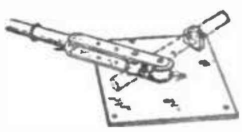
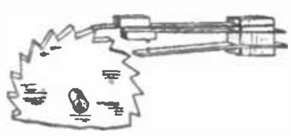
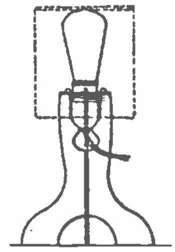
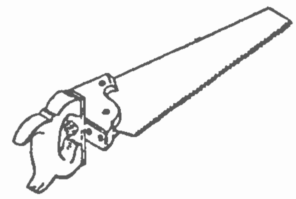
SUMMARY OF PREVIOUS ARTICLES

(Continued from page 261)

the application of the electric current.

Having covered this ground, it is felt that even the lay reader will be prepared to study the internal construction of a modern piece of electro-medical apparatus with an appreciable degree of intelligence, particularly if he has operated the machine (as so many physicians have) without making even a pretense of getting at the fundamental principles of the apparatus.

To this end, therefore, the next installment will be the first of a series analyzing the various parts of machines of this nature.

Recent Novel Patents

Pipe Bending Device

A Chicago inventor has secured a patent on a pipe bending device that is shown in the accompanying illustration and which is strikingly simple. It consists of a long arm mounting at one end two grooved rollers that serve to bend the pipe which is held by an upright through which it passes.

Contact Making Mechanism

A member of an electrical manufacturing company of Chicago has been successful in obtaining a patent on a very simple contact making device that is illustrated in one of the accompanying sketches. His invention consists of a rotating ratchet the teeth of which alternately raise and lower a spring carrying a contact point that makes connection with another contact point mounted on a spring below.

Electric Lamp Stand

The latest in electric lamp stands is probably presented in the invention of a Rhode Island native. The invention covers a simple sheet metal stand that is made by interlocking two members at right angles. Obviously, the stand can be taken apart and packed flat for transportation purposes. In the upper portion of this stand a collar arrangement permits of inserting a standard lamp socket. An electric bulb and some suitable shade completes this rather inexpensive yet efficient lamp.

Improved Saw Handle

By using the newly invented saw handle patented by a Californian, greater use and convenience will be had from the usual saw than at the present time. This invention is quite simple, comprising the usual wooden handle on which is fastened by means of a pivot a clamping member for holding the saw proper. The saw can be turned at any angle in relation to the handle, which will be found very convenient in actual work.

Eyeglasses

A Western inventor has secured a patent for eyeglasses of entirely new design as regards the method of holding the lenses in place. As will be seen in the sketch, the lenses are held before the eyes by a simple framework that is attached to a band fitting around the wearer's head. The main advantage gained with this peculiar frame is that the nose of the wearer does not become sore as in the usual eyeglasses, while another feature is that the field of vision is not disturbed by portions of the mounting.

Cow Tail Holder

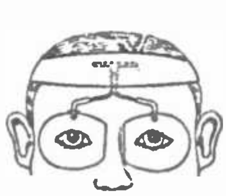
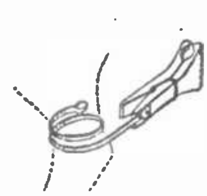
A Middle Western inventor has patented the simple device shown in one of the sketches for holding a cow's tail secure during milking time. This device consists simply of a steel spring portion which coils about one of the hind legs of the cow and which holds in place a spring clamp holding the tail. While inexpensive, this simple device would probably pay for its cost several times over in a short time by preventing the overturning of milk pails and the loss of their contents.

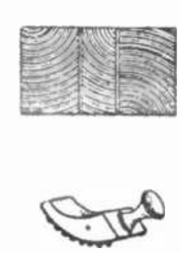
Simple Door Buffer

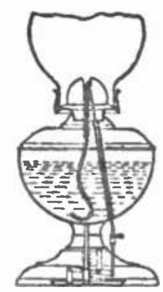
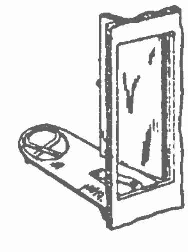
The subject of a recent invention is a simple door buffer that is shown in one of the accompanying drawings. It consists of a metal strip bent in the shape indicated. The buffer is fastened on any floor in such a position as to engage with a door when the latter is thrown open. Not only does the device break the force with which the door is moved, but it also locks the door in position to prevent its undesired closing. A pressure of the foot on the front portion releases the door when it is to be shut.

Wood Graining Tool

In one of the accompanying illustrations is shown a patented graining tool as well as specimens of its work. The tool carries a marking pad on its underside which is used in applying different grain markings on wooden surfaces.




Improved Oil Can

The improving of the usual type of oil can is the subject of a patent granted to an Iowan inventor. The improved oil can is fitted with a flexible bottom as in the instance of the conventional type, but in addition a powerful spiral spring is fitted within the can to return the bottom to its normal shape after it has been pressed. By employing this design it is possible to give the flexible bottom a greater contour and therefore facilitate the application of oil with such a can.

Automatic Lamp Extinguisher

Two Wisconsin inventors have joined forces in patenting a form of kerosene lamp that is automatically extinguished by simply raising it off the table or other support on which it may be placed. The extinguishing device is in the form of a sleeve sliding over the wick and connected to an arrangement in the base that pushes the sleeve upwards whenever the lamp is lifted. If the lamp is to be carried about a small lever on the side can be held to prevent the sleeve from moving upwards. The main advantage of using such a lamp is that the flame is immediately extinguished should it be upset accidentally.

Milk Bottle Holder

If the invention of two Philadelphians becomes widely employed, many persons who are in the habit of securing their milk supply free of charge will have to pay for this commodity in the future. The invention is in the form of a spring door, a ledge for holding the bottle, and the door frame which is mounted on the outside of a wall or door. As soon as the milkman places a bottle on the ledge of the holder, the door closes and the weight of the bottle actuates a member that locks the door securely. When the bottle is removed from inside, the door can again be opened from the outside.

Wire Twister

A New York inventor has secured patent rights on a simple attachment that may be used in connection with the ordinary brace for twisting wires, as shown in the sketch. The attachment consists of two jaws that firmly hold the ends of the wire. By turning the brace the wires are twisted more rapidly and firmly than would be possible by the use of pliers.

Umbrella Locks

A New York inventor has secured a patent on a hollow umbrella handle which contains a chain and padlock for securing the umbrella to any stationary object in order to prevent theft. When not in use the chain and padlock are placed in the handle and concealed by a pivoted cover as shown. The same idea is equally applicable to canes.

Attachment for T-Squares

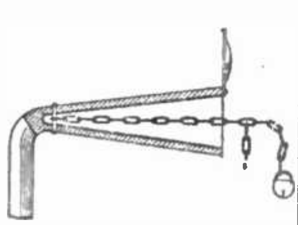
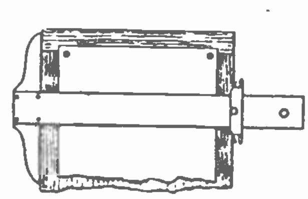
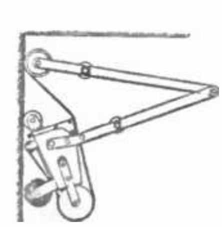
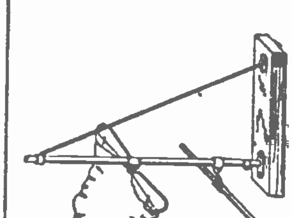
A Pennsylvania inventor has recently secured a patent for an attachment that may be fastened to any T-square and that serves to hold the end of the T-square firmly against the board and insure accurate work. A spring member as well as a clamping screw forms part of the attachment; the device being clamped at the desired place on the T-square while the spring firmly holds the T-square in place on the board. This device is quite simple and inexpensive to manufacture. Accordingly, it should have a very ready sale among draftsmen who will immediately appreciate its merits.

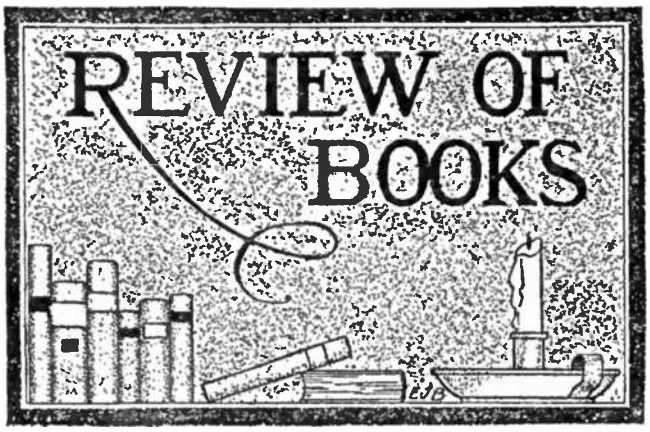
Wall Papering Machine

A rather ingenious machine has recently been patented by a Kansas inventor for use in applying wall paper directly from the roll to the wall with practically no manual labor. As seen in the illustration, the device consists essentially of a framework, a paste receptacle opening at its bottom to a roll over which passes the back of the wall paper fed from a roll, and lastly, a suitable cylinder for neatly pressing the paper in place. The invention is cleverly worked out.

Clothes Drier

A patent has just been granted to two New York inventors on a clothes drier of compact design. As shown in the illustration the drier is made in the form of a suitably supported rod on which other rods may be mounted so as to hold the great number of pieces hung up to dry. A simple wire framework can be fastened at any place along either rod and serves to hold the articles by means of ordinary clothes pins.



School of Practical Electricity

Under the title of "School of Practical Electricity, Vol. 1,"* five authors have contributed a very valuable work to students of electrical engineering. The book is divided into the following general sections: First principles of electricity, batteries and low potential electric wiring; theory of direct current; electric light wiring with problems; magnetism and the commercial applications of magnets; and telephony.

This work is written in a clear manner in order that it may be easily understood by the student, electrician, engineer, architect, and all those engaged in professions allied to the electrical industry. Countless diagrams and illustrations are employed to make the text explicit. Each section of the book is complete in itself and makes recourse to other works unnecessary.

**School of Practical Electricity*, Vol. 1, by Oscar Werwath, E.E., Principal of the School of Engineering of Milwaukee, George J. Kirchgasser, Frederick C. Raeth, Instructor in Chemistry and Electro-Chemistry in the School of Engineering of Milwaukee, and W. E. Hennig and R. A. W. Tamms, Instructor and Assistant, respectively, in the same school. Published by the Electroforce Publishing Company. Price, $4.50.

Art Work in Metal

"Art Metalwork" is the title of a recent addition to the many valuable works of The Manual Arts Press, covering the making, decorating and finishing of many diversified objects in metal. Beginning with a detailed description of the necessary tools and equipment to make the metal-craft objects described later in the book, the work leads the reader through chapters devoted to the designing of metalwork objects, copper and the alloys of copper, the various metal gauges in use, coloring and finishing of metal-craft work, sources of materials and equipment in which firm names are given where the necessary supplies may be secured, etching and soft soldering, straight bending and lapping, saw piercing, annealing, riveting, seaming, the making of beaten-ware, chasing, raising, hard soldering, enameling, spoon making, etc., etc. There are numerous objects described and illustrated as tasks for the reader to perform. And the most striking feature of the book* is that the author has endeavored to permit of using only the simplest and most common of tools and equipments for accomplishing the work.

* *Art Metalwork*, by Arthur F. Payne. Published by The Manual Arts Press, Peoria, Ill. Contains 186 pages and 159 illustrations. Cloth bound. Price, $1.50.

Molded Insulation

A long-felt want in electrical engineering literature has been filled in a most satisfying manner by the publication of "Molded Electrical Insulations and Plastics."* The author evinces a thorough and practical working knowledge not only of the design and application of every form of molded insulator, but, what is perhaps even of greater importance, he offers a comprehensive discussion of the nature and chemical composition of the materials from which the insulators are made. Further, he possesses the rare gift of being able to impart highly technical knowledge in an understandable form which renders it of the greatest value to electrical engineer, designer and manufacturer alike. Reference to the trade names of the various compositions has been avoided and the aim has been to make the work a reference book of every conceivable form of data pertaining to the composition, design and application of molded insulation.

* *Molded Electrical Insulations and Plastics.* Published by Ward Clausen Co., 200 Fifth Avenue, New York. Contains 207 pages and 86 illustrations. Cloth bound. Price, $3.00.

Electric Cooking, Heating and Cleaning

A volume very complete in every detail and dealing chiefly with the application of such electrically-operated appliances of use in the ordinary household as come chiefly under the sphere of woman's work, has been published under the title of "Electric Cooking, Heating and Cleaning."* It is the work of an English woman who writes with the enthusiasm of a possessor of an electric kitchen and a home that is fitted with electrical conveniences throughout.

Some of the subjects treated with great care and thoroughness are:

What electricity can do in the home; the commercial aspect of electric cooking; the duty of central station engineers; oven efficiencies: electric heating; ventilation and air purification.

The volume represents the first definite compilation of data relating to electric cooking in book form and will be of interest not only to the housewife but also to the central station engineer.

* *Electric Cooking, Heating and Cleaning*, by Maud Lancaster. Published by D. Van Nostrand Company, 23 Park Place, New York. Price, $1.50.

Questions and Answers

This department will appear regularly in MODERN MECHANICS, subject to the following regulations: The questions must be legibly written with typewriter or in ink, on one side of the sheet. Each question must be definite and cover but one point of the subject under consideration, although a letter can contain more than one question. On the 10th of the second month preceding the date of issue of the magazine, all the questions on hand will be considered and those which are put in the most intelligent manner and of widest general interest will be selected for publication in such issue, the number being governed by the space available. All other questions will be returned to the writers with a statement of the price for which they will be answered by letter. Return postage must be enclosed with each letter containing questions, and the letters must be addressed to the Questions and Answers Department and contain nothing relative to other departments of the magazine.

AERIAL.

(8) R. J., Indianapolis, Ind., writes:

Q. 1.—I am about to put up an aerial on my house in West Indianapolis, but this is the lowest part of the city. It is flat, but still it is much lower than the rest of the city. Can I get as good results with my set as I could if I placed the same aerial up on a house on the higher part of the city?

A. 1.—As the waves follow the surface of the earth you will not be greatly hampered by being on the low ground since it is flat. If you were behind a high hill you would probably notice a decrease in your range due to the screening effect of the hill. However, since you are on flat, open land, you will probably not experience any great difficulty in covering ranges which will compare with those of the stations more favorably situated.

TRANSFORMER SUPPLY.

(9) E. W. M., New Orleans, La., asks:

Q. 1.—I have 220 volt, three-phase alternating current supplying a motor. I would like to operate a transformer for wireless work from this line. Is there any way I can do it other than by using resistance? I would, of course, only use one phase.

A. 1.—There is no way which will enable you to directly connect your transformer to the three-phase system. The best procedure for you to follow would be to construct a small closed core, 2 to 1 ratio auto transformer. Such a transformer could be constructed for a very small cost and little labor. The fact that you only have three-phase 220 volt supply should in no way hinder you from installing a radio set.

FUSES FOR BATTERIES.

(10) McC. R., O., asks:

Q. 1.—Are fuses made that will operate on battery currents?

A. 1.—Yes, such are regularly employed on common-battery telephone switchboards. Of course, on storage battery circuits fuses have to be of dimensions quite similar to those for dynamo machines.

Q. 2.—Are fuses practicable for induction coil secondary circuits?

A. 2.—No, the currents from such sources are altogether too small to affect even the smallest capacity fuses.

COPPER IN SUBMARINE CABLES.

(11) J. W. H., Melrose, Mass., asks:

Q. 1.—Does the copper of submarine cables crystallize the same as that in trolley wires?

A. 1.—No, for the cause of crystallization of the copper in the latter is due to the frequent bending, as every trolley wheel raises and lowers it. You can bend a copper wire a good many times before it will break, but thousands, or hundreds of thousands of bendings will eventually result in a crack and subsequent break. No mechanical action whatever can be discovered as attributable to the simple passage of the electric current.

Q. 2.—How many messages at a time can be sent over a telegraph wire?

A. 2.—The common working of trunk lines between important cities is on the duplex system, whereby two messages at a time are being sent, one operator at each end of the line sending and another receiving, four operators thereby being engaged, each quite oblivious that he has not exclusive use of the wire. Quadruplex sets of instruments are also largely in use, whereby four messages are being simultaneously sent, two from each end, eight operators thereby being served by one wire. Of course, there is only a single current passing over the wire at a given instant, but this current may be strong or weak, and in one direction or the other, and only certain instruments respond to certain connections.

EDISON BATTERIES.

(12) M. R. P., Seaford, Del., asks:

Q. 1.—How to set up an Edison primary battery.

A. 1.—Since the excitant of this type of battery is caustic soda, a first direction will be to keep the fingers out of it. A saturated solution of the caustic is made and placed in the jar. A layer of heavy paraffin oil, say ¼" or more in depth, is then poured on top the solution. This is to keep the water from evaporating and the salts from crystallizing out. Before immersing the copper oxide positive and the zinc negative plates, wet them. This precaution is merely to prevent the oil from adhering to them in passage.

Q. 2.—What voltage should one of the batteries give?

A. 2.—On open circuit—when no current is being taken—the voltage should be .95, but when supplying normal current the voltage will fall to about .70.

RADIO LICENSE AND EMPLOYMENT.

(13) K. B. R., Waltham, Mass., asks:

Q. 1.—Is an applicant for a commercial radio license obliged to secure an amateur license first?

Q. 2.—How would you advise a boy 15 years old to secure a commercial license; said boy being able to operate all instruments, receive and send at a moderate speed, and having a pretty good knowledge of the theory, wavelengths, etc.?

Q. 3.—How could the same boy, after securing commercial license, obtain employment by the Marconi Co. to work summers?

A.—The above questions are typical of a large number of questions continually being asked us by our readers and it seems advisable here to make the answers more complete than is usually permissible. In this manner we hope to reply in a general way to all questions asked on the subject.

The first step an applicant for any form of radio license should take is to send fifteen cents to the Superintendent of Documents, Government Printing Office, Washington, D. C., and obtain the bulletin entitled "Radio Communication Laws of the U. S." This is a recent publication containing the U. S. radio laws, the international radiotelegraphic convention, together with a liberal interpretation of their meaning and details regarding application for licenses.

Any citizen of the United States may apply for examination for a commercial radio license. He is not required to have had any previous training or to hold any other form of radio license. In the examination, however, 20 per cent. is allowed for previous experience and as 75 per cent. is required to qualify for a first grade license, the applicant must be unusually well trained to qualify if he has not had some previous experience. The holding of an amateur license will receive its credit if the holder has a good record as an amateur operator. Only 65 per cent. is required to qualify for a second grade operator.

The examination consists of questions regarding the regulations relating to radio communication, the adjustment and operation of radio apparatus, the use and care of a storage battery or other auxiliary, and the passing of a speed test. The speed test consists of copying signals from an omnigraph at the rate of 100 characters per minute. The signals do not consist of a complete message, but, instead, of disconnected words, abbreviations, numerals and punctuation marks. There is very little chance for a poor operator to bluff the speed test. The applicant is, however, given five chances in that the omnigraph is run for five minutes while the applicant is required to copy only any 100 consecutive characters. Failing to pass disqualifies the applicant for three months from again applying for an examination.

After obtaining a license the possibility of securing employment will depend on the demand for operators. Application should be made to the local office of the company you desire to work for. If the local manager considers you as sufficiently qualified your name will be placed on file and when your turn comes you will be given employment. In general there are more applicants than positions, so that it is usually necessary to wait considerable time before securing a berth. In your district during the past summer there were applicants who did not receive a single assignment, and others who made but two or three trips. Summer operating appears very attractive; so it is; but one should have patience if he expects to get a good berth.

MOTOR WINDING.

(14) E. M. D., Bellingham, Wash., asks:

Q. 1.—How can I change a 3-phase, 220-volt, 20-h.p. motor so as to permit its operation on 440 volts? There are eight poles, with four coils per pole per phase, making 96 coils in all.

A. 1.—It is common practice for manufacturers to group all the coils that produce an instantaneous North pole in one circuit, and those that produce an instantaneous South pole in another circuit. Then, in a 3-phase motor, there would be the possibility of following out six different circuits. Now if you put each of these North and South pole circuits in parallel, you can get an arrangement that may be right for 220 volts, but if you connect them in series they will be right for 440 volts. Perhaps your motor has the 110-220 volt possibilities. You should write to the manufacturer, stating the serial number.

Q. 2.—How can the horse-power be figured from the readings of switchboard instruments, say in case of a three-phase system, with 800 amperes per phase, 480 volts across phases, power factor being .85?

A. 2.—Multiply the number of volts by the amperes and by the power factor and by the square root of three, or in your case $480 \times 800 \times .85 \times 1.73$. This will be 564,672 watts. Since there are 746 watts per horse-power, the result will be about 765 horse-power.

Q. 3.—How can the horse-power of an induction motor be found from the ammeter reading?

A. 3.—The use of an ammeter alone will not suffice for finding the power.

RADIO SECTION

Devoted to the Encouragement of Amateurs and Experimenters in the Field of Radio Communication.

Radio-Frequency Ammeters

By A. S. Blatterman, B. S.

THE circuit within a high-frequency ammeter must be of as simple form as possible. This requirement is best fulfilled by a single straight wire of very small diameter, and no other arrangement can be taken as a *priori* reliable at all frequencies. The heat production is readily measured in any form of circuit, and in consequence all successful ammeters for high-frequency use utilize the thermal effect. The way in which the heat production is measured, whether expansion, calorimetric effect, resistance or thermal e.m.f., does not affect the accuracy.

In a Bulletin of the Bureau of Standards dated Jan. 15, 1914, an account was given of a long experimental investigation of reliable ammeters for high-frequency work. It was found that two similar wires in parallel—the integrated heat production in the whole being measured—constituted a system nearly as reliable as a single wire. A great variety of ammeters were studied in this investigation. Experimental instruments and commercial instruments of three different companies were included, and it is interesting to note that all types were subject to errors when used at the frequencies of radio telegraphy. Some of the errors were very large. In some cases the readings increased with increase of frequency and in others they decreased, though in most cases it was found that the design could be so changed as to eliminate the errors.

The current in a conducting circuit has no meaning for extremely high frequencies, for in any circuit above a certain high frequency the capacity between different parts of the circuit and of auxilary apparatus is so important that an appreciable fraction of the current is shunted through the dielectric and the

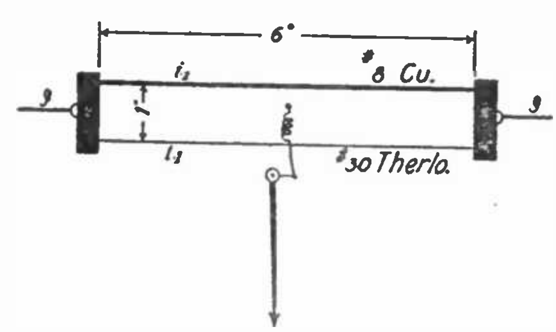


Fig. 1

Diagrammatic View of Hot Wire Ammeter and Shunt.

current is of different amount in different parts of the wire circuit. Thus the two metal terminals, usually binding-posts, to which the heating element is attached, mounted upon insulating pillars or in insulating bushings, virtually constitute a condenser through which an appreciable fraction of the total current may be shunted. Similarly, capacity currents may pass to the frame of the meter. With a sinusoidal e.m.f. E, at frequency n, the current through a capacity C is

$$i = 2 \pi n C E.$$

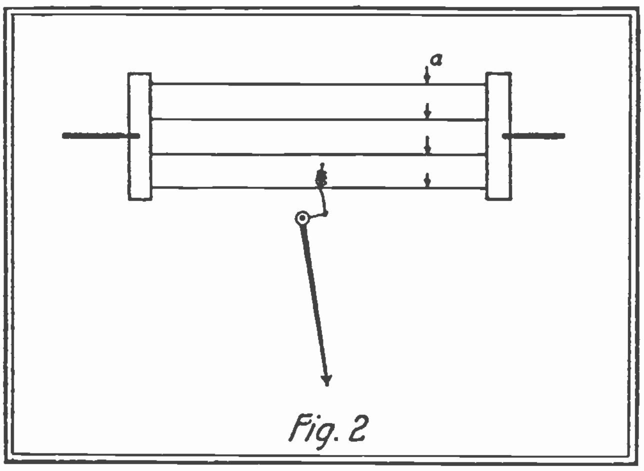


Fig. 2

Diagrammatic View of Hot Wire Ammeter with Shunt as an Integral Part of the Instrument.

Obviously the capacity current may not be negligible at radio-telegraphic frequencies where "n" has a value from 100,000 to 1,500,000 cycles. The location of the current leads is of great importance.

Most of the errors of commonly used high-frequency ammeters are due to mutual inductances or self-inductance of parts, which are often supposed to be negligible. When the active element of a hot-wire ammeter is shunted by another wire the readings of the meter are no longer always dependable but will change with every change in the frequency. Thus, the readings of a meter having for its active element a No. 30 Therlo wire and a shunt of No. 8 copper wire, will increase with increase in frequency and decrease when the frequency is lowered. That is, for short wavelengths the correction factor for the shunt is smaller than it is for long wavelengths; which simply means that at short waves less current passes through the shunt and more of it through the active wire than when long waves are used.

At high frequencies the current density in a conductor is not uniform throughout its cross-section but is greatest near the surface. This "skin" effect is very noticeable in heavy wires; but in wires of small diameter it is not so marked, and in very thin wires is negligible. This, however, does not completely explain the change in the value of the heavy wire shunt mentioned above with change in frequency. Besides the changes in resistance, the effects of self and mutual induction are highly important. As an example, let us take the case cited above of an ammeter having a No. 30 Therlo wire shunted by a No. 8 copper wire, and calculate the ratio of the currents in the two wires. Let each of these wires be six inches in length and let them be mounted parallel to each other 1 inch apart. (See Fig. 1.)

It can be shown that in a divided circuit like that under consideration the ratio of the currents in the branches is given by

$$\frac{i_1}{i_2} = \sqrt{\frac{R_2^2 + \infty^2 (L_2 + M)^2}{R_1^2 + \infty^2 (L_1 + M)^2}} \quad ..(1)$$

where

R_1 = resistance of wire No. 1 (No. 30 Therlo in this case)

L_1 = inductance of wire No. 1 (No. 30 Therlo in this case)

R_2 = resistance of wire No. 2 (No. 8 copper in this case)

L_2 = inductance of wire No. 2 (No. 8 copper in this case)

i_1 = current in wire No. 1

i_2 = current in wire No. 2

M = mutual inductance of wires

$\infty = 2 \pi n$ where n = frequency.

Let us first calculate the value of the ratio $\frac{i_1}{i_2}$ for a working wavelength of 300 meters and then, in order to see the effect of changing frequency, for a wavelength of 900 meters, and for direct

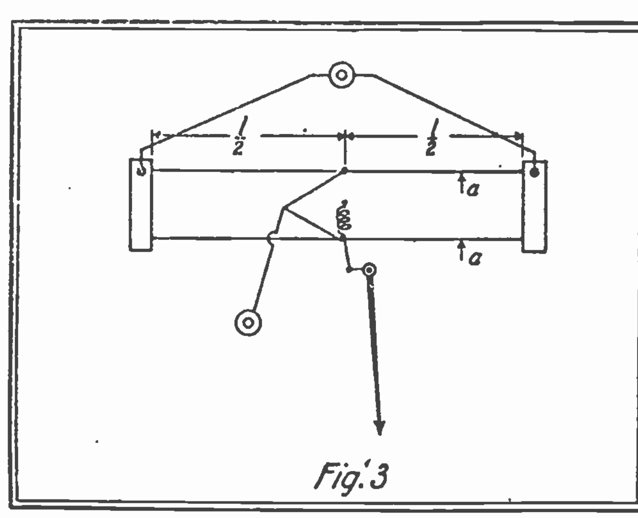


Fig. 3

Another Method of Constructing Hot Wire Ammeter with Self Contained Shunt.

current. The calculated values for substitution in the equation are ·

for $\lambda = 300$ m.

$R_1 = 1.4$ ohms
$R_2 = 0.004$ ohms
$L_1 = 206.8 \times 10^{-9}$ hen.
$L_2 = 129 \times 10^{-9}$ hen.
$M = 65.72 \times 10^{-9}$ hen.
$\infty = 6.283 \times 10^6$

for $\lambda = 900$ m.

$R_1 = 1.4$ ohms
$R_2 = 0.00234$ ohms
$L_1 = 206.8 \times 10^{-9}$ hen.
$L_2 = 129 \times 10^{-9}$ hen.
$M = 65.72 \times 10^{-9}$ hen.
$\infty = 2.094 \times 10^6$

which gives for the 300 m. wavelength

To take the above example this correction factor for the shunt comes out in the three cases considered

$$F_{300} = \frac{1.553}{.553} = 2.81 \text{ for wavelength} = 300 \text{ m.}$$

$$F_{900} = \frac{1.2695}{.2695} = 4.71 \text{ for wavelength} = 900 \text{ m.}$$

$$F_{dc} = \frac{1.0000}{.000224} = 4460 \text{ for direct current}$$

The great error which is committed by using a meter like the one under discussion to measure currents at frequencies

$$\frac{i_1}{i_2} = \sqrt{\frac{0.004^2 + 6.283^2 \times 10^{12} (129 + 65.72)^2 \, 10^{-18}}{1.4^2 + 6.283^2 \times 10^{12} (206.8 + 65.72)^2 \, 10^{-18}}} = 0.553$$

and for the 900 m. wavelength

$$\frac{i_1}{i_2} = \sqrt{\frac{0.004^2 + 2.094^2 \times 10^{12} (129 + 65.72)^2 \, 10^{-18}}{1.4^2 + 2.094^2 \times 10^{12} (206.8 + 65.72)^2 \, 10^{-18}}} = 0.2695$$

If direct current were passed through this instrument the currents in the wires would be in inverse proportion to their *resistances* only and the inductance would be of no importance. Thus for direct currents the ratio i_1/i_2 is

$$\frac{i_1}{i_2} = \frac{R_2}{R_1} = \frac{0.0003142}{1.4} = 0.000224$$

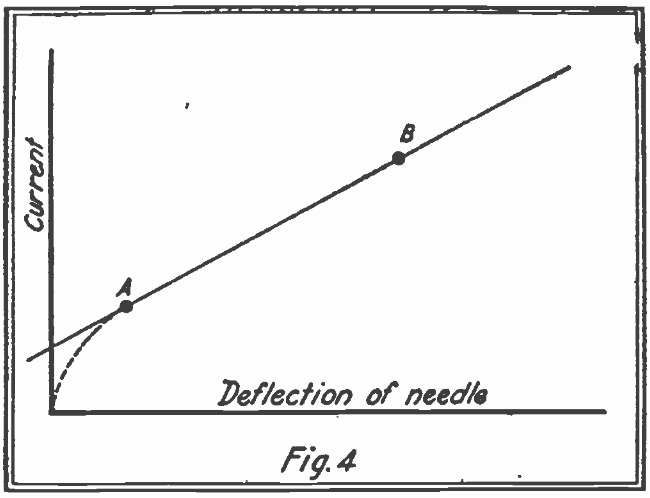
Now the multiplying value of the shunt, *i. e.*, the *number* which must be used to multiply the readings of the meter (given by the expansion of the fine wire) to obtain the actual value of the current in the circuit in which the meter is connected, may be defined as the ratio of the actual current in the circuit, I, to the current passing through the fine wire, i_1; *i. e.*, by the ratio I/i_1. If the ratio i_1/i_2 which was calculated above for three special cases be denoted by k, then the multiplying factor for the shunt is given by

$$F = I/i_1 = \frac{k + 1}{k}$$

other than that for which it was calibrated is apparent. In this particular case, if the meter were calibrated at 900 meters and then used in a circuit with wavelenth 300 meters, the readings would all be

$$\frac{4.71}{2.81} = 1.68 \text{ times too high.}$$

When a meter is used at radio-frequencies with an external shunt the correction factor for the shunt must be determined for each wavelength. The simplest way of doing this is to connect a like unshunted meter in the circuit in series with the regular instrument and use reduced power so that the needle of the unshunted meter just remains on the scale. The ratio of the readings of the two meters then gives the multiplying value for the given frequency. Where only one meter is available a good approximate calibration may be obtained by using reduced power and observing the reading of the meter without the shunt and then with the shunt connected.



Calibration Curve of Hot Wire Ammeter Using Therlo Wire.

But if thereafter the wavelength be changed a new calibration must be made.

In constructing meters for current value where a single fine wire will not suffice to carry the total current, then the shunt should be built into the instrument. It is possible to build such a shunt so that the meter will, for all practical purposes, read accurately at all frequencies and can even be calibrated with direct current. Two constructions which give satisfactory results are shown in Figs. 2 and 3.

The wires *a* are all of the same material and cross-section, and of equal lengths, and are fastened to heavy copper terminal blocks. Only one of the wires takes part in the indication of the instrument; the others are shunts. Since the inductance and resistance of all of the wires are practically equal, they all carry practically the same currents, hence have the same temperature, and thus the shunt ratio is independent of the current strength. Likewise, because the impedance of each path is the same, the indications are independent of frequency. Thus the instrument may be calibrated with direct current and used thereafter in radio-telegraph circuits without appreciable error. The indicating and shunt wires should be of small diameter (No. 30 or finer) to reduce the skin effect as much as possible. What little skin effect then remains produces no effect on the shunt ratio, although it does slightly affect the sensibility of the ammeter as a whole.

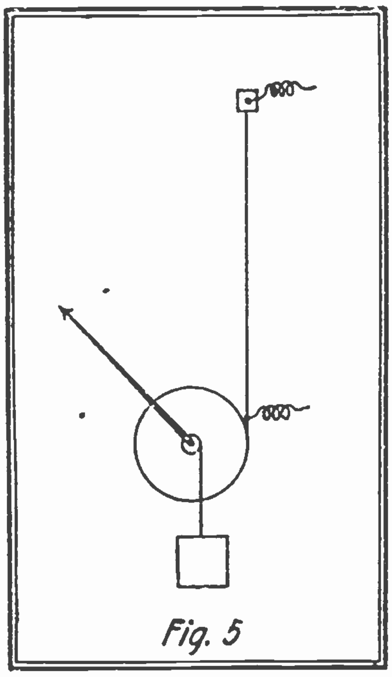
An objectionable feature of some hot-wire meters now in use is the non-linear scale. With such a scale the accuracy in reading cannot be the same for all current values. By suitably choosing the material of the indicating (and shunt) wires the scale can be made to be practically linear, except for a very small region near the zero. The wire for this purpose should have

1st, a practically constant resistance for all frequencies and temperatures up to about 300 or 400 degrees; that is, its temperature coefficient should be small.

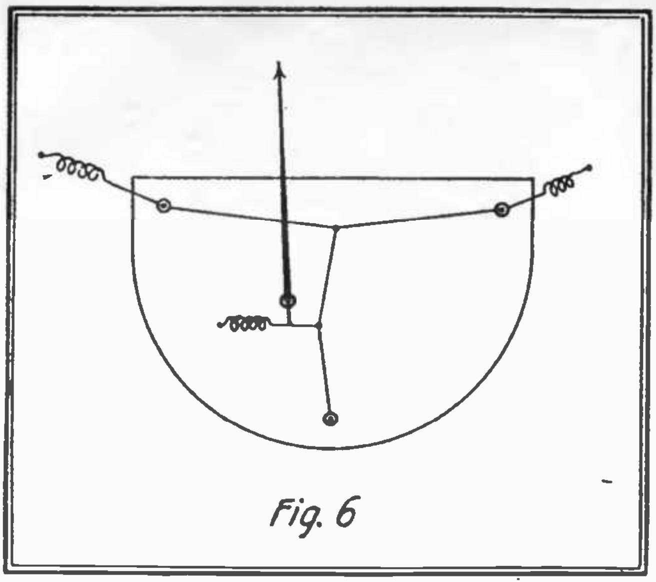
2nd, its coefficient of expansion should be constant within the same temperature range.

"Therlo," which is a patented alloy of copper, manganese, and aluminum, makes an excellent wire for hot-wire ammeters. Its temperature coefficient is 0.0000031 per degree F. and practically constant. Thus the resistance of this wire is practically independent of temperature. The temperature coefficient of copper varies with the temperature all the way from 0.00215 to 0.0042, which is quite high. A copper wire does not give a uniform scale. The expansion coefficient of "therlo" is undetermined as far as the writer knows, but experiment indicates that it is very likely constant.

If Therlo wire forms the heating element (and shunts) of the meter the calibration curve will have the characteristics of that shown in Fig. 4; and the calibration can be quickly effected by obtaining two points on the curve such as A and B and connecting them by a straight line. The current corresponding to any deflection of the needle



Scheme for Transmitting Linear Expansion of Wire to Indicating Pointer.



Principle of Hot Wire Ammeter that Takes Advantage of the Sag in the Wire.

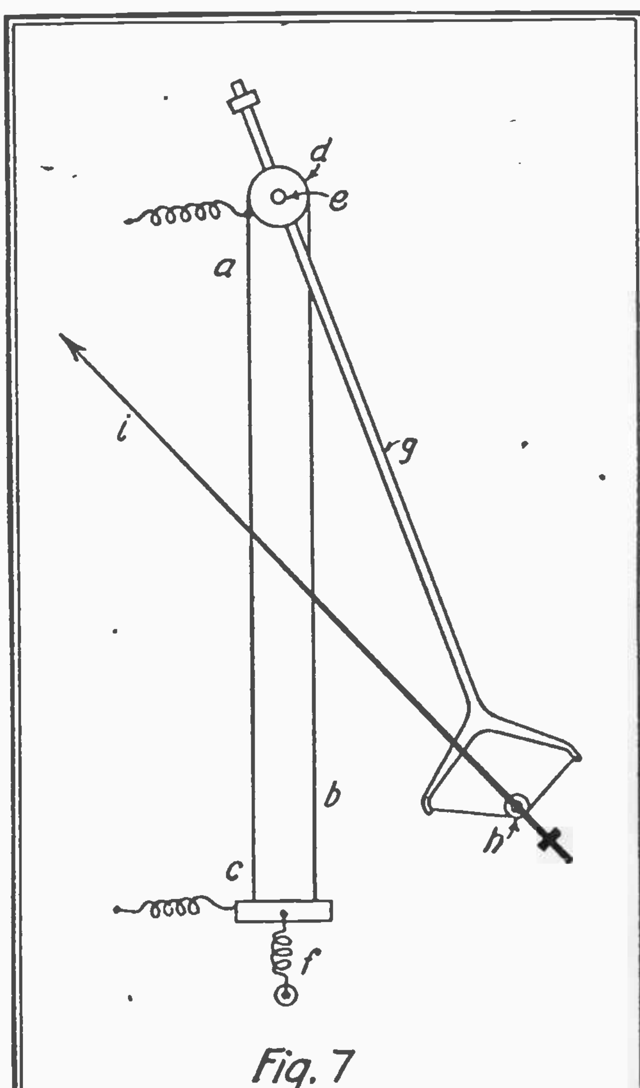
can then be read off directly.

There are two general methods of transmitting the linear expansion of the wire to the indicating pointer. The first method (Fig. 5) makes use of the change in length of the wire directly. This necessitates a long wire in order to produce an appreciable deflection of the pointer which forces an ungainly form on the instrument and aggravates errors due to changes in the temperature of the atmosphere. It is much better to make use of the sag of the wire, since for a given wire the sag is greater than the expansion* and hence it is possible to secure a larger deflection.

One construction which takes advantage of the sag rather than the direct expansion is shown in Fig. 6. The plate upon which the wires are mounted should have the same temperature coefficient of expansion as the wires so as to reduce errors due to changes in the temperature of the air. Means should be provided for the adjustment of the zero; and in this connection it is hardly necessary to say that this adjustment should not be made by shortening the wire, as for instance, by wrapping it up on the spindle of a thumb-nut. Such a procedure changes the resistance of the wire and the readings are no longer accurate.

The Whitney hot-wire ammeter employs an ingenious method for the compensation of temperature changes. Referring to Fig. 7, a wire *a b* of uniform cross section is strung from the plate *c* around the pulley *d*, back to the plate *c* and held taut by the spring *f*. The wire is insulated at one side of the plate so that only the *a* side of the loop forms a part of the electric circuit. Temperature changes in the atmosphere affect both sides of the loop and result in simple expansion and contraction, which is taken up entirely by the spring *f*. The *a* side of the loop carries the current to be measured and becomes heated thereby. The resulting expansion of this side of the loop produces rotation of the pulley *d* which is communicated to the arm *g*, and by means of a small cord about the pulley *h*, the pointer *i* is made to swing over the scale of the instrument. The temperature compensation afforded by this method is practically perfect.

In conclusion it may be said that what-



Principle of Hot Wire Ammeter that Compensates Temperature Changes.

* Unless the wire is very short.

ever the type or form of the hot-wire ammeter, particular attention should be paid to the location of the leads and to the construction of the shunts. While linear scales are desirable and while temperature compensation and methods for zero adjustment are important, the effect of self and mutual inductance as well as skin resistance and capacity currents are so pronounced at the frequencies of radio telegraphy that unless the meter is properly constructed the gravest errors may be made in using meters in these circuits. It is easy to build meters which are independent of frequency, and instruments which are not free from the effects of frequency can be easily calibrated for the particular circuit in which they are placed. A full appreciation of the facts outlined above should demonstrate the importance of these conclusions.

NAVY TYPE AUDION RECEIVING SET

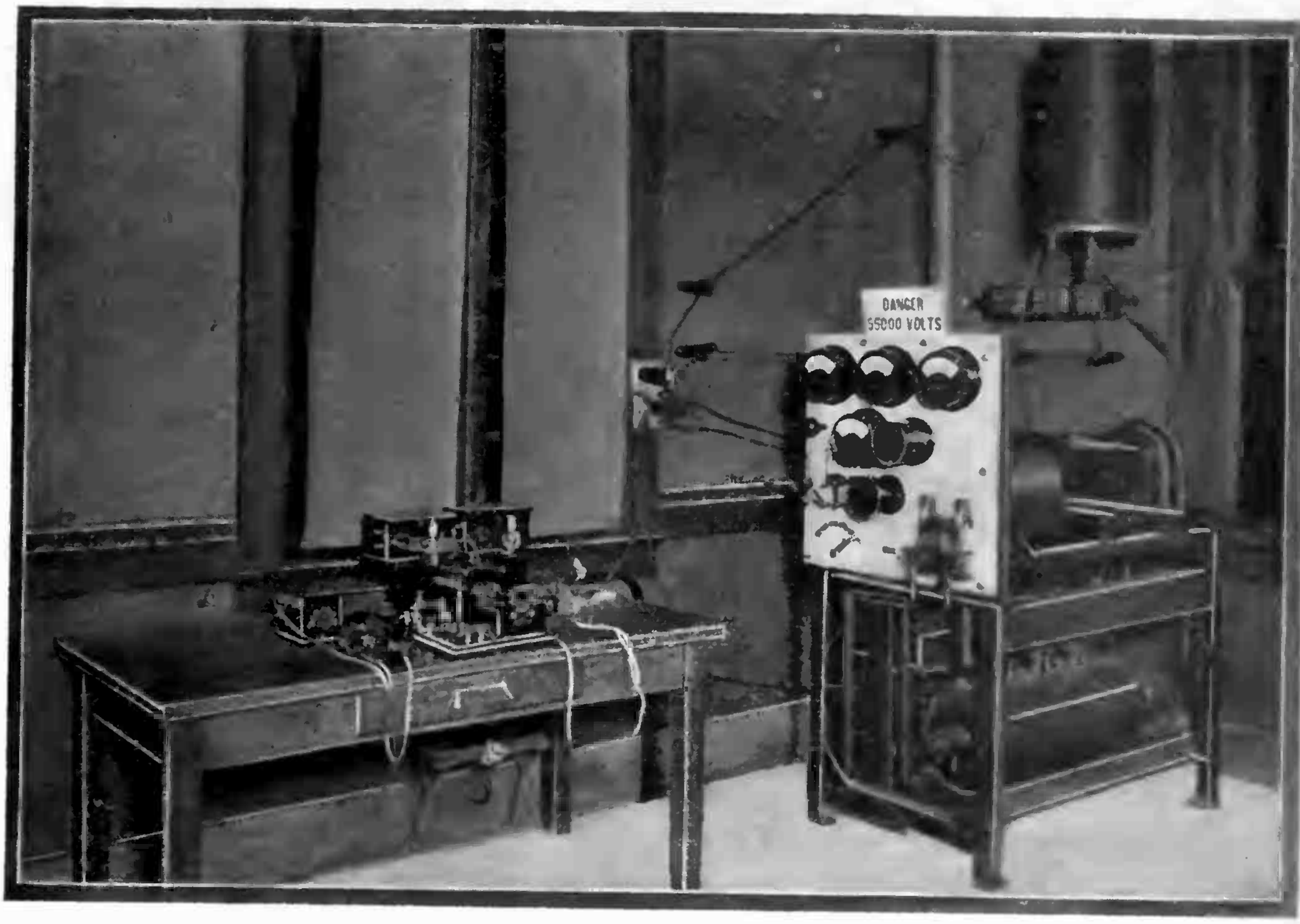
A VERY elaborate and highly efficient navy type audion receiving set has recently been brought out by an American manufacturer of wireless apparatus, of Pottstown, Pa. This set, which is illustrated in the accompanying view, is known as the "Radio Transcontinental" and is licensed under the DeForest audion patents for private use.

The set contains two super-sensitive audions, a 7,000 metre receiving transformer with dead end dividing switches, a primary condenser that may be inserted in series or parallel to the transformer primary, a secondary condenser, a voltmeter that may be used for measuring the voltage supplied to the audion filaments and telephone receivers, a rheostat and an anchor gap. The entire set is mounted on a hard rubber panel which forms the front of an attractive cabinet.

The selectivity of the "Radio Transcontinental" set is said to be unsurpassed and interference has been reduced to a minimum. The set is designed for use in connection with a transmitting break-in system, thus eliminating the necessity of an aerial switch. The life of the batteries in the telephone circuit varies from two to three years with ordinary use.

An Elaborate Audion Receiving Set with Many Refinements.

This set is especially adapted for jewelers desiring to receive time signals over great distances. A distance of 2,500 miles will not prevent the user of this set from receiving time signals from the Arlington station. Greater distances can be covered with larger aerials.



In the accompanying illustration is shown the wireless station installed in the factory of the Illinois Watch Company at Springfield, Ill. The transmitting apparatus is employed for sending time signals to jewelers at 12 o'clock noon and 8 o'clock in the evening, Central Time. The time signals begin five minutes before the hour and the same system is used as that of the Arlington time service.

The transmitting set consists of a 10 KW transformer supplied with 220 volt, 60 cycle alternating current. Glass plate condensers are used, consisting of 60 separate units arranged in three banks. The spark gap is of the rotary quenched type driven by a motor.

The signals emitted by this apparatus are not of a high pitch, owing to the low frequency of the current supplied. However, they appear to possess good carrying quality inasmuch as the signals have been heard upwards of one thousand miles. The wave length of the time signals from this station is 2,000 metres, which is considered efficient, as well as producing the minimum of interference with commercial work.

WIRELESS OPERATOR PRAISED BY SECRETARY REDFIELD

Secretary William C. Redfield, of the Department of Commerce, has recently written a letter of praise to L. A. Lovejoy, former operator on the wrecked steamship *Hanalei*. The letter follows:

December 14, 1914.

My dear Mr. Lovejoy:—

I have noted with personal and peculiar interest the record of your action on the occasion of the wreck of the steamship Hanalei on November 22.

There has come to be accepted in the public mind a very high standard of behavior on the part of wireless operators in times of danger. This has arisen from the uniformly fine behavior of such operators on such occasions. To this admirable rule your coolness and unselfish courage at the time of the wreck of the vessel on which you were employed form no exception.

You are specially to be commended for the ingenuity and persistence with which you maintained communication with the shore during the day and night following the wreck. It is no more than your due that this should be recognized and it is a pleasure to me so to do.

I indorse and approve your commendation of your assistant, Adolph J. Svenson, who showed a fine unselfishness throughout that trying time and who was lost.

Yours very truly,
(Sig.) William C. Redfield,
Secretary.

THE FALLACY OF THE FLAT TOP AERIAL

OF all antenna used in the transmission and reception of wireless signals, those of the inverted L and T types are almost universally employed among amateurs. Perhaps the two principal reasons for this are: (1) That these aerials are more easily erected than other types; (2) that would-be amateurs seeing that their wireless friends have all adopted these types of antennæ, arrive at the conclusion that these are the only designs that may be easily built and will give satisfactory results.

When regarded in the light of common sense, backed up by experiment, the flat top aerial is a very inefficient proposition.

The electromagnetic waves emitted from an aerial when a message is being sent radiate equally in all directions, or nearly so. But the waves that come into contact with the receiving antennæ travel parallel to the ground and come from one direction only; if it be true that they do pass around the earth and reach the aerial from the other side, they are too weak to record themselves in the receiver. If, then, a wave is traveling parallel to the ground from a point nearly at right angles to the aerial, it is logical to believe that the wave first comes in contact with one of the two outside wires. When it strikes that wire, most of the energy contained in this particular section of the wave is absorbed by the wire and carried by the lead-in to the instruments. The other wires merely serve to absorb the smallest part of the wave that escapes the first wire. The proof of this statement lies in the following experiment:

Remove all the wires from a flat top aerial with the exception of a single strand and note to what extent the strength of received signals has diminished. One will be surprised to find but little difference in the signals received with the one wire aerial and the multi-wire flat top aerial.

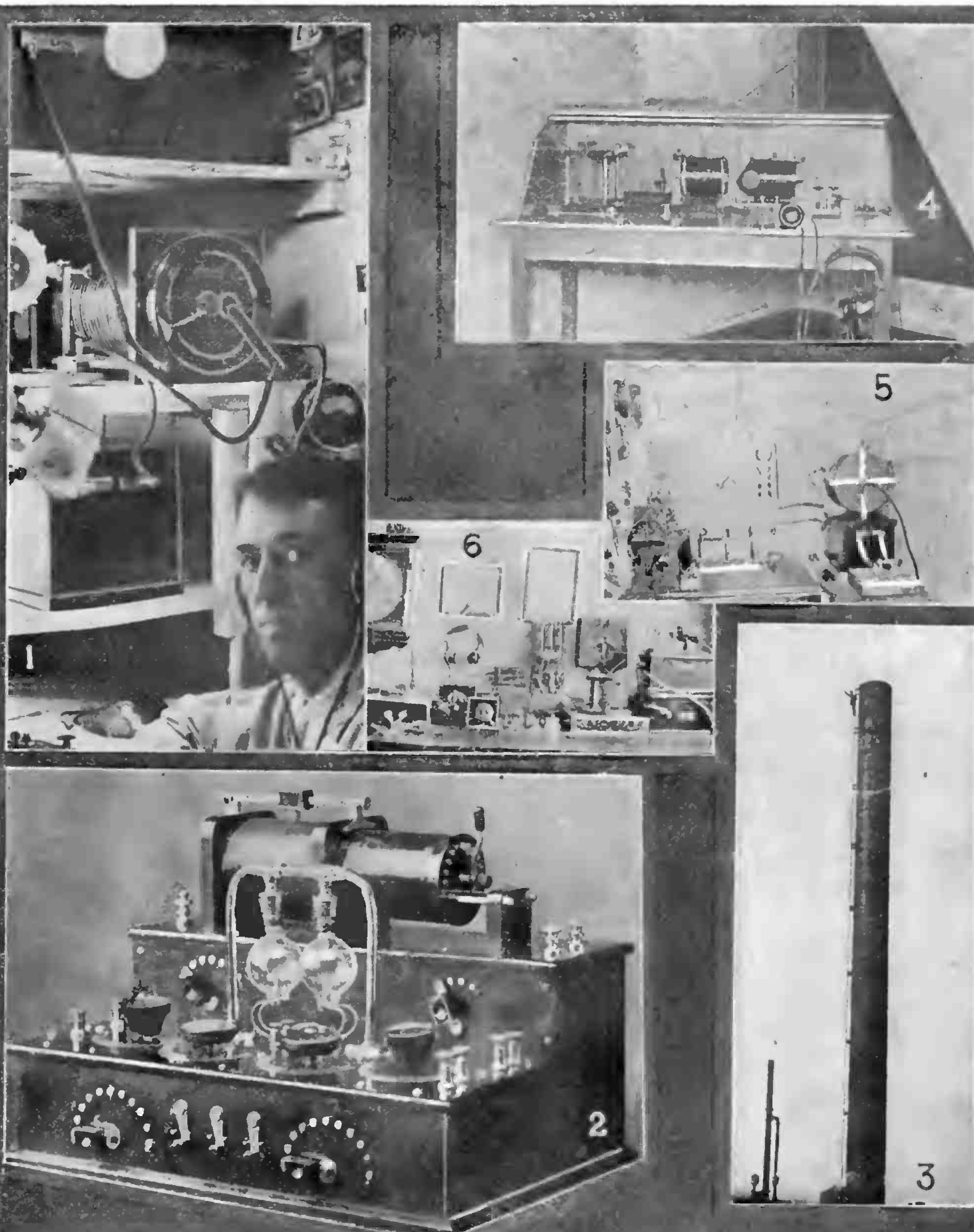
After one has convinced himself of the foregoing, the next step is to arrange the aerial as before with all the wires in place. Attach weights on one end of both spreaders so that the aerial when raised will turn at right angles to its former position, *i. e.*, the wires will be one above the other. On connecting to the receiving set the experimenter will be surprised to note the increased strength of the signals received. Every wire is now doing its full share of the work. The oncoming waves instead of having practically but one wire to intercept them now have from two to ten or as many as the experimenter wishes, placed one above the other, to gather the energy.

An aerial of the type just described may be as readily erected as any other and the results will certainly prove far more satisfactory. Heretofore, most amateurs have secured the maximum receiving efficiency by using a single long wire. However, the latter form of aerial is not always practicable and for this reason the type described in the foregoing may perhaps be of value to many.—JOHN C. CROWLEY.

RADIO-TELEPHONIC SERVICE BETWEEN LONDON AND NEW YORK

According to *Zeitschrift fur Schwachstromtechnic,* the Marconi Society of London is actually engaged in organizing a radio telephonic service between London and New York. In his wireless telephone experiments with the war vessels of the Italian fleet, stationed in Sicilian waters, M. Marconi has already had very striking success. The apparatus employed there has a radius of only 75 to 100 kilometers (45 to 60 miles), but there is good reason to believe that the greater distance between London and New York can be crossed without any insurmountable difficulty. The Marconi apparatus is very simple, and the sending and reception of the radio telephonic messages is as easy as with ordinary telephones.—J. H. BLAKEY.

AMATEUR WIRELESS STATIONS



THE STATIONS AND APPARATUS IN THE ABOVE VIEWS ARE AS FOLLOWS:

(1)—Wireless station of C. M. Jackson, of Pottsville, Pa., which is installed in the State Police Barracks in that city. (2)—(3)—Receiving set of F. J. Suchanek, New York City, as well as the tall smokestack that supports one end of his aerial. (4)—Elaborate receiving apparatus of D. Hoyt, of Massachusetts. (5)—Wireless station of W. L. Teeter, Moravia, N. Y. (6)—Receiving and transmitting apparatus of Byron Sohonwald, Wilmington, N. C.

SUGGESTIONS FOR AMATEURS

HERE are a few suggestions for amateurs that may aid them in improving their sets:

In connecting a buzzer set it is a good plan to bring one lead from the contact post of the buzzer to one side of a telephone condenser. The other lead of the condenser is left free. The condenser will then act as a radiating aerial for the waves generated by the buzzer. This arrangement will be especially appreciated by amateurs who have connected their buzzer test set in the ordinary manner and have found that it can be heard plainly even when there is no detector in the circuit. This scheme of connection becomes almost a necessity when using galena for the reason that the ordinary buzzer test often burns out a sensitive contact point.

In calibrating a sending set with a wave meter, use the combination of iron pyrites and antimony for the wave meter detector. Such a detector will not burn out, even when used in close proximity to a powerful transmitter.

It is advisable to secure station and operator's licenses whether one is obliged to or not. It places the operator and his station in higher regard than if he did not possess these licenses.

In constructing wireless apparatus it is very important to employ careful and thorough workmanship. If the completed instrument fails to work, it is then evident that the principle and not the construction is at fault.

The Underwriters' regulations should be conformed with when installing a wireless station in order to avoid future possible trouble.

It is advisable to have a substantial, sturdy aerial rather than an exceptionally high one that is apt to be blown down by a strong wind.

In making one's own instruments the use of self-cleaning, knife-edge switches is recommended in preference to sliding contacts. In making a loose-coupler the secondary should be adjusted to slide freely and the connections from the secondary should be brought back through the primary tube by means of flexible conducting cord. The employment of the sliding rods for making connections with the secondary is discouraged. Many sets operate at half their efficiency because of carelessness in this particular.—P. W. CONRAD.

WIRELESS CLUBS—ATTENTION!

The Wireless Press, Ltd., Marconi House, Strand, London, W. C., England, is preparing the Year Book of Wireless Telegraphy and Telephony, and desires information concerning all wireless clubs in the United States. In the Year Book there regularly appears a directory of wireless societies and in order to compile the lists accurately the Wireless Press will be pleased to receive notices of changes in title or address which may have taken place during the past year, as well as the name and address of all new societies. The information must reach them before February 1st.

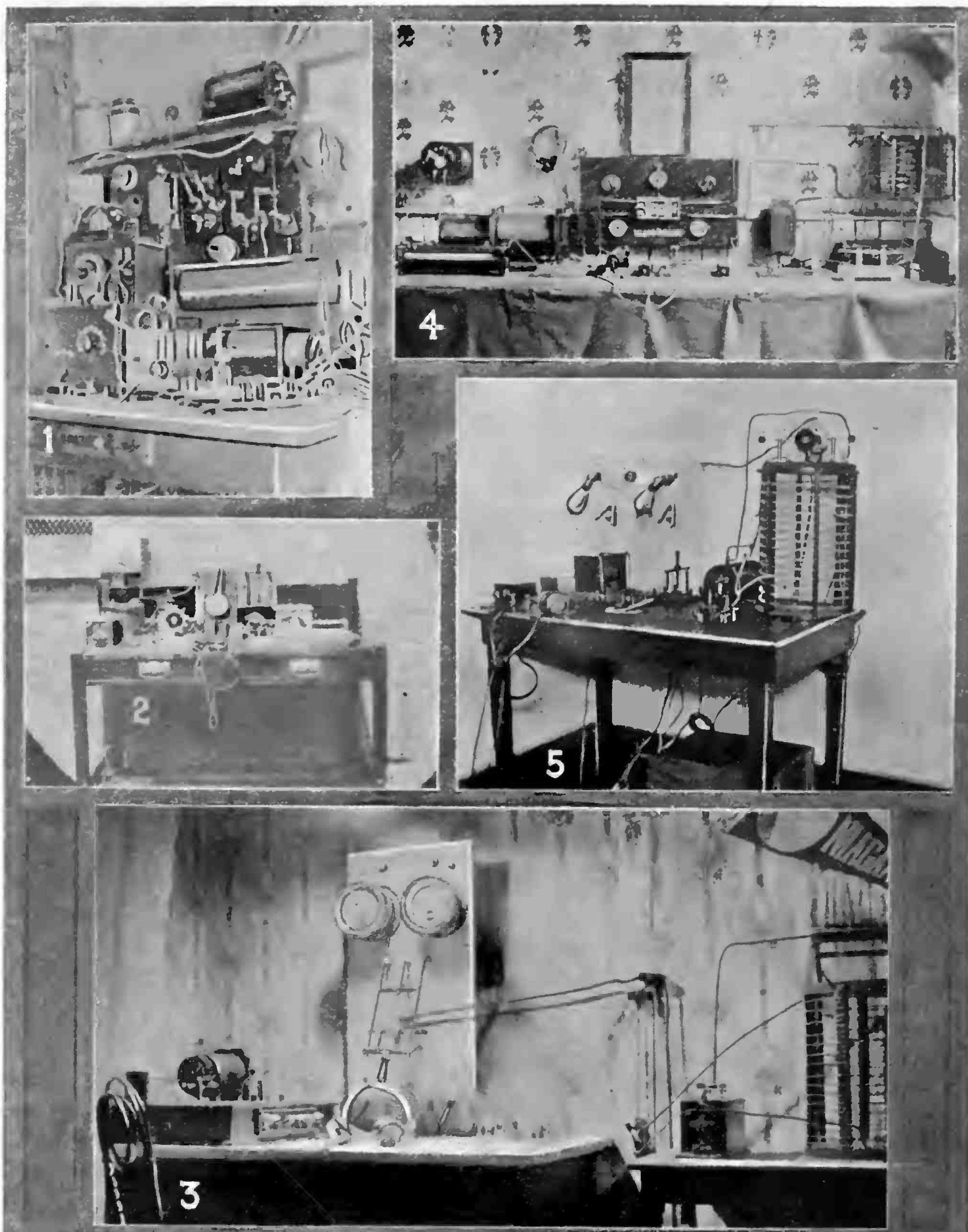
ENGINE SPARK COIL USED FOR COMMERCIAL WORK

Radio Operator Robeson tells of an interesting application of an engine spark coil when the wireless set on board the U. S. S. *Essex* was not in working order. His story follows:

"While cruising about five miles off Bois Blanc in Lake Huron, Chief Operator Dow of the U. S. S. *Essex* received an important message from Mackinac for the gunboat *Luzon* which was then about two miles off Mackinac Island Beach and within signalling distance. The *Essex* having no auxiliary set and the generator being temporarily out of commission,

(Continued over leaf)

AMATEUR WIRELESS STATIONS



THE STATIONS AND APPARATUS IN THE ABOVE VIEWS ARE AS FOLLOWS:

(1)—Wireless station of Andrew G. Halpin, Brooklyn, N. Y. (2)—Wireless station of S. Candide, Brooklyn, N. Y. (3)—Receiving and transmitting set of Harry E. Frost, Buffalo, N. Y. (4)—Apparatus of W. Morrish, Gravenhurst, Ont., Canada. (5)—Wireless station of Wilmar Tims, Cleveland, O.

the operator resorted to the spark coil and storage battery from the power life boat which were connected to the ship's aerial without a condenser. When answers were received by flag from the *Luzon,* they were transmitted to the Mackinac Island station, which was about seven miles distant."

Not only is this incident a noteworthy accomplishment from the point of view of the low power employed, but it is also interesting because of the ingenuity displayed by the operator.

THE CANADIAN WIRELESS AMATEUR

While most wireless amateurs in the United States are now busily engaged in conducting experiments and communicating with each other, the amateurs in Canada are inactive because of the European war. Aerials of the Canadian amateurs have been ordered pulled down and all instruments have been sealed up by the police; the result being that the study of wireless telegraphy is at a standstill in that country. It is obvious that there will be a big rush to hoist aerials when peace is declared.

The present time can and should be used to advantage by Canadian amateurs. Although it is impossible to devote the time to the making of wireless apparatus for the reason that it would be confiscated, the interval of inactivity can serve to encourage the saving of a sufficient sum in order that the amateur can purchase reliable instruments at the conclusion of hostilities.

Another suggestion for Canadian amateurs just now is to form a relay society similar to that of the American Radio Relay League. If a similar organization existed in Canada it would be possible in normal times to transmit a message from the Atlantic to the Pacific through a chain of amateur stations. It is quite probable that if such a system had existed before the war, it would now be used by the authorities.

Lastly, the amateurs can use their time to good advantage by practicing with a buzzer set so as to become proficient in receiving.—W. J. Knipe.

AN IMPORTANT DECISION

On November 24th Judge Wellborn, of Los Angeles, fined an amateur for operating a radio station without a license. The defendant contended that because his apparatus has not been reported as interfering with commercial stations and because in his opinion he could not transmit beyond the boundaries of the state in which his station was located, his equipment did not require a license. The conviction was obtained on the ground that his station could interfere with interstate communication to licensed amateur stations in his vicinity.

This decision is an important one in view of the existing erroneous opinion among most amateurs that if a transmitter will not send signals over the boundary of their state, they are exempt from the requirements of the radio laws. Not only does the law state that an amateur must secure a license if his apparatus can transmit over state boundaries, but it also emphatically insists that a license should be obtained if the transmitter interferes with other stations in the state receiving from stations in other states.

THE LICENSED WIRELESS OPERATORS OF WESTERN NEW YORK

In a recent communication Mr. A. H. Benzee, Jr., Secretary of the Licensed Wireless Operators of Western New York, states that his society has never been disbanded as reported on previous occasions, nor has there ever existed any intention of doing so. The club is holding its meetings regularly. The constitution has been somewhat revised and a new form of application blank inaugurated. The secretary will be pleased to correspond with similar organizations.

Perfecting the Rotary Spark Gap

By A. L. Patstone

Here is an article entirely out of the ordinary. The author points to the fact that the reason why so many home-made wireless instruments fail to give the maximum efficiency is because simple, fundamental principles of electricity and mechanics are ignored. Taking a rotary spark gap as an example, he discloses how the construction should be worked out in order to secure the most efficient results in the finished apparatus.—The Editor.

VISITING a number of amateur radio stations has repeatedly brought to my notice the lack of care taken in the construction of various home-made wireless instruments. From their rough, and sometimes ugly, appearance, they plainly show that their construction was rapid, and upon being electrically tested, they usually fall far below the point of practical efficiency.

At three different radio stations I recently observed a part of the apparatus, namely, a rotary spark gap, appearing in a general way as those so frequently explained in the columns of this magazine. One of these gaps had the appearance of originally being the property of some high-grade electrical supply house. From the strong durability, accuracy and excellent finish, its efficiency could be read at a glance. The other two gaps had a rough, thrown-together appearance, due entirely to the method of construction and not to the material used. Each owner claimed his gap superior to those previously employed. With this self-formed knowledge they were satisfied.

Being interested in these young men, I took an opportunity to roughly test these three spark gaps, resulting in the gap first mentioned producing the highest reading, and noted as 100 per cent. Using this as a basis of calculation the remaining two were found to be 80 and 55 per cent. efficient, respectively. It took this demonstration to prove to one of the owners that his gap could be greatly improved upon. It is well known that a great many of our young radio men make this same mistake, and very frequently—but why? Because the average experimenter usually fails to put his knowledge into a reality, this being more apparent when he cannot obtain the help of an advanced scholar, and because he does not keep to the fundamental parts of the subject. Instead, he tries to understand the advanced theories of the mechanical and electrical details, far in excess of his training, invariably ending in his taking too many of these for granted.

In the making of radio apparatus the most destructive method lies in the quick, hit or miss, construction. Accuracy, both electrical and mechanical, cannot be too rigidly applied to this class of work.

The length of time required in the making of any instrument is a very important factor, but it is often sadly neglected. The greater part of this time should be used in working out the proper steps to be taken, combining any advantages that may be practically applied, especially those which follow the fundamental laws governing the subject under construction. At this point many meet with failure; they neglect to slowly analyze every detail of the work for the slightest defects. A few minor additions as can be practically worked out from the laws upon which wireless telegraphy is based and rightly applied to separate parts of the apparatus, will represent a large amount of the total efficiency produced from a combined set of high frequency apparatus.

The sketch submitted will serve as a partial demonstration of the foregoing negligence. This gap is capable of handling powers from ¼ to 2 kw. input at the transformer. Several details have been added—details pointed out by the fundamental laws of radio apparatus. As these are explained, their reasons of adding a greater efficiency should cause a feeling of regret to those not capable of thinking for themselves the numerous ways in which they may be directly applied to other parts of the apparatus.

The electrodes being made of zinc or brass produce the clearest toned spark, especially the former when the metallic vapor can be sufficiently dissipated by natural or artificial air currents. Their shape should be made as will best adapt them for handling the high frequency currents, and sufficient in size to safely carry the current without causing undue heat. Those of zinc require greater surface than those of brass.

Fig. No. 2 may be prepared by casting in a mould of plaster of paris, divided into two parts, or by trimming the face-end from a length of 9/16 inch round stock. The longitudinal diameter of the trimmed face covers the question of sufficient sparking surface, as pointed out by the fundamental law of skin or surface effect in high frequency currents. The horizontal diameter of ¼ inch is necessary in order to effect a clean break to the spark which gives it that clear musical note. With a ⅝ inch die a thread is run back about 1 5/16 inch. It is almost next to impossible to cut a clean full thread on zinc, owing to its softness. For this reason and from the fact that no great strain must be withstood by the electrodes, ½ or even ¼ of a full thread may be chosen. To make the work compact and of neat appearance the standard ⅝ inch hexigonal brass nuts, used in securing the electrodes, are cut into thirds, giving each a depth of about 3/16 of an inch. These nuts permit of adjusting all electrodes. Under those on the back of the disc and rotating arm, copper strips of the proper shape are secured for the purpose of soldering to the connecting wires.

Careful note should be taken of the manner in which these connections are made to the twelve stationary electrodes in order to insure the same wavelength in the oscillating circuit at all positions of the rotating arm.

When the electrodes are in their permanent position they should be accurately spaced and on the same plane, with

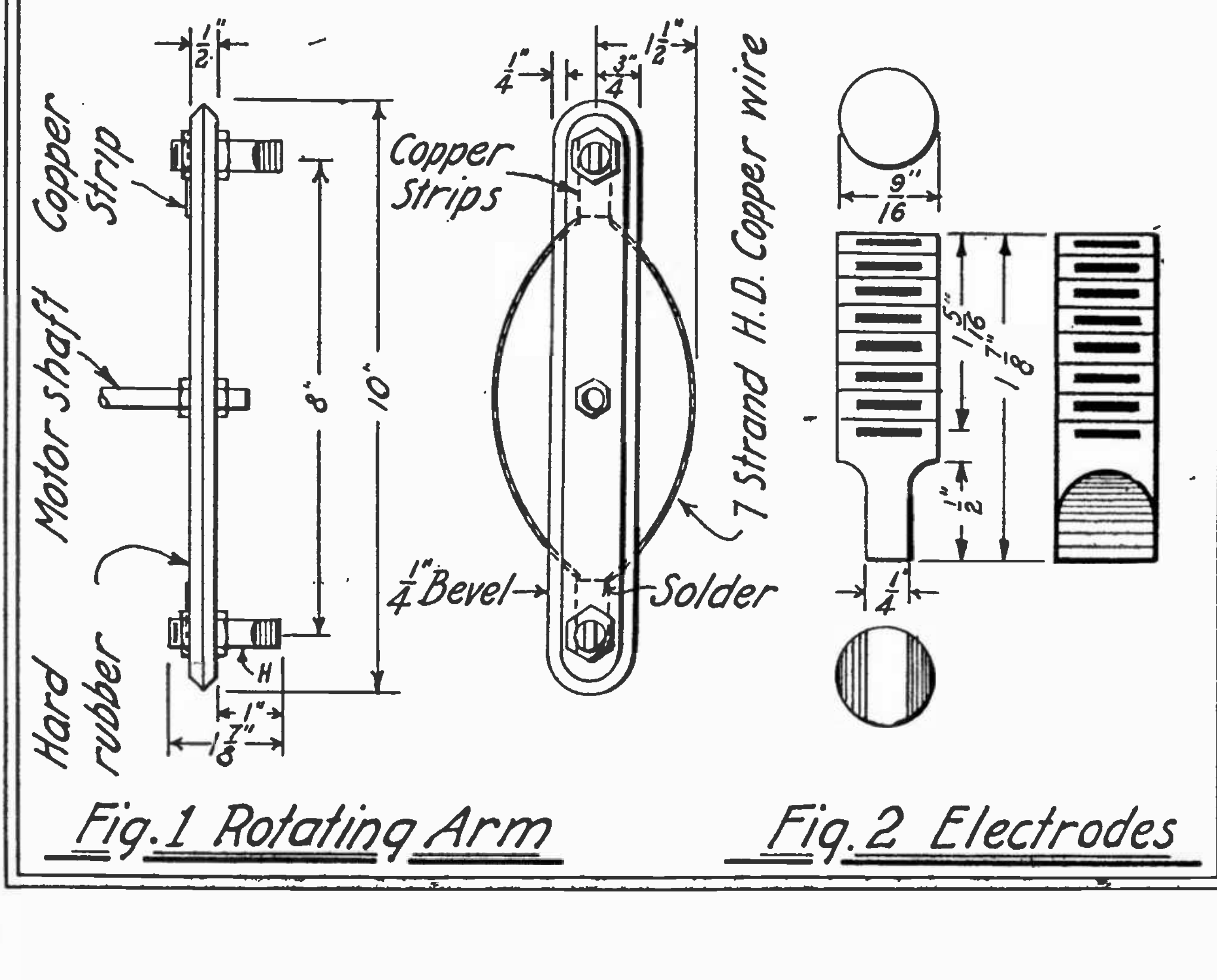


Fig. 1 Rotating Arm Fig. 2 Electrodes

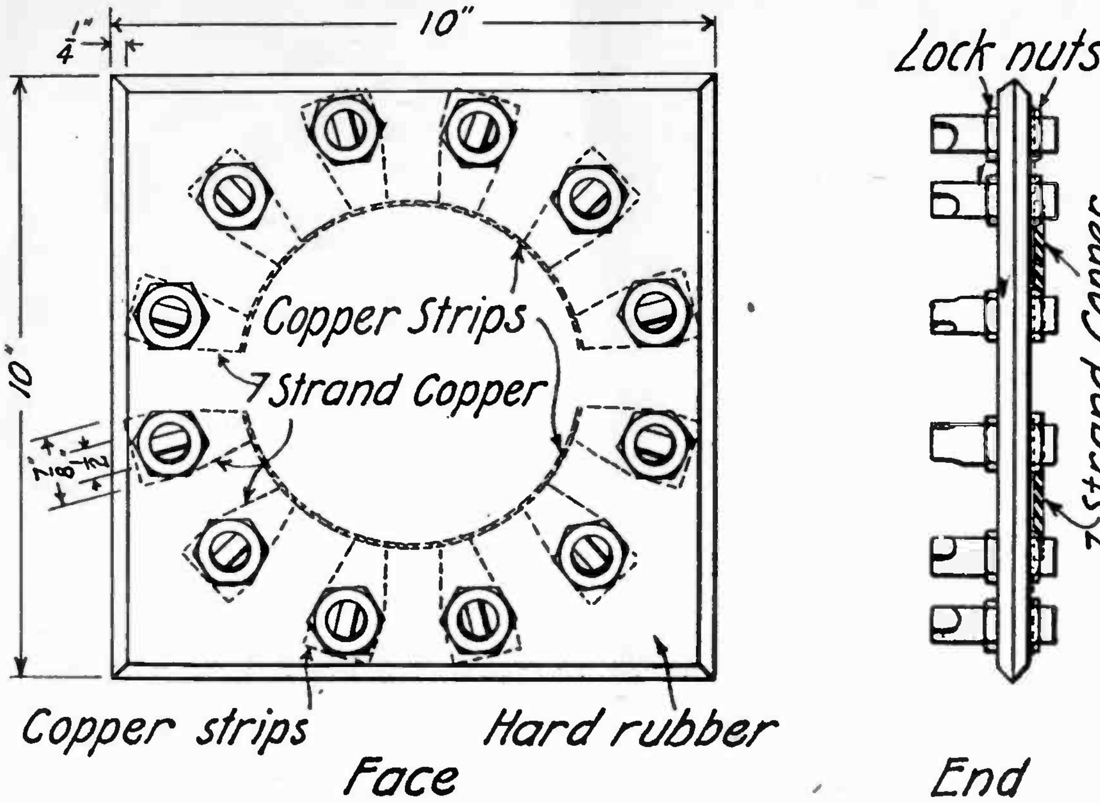


Fig. 3 Stationary Electrodes

the longitudinal diameter of their face-end at right angles to the center of the motor shaft.

For insulation and working qualities, hard rubber heads the list Those who are unable to afford an extensive quantity should determine the next best material within their means, preparing it, if possible, to somewhat increase its dielectric strength, and not say, as many amateurs do, "Wood is an insulator, and will answer the purpose." True, wood is an insulator, but there are other and more practical compositions almost as inexpensive as wood. For instance, pressed fibre is a cheap insulating material which is easily worked into various shapes, but is defective on account of readily absorbing moisture. To a great extent this may be overcome by treating all surfaces with a thick and *smooth* coating of shellac or asphaltum.

Since high frequency currents flow mostly on the surface of a conductor, it is apparent that connecting wires of silver plated stranded copper wire or tubing are preferable to any other practical form. This form is extensively used in the Telefunken system. The next most efficient and that generally used, is stranded copper wire—*not the tinned variety.* Being round, the separate strands offer no opportunity for a brush discharge as does copper ribbon. The size necessary to safely handle powers between ¼ and 2 kw. ranges from 4,000 to 30,000 circular mils. To eliminate all possible brush discharge the edges of all metal parts and of the insulation must be rounded off.

No great importance need be attached to the speed of the rotating electrodes when the motive power of the gap is supplied from an 8-inch fan motor, since this can be controlled through resistance placed in the motor circuit. At no load, small motors are subject to "racing," and when the load is above normal the speed is decreased. Should an 8-inch fan motor be selected, the comparative weight and air resistance of a disc containing 12 electrodes being greater than that of an 8-inch fan will cause the motor to be overloaded, decreasing its revolutions to a point below normal speed. To overcome this trouble the disc is made the stationary member. On the motor shaft is secured the rotating arm of hard rubber, sharpened to an edge on all sides, diminishing the air resistance to a minimum. The thickness of this arm must not be less than ½ inch, otherwise the speed of the motor will generate a centrifugal force upon the electrodes, causing the arm to be strained backward at both ends, increasing the distance between the stationary and rotary electrodes. This distance should be approximately maintained between ⅛ and ¼ of an inch. The arm may be balanced, in order that the motor will run perfectly smooth, by drilling small holes at *H*, Fig. 1, into the electrode at the heavy end.

For obvious reasons the gap should be well muffled. To gain space and eliminate vibration the muffled gap may be suspended from the ceiling at an accessible height.

To the experimenter who works out details of this nature, his efforts will always result in success.

RADIO MAST STRUCK BY LIGHTNING

ON the night of October 14th, last, one of those sudden, terrific, tropical thunderstorms such as are incidental to the countries lying in close proximity to the Equator, swept over the city of Colon. During the storm one of the tall masts of the Government radio station lying at the outskirts of the city was struck three times in rapid succession by bolts of lightning. The operator, foreseeing a possible danger from the approaching storm, had grounded his wires thereby protecting himself from injury or probable death.

When the storm had cleared away, it was found that the station was completely out of commission, the lightning having caused the aerials to break away from their supports. The mast, which was struck, was immediately inspected and condemned by the officials and its removal ordered.

A contractor assumed this responsibility and began plans for its demolishment. To provide against danger to the houses in the near vicinity, it was deemed advisable to fasten guy ropes at the extreme top with a view of keeping the mast from falling in the wrong direction and accordingly two men were detailed to undertake this task.

They had almost reached the top of the mast, when, without warning, it fell, striking the roof of an adjoining house, wrecking it badly and breaking the mast itself into five sections as shown in the views on the opposite page.

The two men were thrown over the house, striking the ground with great violence and being both instantly killed. The station is now being entirely rebuilt.—MELVILLE M. POTTER.

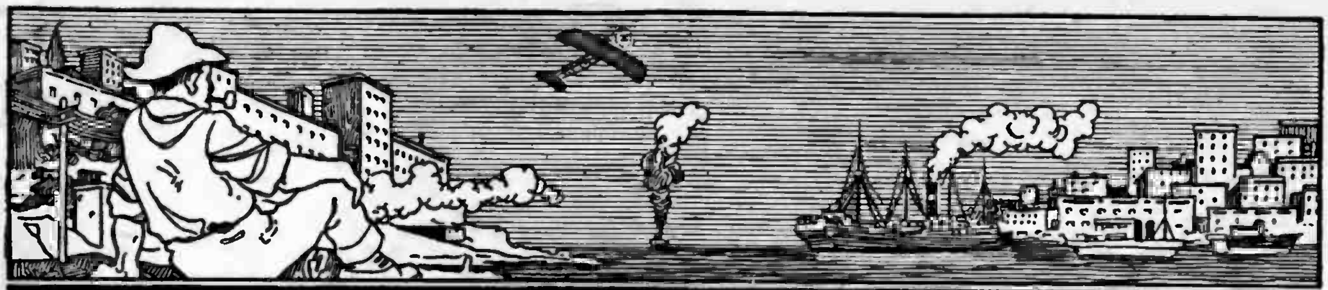
HUDSON VALLEY WIRELESS ASSOCIATION

At the election of officers of the Hudson Valley Wireless Association that took place on November 4, 1914, the following appointments were made:

President, Burr V. Deitz, Slingerlands, N. Y.; vice-president, John G. Wallace, Albany, N. Y.; corresponding and recording secretary, Howard S. Maguire, Albany, N. Y.; treasurer, Walter C. Rextrew, Albany, N. Y.

The secretary will be pleased to hear from anyone interested in the association. All communications should be addressed to him at 814 Lancaster street, Albany, N. Y.

In a recent test a wireless telephone system was used to carry on a conversation between Mare Island and Point Loma, 450 miles distant.



On Polyphase Subjects

AS the last forms of the February MODERN MECHANICS are going on the press, the entire city of New York is shaken with the news of what is undoubtedly the worst subway disaster in the history of the city's transportation system. From the maze of conflicting reports issued as this is being written, it is gleaned that at about eight o'clock in the morning of January 6th, during the peak of the early morning rush, a short circuit was established on the massive feeder cables inside the subway wall at Broadway and Fifty-third Street. The resultant arc immediately set fire to the insulation on the cables and within a few moments dense clouds of heavy smoke filled the tunnel. The short circuit, of course, caused the breakers to blow at the power station and almost immediately every train on the entire line from Brooklyn, beneath the East River, to Harlem on the North was stalled—many of them between stations. In the pitch darkness that ensued, panics started and hundreds of passengers suffered injuries from bruise and shock.

The situation at the point where the short circuit occurred was horrible. In the dense fumes of burning insulation, together with the terrifying darkness, the passengers, packed like sardines in the cars, struggled to escape into the tunnel, only to find after they had forced their way through windows and doors, that the atmosphere in the subway was worse, if anything, than that in the cars.

To this struggling mass of humanity beneath the ground, the firemen and police soon fought their way through manholes and emergency exits in the street, handing out the smoke-begrimed forms, unconscious and with the clothing almost torn from their backs. In the rescue work, many of the first to enter the tunnel succumbed to the fumes and were in turn rescued by those who followed.

It would seem that some practicable way should be devised either to provide a slow-burning or non-inflammable insulation for feeder cables on which short circuits are inevitable, or else to so segregate the cables or seal them from the subway tunnel that the smoke emitted could not find its way in any great volume into the tunnel. The fumes from an overheated motor or a blown fuse are almost stifling in such an atmosphere and the infinitely greater volume from a mass of burning rubber and varnished cambric can well be imagined.

These comments would scarcely be complete, however, if they did not include a tribute to one of the newest achievements of medical science, the pulmotor, to which hundreds upon hundreds of the unfortunates in the present accident owe their lives beyond question or doubt.

ABOUT a year ago a magnificent edifice was erected in the city of The Hague, Holland, and named the Peace Palace. Here it was intended that nations having disputes of any nature should present their cases before an assemblage of representatives from disinterested nations. The decision of these representatives was to be a final one and respected by the nations at odds. Thus it was planned that arbitration would settle disputes in a sensible and fair manner without resort to arms and consequent bloodshed and misery. But along last July came an incident that led to the great European struggle that is raging today. It would have been a simple matter for both countries originally concerned to present their cases before an international court of arbitration, but, instead, they resorted to the strength of their arms to determine the issue. Other countries bound by treaties or interests took sides with the result that a gigantic war followed. All this goes to prove that the world has not yet reached—and probably will never reach—a degree of enlightenment where wars will be permanently abandoned. Now we come to the question of great moment today: Is the United States prepared for war with other great powers? Elsewhere in this issue appears an article by an authority touching on this subject. While the nature of the article is not intimately associated with our editorial policy, it has been presented to the readers because of the great importance attached to it.

Pardonable Mistake

"Tickets," said the collector as he opened the door of the car in which sat a man who looked as if he was anchored to his seat. The man handed over the pasteboard, which was duly inspected. Then, looking around, the collector said: "Is there another gentleman in the car?"

"No."

"Is that other portmanteau yours, then, too?"

"Other portmanteau?"

"Yes; on the floor there by the other."

"Those," said the traveler with dignity, "are my feet."—*Houston Chronicle.*

Before and After

"Jack," said the young wife after she had just danced with her husband, "you've certainly improved wonderfully in your dancing. Don't you remember how frightfully you used to tear my dresses?"

"Yes," replied Jack, "I wasn't buying them then."—*New York American.*

Twain's Errand

Mark Twain did not cherish a fondness for the average office boy. He had an idea that the genus was insufferable, and invariably when the humorist sallied forth into some business office there was immediate armed hostility between him and the office boy.

One day Mark went to see a friend at his office, and the office boy on guard, in icy tones, said:

"Whom do you wish to see?"

Mark mentioned his friend's name.

"What do you want to see him about?" came next from the boy.

Mark Twain immediately froze up, and then with a genial smile, he said:

"Tell him, please, I want to ask his hand in holy matrimony." — *Chicago Ledger.*

One Precaution Overlooked

"Didn't you say," demanded the young man of the captain, "that this ship was equipped with all appliances for human safety?"

"I did."

"Then how does it happen that I now find myself engaged to a lady I did not know when the vessel left her pier?" *Judge.*

Sharing the Loss

Mr. Golden had a new office boy. A few days after his arrival some money was missing from the cash drawer.

Calling the new boy into the private office, Mr. Golden said severely:

"There is $10 gone from my cash drawer, Albert. Now you and I are the only people who have keys to that drawer."

"Well," replied the boy cheerfully, "s'pose we each pay five dollars and say no more about it?"—*Harper's Monthly.*

Majority Rule

"I never like to drink from a public cup."

"Go ahead, stranger, it's all right. Everybody uses it."—*Life.*


MODERN MECHANICS
A CIR-CLE IS A CIR CUMFERENCE AND WHAT'S INSIDE.
DIAMETER - WIDTH OF CIRCLE.
RADIUS IS 1/2 OF DIAMETER.
TANGENTS, ARE WHAT FLIES OFF OF THE EDGE OF THE CIRCLE
SOME CIRCLE
PUTTY
MY YARN!
SOME TANGENT
GET YOUR ARITHMETIC LESSON AND GO TO BED!
THIS MINUTE
THAT'S A CIRCLE ALL RIGHT
HOW'S THAT FOR A DIAMETER?
GET BACK JOHN
SOME RADIUS MY MOTHER CAN MAKE
AND THE CRUMBS THAT SHOOT OFF ARE THE TANGENTS
MA, I GUESS YOU CAN COOK UP SOME MORE RADII!
YES, JOHN, AND I GUESS YOU BETTER TAKE THE BROOM AND SWEEP UP THE TANGENTS
GOOD NIGHT
JACK SMITH