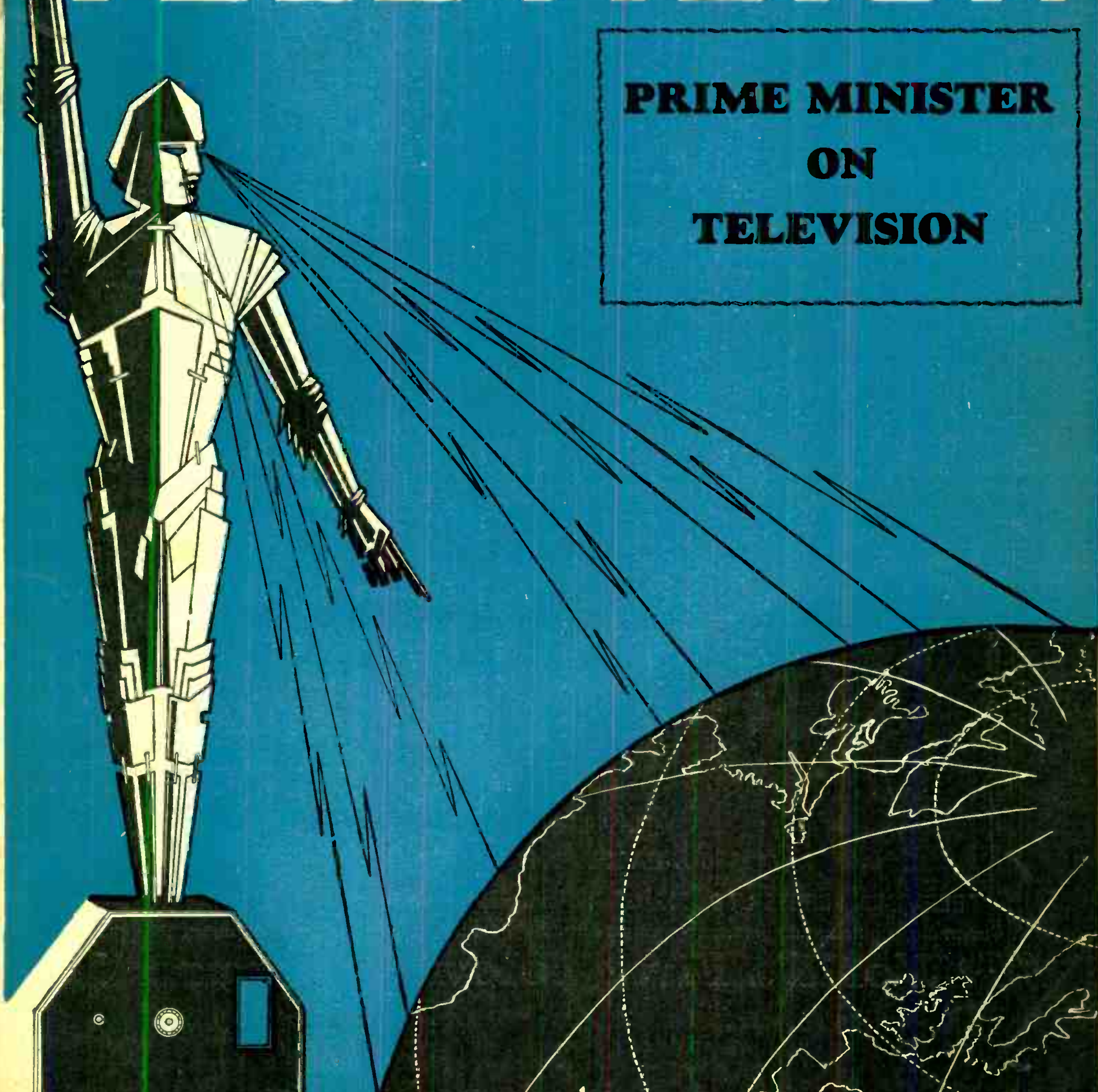
Vol. 4 NOVEMBER 1931 No. 45 ONE SHILLING MONTHLY

TELEVISION

PRIME MINISTER ON TELEVISION



THE WORLD'S FIRST TELEVISION JOURNAL.

TELEVISION

TELEVISION PRESS, LTD.
Editorial, Advertisement and Publishing Offices:
505, CECIL CHAMBERS, STRAND, LONDON, W.C.2
Telephone: TEMPLE BAR 8169

SUBSCRIPTION RATES:
13/6 PER ANNUM, POST FREE.
6/9 SIX MONTHS, POST FREE.
AMERICAN RATE:
$4.50 PER ANNUM, POST FREE.
$2.25 SIX MONTHS, POST FREE.

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TELEVISION

THE
OFFICIAL ORGAN OF
THE TELEVISION SOCIETY

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VOL. IV] NOVEMBER 1931 [NO. 45

THIS MONTH'S CAUSERIE

WITH the new Magazine is heralded the new era in television broadcasts, for the B.B.C. has for the first time in history broadcast television from its Savoy Hill studios. As the *Daily Mail* well says, "The transmission was a great success, and the world for the first time saw Jack Payne and his 'boys.'"

No more popular subject for the first historic B.B.C. transmission could have been chosen than Jack Payne and his Band. Readers will join with us in an expression of jubilation that at long last, after pegging away consistently, this British system is accepted by the B.B.C. as a definite addition to its programme.

At the time of writing the indications are that even more suitable hours will be set apart for the broadcasting of television, and now it is up to British manufacturers to take the great advantage that is offered by co-operating with the Baird Company to meet competition from abroad which sooner or later must be faced. It is not much use waiting, as we have in the past, until our industrial rivals step in. Now is the time!

In conversation with one of the officials of the Radio Manufacturers' Association, he informed me, after I had told him of the true position to-day, that his members were entirely oblivious to the true position, and he suggested that I might come along and address the members at one of their periodical lunches. I shall certainly be glad to do so.

Meanwhile I have to acknowledge the thoughtful telephonic message which reached me at the B.B.C. a few minutes after the broadcast from Mr. Allen, of McMichaels, who said the transmission which he picked up at Bromley was "marvellous." He easily recognised Jack Payne and his boys.

So far so good, but there is a great deal more to do. The pioneer work in connection with television in this country has been done exclusively by the Baird Company. They have had to bear the brunt. But this problem is no longer one which concerns only the Baird Company or the B.B.C.; *it is one of national importance,* and I am pleased to see that eminent politicians are beginning to realise that the matter cannot be allowed to stand where it is.

To descend to the purely personal for the moment, the fight I have been waging without a break for the past three years in order to put television on the map in this country is nearing a finish.

But there is a bigger fight to be won before I throw in my hand, *and that is to arrange with the Government either through the Post Office or the B.B.C. to make British television safe for this country.* Then and only then shall I regard my task as finished.

SYDNEY A. MOSELEY.

America, Finance and the Future

By

Sydney A. Moseley

WE have reached the climax! This is the November issue of the TELEVISION Magazine. Look through it and you will find a constant striving from No. 1 to achieve a course from which we have never faltered, that is to make television safe for this country.

I have returned from America in a mood that some of my friends have described as "glowering." If I were belligerent before, I am as a warrior run amok this time.

I have begun to hit out again in all directions. Full of nervous energy, I have even attacked my friends of the B.B.C. I have threatened where before I cajoled. In other words, I have returned to the militant mood in which we achieved the beginning of television broadcasts against unreasonable, sometimes dishonest, hostility. Why? Because I saw in New York that all my theories were correct. That the American people, once more, were showing more foresight, more enterprise, more determination, than were we in the matter of this important science.

At the house of the Baird representative in New York, I saw on his own "Televisor" four or five different television programmes. I switched on to these different transmissions as we switch on to different stations for sound over here.

* * * * *

Some of my American friends were rather sorry that I had criticised them so much in the TELEVISION Magazine, but I pointed out that that, after all, was perfectly legitimate and necessary. It was not so much attacking America as stimulating and stirring British lethargy. America, so far, has been able to look after herself, and so she needed no bouquets or promptings from me. I have never denied that New York inventors have done some very fine work in connection with the development of television.

At the same time I did not hesitate to point out in friendly conversation that most American books or magazines which one picked up on this subject paid scant credit to the pioneer, John L. Baird. Against this, however, and I make this statement not only readily but joyfully, the bulk of the people I met were full of praise and enthusiasm for the British inventor.

The *New York Times* in particular has paid full tribute to his work. As a matter of fact, Mr. W. S. Paley, the energetic chief of the Columbia Broadcasting Company, told me that one of the articles in the *New York Times*, which resulted from an interview with me, was of such a eulogistic character as he had never read before in that conservative newspaper.

What would Mr. Paley have said if he had seen the subsequent issue of the same newspaper which celebrated its eightieth anniversary by giving a table of the outstanding scientific achievements of the past eighty years? A warmer tribute from abroad has never been paid to Mr. Baird, as the reader will see by looking at the next page where the table is reproduced.

* * * * *

Now, the most surprising discovery I made as a result of my visit to New York, Washington, Boston, Montreal, and other places was that Americans were so assured of the importance of the Baird process that they were ready to help in the development of a British invention by financial backing. Baird shares, as I told my friends when I returned to

London, were the only thing in America that was selling. Baird Television!

* * * * *

A good deal of humbug is spoken about the financial side of Baird Television. I have always been frank with my readers, and I will continue to be so. It is the utmost rubbish to suggest that the development of a science of this nature can be achieved without somebody or other risking capital. Precious little progress would have been made in the world to-day if there had not been people ready to take a chance on whether an invention was likely to turn out well or not.

The procedure adopted by the Baird Company was the same as adopted by most of the big companies in this country.

There was an issue of shares to the public. Members of the public, who were ready to take a chance during a period when speculation was rife, came in and over-subscribed the amount that was needed. At the same time there were other issues made to the public, such as wireless pictures, colour snapshots, and a whole list which will be found in a book of mine entitled *The Small Investor's Guide.*

Some people, who have been hostile to the British endeavours along the lines of television, spread rumours that the Baird Company was more interested in finance than it was in developing the science. How grossly untrue this was can be seen by the facts. *Directors or executive officials of the Baird Company had no more to do with the movements of the Baird shares than the man in the moon.*

Jealous influences in a certain direction who spread these precious falsehoods had a motive in permeating the world with as gross a falsehood as can be imagined.

One of the Baird critics was a gentleman in a high position who did not hesitate to gamble in shares which came from the same stable as wireless pictures, which, at that time, sought to rival television, if you please!

THE NEW YORK TIMES, SUNDAY, SEPTEMBER 13, 1931.

THE OUTSTANDING INVENTIONS OF THE PAST EIGHTY YEARS

The prophecies on this page, describing the world as it may be eighty years hence, assume added significance in the light of man's record of invention in the past eighty—since the day when the first issue of The New York Times appeared. What follows is a compilation of the outstanding inventions since 1851:

1852—Elisha Gray Otis invents the elevator with automatic braking mechanism, later developed for office and building use.

1853—Ginti, an Austrian technician, shows how two messages can be sent over a single telegraph wire (duplex telegraphy).

1854—Henry D. Stone and Frederick W. Howe perfect the turret lathe so that a number of tools may cut metal mechanically. The general idea of the turret lathe goes back to Stephen Fitch (1845).

1855—Robert Wilhelm von Bunsen invents the burner now used in every gas stove.

1856—Sir Henry Bessemer devises the process for making Bessemer steel.

1860—Dr. Antonio Pacinotti conceives the first continuous-current dynamo but does nothing with it. It is independently re-invented by the Belgian Z. T. Gramme (1870-1872).

1861—Coleman Sellers of Philadelphia patents and demonstrates the first motion-picture machine of the modern type. Edison brings out the commercial apparatus in 1893.

Wilhelm Siemens invents the regenerative furnace. This, in the hands of two Frenchmen, Pierre and Emile Martin, is applied in making open-hearth steel (1864).

1865—William Bullock of Philadelphia builds the first press to print from a continuous roll or web of paper.

1867—Christopher L. Sholes invents the modern typewriter. Perfected in 1873.

1868—George Westinghouse demonstrates his airbrake.

1869—J. H. Greathead designs the modern shield used in tunneling under water.

1870—Sir William Siemens invents the electric furnace for melting iron and steel.

1871—Charles Goodyear Jr. invents the welt-shoemaking machine.

1874—Thomas A. Edison devises the quadruplex telegraph, which sends four messages over a single wire.

Sir William Thompson (afterward Lord Kelvin) devises the syphon recorder, which becomes indispensable in writing down cable messages.

1876—Alexander Graham Bell and Elisha Gray independently invent the telephone.

Dr. N. A. Otto of Cologne, Germany, invents the four-cycle internal-combustion engine now generally used in automobiles.

1877—Thomas A. Edison demonstrates his phonograph.

1879—Thomas A. Edison produces the first practical incandescent electric lamp.

1884—Sir Charles A. Parsons receives the first patent for his steam turbine

The modern trolley car appears Van Depoele invents the trolley wheel and Frank L. Sprague the multiple-unit system of control.

Gottlieb Daimler brings out the light compact gasoline engine of today and in 1885 drives a bicycle with it. Thus the automobile begins. Carl Benz of Karlsruhe is simultaneously working on the automobile problem and turns out his first gasoline vehicle.

1886—Ottmar Mergenthaler perfects his linotype machine.

Hall produces aluminum by an electrical process which eventually becomes commercial.

1887—Tolbert Lanston patents the monotype.

The Rev. Hannibal Goodwin patents the celluloid film. George Eastman independently works out the same principle.

The induction motor of Nikola Tesla appears.

1888—John Boyd Dunlop reinvents the double-tube pneumatic tire, the original invention of Robert W. Thompson (1845) having been forgotten.

1890—Dr. Carl Auer von Welsbach produces his montle burner.

1893—Rudolf Diesel publishes a description of his proposed engine. The first specimens are exhibited in 1898 at Munich.

1896—Guglielmo Marconi patents the first high frequency system of wireless telegraphy.

1899—Francis Elmore first actually uses the oil-flotation process for separating ores from waste. The germs of ore flotation are also found in a patent granted to Carry J. Everson of Denver, Col. (1886)

1900—Héroult devises his furnace for producing steel electrically.

1901—Frederick W. Taylor and Maunsel White develop the modern high-speed alloy steels which have made the cheap production of automobiles and other machines possible.

1902—Professor Arthur Korn of Germany makes the first long-distance experiment in transmitting photographs by wire.

1903—The Wright brothers produce a motor-driven airplane and fly it successfully at Kitty Hawk, N. C.

Valdemar Poulsen and Reginald Fessenden independently devise successful experimental radio telephones.

1906—Dr. Lee De Forest invents the vacuum tube now indispensable in all electrical communication

1926—J. L. Baird sends recognizable television images over a wire.

average length of life of man has | for proper employment of leisure will | forward on the intellectual line that | consciousness and begin to show evi-

The "New York Times" of September 13th, 1931, pays a big tribute to Mr. J. L. Baird by including him in their list of outstanding inventions for the past eighty years. See last line of second column.

I recall this because, even now, there are people who are working in the interests of America and who seem to be adept in spreading stories of financial interests whenever the Baird Company endeavours to assert its rights as the pioneer Television Company in this country.

* * * * *

For instance, in New York, where the Baird Corporation has its headquarters, many offers were made by America for the American rights of the Baird process. There was an offer, for instance, to put on the market a million "Televisors," an enticing offer which, however, had to be more closely considered because bigger offers were being examined.

* * * * *

At the same time in London there was a development in regard to Television Limited, the old parent company, which was formed by a few speculative enthusiasts who risked their money on television before its claims had been fully substantiated.

A section of Jim Kelleher's Piccadilly Dance Band, the first band to broadcast by television from the Baird studio.

When the scheme of amalgamation between the Baird Companies was later approved, the old parent company went into liquidation and the block of original shares was left in the hands of the liquidator who sought to realise them.

* * * * *

Now these million deferred shares virtually control the whole position of British television. There are some 3,300,000 shares all told, each with equal voting rights. Since, however, a comparatively small proportion of voters exercise their votes at general meetings, this block of a million shares, as I say, controls the voting position.

* * * * *

In my natural anxiety to see that this control would not pass into wrong hands, I set to work and endeavoured to get some friends of mine to step in and take care of these shares. Indeed, I succeeded so far that I influenced some big people, and at one time the head of one of the biggest cinema corporations in this country assured me he would come in. The full story of this I am unable to tell yet, but I can guarantee that it will form a very interesting chapter in the secret history of television.

* * * * *

To cut a long story short, however. After consulting with Mr. Baird, who, after all, is the man who should be considered so far as the future of his invention is concerned, I was encouraged to make an offer for these shares to the liquidator. You will realise that had these shares passed into foreign or unfriendly control, all my work and the work of my friends in the past few years would have been a sheer waste of time.

* * * * *

Unfortunately I was called away to New York in connection with the development of the American Company. I had to see scores of people on that matter, and at the same time keep an eye on the position in London. Separated by over 3,000 miles from my base, I found it extremely difficult to raise sufficient funds to secure the controlling interests.

Friends of mine in London who would have readily come to my rescue were puzzled to receive cables from me from New York asking for a few thousand pounds each, and in the midst of my strenuous endeavours to make the most of the American situation, I found a bigger crisis looming ahead, which was *that I might be unable to solidify my work on behalf of British television by being unable to raise the money in time to keep control for those who were working on behalf of Baird Television.* So frantic did I become that I made every conceivable offer short of parting with control!

* * * * *

Finally there came to my rescue a British newspaper proprietor who paid the money while I was away in New York. And so control was kept for this country.

With that nightmare passed, I was able to return to London and advise Mr. Baird to go to New York, where he would be royally received.

* * * * *

Now I have been more frank in connection with this financial operation than most men would have been in a similar position, but it is necessary in the interests of truth to give the true position. There has never been, I repeat, *any speculative tampering with shares of the Baird Company by any of the directors or executive.* It is, of course, impossible to prevent stockbrokers on their own initiative from tampering with any shares, as indeed they even did recently with War Loan.

At one period during the boom, a firm of stockbrokers, I understand, sold what is called a "protected Bear" on the Baird shares when they reached a high level. The explanation they gave me when I asked for one was rather technical; they said that when a share reaches an unhealthy height it

(*Continued on page* 356)

From My Notebook

By *H. J. Barton Chapple,*
Wh.Sch., B.Sc.(Hons.), A.C.G.I.,
D.I.C., A.M.I.E.E.

The National Radio Exhibition

THE National Radio Exhibition of 1931 held at Olympia was certainly a memorable one. Although taking place during a time when industrial depression was prevalent and a political crisis had arisen, the attendance, according to the latest figures, reached 198,144 for the eight days during which the Exhibition was open. This represents an increase of about 23 per cent. over the figures for 1930.

It was a wonderful show and, on every side, great enthusiasm prevailed, and most of the exhibitors stated that the amount of business transacted was actually more than anticipated. This is an excellent sign of progress, and visitors, although unable to point their finger at any one outstanding development, could not help but marvel at the improvements that had been made on every side in radio reception.

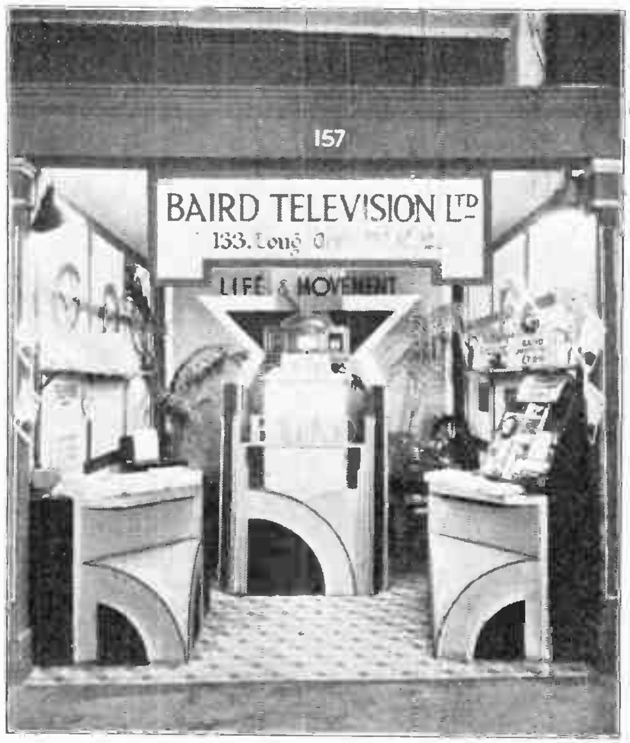
The wireless receivers showed a marked tendency towards the all-in model, that is, complete with loud speaker and mains unit, but the listener who is dependent on batteries was in no way forgotten.

As in previous years each stand was provided by the B.B.C. with signals from a common source, and this enabled manufacturers to demonstrate their loud speakers on the spot. Quite frankly, however, I was not impressed with this. I had the feeling that the quality of the signal was such that it made poor speakers seem fairly good and good-quality speakers were unable to give of their best—in other words, it narrowed the "quality" difference. I suppose this is inevitable, but obviously the final assessing of a loud speaker's value should be made in the comfort of one's own home, and, undoubtedly, this policy was followed by potential customers who made the Exhibition their Mecca.

A New Valve Filament

I learn that a new filament, termed the "Wembley" filament, is now being incorporated in Osram 2-volt battery valves. This is the outcome of an endeavour to produce a filament with an emissive coating having the following advantages:

(1) High electron emission per watt of filament energy supplied.
(2) An electron emission which is lasting.
(3) Non-microphonic properties.
(4) Rigidity and robustness.



A very striking effect was produced by the design of the Baird Company's stand, and throughout every day crowds of visitors plied those in charge with questions—further evidence of the great interest in televison.

The low thermal property which gives the first advantage enumerated above means a reduction in the amount of heating energy required to emit a given quantity of electrons from the filament surface.

This emission efficiency has a twofold advantage:

(1) It effects a saving in the cost of running the valve from an accumulator by cutting down the accumulator charging expenses to a minimum.

(2) It permits a very long filament to be employed even though the filament voltage is as low as 2 volts, and this has the effect of increasing the surface area of the filament available for electron emission.

Miss Eileen Glane has broadcast dance impressions by television from the Baird studios. This type of entertainment has proved very popular, especially as Miss Glane makes a study of form interpretation of classical music, capturing the spirit of a theme.

The greater the emissive surface area available, the higher can be made the electrical characteristics of the valve; thus this filament, with its long length and large area for emission, conduces to a very high electrical efficiency without the necessity for resorting to extremely close clearances between electrodes.

The maintenance of a reasonably wide clearance between electrodes has three immediate advantages:

(*a*) It enables a very much greater consistency to be maintained between valve and valve in mass production, *i.e.* the manufacturing tolerances in characteristics can be greatly reduced.

(*b*) It makes for the production of a non-microphonic valve.

(*c*) It reduces the chance of electrode contact and ensures a more robust valve.

New Causes of Radio Interference

We are constantly hearing of cases of radio interference of an industrial nature which have led to a prosecution by law and an order to make the apparatus non-interfering. Details have now come to hand of a case in which the owner of a grocer's shop in Berlin had an electrical cooling apparatus which was causing interference. The matter was reported to the Court, who ordered immediate steps to be taken to ensure that listeners would not have cause to complain again.

In Karlsruhe it has been found that the electric drive in church and cinema organs causes interference, and four towns in England are out to stop tramway interference by installing collector bows of the Fischer type, which have been found to be non-interfering. The towns are Glasgow, Sunderland, Aberdeen, and Birmingham.

Measuring Sound

The need has often been felt for a unit of measurement of sound. Of late, with the popularisation of sound amplification, it has become absolutely necessary for sound to be measured. Consequently the " bel " has been evolved, named after Graham Bell, and indicates a tenfold amplification. This was felt to be rather too large, and the more common unit will be the " decibel," one-tenth of a " bel."

Approaching the Four-Million Mark

Although it is looked upon as the accepted holiday month with a corresponding neglect of matters appertaining to wireless, perhaps the bad weather accounted for the very large increase in wireless licences which were taken out during August. The figure given was 32,600, and this makes the total number of paid licences for England, Wales, Scotland, and Northern Ireland stand at the huge total of 3,818,000, while the free licences issued to the blind are 25,500, this being for the period ending August 31st, 1931.

Interesting Visits

During October I have had the opportunity of addressing two very enthusiastic television audiences —one in Bradford and one in London. At the first-named city I gave the opening address to the Bradford Radio Society, with which is amalgamated the Bradford Dyers Ltd. Staff Guild Radio Society, and the subject I chose for this occasion was " Television—Yesterday, To-day, and To-morrow." I found the Bradfordians very keen to learn all they could about television, and I urged them to make a co-operative effort amongst themselves to carry out experiments with vision apparatus. The secretary informs me that this suggestion is to be acted upon, and I can warmly recommend the same policy to other societies, otherwise they will be left behind in the general advance of television.

The second lecture was carried out at rather short notice, but, nevertheless, "Recent Advances in Television" gave me an excellent opportunity to deal with the latest Baird achievements on the opening night of the Television Society session. My remarks are reprinted elsewhere in this magazine, and I should like to pay tribute to the enthusiasm of the members.

Interference Again

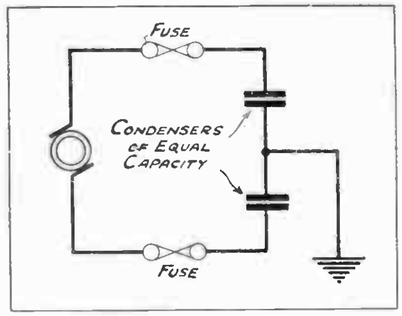
Reverting to the Bradford visit, it was my intention to make tests on the quality and strength of the Baird television signals, and for this purpose I took with me a "Televisor," the "Tele-Power" Unit (described in the September issue), and a Pye All-Mains A.C.4 receiver. The last-named is a four-valve mains portable, having two stages of screened-grid, a detector, and power output. The strength of signals on the vision wavelength of 356 metres was excellent with the combination mentioned above, but unfortunately my tests were negatived beyond this point, for I encountered bad interference from the "Televisor" motor. This interference with the powerful portable set was sufficient to spoil the images, and unfortunately there was not time to apply a "smoothing circuit" to the offending item.

As a rule, motor interference arises from the commutation of the motor, and one of the first steps is to examine the commutator with great care to see if any of the "bars" are raised. Sparking at the brushes should be reduced to an absolute minimum, and in this connection do not omit to look for a faulty brush position, a badly fitting brush, or incorrect brush tension.

A Smoothing Circuit

It happens sometimes that attention to the points just mentioned do not of themselves bring about the necessary clearance of the interference, and in that case some form of smoothing circuit must be incorporated. The accompanying diagram gives a simple, but generally very effective, method of carrying this out. Two fixed condensers of the same capacity are joined in series across the brushes and the centre point connected to earth. It is advisable to include a fuse in each leg of the circuit as a protection against either condenser breaking down or any sudden potential surges in the supply mains. As a rule, the capacities of the condensers are not critical, but where possible various values from, say, ·5 mfd. to 10 mfd. should be tried.

A simple smoothing circuit to fix up to cure motor interference.



Another important point to watch with this arrangement is the length of the leads. Keep these to the barest minimum by mounting the condensers close to the brushes. In addition, see that the lead to earth is not only short and straight, but made from wire of low high-frequency resistance, multi-stranded cable being excellent for this purpose, provided care is taken not to break the strands at intermediate points. Another scheme worth trying is the inclusion of air-core chokes in series with the mains, provided the wire is of the necessary gauge to carry the current.

A suitable inductance value is of the order of 100 microhenries and, if desired, the chokes can be made up as hank-wound coils or alternatively commercial H.F. chokes may be tried.

A "Loud Speaker" Election

The important part which broadcasting has played in the present Election needs no emphasis. There must be few listeners who, by the time the polling day arrived, had not heard the speeches broadcast throughout the country by the various political leaders.

It may not be so widely appreciated that this was but one of the directions in which radio science helped the various candidates. The use of powerful amplifiers and loud speakers at important meetings was also widely adopted, with the result that not only could vast audiences hear every word that was addressed to them, but the voices of the speakers themselves were saved much unnecessary strain.

On the Nature of Light

By Sir Ambrose Fleming, D.Sc., F.R.S.

IF any of the great scientists of the middle of the nineteenth century had been asked whether we knew anything about the nature of light and how it conveys energy, they would have said, "Why, certainly! We know a great deal about it. We know it is a transverse vibration in the ether."

If the same question were asked of any of the chief physicists of to-day, they would be bound to confess that as regards a knowledge of the true nature of light, we are still almost completely in the dark, and more than that, we do not even know for certain whether there is any ether at all. It was merely a convenient hypothesis, which is perhaps better discarded in the view of many to-day. Nevertheless, we have accumulated in the past two and a half centuries an immense knowledge of the facts of optics and how light behaves under certain conditions.

A collection of facts, however, can no more be called a science than a disorderly heap of bricks can be called a house. The bricks must be arranged in a certain way to make a house, and the facts must be strung together by some consistent explanation to create a branch of science.

Accordingly, one great puzzle of science is the true explanation of the essential nature of a ray of light.

The philosophers of the nineteenth century, such as Thomas Young, Fresnel, Brewster, Hamilton, Stokes, Green and, later on, Kelvin, recognised clearly that light is a vibration of some kind, periodic in space and time, as proved by the facts of interference and diffraction, which show that two rays of light from the same source, travelling to one and the same point by paths of slightly different lengths, can annihilate each other so that light added to light can produce darkness. Moreover, the fact that a ray of light can be polarised, as it is called, or have different properties on its two sides, showed that this vibration must be transverse to the direction of propagation, and not along that direction, as in the case of sound.

Our distinguished contributor Sir Ambrose Fleming, D.Sc., F.R.S.

Then further, if light is an undulation, there must be some medium which can undulate, and hence the ether was hypothecated. It was supposed to be immaterial, imponderable, intangible, and yet to have some type of elastic resistance to deformation and inertia or persistence in creating or removing that deformation. In short, it had the mechanical properties of an elastic solid.

Numerous mathematicians then endeavoured to imagine types of elasticity which would make the behaviour of this hypothetical ether correspond to observed facts. One after the other these hypotheses, as to the structure of this elastic solid ether, had to be thrown upon the scrap-heap. The most promising of the lot was that of an Irish mathematician, MacCullagh, who assumed that the parts of this ether did not resist being moved to and fro or sliding over each other, but elastically resisted being rotated or twisted.

Nevertheless, the fact remains that we know nothing directly about the mechanical properties of such an ether, and have no justification for assuming them. Then in 1865 that incomparable scientific genius, James Clerk Maxwell, the centenary of whose birth we celebrated this October, put forward a totally different hypothesis.

If two metal plates are placed parallel to each other, forming what we call a condenser, and if a difference of potential or voltage is applied to these plates, producing in the space between them an electric force, this force creates a state called electric strain, or displacement. This displacement depends upon the nature of the insulator, whether air, ebonite, or mica between the plates, but it is not entirely zero even when the plates are in a high vacuum or empty space. The quality in virtue of which this displacement is produced by voltage or electric force is called the *dielectric coefficient* of the insulator. Hence, even empty space has a certain dielectric coefficient, the numerical value of which is taken to be denoted by unity.

In the same way, if we pass an electric current through a coil of wire, it exerts on the surrounding medium a magnetic force, and this generates a state called magnetic flux or induction. The intensity or degree of this flux for any given force is determined by the so-called permeability of the medium.

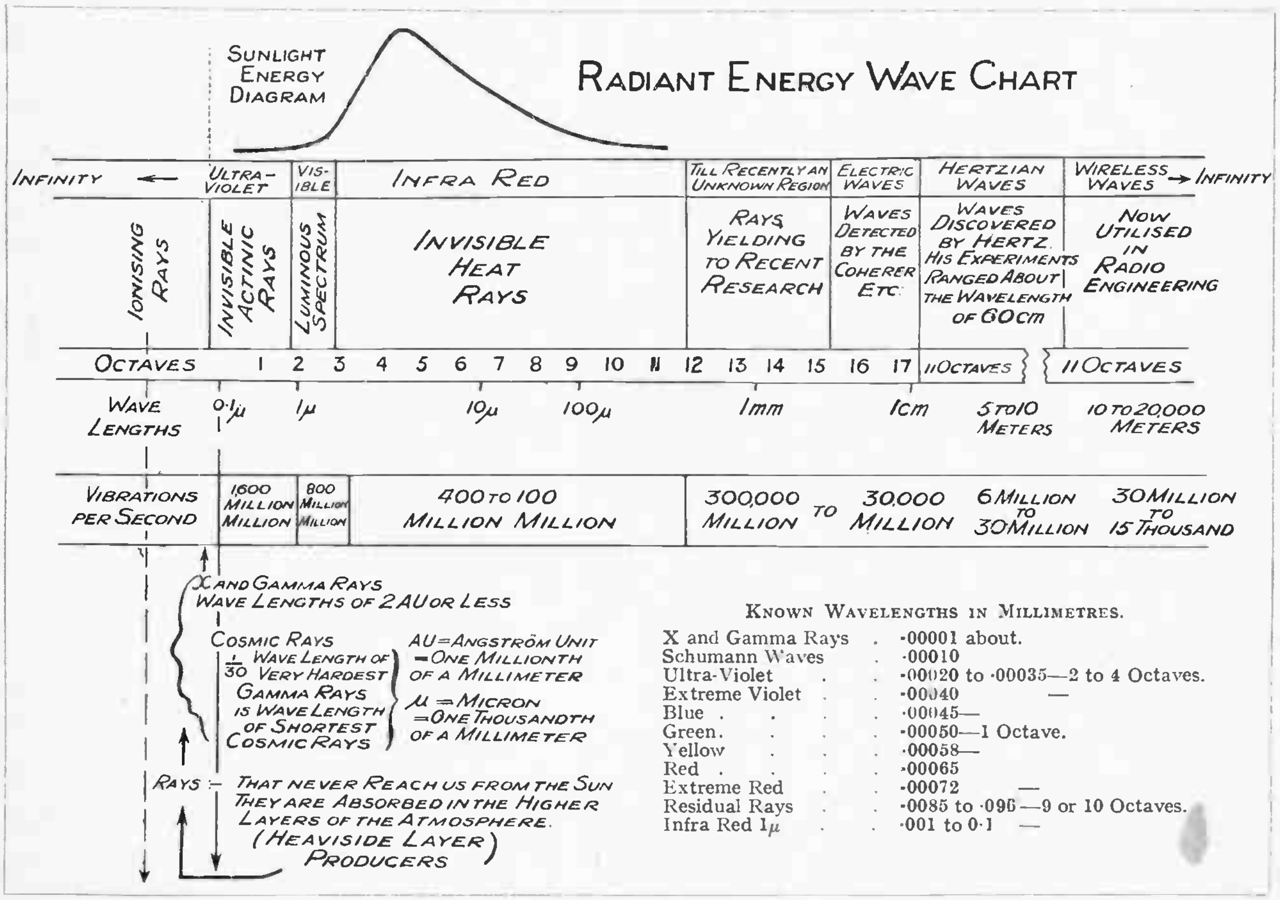
Now, magnetic flux can be created across or in a high vacuum, and therefore empty space must have magnetic permeability which is taken as unity.

Whilst, therefore, we know nothing about any mechanical qualities such as inertia or elasticity of the ether, we do know experimentally that empty space has these electric and magnetic qualities called dielectric coefficient and magnetic permeability.

Maxwell then proved mathematically that we can have produced in empty space or in any insulator an electro-magnetic wave consisting of a periodic variation of magnetic flux and electric strain which act at right angles to each other and to the direction in which the wave is moving. At any one point there is a periodic and simultaneous variation of magnetic and electric force, and at any one instant there is a periodic variation of these quantities along the line of propagation of the wave. Maxwell also proved that the speed with which this electro-magnetic wave travels is measured by the reciprocal of the square root of the product of the dielectric coefficient (K) and the permeability (μ) of the medium or $1/\sqrt{K\mu}$. We do not know the absolute value of these constants for empty space, but, curious to say, we know the value of their product, and the reciprocal of the square root of this product is the same number as the velocity of light.

Accordingly, Maxwell arrived at the conclusion the light was an electro-magnetic wave and that other waves of the same kind, but longer or shorter in wavelength, should exist. These longer waves we now employ in wireless telegraphy and in broadcasting. It was, then, Maxwell who first pointed out the existence of these wireless waves and laid the foundation for all radio engineering.

Maxwell's theory of these waves was first expounded in a celebrated memoir by him sent to the Royal Society of London in 1864, entitled, "A



Known Wavelengths in Millimetres.

X and Gamma Rays	·00001 about.
Schumann Waves	·00010
Ultra-Violet	·00020 to ·00035—2 to 4 Octaves.
Extreme Violet	·00040 —
Blue	·00045—
Green	·00050—1 Octave.
Yellow	·00058—
Red	·00065
Extreme Red	·00072 —
Residual Rays	·0085 to ·096—9 or 10 Octaves.
Infra Red 1μ	·001 to 0·1 —

Dynamical Theory of the Electro-magnetic Field."

It was not, however, until 23 years later that Hertz in Germany showed us how to generate experimentally the long electric waves predicted by Maxwell's theory.

But as Thomas H. Huxley once said, the great and ever-recurring tragedy of science is that of a beautiful hypothesis killed by an ugly fact.

So it has been with the beautiful wave theories of light which have been elaborated. Sooner or later some fact has turned up quite irreconcilable with the theory.

The first of these was the fact that when light or extreme ultra-violet light, that is radiation of shorter wavelength than violet light, passes through certain gases, it ionizes them, that is, detaches electrons from the atoms. But it does not ionize every atom simultaneously. All the atoms are identical, and yet the light wave behaves as if the energy was not uniformly distributed over the advancing wave front surface, but concentrated in certain places spaced over that front.

Then in the next place, when light of a certain frequency falls upon certain metals, such as cæsium, potassium, or zinc, it liberates electrons from them. Such metals are called photo-electric, and this effect is employed in the construction of photo-electric cells used in television.

Here again, although the light falls uniformly on the surface, it is not every atom, but only a certain number that are ionized or have electrons shot out of them. We know from other phenomena that to liberate an electron from an atom requires an energy expenditure between two and three billiergs. A billierg is an amount of energy equal to a million of a millionth of an erg or to $1/10^{12}$ erg.

Now, an illumination equal to that given by a light of 1 candle at a distance of 2 metres or to 1/40 of a candle-foot is more than sufficient to produce an instantaneous photo-electric effect on potassium or cæsium. An illumination of 1/40th of a candle-foot is equivalent to an energy expenditure on that surface of about 2·5 ergs per square centimetre per second. But a single atom has only an area of $1/10^{15}$ square centimetre. Hence an illumination of 2·5 ergs per square centimetre falling on an atom can impart to it at most $25/10^{16}$ erg per second. But the energy required to ionize or liberate an electron from an atom is at least $2{\cdot}5/10^{12}$ erg or $25{,}000/10^{16}$ erg or 1,000 times greater. Hence we see that the light of a single candle at a distance of 2 metres would have to act for at least a quarter of an hour to supply the energy required to ionize an atom. As a matter of fact, it ionizes it instantly.

This, therefore, shows that the energy of a beam of light does not act on atoms as if spread uniformly over the wave front, but as if accumulated in certain spots, and that the wave front as far as energy is concerned is speckled or spotted.

An alternative theory for which there is a good deal to be said is that it is not every atom which at any moment can be ionized. Also reasons can be given for thinking that an atom can draw or suck out of the wave front more energy than corresponds to an area equal to its own surface. An atom may have an axis which has to hold a certain position with regard to the wave front before it can absorb any energy no matter what the energy density of the incident wave may be.

The outcome of this is to show that a pure wave theory of light cannot explain all the observed facts about light, but we are compelled to supplement it by a sort of corpuscular theory.

In fact a beam of light more resembles a shower of rain in some ways than a uniform wave like a sound wave in air. The rain consists of little drops of water of various sizes; and light consists of little drops or quanta of energy called photons. The photons are of different energy sizes. The photons of red light have less energy than the photons of violet light, but the red photons are more numerous than the violet. It is because the violet and ultra-violet photons have each so much energy that they can cause photo-electric emission of electrons in metals, act on photographic plates and films, tan our faces and arms; and also have valuable health-producing and germ-destroying powers.

Sir Ambrose Fleming pays a glowing tribute to the genius of Clerk Maxwell, whose portrait is reproduced above.

(To be continued)

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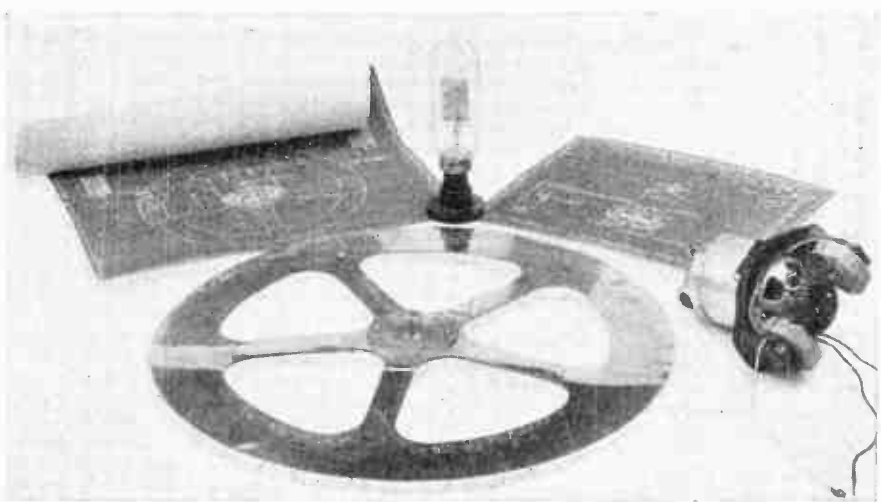

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The Television Society

THE OPENING ADDRESS DELIVERED ON WEDNESDAY, OCTOBER 14th

Recent Developments in Television

By

H. J. Barton Chapple, Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E., Fellow of the Television Society

ANY attempt to keep pace with television developments is fraught with difficulties, for, month by month, new ideas, or advanced developments of old ideas, make their appearance.

As far as this country is concerned television has in no way been standing still, and, in order to make our story quite complete, I think it best to mention briefly what television stands for and how it is carried into effect.

We have become accustomed by means of our normal wireless to hear voices and music which come from hundreds or even thousands of miles away. In this case, however, we are only hearing and are in the position of a blind man. Television is, therefore, of the utmost importance, because it is going to complete the business of hearing by adding sight.

Speaking scientifically, television means "seeing with the aid of electrical methods of transmission, the reproduction of the images of scenes, living or inanimate objects, without being actual eye-witnesses on the spot where they occur." To make the situation clear, let me give you two analogies. If you speak into a telephone mouthpiece, the sound waves of the voice impinge on a small metal plate and cause it to vibrate in sympathy or in exact conformation to the sound wave. This plate movement is impressed on loose carbon granules at the back of the instrument and, consequently, the electrical resistance of the circuit of which they form a part is altered. This sets up a fluctuating current which alters in exact unison with the voice.

In this way we convert sound waves—that is, speech, song, or music—into fluctuating currents in a wire circuit, and these are transmitted to the receiving end, where they pass round a magnet mounted behind another metal plate. The varying current alters the attraction of the magnet on the plate, and the resulting movements are similar to those taking place at the transmitting end.

Thus is speech reproduced, and, when we come to consider it, the process, like all great inventions, is amazingly simple.

Wireless broadcasting is effected on very similar lines. The artiste stands before a microphone, and the sound waves of his voice are converted, as in the telephone, into electrical currents varying with the sound waves. These fluctuations, minute in character, are amplified and superimposed on the high-frequency carrier wave of the station, this wave taking the place of the wires of an ordinary telephone. Then the waves are radiated into space, and, if you have a wireless aerial and receiver tuned in, you can detect these waves because they produce minute voltages in the aerial circuit.

Further amplification then takes place, and the output from the receiver passes to the loud speaker which, acting somewhat as the telephone earpiece acts, gives you an aural replica of what is taking place in the wireless studio.

In effect the process of television is very similar. The person to be televised stands before the transmitting apparatus, and the light reflected from his face or body acts upon sensitive photo-electric cells, and these cells convert the light into current variations. Then, as in the analogous cases of the telephone and the broadcasting system, this effect is sent from the transmitter to the receiver by the aid of wire or wireless, and, just as in the case of the telephone, no actual sound is transmitted, but merely an electrical replica; so in television the actual light and shade of the features and form of the televised person are not transmitted but an electrical replica only.

Many and intricate are the methods which have been applied to bring to fruition this television scheme just referred to, and the first man to achieve demonstrable results was Mr. J. L. Baird. Fortunately I have been in constant touch with this inventor for some years and have watched the progress made, and I should like to explain some of the outstanding achievements of the past two years.

Let me deal first of all with the present television broadcast service. Prior to 1929 the Baird Company broadcast experimental television transmissions from their own transmitter of low power situated on the roof of their laboratories in Long Acre.

These were very successful, but obviously the service area served by these broadcasts was of a very narrow compass. Negotiations were, therefore, undertaken between the Baird Company and the B.B.C. to see whether television could be broadcast inside the normal broadcasting band as allotted to public-service stations.

Early in 1929 the Baird Company gave a demonstration of television through the old 2LO station before a representative Committee of the engineers of the Post Office and B.B.C. and Members of Parliament. Television was received on portable "Televisors," both at the Post Office and at Savoy Hill, no separate synchronising signal being transmitted, and only the ordinary broadcast service channel as used for speech being employed.

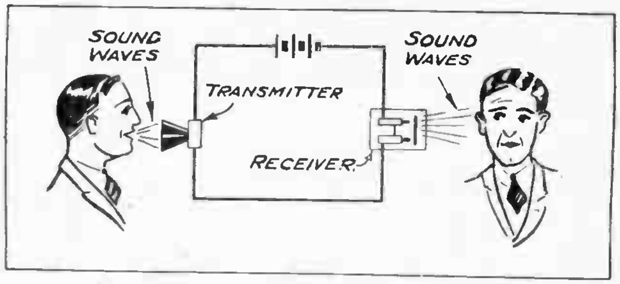
This established once and for all that television could be broadcast under commercial conditions, and the demonstration was hailed by the Postmaster-General and his Committee as a "noteworthy scientific achievement." This led up to the successful conclusion of the lengthy negotiations between the B.B.C. and the Baird Company for an experimental television service through 2LO, and this was inaugurated on September 30th, 1929. This was for vision only, as on that date the present Brookman's Park transmitter was unfinished, and during the inaugural ceremony it was necessary to transmit first of all speech and afterwards the vision of each individual speaker and artiste.

This single service of vision alone ran for seven months, and on March 30th, 1930, dual sound and vision made its bow to the public from the completed Brookman's Park twin transmitting stations.

Originally the control room and studio situated at the Baird Company's premises at Long Acre were of rather small dimensions, and it soon became apparent that, if the service of television was to be maintained at a high standard, it would be necessary to increase both the size of the studio and the control room. This was done and has been in use for several months now.

It will be interesting at this juncture to digress for a moment and explain the *modus operandi* for conducting a normal television broadcast. The transmitting apparatus is sectionalised into two parts, that of the studio and that of the control room, these two rooms being divided by a special partition which is noise-proof; that is to say, the sounds from the studio cannot pass through into the control room. There are three windows in this partition, two for use in conjunction with the television transmitters, and a centre one for use as an inspection aperture. High-quality plate glass has to be employed, and this must be thinner than is really advantageous for deadening the sound, otherwise light would be absorbed, and, furthermore, the quality of the glass must be above suspicion, otherwise curious image effects will result.

In the studio, which has the usual drapery on



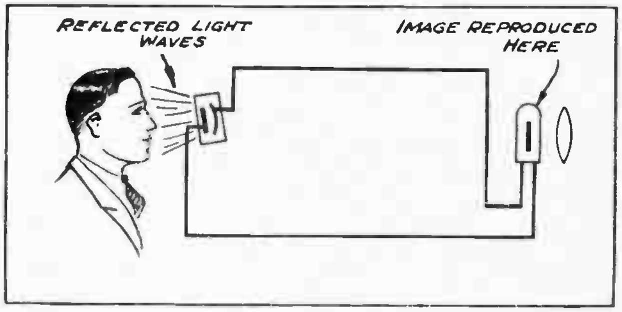
Indicating in a simple manner how telephonic communication is established between two individuals.

the walls, are arranged the banks of photo-electric cells on suitable movable stands, and also the signalling lights which function between the studio and the control room.

There are two transmitters employed, one a light-spot disc model somewhat similar to the early pattern of transmitting tables used by the Baird Company, except that it is now possible to "swing the light beam" vertically and horizontally as required in order to follow the movement of the artistes.

This particular transmitter is utilised for the familiar close-ups, that is the head and shoulder images. In the early days of television broadcasting it was felt that from the entertainment point of view a great deal was missing owing to the inability to transmit full-length images.

Intensive research work has, however, enabled the

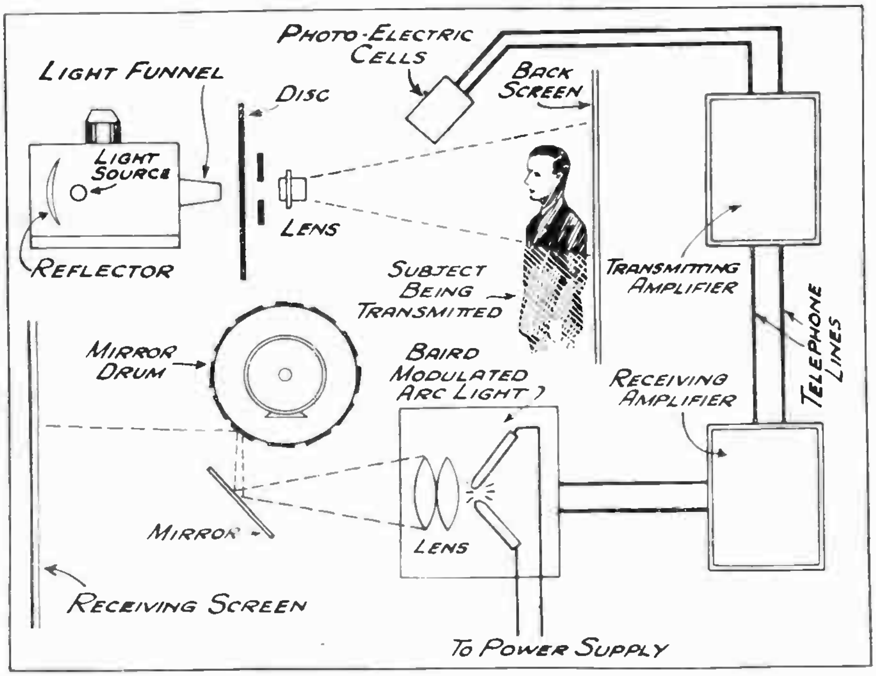


In an analogous manner the transmission of individuals and scenes is effected by the Baird process.

Baird Company to develop this side of their service, and in the control room there is now a mirror-drum transmitter which is employed for semi-extended and extended scenes, it being also possible, as in the case of the light-spot disc model, to follow the movement of the artistes when such a course is necessary.

Leaving for a moment the nature of the programme broadcast, let me turn to the scheme employed for transmitting these signals through to Savoy Hill. The television signals are translated from light and shade to an electrical replica by means of the photo-electric cells, and passed through three separate amplifiers and a corrector before being handed on to the landline linking Long Acre with Savoy Hill. More than one bank of cells is utilised, so that it is necessary to "mix the signals," and this is carried out ingeniously through the medium of suitable controls on large amplifier panels which run along the whole length of one wall of the control room. In addition, on these same panels there are modulation meter controls for signal strength. Positive and negative image corrections can be made, This is a big advantage, and avoids any break in the continuity of the programme from the receiving end. In addition, in order to assure lookers-in that the television transmission has not failed while this change-over is made, some gramophone records are transmitted on the sound wavelength, this being faded out as soon as the television transmission is ready to recontinue.

In the early days many of the critics passed uncomplimentary remarks, and frequently these were based on the fact that a head and shoulder image, after the first interest had worn off, presented very little entertainment value. To a certain extent this criticism was justified, inasmuch as it restricted the nature of the broadcast. It was possible, however, to exploit this close-up in such a manner that it



The latest Baird invention is the modulated arc. Through this medium it is possible to produce large screen images of intense brilliancy, and this diagram shows in a pictorial manner how the whole process is carried out.

and duplicates of each amplifier are kept ready in case of breakdown, so as to avoid any of those technical hitches which are so apt to mar a programme.

It is also possible quite simply to switch from landline demonstrations to radio and vice versa. One engineer is on the control board, and is responsible for both the vision and the sound signals which are sent through the landline. In addition, he effects the signalling to the studio for passing on any instructions appertaining to the position of the artistes, strength of the voices, etc.

A second engineer devotes his time wholly to the transmitters themselves, either the mirror-drum or the light-spot disc, as the case may be. During the transition stage from one type of scene to another, a synchronising signal is radiated on the vision wavelength, so as to enable lookers-in to maintain their vision apparatus in synchronism, both phase and frame, and thus be ready immediately for the next scene without having to adjust motor speed, etc.

produced some really interesting transmissions, as witness the televising of "The Man with the Flower in his Mouth," in July 1930, with the co-operation of the B.B.C. In addition, small sketches in which only one artiste had to appear at a time were successfully produced, and another transmission which proved successful was the Marionette Players.

The whole technique has altered, however, now that extended scenes are possible. No longer need the activities of the Studio Director be confined to close-up views, for he can show full-length images of the artistes. This extended scene has proved most popular, and to give an idea of the type of entertainment which can now be put over quite successfully, I can mention that, in addition to sketches with two or three artistes complete with stage properties, lookers-in have an opportunity of watching ballet, cabaret, and Scotch dancing, tap, buck, and wing dancing, classical dances, illustrations on how to play tennis, cricket, and badminton, hints on physical culture, ju-jutsu, etc. Furthermore, there are illustrated talks in which the demonstrator can show models; while another popular turn is to watch the pianist at the piano, both piano and pianist being in full view of the looker-in. A few days ago three short rounds of a boxing match provided excellent entertainment; and, according to reports received, this came over remarkably well.

I could continue to add to this string of successful extended scene transmissions, but I think enough has been said to convince the most rooted sceptic that television has, as a form of entertainment, finally established itself, and will continue to progress together with the development of the new technique which has arisen inevitably from the point of view of producing these television plays, and we can look forward with confidence, happy in the knowledge that the art will grow apace.

I can well remember the early theorists proving, quite conclusively, by means of the "dot" theory that a television transmission of the nature which I have just discussed was absolutely impossible. No one can deny that television has a difficult furrow to plough, but why strew hypothetical obstacles in the path?

The width of the frequency band for large television images complete with intimate detail is certainly an acute problem, but it is beyond my comprehension why so many people attempt to deal with the question by quoting a picture point analogy when strip scanning is used almost universally for television purposes.

If you examine a television image quite closely you can readily trace this strip effect, but obviously you will not adopt a policy of watching an image of this character with your eye a few inches away, any more than you would attempt to criticise an Academy painting wrought by the artist's brush by standing up close to it, or expect to have an evening's enjoyment free from eye-strain and headache by sitting through a cinema performance in the front row of the theatre.

In the image the light and shade is distributed throughout in a form of wash drawing or continuous surface, and it is necessary to stand two or three feet away in order to appreciate the beauty of the image that is being built up before your eyes.

(*Continued on page* 362)

OWING to Mr. Baird's departure for America, he has been unable to prepare his promised article, "THE TRUTH ABOUT TELEVISION."

It will, however, be published at an early date.

Place a regular order with your newsagent for TELEVISION, or, if preferred, take up an Annual Subscription direct with these Offices.

The original photograph, which may be compared with the others in recognising faults.

Recognising Faults in Television Images

By *D. R. Campbell*

TELEVISION is such a new science that even the keenest of enthusiasts has little or no standard whereby he can check the quality of his reception. We can all judge the reception of speech and music, but a television image is an unknown quantity, except to the few who have seen demonstrations in the Baird Company's premises in London and at the exhibitions held from time to time.

Critical Observer

Owing to the difficulties of procuring a photographic record of a television image, and the apparently poor results obtained due to the lack of movement, very few photographs have been deemed good enough to publish. It can be generally assumed that the average reception of vision is not up to the standard of transmission, which of course is just as true of sound reception. While the average ear can tolerate sound as represented by the absence of a considerable portion of the vibrations or frequencies which go to make the whole, the eye, unfortunately, is a very much more critical observer.

Sound can be broadcast with wonderful fidelity on a band of frequencies ranging from 50 to 9,000, and the B.B.C. actually use a slightly larger band, but if figures were available it would be a relatively low percentage of receivers that do anything like full justice to this high standard of transmission.

The television signal broadcast by the Baird Company has to fit itself into the same group of frequencies as sound, which is decidedly less than is required for the best results on a 30-line picture of the ratio used by the Baird Company.

Stressing the Low Frequencies

A great deal has been written and spoken about the high frequencies required for television, which mathematically at least can be proved necessary for satisfactory results, but little or no mention is made of the equally important low frequencies, which, with the present limit of frequency band available, are more *essential* for pictorial results than the higher frequencies of the narrow band at present used.

A television picture of the ratio broadcast at present can be compressed into a relatively narrow frequency band, and, for broadcasting, this extends from 25 to 9,000 cycles per second, which will give a result differing from the theoretically perfect that the casual observer would probably fail to detect.

From the above it will be obvious that the radio-frequency sections of the receiver used for television must not be too selective, unless it is of the band-pass filter type, or the higher frequencies will be lost. After the signal is rectified, the audio-frequency amplifying sections must be capable of passing all the necessary frequencies.

Three Groups of Faults

This article is intended to give indications of the cause of faults in the image as broadcast to-day. These can be divided into three groups—mechanical, electrical, and, if I may use the term, atmospherical. Taking mechanical faults first, faulty spacing of the apertures in the scanning disc is the most disconcerting and not always recognised. If the angular space is not true, a bad form of distortion is present however perfect the rest of the apparatus may be. It may be recognised most easily when any article which has a straight edge is transmitted, like the top of a table. This will appear either jagged or lopsided as in Fig. 1.

Bad spacing radially is noted by the presence of continuous black or white lines which appear vertically when the disc is run up irrespective of there being any signal applied to the neon. The proper correction of these faults obviously is a new disc, although if only one or two apertures are faulty these can be blocked up and remade, according to the skill of the worker and the material of which the disc is made.

Puzzling to the Beginner

Another one of the mechanical faults is mounting the disc out of truth with the driving shaft, and a steady slow flapping of the disc when run up to speed, generally due to some kink or springy bend in the metal of which it is made. The cure is obvious.

But by far the most puzzling to the beginner are the electrical faults, which in almost every case are due to the cut off of certain frequencies. It has been pointed out previously that photographic records are hard to obtain, so an attempt has been made to fake some pictures into the desired effect.

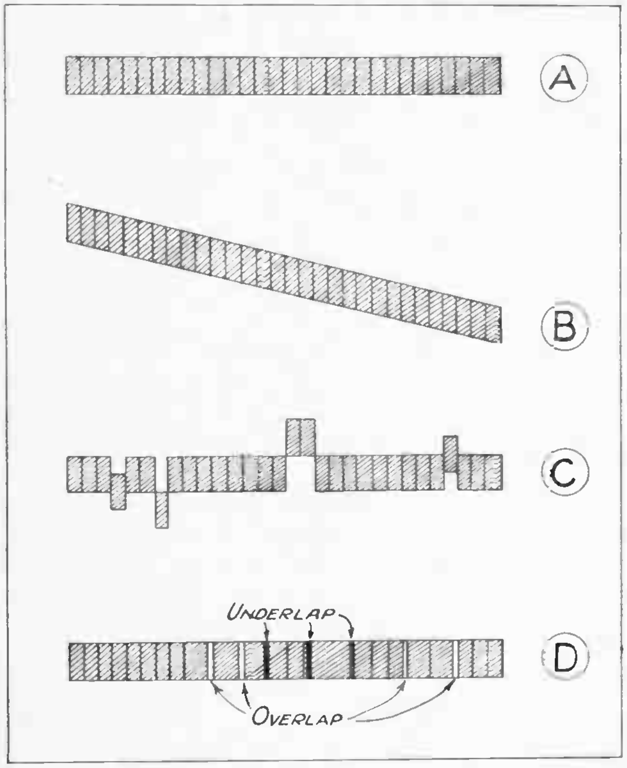


Fig. 1.—Mechanical faults in a disc due to inaccurate angular spacing, and underlapping or overlapping holes are shown quite clearly.

Turn to illustration *A*. An attempt is made here to reproduce considerable losses of the lower frequencies and a similar loss, though to a lesser degree, of the higher ones. The first thing one notices in

Illustration A.—Demonstrating the bad effects produced in a television image when there is a considerable loss of the lower frequencies.

pictures lacking L.F. is a light thrown up behind a person's head, while the white background on either side has become almost black on the top of the picture on either side.

As the artiste moves from side to side the white flare above the head will follow, but in most cases will be much less intense if the artiste turns side face. In some cases of L.F. loss a dark flare like a shadow will be present on the forehead (as in *A*) just above the nose, also two beardlike shadows on the lower jaw either side of the mouth will be observed. The latter is especially noticeable in the case of a man wearing a large expanse of collar.

Using Low Frequencies

In extreme cases white flares will appear streaming upwards over the eyes and mouth. In fact, anything occupying about $\frac{1}{10}$ of a spot's strip traverse, if extra dark or light, will throw up a flare or shadow of the reverse nature; that is to say, a dark object has a white shadow and vice versa.

Other causes of these very objectionable shadows or throw-ups are overloading and too little H.T., or the neon or output valve incorrectly biased. In the last causes it will be the low-frequency component of the signal which will detect the weak spot in the amplifying apparatus, as would also be the case in sound work. As a general guide, any continual streaky shadows appearing to travel up the picture are a definite indication that the lower frequencies are not compatible with what is being broadcast and the receiving apparatus is capable of improvement.

Lack of the higher frequencies is not nearly so objectionable as that of the lower. It has the pictorial effect of a general blurring or out-of-focus effect. Note the eyes, for example, in *A*. One can well consider the eyes in *A* as losing all the H.F. permissible as compared with the eyes in the photograph at the heading of this article, produced with full high-frequency response.

A Rare Occurrence

Another fault, though one which occurs somewhat rarely in broadcast reception of television, is an excess of high frequency, which results in haloes above certain lines running horizontally, or nearly so, across the picture; see illustration *B*. Note the white halo followed by a secondary of the original image across the top of the head, the eyebrows, mouth, and shoulders. These effects are due to methods employed to prevent the attenuation of the higher frequencies. All frequency boosters are some form of tuned circuit, and if too drastic in action will definitely oscillate, resulting in a negative image, the white halo, followed by a weaker positive one, being spaced according to the various factors of the circuit.

Illustration B.—Halo effects are sometimes produced, and the causes are described on this page.

This form of trouble is sometimes found when an ordinary sound receiving apparatus has been connected to a "Televisor," and, while not apparent to the ear, the eye quickly detects the fault. The cause is due generally to a resonance in the inter-valve transformers, and may be cured by suitable damping. The halo effect may also occur from feed back in the high-frequency sections of a receiver. Most

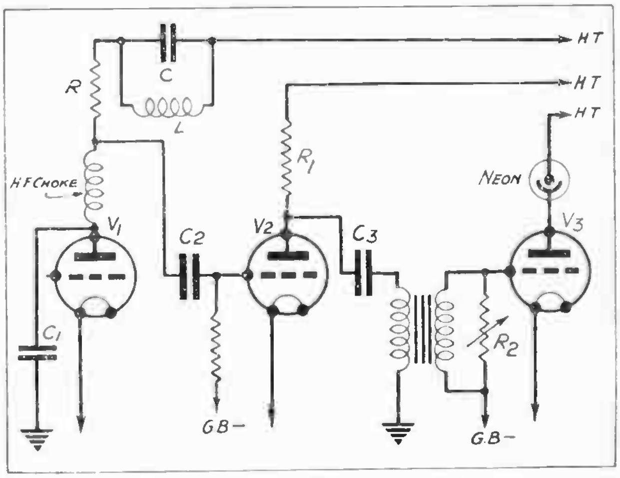


Fig. 2.—A simple circuit which will enable all the high- and low-frequency effects described to be introduced artificially.

receivers, unless of the band-pass type, will give a better picture when slightly out of resonance with the transmitting station.

Oscillation

In the third group of troubles comes interference in its many forms, "X's," and heterodyning. Heterodyning takes the form of a fairly fine mesh over the picture (see illustration *C*). High-frequency machines as used by hairdressers have a somewhat similar effect. The neighbour oscillating will cause a pattern of various shapes to flash across your screen. A.C. mains will bring about a series of vertical shadows, generally about six in number, which slowly pass from left to right. Occasionally the carrier of the London Regional causes two broad shadows to pass from left to right. This interference cannot be heard, but I have "seen it" on a valve voltmeter.

Atmospherics show themselves by violent black or white flashes which *momentarily* blot out the picture. One rather troublesome form of interference is caused by a sparking of the disc motor. This generally can be located at once as, whatever form it may take, it remains stationary something like the white spots in illustration *C*, and, by the way, it must not be forgotten that they are just as likely to be black.

Minor Disturbances

If the spots appear at different places on the picture, the trouble is most likely to be something other than the disc motor. Faulty light switches often cause mysterious black or white splashes. Sometimes a peculiar fine rippling interference, rather similar to the grain one can see if close to a cinema screen, is present. This effect is probably more noticeable as the distance from the transmitting stations is increased. It is due to the minor atmospheric disturbances, and in sound reception can often be heard when the carrier wave is tuned in.

It is hoped that these brief notes will assist others in solving their poor image quality problems. Before closing, the reader's attention is drawn to a simple theoretical circuit (Fig. 2) in which, by the judicious alteration of component values, all the high- and low-frequency effects mentioned may be obtained.

A Circuit to Try

In the circuit L and C are chosen so as to resonate at about 10,000 cycles, while R should be slightly

Illustration C.—Heterodyning takes the form of a fairly fine mesh over the whole of the image.

less than the impedance of the valve. R_1 will have to be from 30,000 to 50,000 ohms according to the transformer impedance, C_3 of sufficient value to resonate at about 12 cycles, and C_2 not less than one microfarad. These values are for good results.

Now, to give more accentuation to the high frequencies, reduce R, also try the effect of different values of C and L. A reduction in the value of C_2 will mar the low frequencies, though the effect will be more drastic if C_3 is altered.

R_2 should be the usual 500,000-ohm type of variable resistance, and its reduction will, of course, decrease the high frequencies. This may also be done by shorting L.

On first connecting up a negative image may result; if this is the case reverse the transformer input. No decoupling devices have been shown in the circuit for the H.T. supplies, and these may be required if the amplifier becomes unstable.

Studio Television

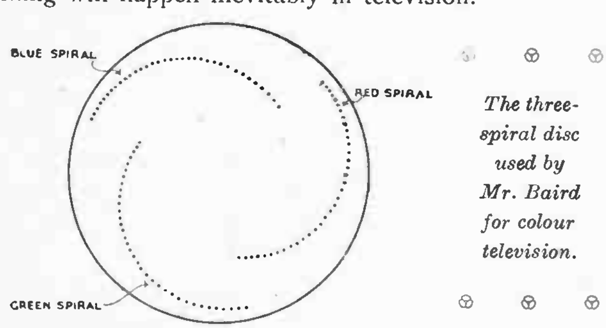
By *T. Thorne Baker*

NOT very many years ago amateur wireless consisted either of listening for stray signals from ships or from a few stations such as the Eiffel Tower, or in transmitting to friends with a small spark installation and exchanging messages in Morse. Until recently, television may be said to have been in a somewhat similar state, whereas to-day we are on the threshold of a new era, in which scenes from studio to theatre screen are being transmitted without the intervention of the photographic camera or film.

Scanning devices, similar in action to the cinematographic cameras used in motion-picture studios, have been successfully made, and broadcasting is already taking place on entirely novel lines. The day is approaching, too, when a picture theatre while showing a film will be able to telegraph an image of that film to the screens of numbers of other theatres by television.

Rapid Development

There are thus two distinct ways in which television on the broader scale can be carried out, both of which may develop with surprising rapidity. And with them will come yet another development which a year or two ago seemed fantastic—that is, television in natural colours. The black-and-white motion picture will be replaced by colour as surely as the sound film replaced the silent, and the same thing will happen inevitably in television.



The three-spiral disc used by Mr. Baird for colour television.

The two lines on which studio television, as we may legitimately call it, is being developed are seen in the evolution of the scanning disc and the method of illumination of the subject. Mr. Baird, for example, in some of his experiments is reverting to the illumination of the entire subject, as he did in his earlier experiments, and letting the scanning disc pick up piece after piece of the *illuminated* scene and throw its light value upon the photoelectric cell. Mr. Francis Jenkins, on the other hand, is throwing the scanning light beam over the unilluminated subject just the same as Mr. Baird's spot-light transmitter, and—in cinematograph language—shooting his subject with a camera which is on all fours with the ordinary motion-picture camera.

A Supreme Controller

In a movie studio the camera-man is the supreme controller of the lighting, efficiently carried out by a staff of electricians. He has a camera fitted with a turret of lenses for long shots, medium shots, and "close ups." The lenses are of different focal length, and some of them are of the wide-angle type, embracing a large angle of view. In modern cinematography one "shot" invariably "fades" into the next.

Now the fact that television is being conducted to-day on the same studio lines, i.e. with a scanning "camera," capable of long shots and close ups, of fading and so on, brings our new science an immense step forward. It means, in fact, that television has to-day entered the lists of legitimate motion-picture work.

Sound Foundations

I do not think too much emphasis can be laid on this point. It must be admitted that recent attempts at broadcasting have been remarkably successful, although in some places distant from the transmitter blurred and poor quality images are obtained. There is a new television studio being built in New York in an attempt to improve matters, and this will be the highest building in that lofty city, while practical investigations are going on to determine the causes of interference and means of its elimination. Provided the underlying principles of television are sound, we need not worry about interference or lack of definition due to transmission through an electrically-ridden city. Organised research will put the defects right in time, provided the foundations of the system are sound.

Let us admit then that, basically, we are on the eve of practical accomplishments. Television has been put on a working foundation akin to photography. The outstanding difference between motion-picture photography and television is that one uses the medium of the photographic film, the other does not.

The fact has now to be faced that pink pictures will not provide the ultimate solution of the televised image. Black and white would be better, but natural-colour reproduction will be insisted upon almost as soon as television becomes generally available. There is nothing alarming in the prospect that television must be in natural colours; there are, indeed, many reasons why its accomplishment should be comparatively easy.

It should be mentioned, by the way, that both Mr. J. L. Baird and Dr. H. E. Ives have already achieved some success in this direction. This we must not forget. Nevertheless, to put natural-colour television on a practical basis is not far removed from putting television itself on a workable foundation.

Using Three Primary Colours

It is, of course, generally known that all colours can be imitated by suitable mixtures of three primary colours—blue-violet, green, and orange. If two bull's-eye lanterns were flashed on the same white spot, one shining a green light, the other an orange, the spot would appear yellow. Similarly all colours can be produced by "addition," i.e. by the mixture of two or three primaries in the necessary proportions.

Violet + Green + Orange gives White.
Violet + Green gives Blue.
Violet + Orange gives Mauve.
Green + Orange gives Yellow.
Violet + Weak Orange + Black gives Dark Red.

And so on. Every conceivable intermediate hue can be obtained by varying the proportions of blue-violet, green, and orange. Many attempts to produce motion pictures in natural colours by mixing *two* primaries have been made, with considerable success, the spectrum being divided for this purpose into two instead of three primary portions, viz. bluish-green and orange-red. Although a perfect range of colours cannot be obtained with two only, the results are, nevertheless, very pleasing, provided colours are chosen for the original subject with due care.

Mr. Baird to the Rescue

Televising a subject in two colours would at first sight involve sending twice as many signals as in black and white. Here Mr. Baird has come to our rescue, and has shown that scanning is *not* increased in complication in direct ratio to the number of colours. In other words, if thirty apertures are ordinarily used in the disc, it is not necessary to have three sets of thirty for transmission in three-colour. If the apertures are fitted with blue, green, and orange light filters in alternation, thirty in all only being maintained, the detail and definition is not actually far behind what it would be when televising in one colour only.

This fact, recorded by Mr. Baird after his original experiments in colour, is borne out by recent experiences in natural colour cinematography. Here, in additive processes, the details of the picture are made up by masses of coloured units or areas of the three primary colours, and a change in colour or hue between two contiguous bits of the picture suffices to give *definition* to the eye almost on a par with the definition that black and white would give.

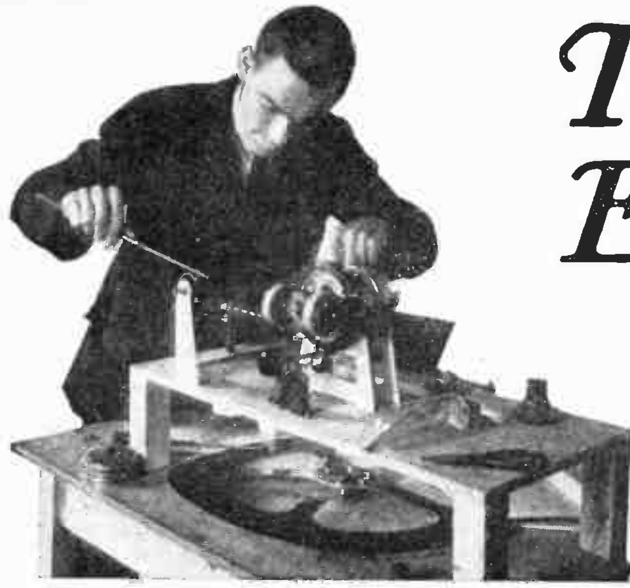
Mr. Baird explaining his colour television transmitter during the course of the British Association meeting held in Glasgow in 1928.

The Amateur to Play a Part

Naturally, the greater the number of apertures the better the definition will be, but it seems unlikely that the introduction of a two- (or three-) colour process will anything like double (or treble) the number of signals that must be transmitted.

Great progress has been made recently in the way of photo-electric cells sensitive to colours, and the production of high-frequency lamps of suitable spectral emission for viewing in the primary colours presents less and less difficulty, and will certainly be solved.

The amateur in television must be prepared to see future developments take place to a large extent on "studio" lines, but be it always remembered that it is his own researches, experiments, and enthusiasm that are largely helping to bring about practical success, just as they did in the case of wireless telephony!



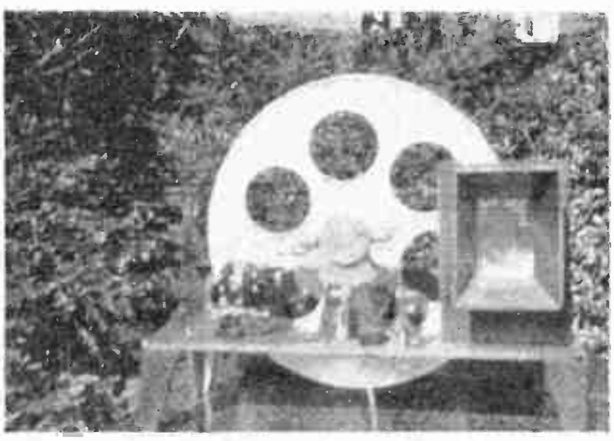
The Enthusiast Sees it Through

WITH the inauguration of our first shilling issue we are able to record an added interest in television just as we predicted last month. Many letters have reached the editorial offices, and although the "winter season" is young, enthusiasm abounds in a manner which reflects credit on the unstinted efforts of our readers to further the cause of the science in the Old Country.

Prospects for the future are excellent, so redouble your efforts and send along an account of your experiences for the benefit of others.

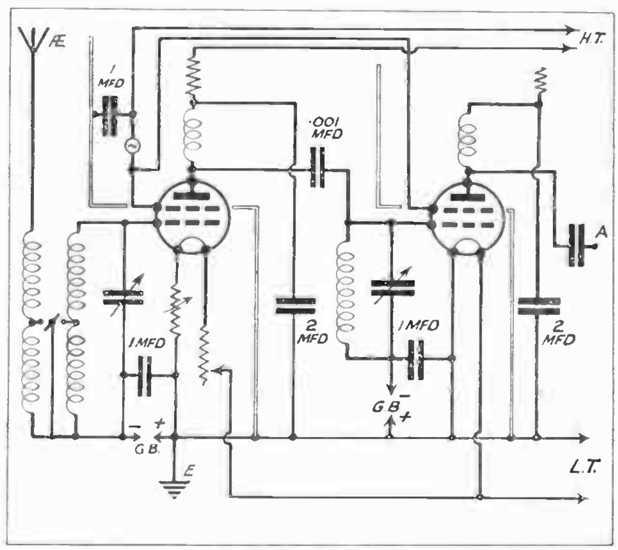
Results in York

"Very fascinating" is the expression used by Mr. C. W. Gilderdale, of "Hartside," New Earswick, York, to describe his work in connection with television. He refers to the assistance we gave him some time ago, and he has made rapid strides since then, and is now in a position to write about his results and encourage others. He says:



Although home-made, Mr. Gilderdale obtains quite good results with his apparatus in York.

"Some time ago you gave me good advice regarding the wireless receiver which I had built for receiving the Brookmans Park vision signals on 356 metres, and I thought you might be interested to learn how I am getting on in York.



In order to increase signal strength an additional stage of screened-grid H.F. is added to the circuit shown on the other page.

"I enclose some photographs of the apparatus used. The vision apparatus is home-made, the disc being cut exactly as recommended in your valuable paper many months ago. It is mounted on a spindle carried on ball bearings, and is belt driven from a small motor taken from my Pathé Ciné Projector. This motor runs over 2,000 r.p.m., hence the need for a belt-drive. I have made a toothed-wheel synchronising arrangement on Baird lines. The motor is fitted with a friction-type speed regulator, but this is not nearly accurate enough. The neon and lenses were purchased from the Baird Co., and have proved very satisfactory.

"You will see from the photograph that I have fitted a stroboscope for speed regulation, and an ordinary beehive neon is used, lighted from the A.C. mains, to light this cardboard disc.

"The vision apparatus has given satisfaction except that the synchronising hold is not too certain, for two reasons. The first is that London fades badly in York, sometimes it goes right away, and secondly the toothed wheel is mounted on the disc spindle and has to control the motor speed through the belt, working from a large pulley to a small one on the motor, and hence at a mechanical disadvantage. However, by careful manipulation of a resistance, when the vision signal is strong the picture can be held fairly well.

"The receiver is a combination of two sets, one of which was designed by William J. Richardson in your paper, and the other in *Television To-day and To-morrow*. These are mounted on the same baseboard, and are 1 screened-grid, anode-bend detector, and 3 stages resistance coupled, using LS5 valves.

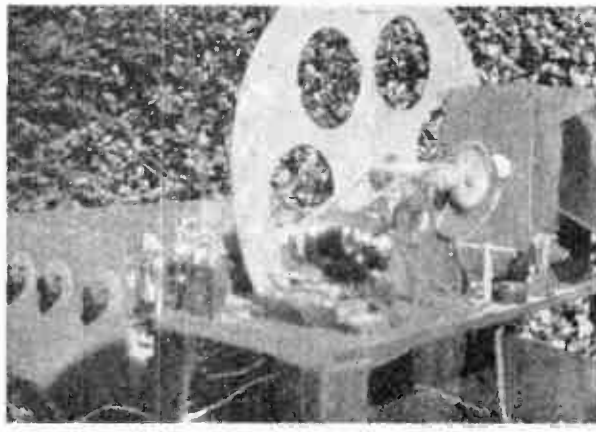
"The photograph does not show the set very well, but the eliminator shows up better.

"This gives me 100 mA. at 350 volts, with tappings from potentiometer for screen, S.G. plate, and det. plate.

"The set is made up from Heayberd transformer, choke, etc., and incorporates two H.T.2 Westinghouse metal rectifiers.

"Now as to results, I cannot guarantee to get a picture every time, due to weak signals and jamming with foreign stations, but on some nights the picture has been very clear and the shading good. film picture, but perhaps as the winter comes the signal strength will increase.

"I have tried many things to increase the signal strength, including the adding of a second S.G. valve, without much success. I have not been able to stabilise the set with two S.G. valves and should value any help you could give me in this direction.



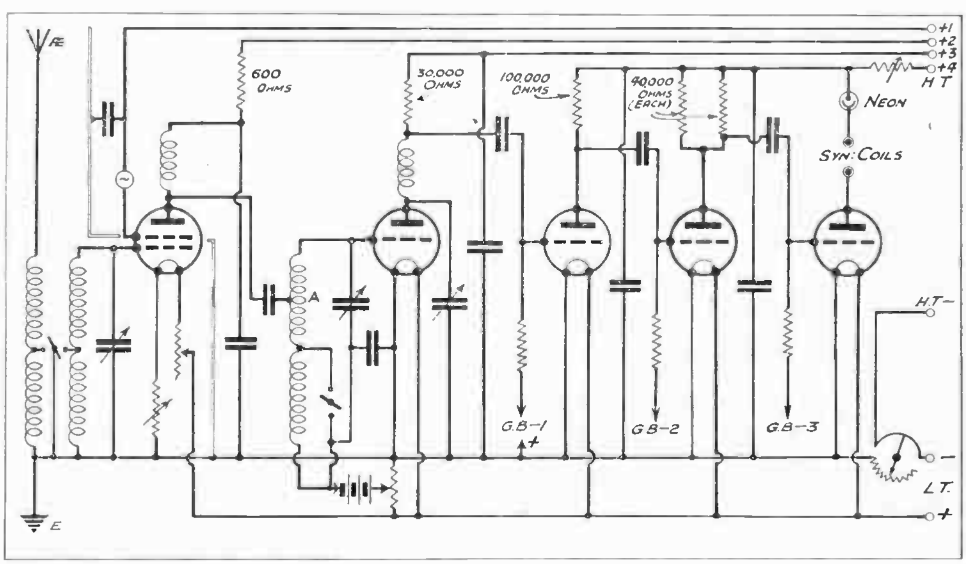
This vision apparatus is mounted on a spindle carried on ball bearings and is belt-driven from a Pathé Ciné Projector motor.

The diagram attached shows the set as normally used and with the second S.G. valve.

"I find the subject very fascinating, but if only we could get programmes from the North Regional and at reasonable times, I think there would be much more interest taken in the North of England.

"Wishing TELEVISION the best of luck."

[No doubt Mr. Gilderdale will obtain considerable assistance from the promised Tele-Radio Receiver design which Mr. Barton Chapple is preparing for this magazine.—ED.]



The receiver employed by Mr. Gilderdale is a combination of designs by William J. Richardson and H. J. Barton Chapple.

The head and shoulder pictures come out most clearly, but lately they tend to be a little 'over-cooked.'

"The full-length figures at times are good, the man dancer in white shirt came out very clearly the other night. I have not yet succeeded in getting a

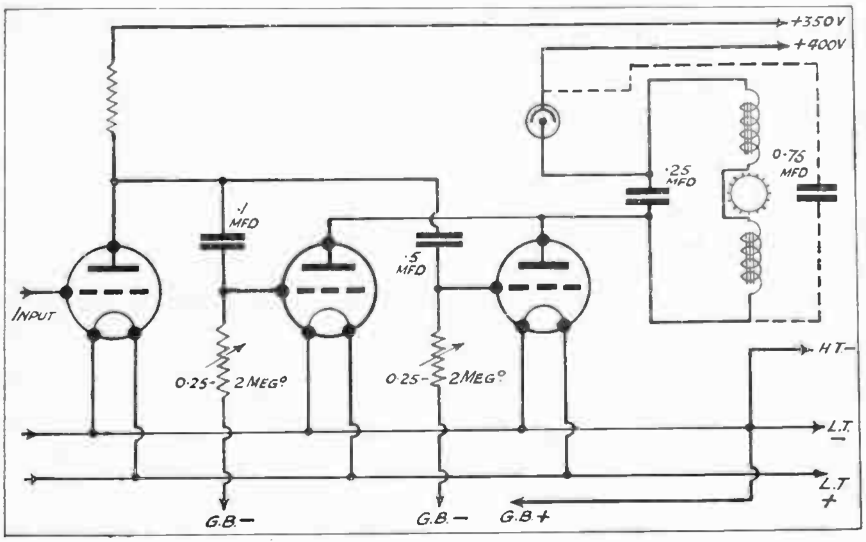
More News from Crieff

Readers will remember that Philip S. Bowden, of 12 East High Street, Crieff, Perthshire, the Acting Secretary of the Crieff Television Club, a short time ago supplied us with details concerning their activities. He has now sent along further interesting items of news, and we are sure that there are many other districts in which television enthusiasts reside who could band themselves together and conduct demonstrations on lines similar to those of the Crieff Club. We take this opportunity of wishing them continued success in their efforts, and are sure that their pioneer spirit will be amply rewarded. In writing to us he says:

"In view of the interest shown by you in our television experiments, we feel that you will be pleased to learn that these are continuing to show progress, and we have made several improvements in our apparatus following the publication of our article, which appeared in the July 1931 issue of TELEVISION.

"As the improvements have been fully justified, a short description may be of interest.

"Regarding reference to the radio set for the reception of sound, which was under construction, this has now been completed to our satisfaction and has proved of great advantage during television reception.



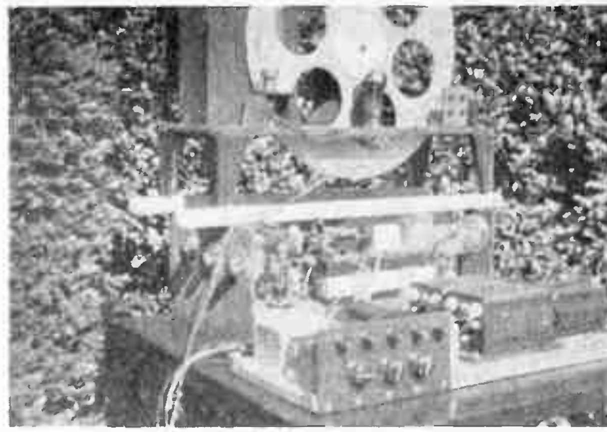
Mr. Weeks, of Kilburn, has been conducting several experiments in connection with television reception. His L.F. amplifier circuit is shown here, the condenser joined by dotted lines being a large shunt capacity which produced the effects shown below.

"As previously mentioned, the motor was 8-volt shunt wound and run by accumulators; this has now been rewired in series to suit 20 volts, and is now run from 250-volt mains with lamp resistances in series.

"This is a great advantage, as the accumulators constantly required charging, and the speed of the disc is now more easily controlled.

"The scanning disc, which has already been mentioned and shown in photographs previously sent, has been replaced by a standard 'Baird' graduated disc, and although the old one gave very good service, the improvement on fitting a new disc was at once noticeable, more detail showing.

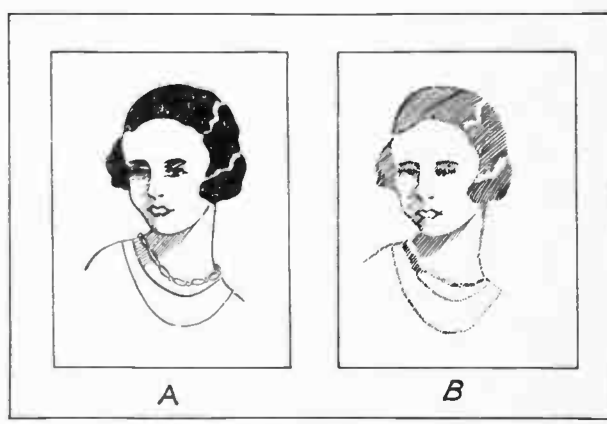
"As a result of experiments with lenses in the viewing tunnel, we have been able to enlarge the image to practically postcard size, without introducing undue distortion. As we are particularly interested in obtaining a still larger image than at present possible with our apparatus, several experi-



A good view of the eliminator and back of the vision apparatus made up by Mr. Gilderdale.

ments in projection have been attempted, but we are rather handicapped with the lack of intensity in light supplied by the neon lamp.

"With regard to enclosed card, it may be of interest to state that we were compelled to form some method of regulating the number of visitors to our

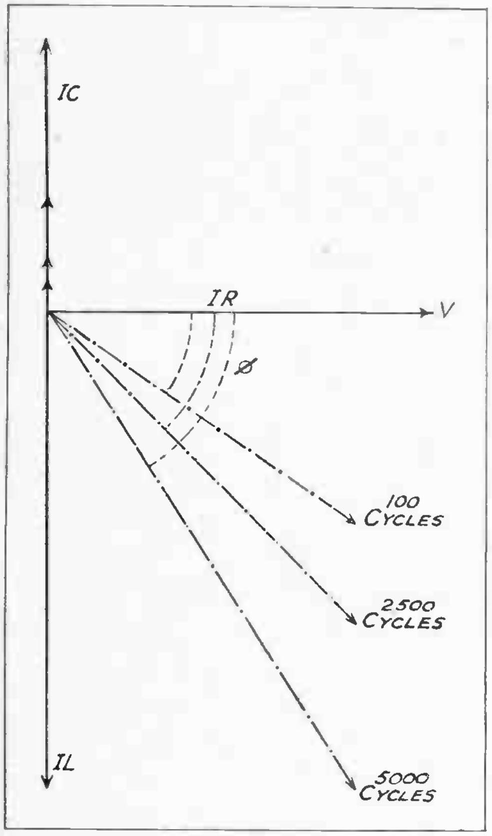


A denotes the general effect of the average received image, while B shows how "fine detail" is introduced when a condenser is included as in the diagram above.

Club, and we now limit the number to twelve each night, Tuesday and Friday every week. This method has proved quite popular, as our visitors retain the card as a souvenir, and its date is stamped on the back.

"We have also a visitor's book, for signatures, and find that since commencing our demonstrations we have had over 250 visitors, many of whom have repeated their visit several times.

"In conclusion, we would thank you for the interest shown in our efforts, and trust that the well-merited popularity of your journal may continue."



To substantiate his theory, Mr. Weeks sent along this diagram showing how the power factor of the circuit has a special influence

Advancing a Theory

In order to account for certain results he has observed, Mr. H. E. Weeks, of 25 Charteris Road, Kilburn, London, N.W.6, advances one or two interesting theoretical aspects which will no doubt provide food for thought for other readers. We shall welcome other contributions dealing with the points raised by Mr. Weeks, and in the meantime quote extracts from his letter:

"I have been doing a considerable amount of looking-in with varying results lately, my chief difficulty being 'holding the motor.' I have a 6-volt unit in use, the synchronising coils requiring approximately 400 volts to energise them sufficiently to hold the motor steady.

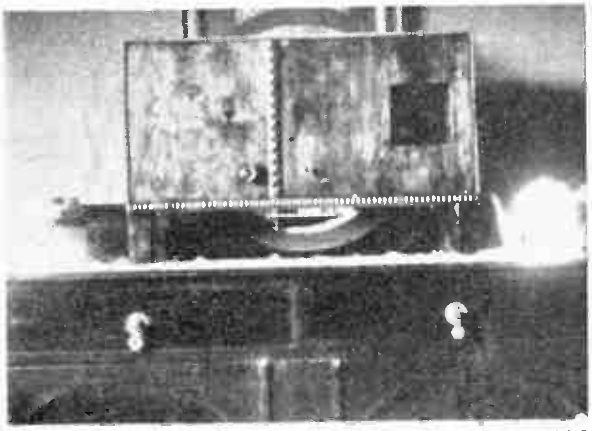
"I have installed electric power, and am constructing a complete new television unit with improvements which no doubt will overcome my difficulties. I will endeavour to let you have a photograph or sketch of this when completed; also results.

"No doubt you appreciate that most of us television enthusiasts would not be able to carry on if we had to buy costly parts and components, so we have to manufacture these, and time is often wasted which could be better employed on more intricate work and the development of ideas.

"I am forwarding you a sketch of the output stage of my amplifier, also other sketches—*A* showing the general effect of the average image received, and *B* the effect I observed when I connected a condenser of large capacity across the combined impedance of the neon, coils, and shunt condenser, indicated by dotted lines. I expected to find the main part of the signal by-passed, but it was not so, and I observed an image of very fine detail but the dark parts not so pronounced, which I have endeavoured to show you in sketches *A* and *B*.

"A possible theory is that the condenser advances the power factor of the circuit, thus reducing waveform distortion due to the lag of the inductive current *if* the coils are in the output circuit. Also this lag or phase angle varies with frequency and time, and is a condition to avoid if good detail reception is aimed at. I have shown in a vector diagram how the current varies with frequency when a reactance is in circuit, and it is obvious this condition must cause distortion of the signal received.

"Another point I have often considered is that according to many radio experts, a large number of frequencies are required to transmit any kind of image. I have enclosed a sketch with a scanning strip and the curve of the variations of light required. Now compared with an electric lamp giving



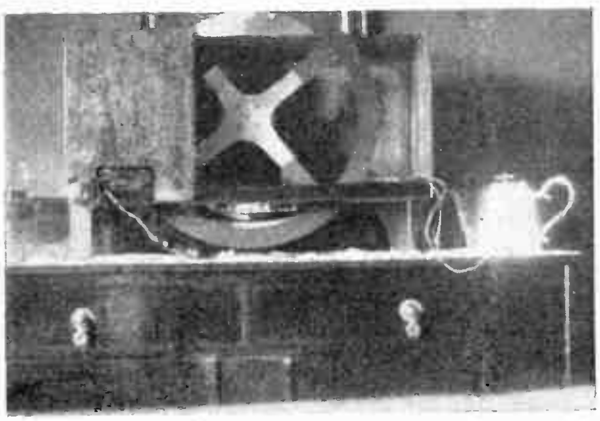
A front view of the vision apparatus used at Breaston which gives very good results at little expense.

a steady light on 25 cycles per second, the neon should give an even better response with the D.C. impulses and not be extinguished completely or the current reach zero on large sections of light. Another point which has a bearing on the same subject is that one impulse can give every shade from darkness to light and to darkness again.

"I hope I have not wearied you by this long letter, and I will have some more interesting results for you when I get my new apparatus going."

Pleasing Results at Little Expense

Although at first his results were rather poor, Mr. N. M. Button, of 9 Richmond Avenue, Breaston, near Derby, was in no way discouraged.



For synchronising, Mr. Button uses thin twine round the motor spindle, together with a resistance control.

He persevered as others have done, and now asserts, quite proudly, that he obtains most pleasing results at little expense. This is the right spirit, and we congratulate Mr. Button on his efforts. In the course of an interesting letter he says:

"During the last few months I have been experimenting with my home-made television apparatus, and have had some most pleasing results at such a little expense.

"Although results were poor at first, as was to be expected, after trying again and again, the results are at last nearly perfect.

"My receiver is a four-valve—S.G., det., L.F., and power; this gives a good positive image, the last stage being choke output.

"This is connected to an Osglim lamp (with resistance removed), then direct to 160-volt accumulators, which gives a brilliant light. The light is then condensed on to the disc by a 3-in. dia. lens and on to a 4-in. dia. lens in the viewing tunnel. The result is a remarkably clear picture, and can be viewed by two or three people at one time.

Mr. Weeks has sent along a sketch to show the light variations for a scanning strip passing over a woman's face.

"My last disc to try is a double-spiral 20-in. aluminium one with ·02 in. sq. holes, as strongly recommended by Mr. Halket a month or two ago.

"I have no special synchronising gear at the moment, but I use a thin strong twine round the spindle of the motor (not the pulley), which is in series with a small resistance, and the two together give a fine adjustment, and I can hold the picture steadily the whole half-hour's run.

"The only real difficulty is to find a really good electric motor. I have just bought a Meccano 6-volt motor, which seems to be fairly strong, and I hope to try very soon one of S. Lee Bapty's standard aluminium discs.

"I hope my few remarks will be of some interest to the ever-increasing number of TELEVISION readers, and will close wishing the TELEVISION journal everything of the best."

Workshop Hints

By *Thos. W. Collier*

THERE are many advantages in having a whole room for a workshop. For one thing you can be quite free from interference, neither does it matter very much if you make a little noise, but the chief point, at least to my mind, is that if you have not finished the job you have in hand, it can be left until you are ready to start again. It is a great mistake to tire yourself out before a job is finished, as one is apt to lose interest, after which there is very little incentive left to put a real finish into the work.

I shall endeavour to describe in these articles how to make things from raw materials to a finished job, as far as is possible to the unskilled but enthusiastic constructor, and would be glad to hear from any readers who meet with any difficulties.

A Useful Bench

If you are unable to have a whole room for your workshop, the next best thing is a good strong cupboard, which can be easily converted into a useful bench, probably only requiring to be cross braced to keep it quite rigid. Such a scheme is indicated in Fig. 1, the only addition being a wooden rack on each side. This is handy for keeping files, screwdrivers, etc., while a shelf at the back is useful for any tin boxes acting as containers for odd nuts and screws, etc.

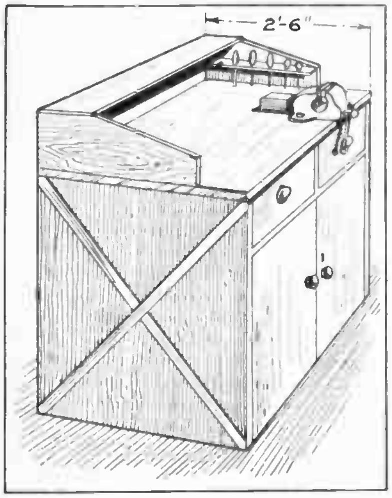
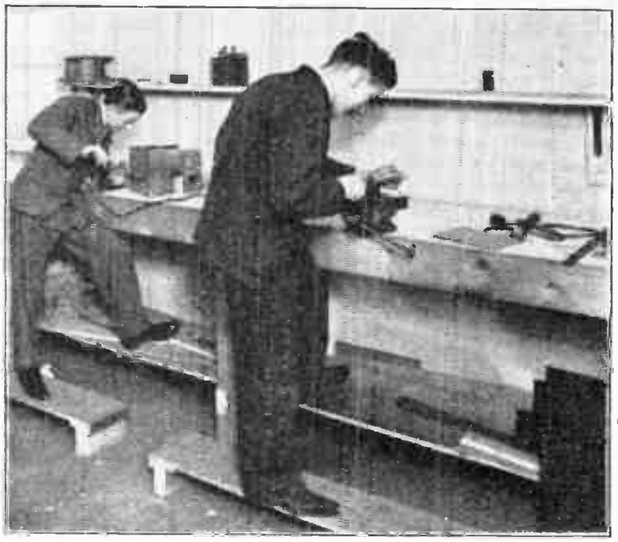


Fig. 1.—A strong cupboard can be converted very easily into an excellent bench for carrying out any of the work described here.

A vice is bolted down to the top of the bench, and a simple way of finding the most comfortable height is to fold the arm as illustrated in Fig. 2 and fix the vice at the height of the elbow.

I have prepared a list of useful tools which are by no means expensive. These should be of good quality, and approximate prices are given, but in many cases your local Woolworth's Stores will supply many of these at probably half the cost indicated.



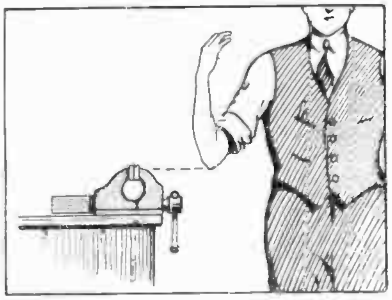


Fig. 2.—Finding a comfortable height for the bench vice.

	Approx. Cost. s.	d.
*One 3-in. Jaw Vice	10	0
Six Assorted Files	6	0
Eight Swiss Files	1	8
*One each 2, 4, and 6 B.A. Taps (seconds)	2	3
One each 2, 4, and 6 B.A. Dies	7	6
One B.A. Dieholder	2	3
*One 10-in. Malleable Iron Frame Hacksaw	2	1
One 12-in. Steel Rule (Chesterman No. 412D)	3	0
*One 9-in. Combination Square (Starrett No. 94)	5	9
*One each Nos. 42, 34, 26, and 12 Morse Twist Drills	1	0
*One Drill Brace, capacity of chuck ¼ in.	4	10
*One Scriber		6
*One Set of B.A. Spanners (Terry's)	1	9
One Pair 6-in. Pliers	1	10
One Pair 6-in. Dividers	3	10
One Pair 6-in. Tinman's Shears	1	9
One Ball-pane Hammer, 6 oz.	1	10
*One Ball-pane Engineer's Hammer, 1 lb.	1	5
*One Centre Punch		6
Total	£2 19	9

The tools which are marked with an asterisk are those which are really essential, the others can wait until you are ready for them.

Drills

The next thing to deal with is the best position for the bench. From experience, I find it preferable to have a window to one side of the bench rather than at the front, as it is easier to see lines marked on materials when held in the vice.

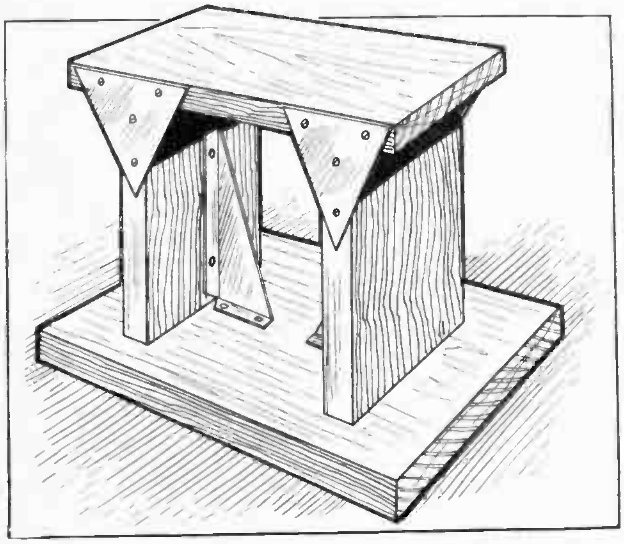


Fig. 3.—A simple home constructed support for holding a motor driving the vision apparatus disc.

Probably you have noticed that only four drills are given in the list for drilling, tapping, and clearance holes for the 2, 4, and 6 B.A. threads. This is not recommended in actual practice in production shops, but will be found to answer quite well for our purpose, as we are only dealing with a handbrace for our drilling machine, and one does not expect too much in the way of "dead" size accuracy when using hand drill-braces. You will use your

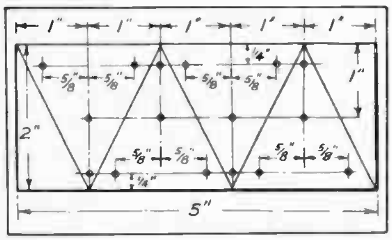


Fig. 4.—Dimensions for marking out the four clamping plates.

drills for tapping and clearing holes as shown in the table.

B.A. Thread	2	4	6
Tapping Drill	26	34	42
Clearing Drill	12	26	34

Now, having got our workshop or bench installed and equipped, the question arises, What are we going to make? We all know that most things can be bought, but it is the little individual requirements that cannot be met.

Motor Brackets

Here is an item which can be made with very little difficulty and with the tools we have at our disposal. I refer to metal brackets and clamping plates for which you can always find a use. Fig. 3 shows a very ordinary or average method for mounting a home-constructed vision apparatus motor, where clamping plates may be used to advantage. This is a structure built up from wood about $\frac{1}{2}$ in. thick, consisting of a baseboard supporting the motor platform by means of two vertical strips, which should be the same width as the platform. The size of the structure is, of course, governed by the diameter of the disc and the amount of space required by the motor. There are four clamping plates and two rigid brackets. We will first of all deal with the clamping plates.

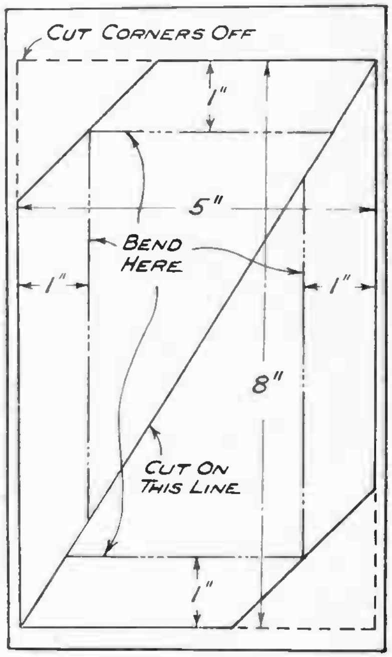


Fig. 5.—Two metal brackets are required for the stand shown in Fig. 3. These can be made up from a small sheet of metal marked out as in this figure.

Take a piece of metal approximately $\frac{1}{16}$ in. thick, an old aluminium panel will do quite well, and mark off a strip 2 in. wide by 5 in. long. This will make the four clamping plates if you follow Fig. 4.

From one end of the metal strip scribe four lines 1 in. apart. This will give you five 1-in. spaces. Now scribe a line diagonally across the first, third, and fifth spaces, next scribe two lines, also diagonally, but in the opposite direction, in the second and fourth spaces. The next operation is to mark off two lines parallel with the outside edges on the length of the strip $\frac{1}{4}$ in. in on both sides. Now saw through all the diagonal lines, and this will give you four com-

(Continued on page 361)

5 April 1930

10, Downing Street,
Whitehall.

Dear Mr Baird

I must thank you very warmly for the Television instrument you have put into Downing St.. What a marvellous discovery you have made! When I look at the transmissions I feel that the most wonderful miracle is being done under my eye. I congratulate you most heartily & send you my sincerest hopes for your further success. You have put something in my room which will never let me forget how strange is the world - and how unknown. Again & again I thank you

With kindest regards

Yours very sincerely

J. Ramsay MacDonald

"Television" has no politics, but it cannot refrain from reproducing the Prime Minister's letter to Mr. Baird as an indication of his generous impulse and of the fact of his early belief in the new science. Mr. MacDonald was one of the first to come to the Baird studios to be televised.

Introducing the New Tele-Radio Receiver

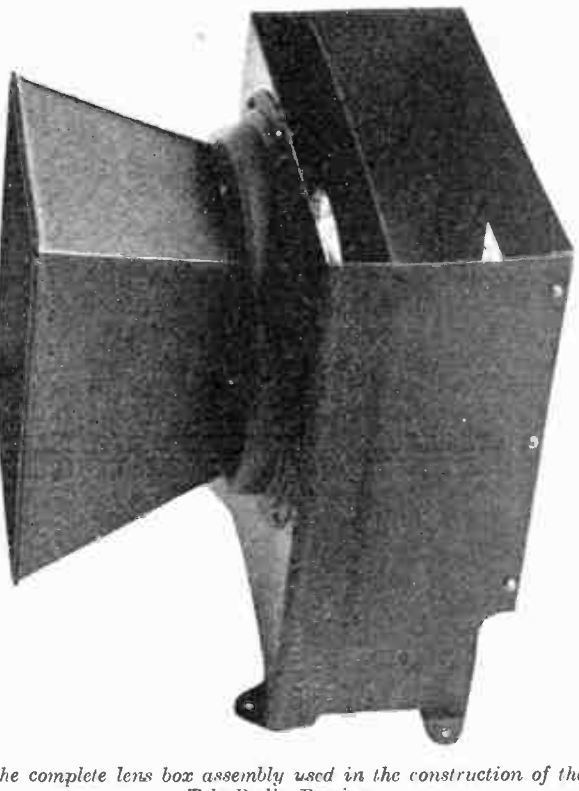
(PART 2)

DESIGNED AND DESCRIBED BY

H. J. Barton Chapple,

Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

LAST month we discussed very thoroughly the various aspects opened out by the proposed design of the Tele-Radio Receiver, and we must now turn our attention to the constructional side. I decided that it was best to make up the vision apparatus first of all. This is the simplest task of the whole scheme, but I felt that once this section was completed readers might like to carry out some experiments on their own by connecting it up to any existing wireless receiver that may be available.



The complete lens box assembly used in the construction of the Tele-Radio Receiver.

Components Required

With this in mind let me detail the components required, together with the manufacturers' names, so that you can duplicate the material exactly as I have drawn up the list.

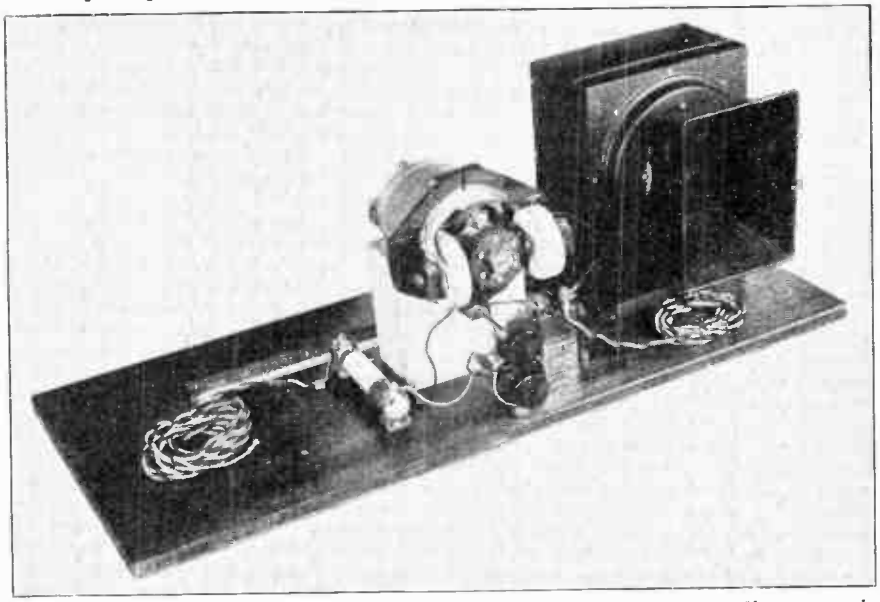
One Junior Kit (Baird Television, Ltd.).
One ·1 mfd. Type BB condenser (Dubilier Condenser Co. (1925), Ltd.).
One Zenite resistance and supports (see text for resistance value) (Zenith Electric Co., Ltd.).
One lens box assembly, complete with viewing tunnel and lenses (Baird Television, Ltd.).
One motor stand, complete with pinion, spindle, and knob (S. Lee Bapty).
One 150-ohm variable resistance to carry 0·3 amp., complete with knob (Baird Television, Ltd.).
One wooden baseboard 27 in. by 12 in. by $\frac{3}{4}$ in., length of red and black flex, and wood screws.

I will go into screw details when I come to discuss assembly.

Component Positioning

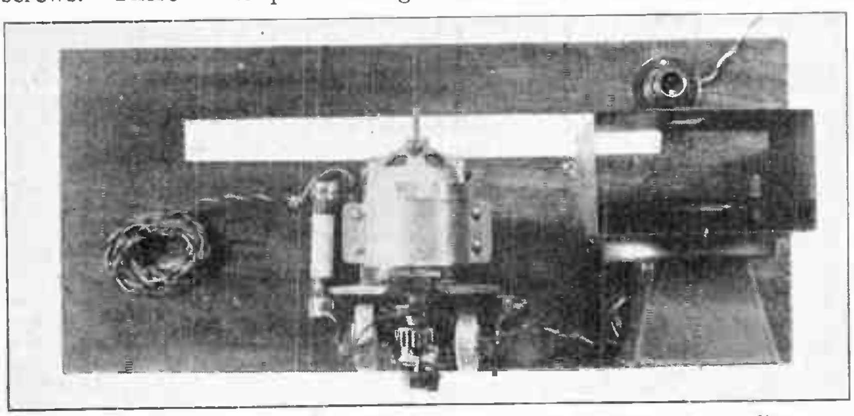
A reference to the wiring diagram and baseboard layout, Fig. 1, will show you exactly how the various components are positioned. First of all take the baseboard—either Gaboon mahogany laminated or plywood, I used the former—and cut out a slot $17\frac{1}{2}$ in. by $1\frac{1}{2}$ in. with a keyhole saw exactly where shown. This gives freedom of movement for the disc projecting about 4 in. below the underside of the baseboard.

Then assemble the motor on the support supplied by Lee Bapty. This consists of a hardwood block cut out to take the motor carcase, aluminium strap, pinion and bracket, the last-named two items being for "framing the image" by moving the synchronising coils with reference to the motor pole pieces. hole positions shown in Fig. 1, and fix this on to the baseboard.



In the view shown here the reader can see exactly how the variable resistance is mounted immediately beneath the framing knob.

Now mark out the motor support position according to Fig. 1, and drill four holes to take four 2-in. No. 2 screws. These must pass through the baseboard from the underside and enter the wooden block, and thus ensure absolute rigidity under running conditions.



A plan view of the vision apparatus indicating exact component positioning.

Lens Box Assembly

Next mark out the position of the neon lampholder, and screw into place after making sure that the holder is round the right way so as to allow the flat plate of the neon to be parallel with the scanning disc.

The assembly of the lens box is the next task, and if you examine an accompanying illustration you will notice that the work is quite straightforward. All the holes are threaded to take the 6 B.A. screws supplied, and you should note that the smaller of the two lenses is held in place on a partition clipped in the main frame, while the larger lens is screwed on to the front with the convex side towards the observer, that is, pointing into the "tunnel." When this assembly is finished, carefully mark the screw-

It should be noted that a correct alignment is essential between the lenses accommodated in the box and the neon lamp, so that the scanning holes of the disc pass over the plate area and are seen clearly when looking into the "tunnel."

Resistance Value

The variable resistance must be mounted immediately beneath the framing spindle, as shown in Fig. 1 and the accompanying photographs. For this pur-

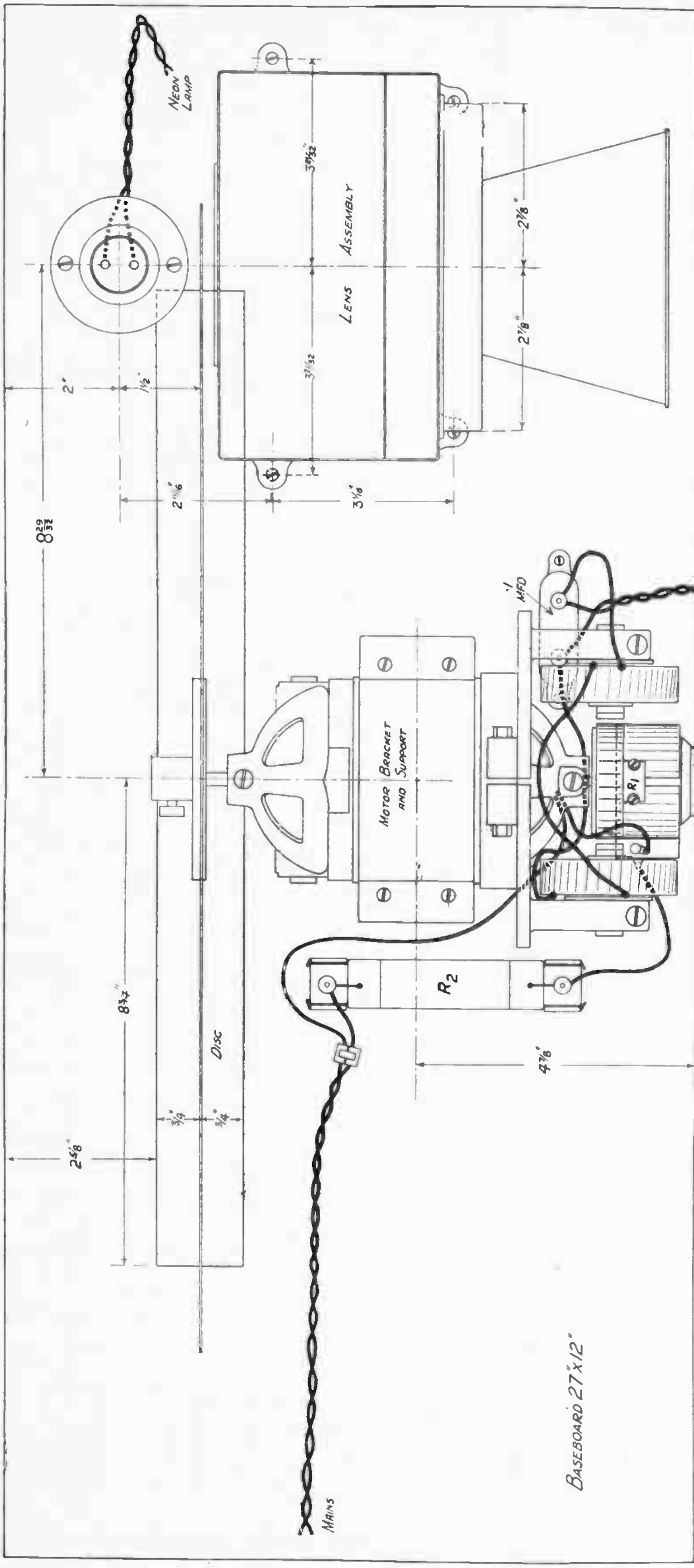


Fig. 1.—*A dimensioned baseboard layout and wiring diagram which should be adhered to exactly by the constructor when making up his apparatus.*

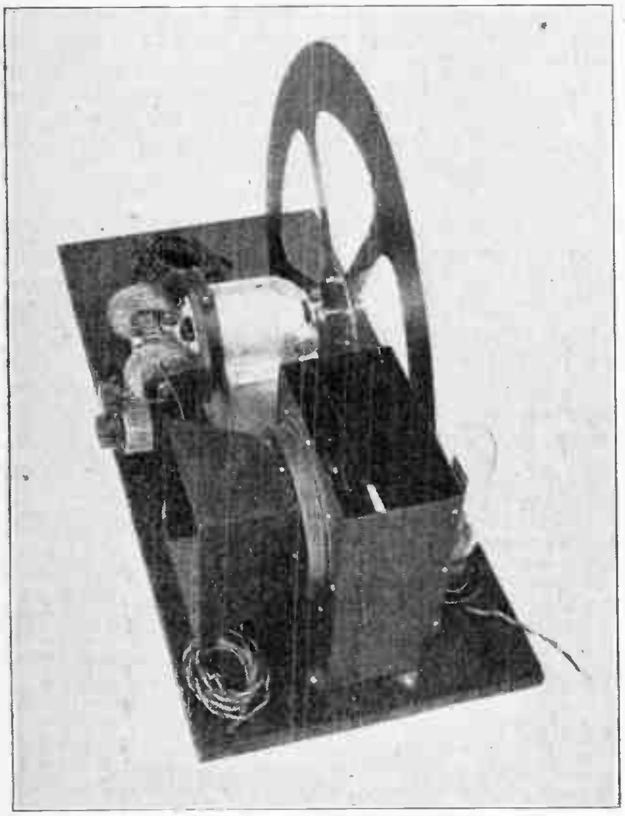
pose I unearthed a small right-angled bracket from my junk box, the resistance being held so that the circular resistance element is comfortably clear of the baseboard itself. If you do not happen to have a bracket handy, it is only a few moments' work to make one up with a clearance screw hole in the bottom lip, and another hole or small slot in the vertical section to take the screwed spindle shank of the resistance.

Coming now to the Zenite resistance, its value in ohms will depend upon your supply voltage. According to information issued by the Baird Company, their motor requires approximately 50 volts D.C. or 100 volts A.C. (50 cycles) to run it, and takes a current of approximately 0·3 amp. In consequence, the function of this fixed resistance is to drop the voltage to the required value in conjunction with the variable resistance used in series with it. To calculate the resistance value is therefore quite a simple matter by using Ohm's law, but to assist readers I append a short table which gives the mains voltage and the fixed resistance values recommended by the Baird Company. For my own house mains which are 240 volts A.C., I have used a fixed resistance of 500 ohms in series with the variable resistance of 150 ohms.

Mains Voltage	Fixed Resistance	
	A.C. (50 cycles)	D.C.
200 .	400–460	460–520
210 .	400–460	460–520
220 .	400–460	520–580
230 .	460–520	520–580
240 .	520–580	580–640
250 .	520–580	640–700

Fix this resistance and the ·1 mfd. Dubilier condenser in the positions shown, and all is then in readiness for the small amount of wiring. This is indicated clearly in Fig. 1, while the theoretical diagram of Fig. 2 shows you how the points are linked up. Use a length of twin-flex to the neon lamp-holder—the exact length cannot be given at the moment, since the receiver to which it is to be connected is not yet completed, but 3 or 4 ft. should suffice.

The same remarks apply to the flex lead joined to the extremities of the synchronising coils (which by the way are connected in series), and across which is shunted the 0·1 mfd. fixed condenser. Just allow 3 or 4 ft. spare. Finally the flex lead which passes



Do not forget to see that the lens box assembly and neon lamp are in alignment.

to the house mains for driving the motor, as indicated in the diagram, can be about 4 or 5 ft. long.

After joining up the one or two leads, as shown in the diagram and photographs, it is advisable to give the vision apparatus a trial run to see that all is in order. The disc must therefore be attached, and to allow for the portion of the disc projecting below the baseboard it will be necessary either to support the apparatus on the table edge with this disc portion overhanging or alternatively screw on four wooden feet, one at each corner, about 5 in. long.

The disc should be held on the motor shaft by the grub screw provided, so that it is exactly in the centre of the long slot cut in the baseboard. Do not worry if it "flaps" somewhat when stationary, for when once run up to speed the centrifugal force will make it revolve as a flat disc. Any slight adjustment of neon lamp-holder position that may be required will have to be undertaken when the plate is rendered

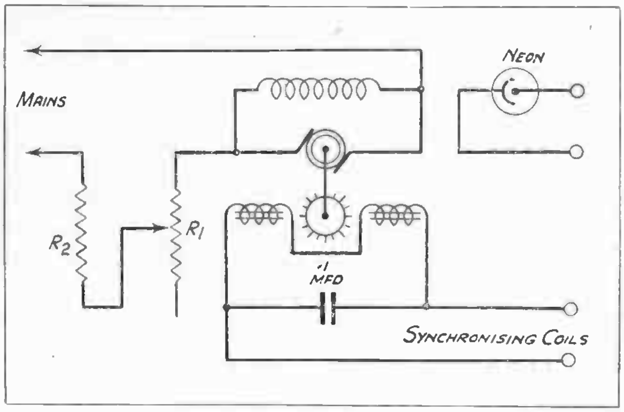


FIG. 2.—*The theoretical connections for the vision apparatus are very simple.*

incandescent by being joined up in circuit, so we will defer this until our design has progressed a stage farther.

America, Finance and the Future

(*Concluded from page* 326)

is far better for responsible brokers to sell those shares in order to bring them down to a healthy level, *so that they can be repurchased should there be a break in the shares.*

Frankly, though I am not altogether convinced of the logic of this explanation, other members of the Stock Exchange tell me this is a common practice. In any case, so far as I know, and I have made every inquiry, no one directly associated with the Baird Company has anything whatever to do with these Stock Exchange movements, and if any of my readers hear otherwise, I can tell them that they are able to give the lie direct.

* * * * *

To put this assertion beyond all possible question of doubt, I will say that in asking the Postmaster-General for an inquiry into the whole position of television I would urge that this point be cleared up once and for all; I would tell my friends in Fleet Street and in Parliament that, if at any time there is any doubt at all regarding the conduct of television *in any possible way whatever,* I am prepared, as I have always been, to give the fullest information and to disclose every possible document. I cannot say more.

* * * * *

To revert to the American position, developments are on the way which may make a great deal of difference to the British Company. My visit showed me primarily that the fight I have been waging is the right one. America, so far as I could see, has nothing "on us" at present. Mr. Jenkins has done and is doing excellent work. Other inventors and companies, some of which were desirous of joining with our American Company, are also showing activity. In fact, not only New York but the whole of America is alight with television.

England, the home of television, is in comparative somnolence.

* * * * *

That is a state which I propose to alter, and that, I am glad to say, is what is happening now. By next month's issue there should be something of the utmost importance to report in this connection.

NOTICE TO READERS

WITH the increasing interest which is being manifested in television developments and the growing numbers of amateurs who are conducting definite experiments in the science, we have had a very large number of queries sent in from readers who are seeking advice.

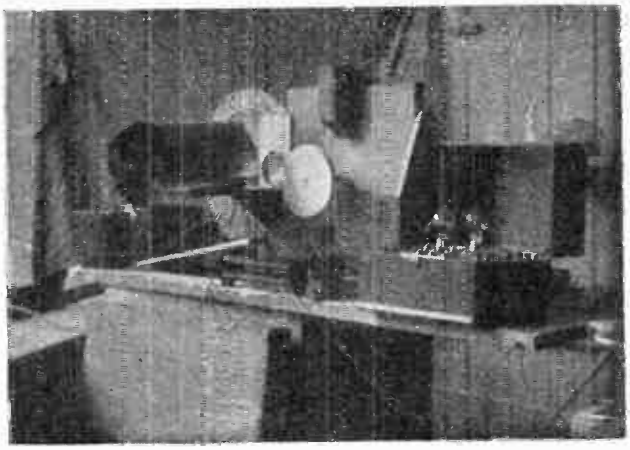
We are, therefore, inaugurating a query service for the benefit of these readers. Will they note that, starting with this month's issue, we shall be pleased to give advice on their problems, provided these are set out carefully and neatly on one side of the paper?

There will be a nominal charge of one shilling for this service, the number of queries to be answered for this sum not to exceed one. We cannot, however, undertake to supply blue prints, circuit diagrams, etc., in this service.

If there is space in the magazine, we shall include one or two selected queries in our Editorial columns, so that others can reap the benefit of our advice.

The Value of Research

By *William J. Richardson*



THE term research frequently is a misnomer. Too often is it applied in the wrong category, or alternatively not qualified in a correct manner, and the result is a confusion of facts. With a science such as television, the value of properly conducted research cannot be overestimated. The independent worker has made many valuable contributions to our scientific knowledge, but, speaking generally, it is the collated results of several tests carried out under an efficient organisation which has enabled the most rapid progress to be made.

Evolution

There has been an ever-increasing application of science to industry; although in the early days this met with stubborn resistance, as witness the industrial riots of even the last century. Furthermore, there is such a complexity of products in any one industry coupled with the question of quantity production that the successful manufacturer has appreciated the vital need for a sound technical staff in his organisation.

Many cases can be quoted to indicate the more usual steps in the evolution of a new piece of apparatus. In the first place, a trained investigator in the laboratories, or an ardent amateur seeking to extend the scope of his scientific knowledge, makes an important discovery. One very outstanding case with which we are all so very familiar is that of Mr. J. L. Baird. With infinite patience and the burning of much midnight oil, he evolved his world-famous schemes for television. It was not a shot in the dark, but the culmination of whole series of experiments based on a strong conviction that modern methods of science could or should enable one to see by electrical methods of communication, just the same as it was then possible to hear by similar methods.

Development

After this there are two courses which generally materialise. Either a development company is formed to carry out further investigation and improvements to bring the scheme to a commercial standard, or a worker or group of workers in an industrial institution recognises the possibilities of the discovery, and further work is undertaken to bring to light practicability.

A third stage arises when a development worker takes the matter in hand to elaborate an actual product. The function of this third party is to strip the experimental apparatus of its "trimmings," strengthen up the weak points, and generally render the apparatus suitable for manufacture in the workshops to be accepted (or rejected) in the commercial world.

Industrial Research

This process of industrial or utilitarian research is quite distinct from pure research undertaken for philosophical motives, and justifies its existence in the formulation of articles of utilitarian value. A noteworthy exponent of these methods was Edison, whose recent death is deplored by the whole world. He had the huge total of 1,400 inventions to his credit, and the benefits accruing from his industrial developments manifest themselves in every civilised household.

It has been said very aptly that "Necessity is the mother of invention," and this is a truism which none will deny. Just recall to your own mind how our everyday radio represents a practical illustration of the benefits accruing from properly organised research work. To quote an example, just trace the evolution of the coils that we use in our tuning circuits.

Examples in Radio

Have you ever seen the cumbersome loading coils of the early days, when the reception of even faint morse signals brought joy to the heart of the patient listener? Those were pioneering days, for in 1920 only one thousand listeners heard Dame Melba's voice from the old Chelmsford station—now the licence holders are rapidly approaching the four million mark. One and all will hope for a similar display of progressive interest in television.

However, to get back to our coils. The craze for larger and larger coils brought all manner of defects in its train. The limitation effects of the shunting self-capacity soon manifested themselves, and divers methods of coil winding were invented to overcome the difficulty. With the increase in the number of transmitting stations came the desire to tune in each at will, but selectivity was offset by coil resistance, and this ushered in that phase of wireless popularly termed the "era of low loss."

Single-layer coils, screened coils, fieldless coils, dual-wave coils, and now the latest band-pass coils, all found their advocates and users. It was specialised research, however, that brought these products to fruition, not trial-and-error methods, which are handicapped by such long odds against striking the correct solution.

Valve Work

The same phases of development befell all radio components, and yet another outstanding example of research can be voiced if we turn to valves. Picture the judicious handling of those "lively" sets, which were made so unstable in action owing to the improvements in the characteristics of the valves. After applying direct methods of damping out these unwanted oscillations neutralised circuits became the vogue, until finally we saw the evolution of the screened-grid valve.

Research has now given a solution to another important matter. With the increasing power of the transmitting stations in Europe, the problems of efficient volume control and improvements in selectivity to receivers are becoming of rapidly increasing importance.

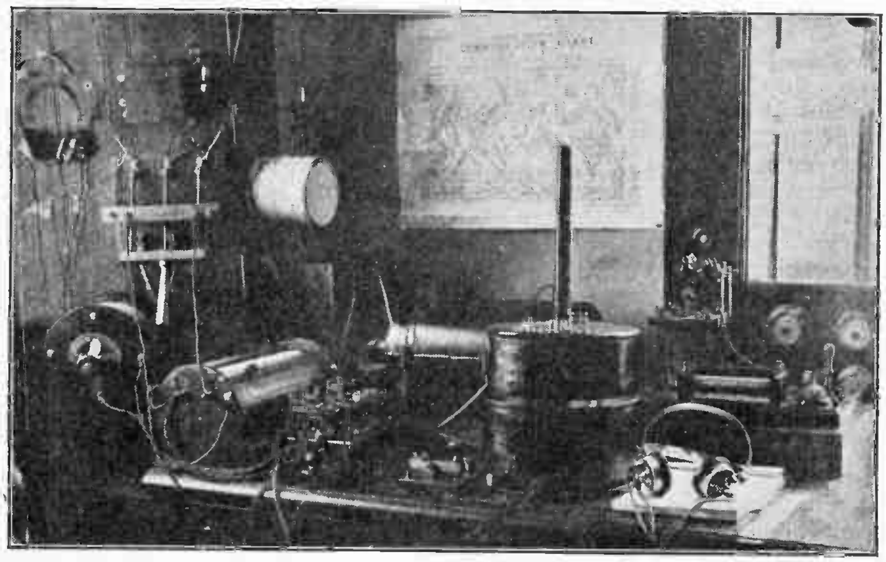
the corresponding tendency to introduction of valve noise. The third method has the disadvantage of cramping the valve characteristic and tending to introduce distortion on a loud signal.

Of the four methods, the last named, i.e. grid-bias control, is very convenient, provided that the valve characteristics are suitable. The impedance of a screen-grid valve is so high that its amplification is approximately proportionate to its mutual conductance. By increasing the grid bias to a point where the conductance is sufficiently small, the amplification can be reduced to as small a figure as desired (it may even be less than unity).

With the ordinary screen-grid valve, however, this method of volume control is limited, due to the sharp curvature of the characteristic at the point where the conductance is low, leading to rectification and introduction of the trouble known as "cross modulation."

Varying the Mutual Conductance

It is to obtain the advantage of grid-bias control without the disadvantage named above that the new types of valves, such as the Osram V.MS4, have been designed. The characteristics are such as to permit easy control of a large range of signal voltages without the use of local-distance switches or potentiometers. By varying the negative grid bias the mutual conductance or "slope" may be varied from the



This is what a typical amateur wireless enthusiast's installation looked like in 1914. The receiving equipment (at front of table) is but little different from that which was used by listeners-in when broadcasting first started.

Research and Selectivity

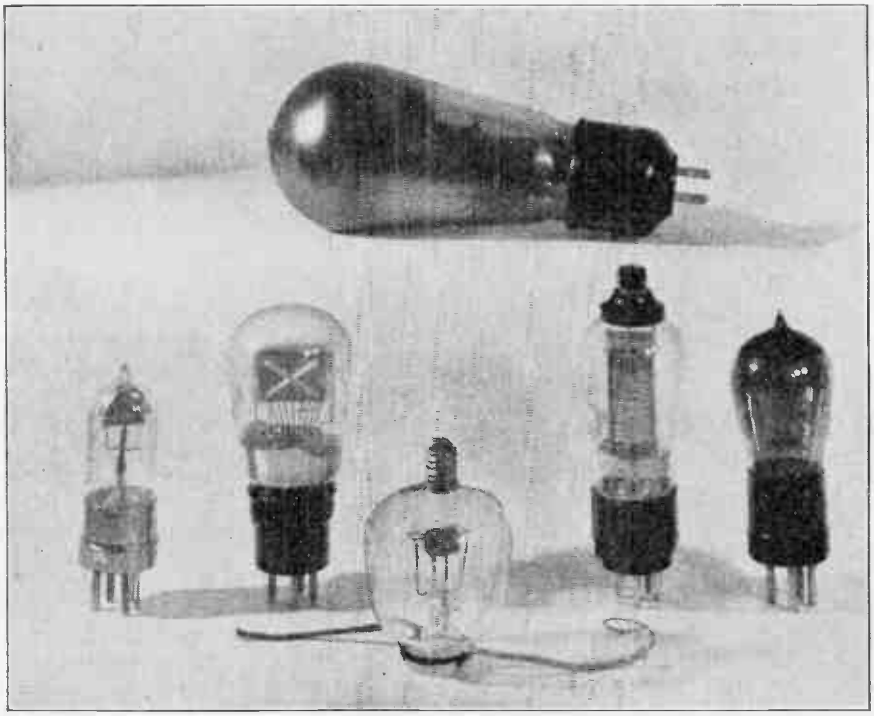
Several methods of pre-detector volume control have been variously employed, such as potentiometer input to the first high-frequency valve, variable resistance across the aerial tuned circuit, variable screen-grid voltage to the H.F. valves, and variable grid bias to the H.F. valves.

The first two named may be said to have the disadvantages that where ganged controls are employed they tend to upset the ganging at different settings of the tuning dial, and also that when the volume control is at the minimum point the H.F. valves are still operating to give their full magnification with

maximum of 1·1 mA/volts at about 3 volts bias to low values of the order of 0·005 mA/volt at a grid voltage of approximately — 40.

Furthermore, during the operation of the volume controlling resistance, which increases the negative bias, the mutual conductance is varied exponentially, or the log conductance is a straight line function of the negative grid bias. This gives a perfectly smooth volume control from maximum amplification on weak signals to practically zero when tuned to a loud signal.

Due to the moderately low value of mutual conductance and the very large working grid base, a particularly long straight anode current characteristic is obtained. When the bias is adjusted to a sufficiently great negative point to receive a strong incoming signal without detector overload, the characteristic is far more linear than an ordinary valve; in other words, at the working point for receiving the local station, we are dealing with a long straight characteristic curve rather than with a sharply bended curve. This means that the chances of rectification are very small, and accordingly those of cross modulation by a higher power station of adjacent wavelength are much reduced. When receiving weak signals from distant stations a low bias of about 1½ volts is used, which again brings us on to a straight part of the curve, ample for dealing with the weak signal.



A group of Cossor valves indicating development stages. Left to right, bottom row (1) 1921, 0·6 amp. filament, power valve, Stentor class; (2) modern pentode; (3) 1916 valve of peculiar construction; (4) modern mains S.G. valve; (5) 1923, 0·3 amp. Kalenised filament. At the top is shown a modern super-power valve having 60 watts anode dissipation.

I could go on giving many other examples, but I think sufficient has been said to emphasise the supreme importance and value of research in radio. Now the science of television is young, so you are on very virgin soil. What greater incentive could you need, therefore, to start your own investigations with a view to hastening the popularity of television. Do not start your task haphazardly, but for reasons of expense, and because invariably two heads are better than one, form a small band of earnest enthusiasts and split up the work between you.

The first task is to seek out every available source of information on the subject, so that you do not attempt to cover ground which has already been investigated. Public libraries, and especially the Patent Office library, will serve as veritable mines of information, and once you have assimilated all the knowledge you can, set out to accomplish your own task.

Do not attempt too much at once, or you will meet with failure, and bear in mind that the earlier inventions stand the best chance of immortality and indispensability, and those that come after concentrate on improvements. On the other hand, a later invention or improvement sometimes earns the greater financial reward; for a detailed improvement may prove to be very profitable if it brings about a displacement of something more costly to operate or instal.

There are many phases of television in which the amateur can help, and these can be sectionalised. Apart from the brilliant discovery of the Baird modulated arc, the present light sources for producing an image are the neon lamp in its various forms and the Kerr cell. Set out to discover any other means, for undoubtedly the present type of neon lamp, although greatly improved upon since the first ones appeared, still suffers from a lack of candle-power.

Even with the simple scanning disc it will prove interesting to examine the effects produced by various hole shapes and sizes, and whether a "mixed scan" is preferable to the straightforward simple spiral. The present "television eye"—our photo-electric cell—is by no means perfect and provides ample scope for the experimenter, although this work may prove somewhat more expensive than other sections of television work.

There is really no need for me to continue to add to this list by mentioning synchronising, frequency limits, image detail, colour working, and so on, for these items should suggest themselves to you automatically. The whole scheme is not perfect any more than radio was in its early growth. So with the winter evenings upon you make a start now, the time will be well spent, and once your interest is aroused you will become a television stalwart and not be left behind in television's progressive march forward.

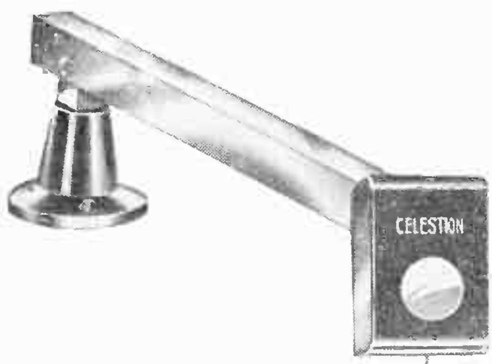
TRADE NOTES OF THE MONTH

REPORTS ON APPARATUS TESTED

Celestion W.5 Pick-up

THE benefits accruing from the playing of gramophone records so that they are reproduced through the home wireless receiver are well known to readers, but obviously there are three links in the chain which must be above suspicion, first of all the pick-up, secondly the L.F. side of the receiver, and finally the loud speaker itself.

At the moment we are concerned with number one. Messrs. Celestion, Limited, have submitted their W.5 Pick-up for test and report, and we are pleased to say that it has given very fine results.



The well made and very efficient pick-up, made by Messrs. Celestion, Ltd.

The pick-up itself has transverse rubber damping which allows an exceptionally easy movement of the needle, and this, in conjunction with the ball-bearing tone arm, which is supplied complete with the pick-up, make record wear almost non-existent. The tone arm itself is corrected, to give true tracking, while another pleasing feature is the quick needle release operated by a press button.

The instrument is exceedingly well finished in bronze, and both in appearance and performance can be highly commended. With extraordinary fidelity it is capable of reproducing any musical or vocal composition, the real bass notes being brought out without boominess, while the highest frequencies are retained giving a brilliant rendering. We can unhesitatingly recommend this product to all critical music lovers. One point that should be noticed is that since this pick-up is of the high-resistance type, namely 4,000 ohms, the quality is likely to be impaired if it is coupled with a transformer or tone control. In view of this the makers recommend that no tone control should be used other than a parallel resistance of a quarter megohm.

Benjamin Catalogue

This year's Benjamin Catalogue contains details of switches, valveholders, and the turntable marketed by Messrs. Benjamin Electric, Limited. In addition to this the last few pages are devoted to giving details and circuit diagrams of three modern receivers which, as it happens, have been designed by our own consultant, Mr. H. J. Barton Chapple. They consist of a Local Station Two, an All-mains Three, and a Super Four, the last-named being suitable for battery operation or working with an eliminator. The capabilities of each circuit are set out quite clearly, and any of our readers will be supplied with a copy of this catalogue if they write to the firm in question at Tariff Road, Tottenham, N.17, mentioning this journal.

For Valve Users

Messrs. A. C. Cossor, Limited, have compiled a very useful valve and wireless book, which contains much useful information of a general character, together with many interesting facts concerning the structure and operating conditions of Cossor valves.

This little booklet is a veritable mine of information, and should be in the hands of all radio users for reference purposes. It can be obtained direct from Messrs. A. C. Cossor, Limited, at Highbury Grove, N.5, if readers mention TELEVISION.

In addition, they have furnished us with a copy of their new station identification chart. This little chart gives you the station wavelength, call sign, interval call, announcer, distance in miles from London, when noon at Greenwich, frequency, and power of some of the most important broadcasting stations, and a space is provided for adding the wireless receiver dial settings for these stations in turn. The chart can be obtained for *2d.*, post free, by sending an application direct to Cossor's head office.

W.B. Moving-coil Loud Speaker P.M.3.

As promised in these columns last month, we have now had an opportunity of making extensive tests on the Whiteley Electrical Radio Co., Ltd.'s P.M.3 Loud Speaker Chassis. As will be gathered from the illustration, this model is of particularly robust construction, and we learn that it was only by continuous experiment and close co-operation with leading manufacturers of Sheffield cobalt steel magnets that this permanent magnet speaker was evolved.

When we remembered that the price was only 45*s.* for a chassis alone we were frankly surprised at the exceedingly good performance put up by this speaker. Its sensitivity was remarkable, it being possible to work it in conjunction with any good-quality two- or three-valve receiver which is capable of working an ordinary cone speaker.

Quality of reproduction was of the highest order, there being a complete absence of boominess in the bass notes and realistic rendering of the higher notes. No undue resonance peaks could be detected, and we should like to congratulate the manufacturers on producing an instrument capable of such a good performance at the low figure quoted.

Since this speaker has a low-resistance winding it is necessary to employ a multi-ratio step-down transformer between the set and the speaker, and the manufacturers have designed one to use in conjunction with the P.M.3 at a cost of 7*s.* 6*d.* In addition, if it is desired to house this chassis in a cabinet, there is one supplied in grained oak at a cost of 30*s.*

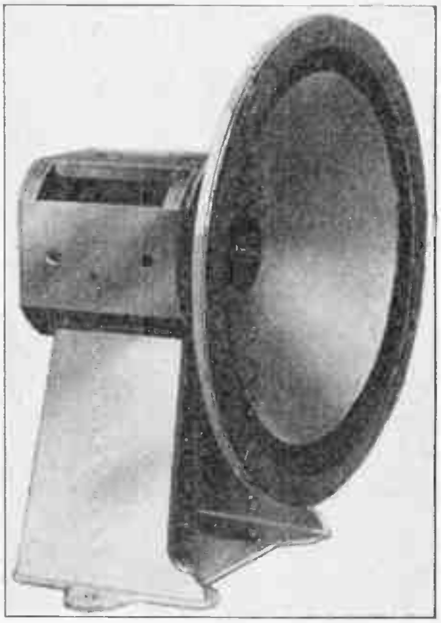
We can strongly recommend this product to our readers as being a sound investment.

Workshop Hints

(*Concluded from page* 350)

plete triangular-shaped pieces, each with a vertical line down its centre, and with a horizontal line ½ in. from its base. Finally mark off and drill the screw-fixing holes as shown in the last section of Fig. 4. Care should be taken in the selection of the drill size. Use wood screws, the shank diameter of which is nearest to the drills you have.

Assuming you have some of your old panel left, this will be suitable for the bracket. Suppose we wish to make a pair of brackets 6 in. by 3 in. with a 1-in. flange, this is how we start. Mark off a rectangle 8 in. by 5 in., and then another rectangle 2 in. smaller inside it. This gives you a second rectangle 6 in. by 3 in. Scribe a line diagonally through both (see Fig. 5) and mark off the top and bottom corners at 45 degrees to the outer edge. Saw through the centre diagonal line and the bottom corners. The pieces are now placed in the vice, and bent over on the lines left from the inner rectangle.



The W.B. P.M.3 loud speaker is made by the pioneers of permanent magnet moving-coil speakers.

All you have to do now is to drill the flanges where required.

The brackets can be screwed first to the inner sides in the centre of the vertical strips, taking care that they are flush with the bottom edges, then screw the brackets down to the baseboard. Now place the platform in position on top of the vertical strips, and screw on the four clamping plates. We have now completed our assembly, and all the parts can be used again if at any time we wish to modify our construction.

Recent Developments in Television

(*Continued from page* 337)

There are two other facts which are nearly always overlooked by people when discussing television. These are the tolerance or self accommodating nature of the human eye, and the fact that, although every subject televised undergoes movement, this question of visual persistence makes television and cinematography possible, and, furthermore, when we look at a scene we unconsciously "scan" it by allowing our eye to wander over it in much the same manner as a television scanning spot.

Before we have had an opportunity of absorbing all the detail of a televised subject or a person in one position it has moved to another, and thus unconsciously the amount of noticeable detail is less than would be the case for stationary objects. Bear these points in mind, and also the fact that although the frequency problem is a great one where television broadcasting is concerned, it is not so for landline transmissions such as might take place for transmitting television to large screens.

Keep these aspects of the problem quite distinct whenever you indulge in a discussion on the subject, and then the issue will not be confused.

The next point that I want to take up is television on a large screen. Dealing with the subject generally, we are justified in saying that, at present, there are three primary methods for projecting images upon a large screen.

The first method which was shown by the American Telephone and Telegraph Company in 1927 consisted of a screen built up from a continuous neon tube, different areas of which were activated in sequence by means of a commutator.

The second method was demonstrated in England by Mr. Baird, in America by the G.E.C., and in Germany by the Telefunken Company, and depended upon the projection of a spot of light on to a screen, the spot of light being made to traverse the screen by means of one of the usual forms of scanning device.

The third method consists of the now famous bank of lamps, and is fundamentally different from the two preceding methods. In the bank of lamps we had a receiving screen built up from 2,100 tiny metal filament lamps, each lamp being set in a cubicle so that the screen resembled somewhat a gigantic honeycomb with 2,100 cells, the centre of each being the small electric lamp. In front of these cells was a sheet of ground glass, while each lamp was connected to a separate bar of a gigantic commutator whose function was to switch on only one lamp at a time, and as the contact of the commutator revolved each of the lamps was switched on in succession. The whole of the 2,100 lamps were switched on and off in just over one-twelfth of a second, and, since the selector brush revolves at 750 revolutions per minute, it will be seen that 26,250 contacts are made every second.

In operation the incoming television signal is first of all amplified, and this powerful current is then fed to the revolving commutator, where the lamp switching takes place. As in normal television working the current is strong at the bright parts of the image and weak at the dim parts, so that the small lamps are bright or dim accordingly, and the image is evolved or built up from this mosaic of bright and dim lamps, and of course the intermediate shades.

At the time when this lamp screen was demonstrated, synchronism was obtained with synchronising gear differing from the standard Baird toothed-wheel synchroniser in size only. A bank of lamps of this character has luminous inertia—that is to say, the luminosity of the screen persists so that we do not have a travelling spot of light reproducing the image as in the two previous methods I mentioned, but a semi-permanent image remains on the screen, persistence of illumination supplementing persistence of vision. This effect of a large number of the small lamps being alight simultaneously gives the effect of great brilliance and considerably reduces flicker.

Of these three methods the first has the disadvantage of expense, while the second method has the advantage of comparatively simple construction, but in the early days suffered from the disadvantage that it was difficult to obtain sufficient brilliance adequately to illuminate a large screen. This, however, has been counteracted by Mr. Baird's latest invention, the modulated arc, about which I shall have more to say later on.

The third method has the disadvantage of expensive construction, but the advantage that any degree of illumination up to the most intense brilliance can be secured, and also the further advantage that I mentioned a few moments ago, that owing to the phenomenon of illumination persistence, image flicker can be greatly reduced.

The lamp screen was designed originally to receive the standard Baird transmissions now being sent out through the B.B.C., and as these transmissions are limited by regulations governing sound transmissions, the screen had, accordingly, only a limited number of lamps. There is nothing, however, to prevent a screen of any desired magnitude being built for theatrical or other purposes, and it is a public fact that the Baird Company built up a lamp screen using twice the number of lamps for experimental purposes.

Members of the audience will no doubt remember that after this lamp screen made its debut on the roof of the Baird Laboratories at Long Acre, it was shown at the London Coliseum, this being the first time in the world's history that a paying theatre audience had been privileged to witness television on such a large scale.

After this the screen travelled to Berlin, Paris, and Stockholm, and the Press were unanimous in their praise of the developments that had been made.

Brilliancy of the screen will become a more acute question as the quality of the transmission channels improves, since the greater the number of elements the picture contains the less is the brilliancy where a travelling light-spot is employed. This is because the light-spot becomes proportionately smaller in relation to the screen as the number of elemental areas contained in the picture increases.

One way of overcoming this particular difficulty is to transmit the picture in zones, using a plurality of light-spots, but the complexity of this method for wireless purposes is a serious practical drawback. Where landlines are concerned, however, there is no difficulty in transmitting a series of zones.

On January 2nd, 1931, three zone television apparatus were demonstrated to the Press at the Baird Laboratories. The images were shown projected on to a small glass screen, and full-length figures of as many as eight persons were seen, together with an impromptu tea party, a boxing match, and demonstrations of cricket strokes. These pictures were made up of three sections transmitted side by side, and an examination of the transmitter revealed the fact that its essentials were a large mirror-drum with 30 mirrors which, revolving rapidly, caused a succession of images to be moved over three different apertures admitting light to three separate photo-electric cells. Each of these cells transmitted one-third of the total scene, the picture being split up into three adjacent zones.

At the receiving end was an apparatus arranged so that the light from three neon tubes was controlled by the current from the corresponding cells at the transmitter. Spots of light from these neon tubes were made to traverse the ground-glass screen building up an image of the scene in front of the transmitter. In effect, there is really no limit to the number of zones that can be utilised in this way. Obviously, the larger the picture the greater the number of zones, and unfortunately the greater the complication and the expense.

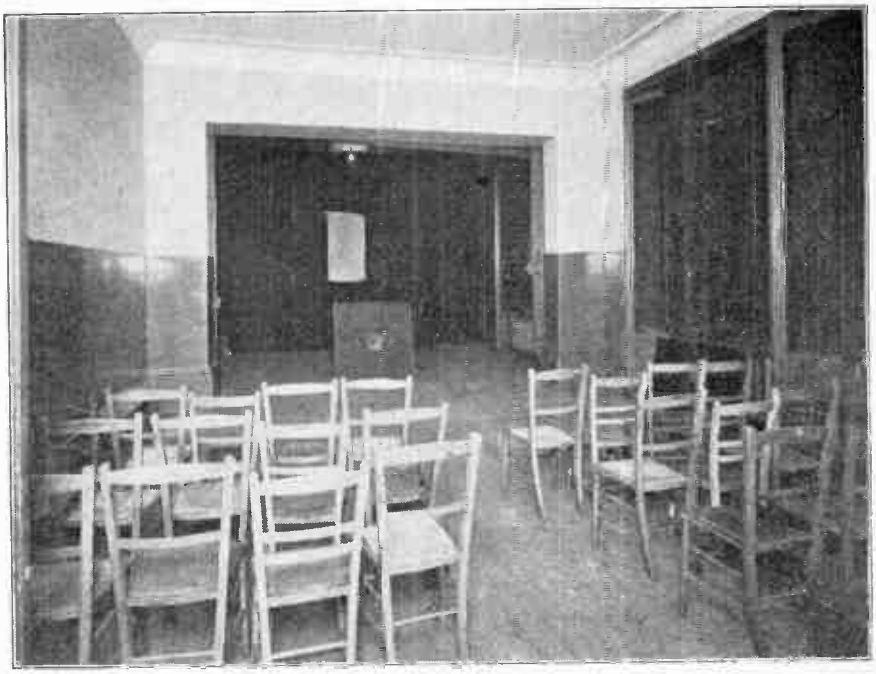
These last two items are, however, not serious matters where a public service, such as a theatre, is concerned, and it is for this purpose that zone television, in its present form, is primarily adaptable. It is noteworthy to record that the system was described in one of Mr. Baird's patents taken out as far back as 1925, but has only recently been developed, as it is unsuitable for wireless broadcasting since several communicating channels are required.

The apparatus which was demonstrated had one rather noteworthy feature, an ordinary flood-light was used in place of the moving light-spot with which we are so familiar. This suggests immediately the great advantage that the apparatus can be used with ordinary daylight, and no doubt members of the audience will remember that a short time after this zone television demonstration another development made its appearance in the form of daylight television.

The first daylight television demonstration was made as far back as June 1928, but the apparatus employed then differed considerably from that used in the later experiments. It was on Friday, May 8th, that an actual street scene was transmitted by television. Unfortunately the weather was of the usual fickle character associated with that month, but even with an overcast sky it was possible to see Covent Garden porters, policemen, and the usual business people walking up and down Long Acre in the small screen of the Baird commercial "Televisor."

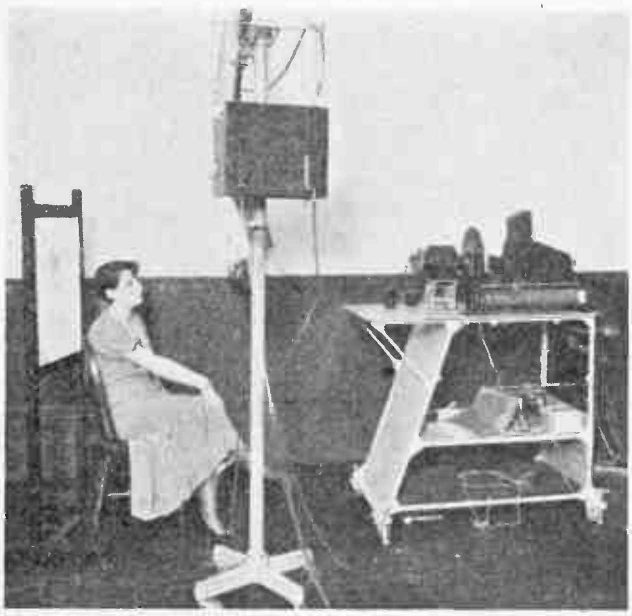
The transmitting apparatus was housed in a grey caravan, and from the van's open door the scene was picked up through the medium of a mirror-drum revolving at a speed of 750 revolutions per minute. By this means a succession of images of the scene being transmitted was projected upon a special photo-electric cell, and in this way a conversion into an equivalent form of varying electric current was effected.

A few days prior to this an experimental trans-



The screen used in conjunction with the modulated arc was set in a black background, with a loud speaker to reproduce the voice in the foreground. Members of the audience at the British Association meeting were then able to watch the effect when seated in the chairs at the back of the room.

mission was made through the B.B.C. of a scene on the roof of Long Acre, and it reflects great credit upon the Baird Company's engineers that they were able to concentrate on this apparatus and perfect it in such a manner that it was capable of producing these daylight scenes. No doubt the audience will recall that in the early days of Baird television, it was pointed out that the application of the principles would enable such scenes as the Derby to be televised, and critics used this fact to pour



At the transmitting end a Baird light-spot transmitter was used to send signals to the modulated arc.

scorn on the whole scheme. But June 1931 saw that promise fulfilled.

This was the first experiment of its kind to be made in the history of the science, and was carried out by the Baird Company in conjunction with the B.B.C. By the side of the rails at Epsom, opposite to the Grand Stand, the same caravan was erected on a wooden stand, and it was possible on that great day to see the parade of the horses, first in one direction then in the other, and finally, watch both horses and jockeys flash by the winning-post.

To secure a change of vista a very ingeniously contrived mirror was fitted on the caravan side farthermost from the course, and, when turned, this reflected different pictures of the adjacent activities. It was these reflected images that were scanned by the revolving mirror-drum. Housed in the caravan were powerful amplifiers, which handed on the vision signal to Post Office lines passing under the racecourse, and were then linked up to other lines passing through to Long Acre. From thence they passed to Savoy Hill, from Savoy Hill to Brookman's Park, and were finally broadcast into the ether to be received and watched by anyone possessing a "Televisor."

This experiment, although somewhat restricted in the size of the scene it was possible to televise, proved beyond all doubt to the most sceptical of die-hards that television had emerged from the studio into the realm of topical events. The restriction of four walls and artificial light had been broken down, and Mr. Baird had fulfilled the promise which, as I indicated earlier, had brought down a storm of disbelieving contempt on his head.

Let me now pass to Mr. Baird's latest invention, namely the modulated arc. To anyone interested in television it has been apparent for some time past that if the scope and size of television images are to be increased to any appreciable extent a more powerful source of modulating light had to be evolved. A television image is, in effect, really built up from a single small spot flying across the screen so rapidly that the eye does not dwell on the mechanism of the process, but receives the impression of an evenly illuminated area.

It is obvious, therefore, that the spot must be of great intensity, and whereas the present area of the spot in the Baird image is two thousand one hundredth of the screen, if the detail is to be increased this ratio will go up proportionately, as will the necessary intrinsic brilliancy of the spot. Apart from the lamp screen, only two forms of light have been used for television with any success. These are the neon tube with its comparatively faint red glow with which you are all no doubt familiar, while the other device is known as the Kerr cell. In the case of the Kerr cell, although this has been working in the Baird Laboratories for some time past, it is not yet of the highest efficiency.

The light from an arc is first polarised by a Nicol prism, and then is passed between two metal plates immersed in nitro-benzene. If this resultant Kerr cell is followed by a Nicol prism crossed with respect to the first prism, no light will pass, but should a potential be applied to the plates of the cell a rotation of the light is secured, causing it to pass through the second prism. In this way the arrangement becomes in effect a light valve, but, since only about 20 per cent. of the light actually gets through this system, the remainder being absorbed in the cell and prisms, it will be appreciated that in the present state of the art this does not afford the best solution to our problem.

Now, the most intense light source known is the electric arc, and this form of illumination immediately suggests itself, but when one tries to put it into practice it is found that the simple arc is not capable of varying its intensity with anything like sufficient rapidity for our purposes. The work of Duddell and Ruhmer in connection with varying the light of an arc in proportion to speech currents from a microphone is, no doubt, familiar to most of you, but it has remained for the staff of the Baird Television Laboratories to evolve a new form of arc which can be modulated over a sufficiently wide frequency band, and with the necessary consistency and accuracy, to make it suitable for television purposes.

This has now been done, and it is possible with the modulated arc to obtain a brilliantly illuminated image which can be projected successfully on to a large screen.

This was demonstrated publicly for the first time last month at the British Association Meeting in the section devoted to Mechanical Aids to Learning. The audience was seated several feet away from the screen which was set in a black background. First of all a large image, in this case a man's head and shoulders, addressed the audience from the screen, the voice being heard from a loud speaker accommodated in the foreground. Having explained briefly the principles involved, and pointed out how this invention in its present form opened up a new field in education, since a lecturer complete with demonstrable apparatus could be located in one central studio and his image seen and his voice heard at various remote points linked by wire or wireless, the announcer disappeared from the screen, his place being taken by a lady singer.

The public were at liberty to examine both receiving and transmitting apparatus, the latter taking the form of a standard light-spot transmitter to which I made reference earlier in this lecture. At the transmitting end behind the screen was seen the mirror-drum with each of its thirty mirrors set at a slightly different angle from the preceding one. Before this drum was a lens concentrating the light from the Baird modulated arc on to the mirrors, and, as the drum revolved, the light-spot was made to traverse a screen in a succession of 30 parallel lines, the light from the arc lamp flickering in and out corresponding to the light and shade of the image, being bright at the high lights and dim at the shadows, the whole process being really in principle very similar to that of the ordinary Baird "Televisor."

Since the arc equipment was arranged parallel to the screen, it was necessary to include a large mirror to turn the light beam through an angle of 90 degrees. I regret that the present moment is not opportune to dwell further on this most important invention, but I hope that at some later date I shall have the privilege of giving complete details. Suffice it to say that, having solved the very acute problem of a powerful light source which can be modulated successfully for television purposes, it is reasonable to hope that further development will be rapid, for the brilliancy question is one that has hitherto stood in the way of successfully projecting television images directly upon a large screen.

There are just one or two other items I should like to mention before concluding this lecture. The first is the much closer co-operation which now exists between the B.B.C. and the Baird Company.

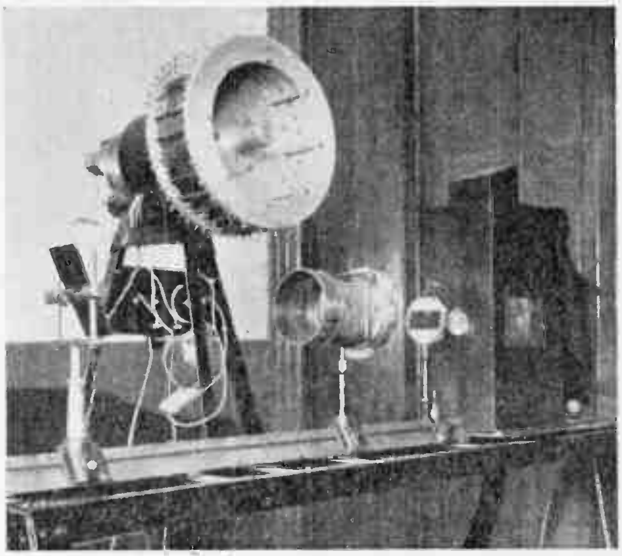
A portable transmitter was installed in No. 10 Studio some months ago, and was used on several occasions for transmitting television images direct from that building. The success achieved in that direction is reflected in the announcement which was made public a few days ago, namely that television at long last is to come within programme hours.

Starting from to-morrow night, Thursday, there will be a weekly half-hour transmission from No. 7 Studio at Savoy Hill, this transmission commencing at 10.50 p.m. The first subject to be televised will be Jack Payne conducting his B.B.C. Dance Band. In this connection it should be noted that since the usual broadcast of Jack Payne's Dance Band takes place on the London Regional wavelength of 356 metres, the accompanying vision will be broadcast on the London National wavelength of 261 metres.

This transmission, which it is hoped will be extended in the very near future, will take the place of the two previous weekly midnight transmissions, and should serve to stimulate an enormous interest owing to the improvement in the time question. It is anticipated that lookers-in will be able to see as well as hear some of their favourite B.B.C. artistes, and I am sure that we all welcome this concrete evidence of B.B.C. interest in this wonderful science.

In addition, experiments are now being made by the Baird Company in conjunction with the B.B.C. engineers to ascertain whether the landline link can be used to convey the television signal in sufficient strength and purity to enable the North Regional station at Slaithwaite to repeat the television transmissions of Brookman's Park.

These tests are now well in hand, and I do not think I am betraying a confidence when I say that so far they have proved most promising. This will afford television enthusiasts in the North of England an opportunity for pursuing their hobby under more favourable conditions than have hitherto existed as, according to reports which I have seen, the London Regional station does not give the best of results in the northern localities.



The optical side of the Baird modulated arc apparatus, showing the mirror drum, lenses, etc.

In conclusion, I feel it only right to add that a debt of gratitude is due to the Baird Company for having provided a television service free of charge for such a long period of time. I do not propose to discuss questions of finance in television, but I would point out that at present you are getting something for nothing, and if only it was possible for, say, 1 per cent. of the present B.B.C. licence money to be handed over for television development and service, then progress would be more rapid.

LETTERS TO THE EDITOR

The Editor does not hold himself responsible for the opinions of his correspondents. Correspondence should be addressed to the Editor, TELEVISION, *505, Cecil Chambers, Strand, W.C.2, and must be accompanied by the writer's name and address.*

EXPRESSING THANKS

To the Editor of TELEVISION

DEAR SIR,—I have been an enthusiastic reader of TELEVISION since its inception, and I only hope it keeps up its present high standard in all its articles. I would specially commend the articles "The Enthusiast Sees it Through," as well as all the technical and constructional articles which have appeared regularly since the beginning.

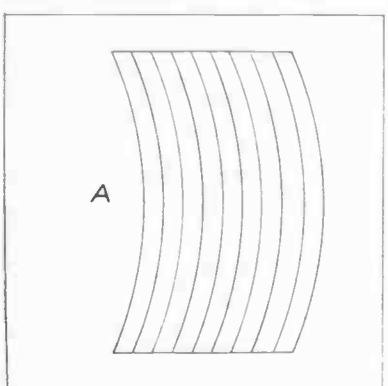
Yours faithfully,
C. J. HARDING.

120 GLENTHORN ROAD, WEST JESMOND,
NEWCASTLE-UPON-TYNE.
September 1st, 1931.

A SCANNING SUGGESTION

To the Editor of TELEVISION

DEAR SIR,—I have studied the science of television for quite a long time by the aid of your



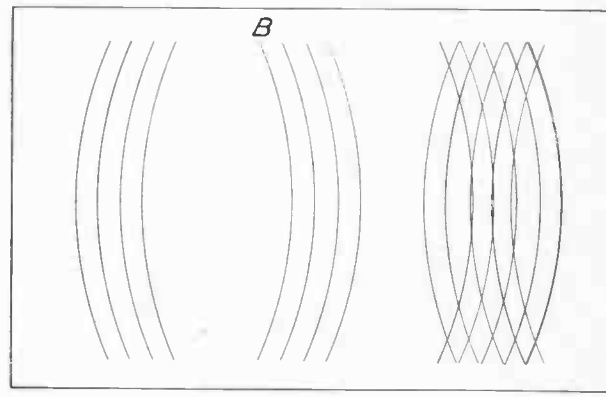
The scanned area normally obtained with a single spiral holed disc.

valuable journal, and have come to the conclusion that the Baird discs are only used half as effectively as they might be.

To get twice the value out of these discs I have thought of an alternative arrangement which may or may not work, but I should like to submit the idea to you and perhaps your readers will comment upon it.

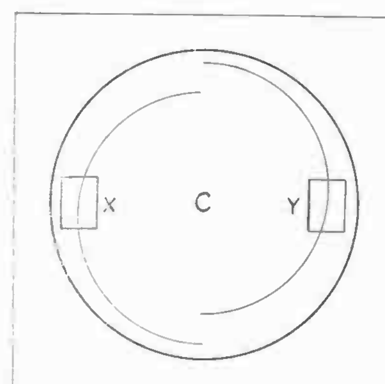
In the normal use of these discs only one tiny corner is employed. A square aperture is "scanned" by means of the passage of holes, coming in turn, in the form of a spiral. Consequently a scanned area is obtained like that shown at *A*.

Supposing an *oppositely* curved scanned area could be superimposed at alternating intervals like *B*. Much more detail could be obtained. To do this,



Illustrating the effect of superimposing two oppositely scanned areas.

an aperture, half normal size longitudinally, could be placed on the two sides of the scanning disc at *C*, so that, while a hole was "scanning" at *X*, *Y* would be out of operation or "blind." Then, when that hole had passed *X*, *X* would be "blind" and a hole would be operating at *Y*. Two photo-



Operating alternate sides of the disc so that when X is being scanned Y is "blind" and vice versa.

electric cells could be placed at *X* and *Y*, so that continual scanning could be employed.

Arrangements would be made by lenses, of course, so that at the receiving end the two scannings of the same image could be superimposed. Also the apertures would have to be placed by experiment.

If you or your readers can see through the idea, test it out if at all possible.

Yours faithfully,
GEORGE E. LAND.

61 KING STREET,
HODTHORPE,
NR. MANSFIELD, NOTTS.
September 16th, 1931.

TO NUNEATON READERS

To the Editor of TELEVISION

DEAR SIR,—I wonder if you could put me in touch with any other television enthusiast in Nuneaton. Perhaps we could help each other in this way. I note that you are proposing to start a query page. I think we shall all appreciate this and have no doubt that it will prove useful.

I am looking forward to television in programme hours, and trust you will keep agitating for longer transmission times.

Yours faithfully,
H. E. SMART.

"DOMUS," THE AVENUE,
WEDDINGTON,
NUNEATON.
October 2nd, 1931.

TRYING BAND-PASS TUNING

To the Editor of TELEVISION

DEAR SIR,—I am still as enthusiastic as ever and always will be, but I have not written before owing to my not being able to use my vision apparatus because of atmospherics which are very bad here at this time of the year. The only alteration to my receiver has been to add an input "band-pass" tuner, and also to use an output transformer as recommended in one of Mr. William J. Richardson's excellent articles.

I was very pleased with the results, hardly any difference in the picture was noticeable, and I can recommend band-pass tuning to other amateurs. My method of trying the band-pass was to purchase another aerial coil and condenser, both of the same make and connect them up as in the diagram.

During the week I read in the *Manchester Evening Chronicle* that Baird Television, Ltd., were trying to send the vision signals by land-line for rebroadcast from the Northern Regional. Well, I know a good many wireless amateurs who are only waiting for this to happen, and then they will become television enthusiasts, so let us hope for the best and an excellent winter. I wish television every success.

Yours hopefully,
A. WALTERS.

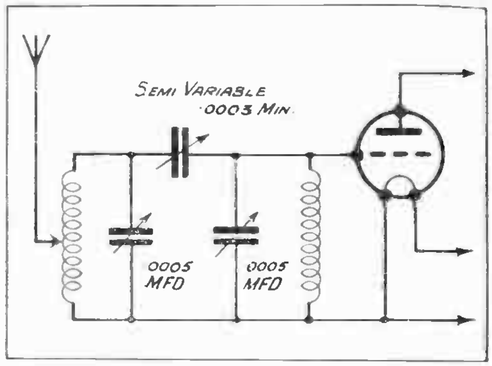
56 WEST TOWER STREET,
SEEDBY,
SALFORD.
September 14th, 1931.

QUERY SECTION WANTED

To the Editor of TELEVISION

DEAR SIR,—I have looked-in to the midnight transmissions a few times during the summer with the aid of a new McMichael All-mains Three, but have not had as good results as from my old 1-v-2 receiver, now dismantled, but this I blame to the weakening of signals due to summer conditions.

Mr. A. Walters' suggestion for trying out band-pass tuning.



What we want up here is the vision signals put out from 5XX or the North Regional. I appreciate your journal very much, and would be glad to pay 1*s.* for it, if that would help at all, *and so would all who want to see British television win,* but I wish you had some kind of query section, as lack of technical knowledge sometimes results in the choice or making of components which are useless and money is therefore wasted.

Before closing I might state that when I can secure a strong signal I can get fairly good image reproduction, perhaps not comparable with some of your Southern correspondents, but still sufficiently good to show that television is certainly worth while.

I will let you know if I achieve any outstanding results, and send photographs of my apparatus at the earliest possible.

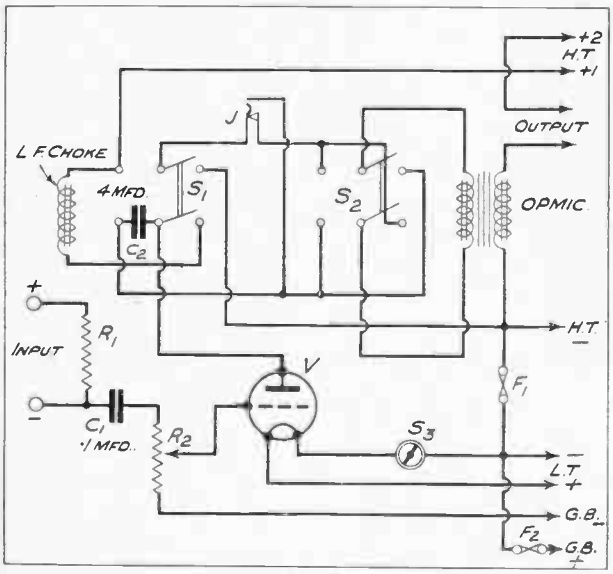
Yours faithfully,
F. F. Bowling.

Stainforth Market,
Doncaster.
September 7th, 1931.

NEWS FROM AUSTRALIA

To the Editor of Television

Dear Sir,—I am taking the liberty of writing to you as one who has been interested in Television ever since the appearance of news in the electrical journals that Mr. J. L. Baird had demonstrated television to the members of the Royal Institution in 1926, and another of your readers since No. 1. I had the good fortune to be in England in 1928 and to be permitted through the courtesy of the Baird Company to witness the first public demonstration of television in the world at Olympia.



A slightly amended circuit for Mr. Barton Chapple's Output Power Unit. This is a proposal submitted by Mr. Cox, of Australia, to make switch S_1 a two-pole instead of a three-pole.

When reading the article entitled "Build the Output Power Unit" in the July 1931 number, I thought that the three-pole switch S_1 in Fig. 1 could be replaced by a two-pole double-throw switch, and I am enclosing the diagram of connections. If this does not arrive too late, it may be of assistance to some builders of the power unit who may prefer a two-pole to a three-pole switch.

I would like to take this opportunity of suggesting that more articles on the radio end be included, such as the theory of detector, resistance-capacity and other couplings, transformer theory, and valve characteristic curve discussions.

There have been some excellent hints on these in the constructional articles by William J. Richardson, A. A. Waters, and others, and some more articles devoted to receiving-set theory, with practical hints, would be most acceptable.

Congratulating you on the excellence of your magazine.

Yours faithfully,
A. A. Cox.

South Kensington,
Sydney, Australia.
August 21st, 1931.

WATCHING A BOXING MATCH

To the Editor of Television

Dear Sir,—The boxing exhibition transmitted by television yesterday morning proved to be one of the most interesting transmissions I have seen to date.

At my house at North Gosforth, 300 miles from London, the boxers could be very plainly seen circling round, hitting and clinching. The part of the picture where one of the boxers was down and the other was counting him out was plainly seen, also the part where the two boxers were seated on their chairs and being cooled by a towel flapper.

The whole transmission was extremely interesting.

Yours faithfully,
T. Payne.

7 St. Andrew's Buildings,
Gallowgate,
Newcastle-upon-Tyne.
October 2nd, 1931.

The list of live dealers who are demonstrating

BAIRD TELEVISION

gets bigger every week !

ABINGDON	ABINGDON WIRELESS SUPPLIES	45 Stert Street
ASHFORD (KENT)	C. HAYWARD & SONS	20/42 New Street
ASHFORD (MIDX.)	WESTLAKE RADIO	Church Street
BISHOPS STORTFORD	H. R. MOORE LTD.	Northgate End
BRIDGEND	WRIGHT & ASHWORTH	Kings Bldgs., Adair Street
BAGSHOT	LINDFIELDS GARAGE	Surrey
BEACONSFIELD	BEACONSFIELD MOTOR CO. LTD.	65 London End
BALDOCK	P. C. THOMPSON	High Street
BICESTER	LAMBOURNE BROS.	47 Market Square
BIRMINGHAM	C. WEBB LTD.	41 Carrs Lane
BOURNEMOUTH	J. E. BEALE LTD.	Hants
BRACKNELL	DRAKE & MOUNT LTD.	Berks
BUCKINGHAM	A. C. MARRIOTT	Castle Street
BURNHAM	TIMMS & ALDRIDGE	Bucks
BIRMINGHAM	SHANNON & CAPENER	13 Aston Road North
CHALVEY	J. D. HALLIDAY	Nr. Slough
CHELMSFORD	LONDON RADIO CO.	200 Moulsham Street
CATERHAM VALLEY	KINETIC WIRELESS AND ELECTRIC SUPPLY	5 Godstone Road
CHERTSEY	RADIOGRAM STORES	81 Guildford Street
CHESHAM	A. A. KEEN	48 Broad Street
CHESTERFIELD	G. KENNINGTON (CHESTERFIELD) LTD.	Victor Lane
COLCHESTER	SHROSBURY & BAKEWELL CO., LTD.	73 Crouch Street
COULSDON	THE "VIC" WIRELESS STORES	21 Chipstead Valley Road
COVENTRY	MAX. A. BUCH	143 Lower Ford Street
DEAL	G. CLOUT	Electrical Engrs.
DARLINGTON	C. SHARP	321 North Street
ERITH (KENT)	CREFFIELD ELECTRICAL SUPPLIES	90 High Street
FARNHAM	WILEYS	Downing Street
FELTHAM	SPARKS & CO.	36 High Street
GERRARDS CROSS	R. F. CHIPPS	6 Oak End Way
GODALMING	H. J. CHALLEN	12 Church Street
HORLEY	S. A. COUTTS	Victoria Road
HASLEMERE	F. J. PRINNETT	West Street
KNEBWORTH	E. S. HEAP	London Road
KIRKCALDY	GIBB & WATSON	270 High Street
LEIGHTON BUZZARD	GRIFFIN BROS.	11 High Street
LONDON :		
BROMLEY	UNIVERSAL ENGINEERS	1 Chatterton Road
EAST DULWICH	R. MANSEL JONES	40 Lordship Lane
EAST DULWICH	RAND & BARKER	Melbourne Grove
EALING (WEST)	L. LEAMAN	97 Northfield Avenue
EAST HAM	EAST HAM WIRELESS SUPPLIES	127 Barking Road, E.6
EDGWARE	J. F. WISSON	2 Cheapside, Deans Lane
EDMONTON	E. J. HERAUD	78 Fore Street
ENFIELD	HOWARDS LTD.	31 Church Street
FULHAM PALACE ROAD	"ECONOMIC"	24 Fulham Palace Road
HAMMERSMITH	W. H. OATES	195 Hammersmith Road
HARROW	BATTERY SERVICE CO.	47 St. Annes Road
HARROW (NORTH)	GUARANTEED ACCUMULATOR SERVICE	23 Broadway Parade
HENDON	S. G. THAINE	192 Brent Street
HOLLOWAY	JONES BROS. (HOLLOWAY) LTD.	Holloway Road
ISLEWORTH	S. R. WEBB	191 Twickenham Road
LEE	A. BEDFORD & SONS	11 High Road
OXFORD STREET	SELFRIDGE & CO., LTD.	W.1.
NEW BOND STREET	KEITH PROWSE LTD.	159 New Bond Street
PALMERS GREEN	PALMERS GREEN RADIO SERVICES	15 Melbourne Park, N.13
THORNTON HEATH	D. L. KING & CO.	20 High Street
TOTTENHAM	B. HOGBEN, A.M.INST.B.E.	272 High Road, N.15
WEST NORWOOD	E. SHELDRICK	493 Norwood Road
WEMBLEY	MELODY HOUSE (J. C. MILLS)	56a Ealing Road
MAIDENHEAD	EVANS & SONS, LTD.	16/18 King Street
MIDHURST	V. DALE	North Street
NEWCASTLE	PAYNE & HORNSBY LTD.	7 St. Andrews Buildings
OXSHOT	H. G. & A. OSMAN LTD.	Surrey
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ROCHDALE	BANNISTER & FITTON	27 Milnrow Road
SLOUGH	G. CASE & SONS	2 Grove Parade, High Street
SOUTHALL	LAYTON & CO.	10 South Road
STAINES	V. & D. KEALE	Kingston Road
SUNBURY COMMON	J. SPIGHT	3 Station Road
TONBRIDGE	A. T. LANGTON	High Street
UXBRIDGE	WILLIS & SONS	278 High Street
WALTON ON THAMES	H. N. BULLEY	18 High Street
WATFORD	L. J. IVE	7 Clarendon Corner
WELLING	WELLING RADIO STORES	3 The Parade
WELLING (KENT)	S. A. HOLMES	Welling Corner
WEST DRAYTON	SPRATLEY BROS.	Station Road
WEST BYFLEET	A. LONG	1 Byfleet Corner
WESTERHAM	WESTERHAM WIRELESS STORES	High Street
WEYBRIDGE	E. W. FARROW	42 High Street
WINDSOR	S. A. SURPLICE	27/29 Sheet Street
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Advt. of Baird Television, Ltd., 133 Long Acre, London, W.C.2.

Printed by HAZELL, WATSON & VINEY, LTD., London and Aylesbury, and published for the Proprietors, TELEVISION PRESS, LTD., 505, Cecil Chambers, London, W.C.2, by THE ALDINE PUBLISHING CO., LTD., Crown Court, Chancery Lane, London, W.C.2. Address for advertisements, "TELEVISION" ADVERTISEMENT DEPT., 505, Cecil Chambers, London, W.C.2. Sole Agents for America, THE INTERNATIONAL NEWS COMPANY LTD., 131 Varick Street, New York, U.S.A. Registered for transmission by Canadian Magazine Post. Entered as Second Class Matter. March 15, 1929, at the Post Office at Boston, Mass., under the Act of March 3, 1879 (Sec. 397, P.L. and R.)