MAKING A LIVING IN RADIO

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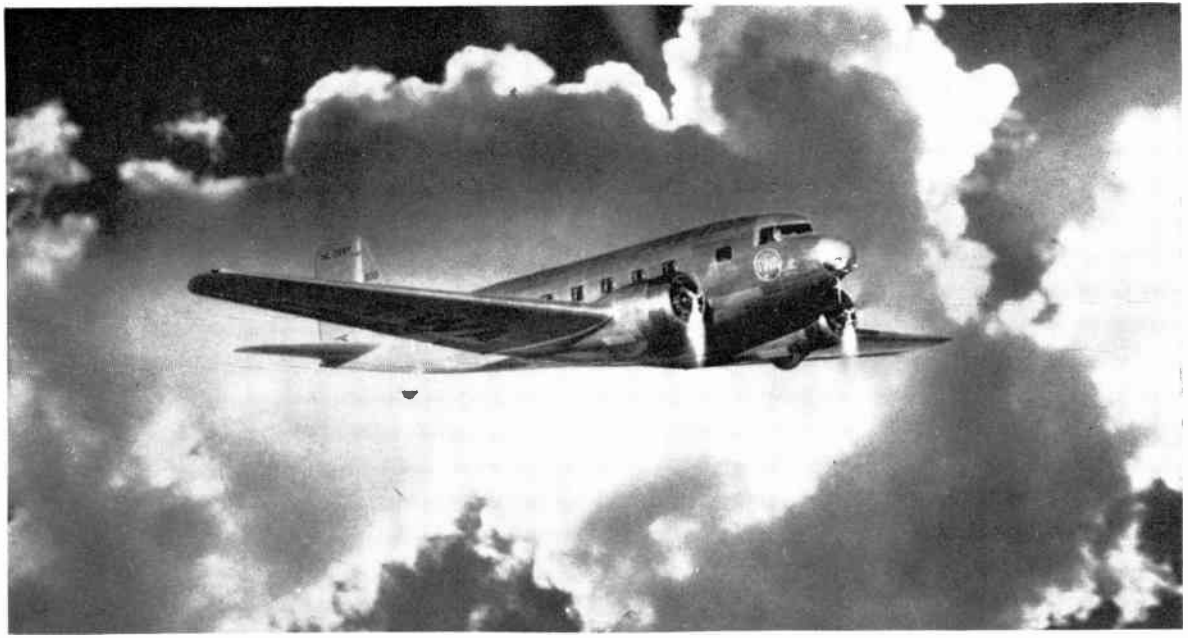

(*Frontispieee*)

"Neither snow nor rain nor heat nor gloom of night stays these couriers . . . " — guided by the tenuous beam of the radio lighthouse.

The radio industry is one, indeed, in which a man can make use of many secondary talents.

—FIRTH AND ERSKINE
(in "Gateway to Radio")

PREFACE

THIS book might have been written any time in the last ten years, but its justification would have been dubious. Making a living in radio, during the boom days of a decade ago, was relatively an easy matter. And the industry, with its opportunities, was in the throes of so violent an evolution that the utility of such a book would have been as ephemeral as some of the careers and circuits of those days. It may be that the implications of these two observations justify the emergence of this book at the present time.

In the stabilized state of the industry today, the ballyhoo can still be heard faintly—but only as echoes of past years, and subsiding, we trust, along the familiar curve of decrement. The bonanza days are over. True, the gold is still there, but it is not being dislodged in nuggets by a lucky stroke of the pick.

Considering the scope which the author has endeavored to encompass in this volume, it is obviously impossible for him to draw altogether from his own experience in its preparation. While his associations with radio are of prewar vintage—dating from the days when it was more properly called wireless—while

they range from operating to engineering in a minor way, and while fifteen years on both sides of the radio editor's desk have placed him in intimate contact with many thousands who are actually making a living in radio, the author has deemed it desirable to substantiate his personal ideas and advice by relegating to cordial collaborators, in different fields of radio, at least part of the burden of authenticity. He wishes to say "Thank you" to: Dr. Alfred N. Goldsmith; Carl Dreher, director of sound for R.K.O.; John V. L. Hogan; Ralph Langley, president of the Radio Club of America; Laurence M. Cockaday, editor of *Radio News;* his associates S. Gordon Taylor and Samuel Kaufman; Keith Henney, associate editor of *Electronics;* E. L. Bragdon, radio editor of the *New York Sun;* Hugo Gernsback, editor of *Radio Craft;* John F. Rider; Hoyt Haddock, president of the American Radio Telegraphists Association; J. E. Smith, president of the National Radio Institute; E. H. Rietzke, president of the Capitol Radio Engineering Institute; Ray D. Smith, president of the Radio and Television Institute; H. C. Lewis, president of the Coyne Institute; Walter H. Candler, director of the Candler System Company; Louis L. Credner, principal of the New York Y. M. C. A. Schools; W. S. Fitzpatrick of the R. C. A. Institutes; Kenneth B. Warner, secretary of the American Radio Relay League and editor of *QST*; Kenneth Hathaway, executive secretary of the Institute of Radio Service Men; the Personnel and Publicity Departments of the National Broadcasting

Company, the Columbia Broadcasting System and the Bamberger Broadcasting Service; the Personnel, Communication and Engineering Departments of Radiomarine, R. C. A., The American Telephone and Telegraph Company, United Air Lines, Eastern Air Lines, Transcontinental and Western Air Lines, Pan American Airways, Inc., and the Police Department of New York City.

To say "Thank you" to these persons, many of whom are friends and associates of long standing, and to these cooperating organizations is more than a mere gesture of formal appreciation.

As it has been obviously impossible for the author to have had adequate experience in all the fields of radio which he is endeavoring to cover in this volume, similarly it has been impractical for him to read all the books dealing with specific branches of the radio industry. And books—chronicles of things done in the past—provide the background of a radio education essential to genuine attainments. Books are mentioned freely in the chapters that follow. They are works that the author has personally read and studied—the majority of which, thumbed and annotated, are on the shelves of his own library. While these books are referred to only by name and author in the text, information regarding publisher and price is given in the appended bibliography, where these books have been reviewed briefly in an effort to acquaint the reader with their merits as applied to his individual requirements. However, as implied, there exists a

large number of other excellent books on all radio subjects. The reader will find these advertised in periodicals and catalogues, and they should be read and studied whenever possible. The author has never found all the things that could and should be said contained between the covers of a single volume.

A comparable problem has been encountered in reference to schools—correspondence and residence—teaching the various branches of radio and related subjects. There are many such schools, a number of which are, in all probability, destined to a short existence. It is hoped that the usefulness of this book will be of greater longevity than the life of the less permanent institutions; and thus, mention of them, even in an appended form, would hardly be helpful. The author's recommendation could be extended only to the half dozen courses with which he is personally familiar, which would be a matter of discrimination obviously less fair than his preferential bibliography. He deems the problem best met by endeavoring to show the reader how to choose the school—from the advertised galaxy—best suited to his own pocketbook, convenience and educational needs. Schools and colleges have been definitely named only when their uniqueness is such as to eliminate the commercial element of preferment, or when their statuses as national institutions—in the broad sense of the word—convey no specific recommendation.

Statistics and more general information as to opportunities and remuneration necessarily are those

obtaining at the time of writing. However, where justified, trends and tendencies have been indicated. Prognostication has been avoided. And, it is hoped that the generalizations behind conditions subject to the vicissitudes of economic vacillation will be such as to extend the usefulness of this book, even in its original edition, for some years to come.

ZEH BOUCK.

MIDDLEBURG, N. Y.,
September, 1935.

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FOREWORD

HAVING had the opportunity of reading this book on "Making a Living by Radio," I can say that fundamentally I agree with Mr. Bouck's views and enjoy his mode of expressing them. There is no occasion for him to apologize for his realistic presentation of a subject and for related advice that may mold the lives of some of his readers. I do not regard a cool and fair examination of facts as pessimism—but rather as friendly common sense. If the tone of his book is grim in some spots—well, so is the radio field as well. Assuredly, like other major competitive industries, it is no loafer's paradise nor yet a dreamland where vain and leisurely imaginings come true. Indeed, the sober and thoughtful presentation of facts in this book is vaguely reminiscent of the surgeon's job—direct, unsentimental, but tremendously constructive.

The facts that radio is a vast field even today and that one can envision some of its further expansions and proliferations are no reasons for regarding radio as a happy Utopia to which life's misfits can repair and be at perpetual peace. Radio, in the nature of

things as we find them in this corner of the cosmos, is a highly competitive activity functioning at just about the same level of difficulty and reward as most other human activities. It would be ridiculous to expect it long to remain otherwise. We do not expect to see mounds of water towering into the sky in the middle of the ocean and remaining ever at rest. Inevitably the tossing wave falls to the calmer level of the remainder of the ocean. It is well-known to be against nature for it to do otherwise. And if any field of human endeavor were so amazing a bonanza as some have believed radio to be, assuredly it would not be long ere the hurrying influx of those attracted to the field by its special appeal would so overcrowd it as to reduce it to the competitive level of other and perhaps more commonplace industries. The thoughtful reader will probably regard this as almost in the nature of mathematical proof of the absurdity of expecting radio long to remain a field which, by special dispensation, is secure against the problems besetting the other activities of the world.

As one who has had decades of experience within institutions of so-called "higher learning," I am prepared to define a school from one viewpoint as "a place where a good opportunity to learn and to improve himself should be offered to the student." This is the opposite of the theory that a school is a sort of intellectual hypodermic syringe whereby thoughtfulness and ability are injected painlessly into the fortunate student-patient. Schools are *not*

automatic providers of knowledge, wisdom and success. They are a sort of lapidary's grinding and polishing machine. Given a diamond in the rough, in the form of a capable, ambitious, and hard-working student, they may greatly assist in polishing him to the point where his innate brilliancy shines and is evident to the world. But given a mere pebble, in the form of an unqualified, casual and lazy candidate for life, their grinding does no more than reveal the inherently mediocre quality of the rough material. Schools do not make men—they help men to make themselves.

This brings me to a brief consideration of what is implied by engineering. Engineering is really a state of mind as well as the knowledge and ability that are the results of training and experience. The engineer, at his best, should be of an inquiring turn of mind, analytic in his examination of problems and alleged facts presented to him, opposed to sham and pompous pretense no matter how portentous, and ever seeking and utilizing that inspiration through which progress comes. Let the candidate for this difficult profession critically examine himself in the light of these criteria. It will be to his advantage.

It may be that the list of future ramifications of radio given by Mr. Bouck could be somewhat expanded. If so, there would be added or further emphasized the fields of ultra-short-wave broadcasting, communication and relaying; the fundamental improvement in the transmission and reception of the

short waves required for their fuller utilization in broadcasting; the wide acceptance of truly high fidelity reproduction of sound; the renaissance of the phonograph (possibly through radically novel methods); the systematic use of higher transmission powers as required for superior coverage; the expanded use of radio for overland communication covering small and moderate distances; radiodynamics or the remote control of mechanisms by radio means; facsimile communication and broadcasting; and lastly that stormy petrel of radio: television. Even a "glutton for punishment" will find enough to tackle in this group.

So it is the belief of Mr. Bouck and myself—if I read this book aright—that for years to come training, accurate self-appraisal, initiative and consistent endeavor will bring normal rewards in radio as they would in any other reasonably hopeful field. The returns are there awaiting him who will garner them, but they will not fall automatically into the laps of careless passers-by. The squared jaw and the shoulders thrown back are the symbols of success in radio as elsewhere. I regard this as a message of cheer and encouragement. But if this be pessimism, let the reader make the most of it.

ALFRED N. GOLDSMITH.

NEW YORK CITY,
September, 1935.

Chapter I

INTRODUCTION

IN FLYING circles there is a story that has been told and retold. It has rumbled down every runway in the country and echoed through every operations office and through the gloom of half-vacant hangars. It is officially known as the "gorilla story" and tells the sad tale of a barnstorming flier who "washed-out" his plane in a Texas bog. He had invested his entire capital in that crate, which, by a slight error in judgment, had been reduced to a heap of jackstraws with a few pieces of fabric fluttering an invitation to dine to strolling cattle—cows having an abortive taste for doped linen. It happens that a traveling circus was visiting a near-by town, and the flier, after patching himself up with judicious applications of adhesive tape, applied to the manager for a job. He showed him his license and explained that he was transport pilot with some 3,000 hours to his credit and no serious accidents. The manager laughed at him and said that, while he might be able to employ a man on the flying trapeze, a transport pilot was about the

last thing in the world he could use. The flier pleaded, explaining that he was dead broke and would do anything.

This gave the manager an idea. His gorilla, a featured attraction at the circus, had died that morning, and he offered the pilot $20 a week, if he would don the beast's skin, strut around the cage, show his teeth, and occasionally shake the bars. The flier accepted avidly. He put on two shows a day, and at night was happy to crawl on a bed of straw in his cage.

All went well for a couple of weeks, until one night a keeper, apparently making a mistake, turned a lion loose in the gorilla's cage. The flier awoke and saw the king of beasts staring him in the face. With a wild whoop for help, the pilot climbed the bars of his cage in true gorilla fashion, making altitude at a rate of climb he could never have exceeded in the cockpit of a plane—all the while continuing his frantic yells for help.

The lion stood quietly below, looking up at him. Finally the lion said, "Hey, pipe down. Do you figure you're the only transport pilot out of work?"

We might retell this story, substituting for the marooned aviator a radio serviceman, engineer, operator, announcer, radio writer or broadcast artist. Take your choice!

It has been said so many times that radio is in its infancy that one wonders if it will ever be graduated from swaddling clothes. The author feels that radio, like aviation, is suffering the growing pains of adolescence and is sprouting up like a pimply youth. (Phy-

sicians tell us today that there are no such things as growing pains, that adolescence, regardless of its manifestations, is a perfectly normal and healthy process. The tendency at present is to agree with this opinion.)

Radio, like flying, has suffered its figurative ups and downs. Similarly it has undergone the distortions of a thousand ballyhoos. However, both flying and radio have established themselves irrevocably in the scheme of modern life, and no one can doubt the solidity of their futures.

As a matter of fact, radio is today so well established that it is quite comparable to any other large industry, in individual and mass competition. It no longer offers the glamour and striking opportunities that existed in the pioneer broadcasting days of a decade back. The author does not believe that the opportunities for making a living in radio are truthfully implied in those school advertisements directed to an emphatic *you*, giving *you* the choice of plodding through life with a thin pay envelope, or riding luxuriously through the years in a high-priced car—the owner's certificate in your pocket alongside your diploma from that particular school. The coupon in the lower right corner, signed by *you*, *today*, is supposed to determine whether you will plod or ride. However, one cannot altogether condemn the schools for their "optimism," nor judge the merits of the courses offered by the exaggeration and unjustifiable implications in their advertising. They are no worse in this respect than manufacturers of toothpaste or

gasoline. Concerning naked truth in publicity and advertising, one may say with the Greeks, who have a word for everything, *mellonta tauta*—such things are for some future Utopia. Certainly frankness in advertising is not an American tradition.

Of those who sign the coupon and take the course, many will ride and many will continue to plod. It does not necessarily follow that all those who fail to clip and sign will always plod.

This attitude—the gorilla story, *et al.*—may seem somewhat pessimistic. Really it is not. Were the author doubtful about the possibilities of many thousands' making a better living in radio, this book would not have been written. As a matter of certainty, hundreds of thousands of unemployed today (comprising those of subemployment age and persons now working in other industries, as well as those simply "out of a job") will necessarily be making a living in radio within the next decade or two, and thousands will be doing so within the less remote future. It is inevitable that other thousands whose labors are at present associated with the industry will find themselves progressing, with the years, to better radio positions. (Equally great numbers are destined to receive along with their pay checks the information that their services will no longer be required.) If this and what is to follow in this introduction are pessimism, it is the sort of pessimism your banker affects when he advises you to put your money in a first mortgage paying 6 per cent, rather than in an oil stock flaunting 10 to 50 per cent dividends.

WITHIN THE LIMITS OF PERFECT ELASTICITY

In examining the possibilities of making a living in any field, it is desirable that those who like cake, or even bread and butter, examine the opportunities with a microscope rather than with rose-colored glasses. It is said that figures never lie—and it has been observed with equal truth that liars can figure. Statistics are, *per se*, truthful; it is only in their interpretation that elasticity enters.

In the year 1934 some 5,350,000 radio sets were sold. This was a 40 per cent increase over the preceding year and established a new record over the previous high of 4,438,000 receivers dispensed through the radio market in 1929. These figures have been interpreted to indicate a sort of radio renaissance, a return to the bonanza days of the late twenties, with renewed opportunities for everyone associated with the industry. Were he running a radio school and if he wanted students badly enough, the author would play up this peak-sales argument, and suggest that every reader of his advertisement climb aboard the refurbished bandwagon and race onward (no plodding here!) to prosperity.

However, the permanency of this increased production is to be questioned when the factors that contributed to it are inspected. In April, 1930, there were some 12,000,000 radio homes. Naturally, the equipment was purchased prior to 1930 or in the first three months of that year. During the years 1930, 1931, 1932, and 1933, the sales of radio sets (exclusive of

automobile radio, which would not affect the number of "radio homes"), were just about one-third more than enough to keep pace with the increasing number of radio homes. In other words, one-third of the sales during these four years consisted of replacements of obsolete equipment—for the greater part, old-type battery sets and the more antiquated alternating-current receivers. This left some 8,000,000 homes, at the beginning of 1934, with old radio sets. Between 1930 and 1934, these receivers, while not of the most modern design, could not be termed obsolete. They gave excellent service, had fair sensitivity and good quality, and were quite satisfactory. Also, they represented a substantial investment as they were bought during a period when the average price of manufactured receivers was $170! With these facts in mind—satisfactory reception and a relatively large investment, not to mention the lowered buying power of the American people during those years—two-thirds of the persons owning radio sets in 1930 had been fairly content with their receivers for three or four years.

However, by 1933, radio developments had progressed to the extent that these sets were virtually obsolete. The contrast with truly modern receivers, equipped with automatic volume control and the all-wave feature and operating with increased efficiency on fewer tubes, caused millions of set owners to consider seriously the desirability of investing in a new receiver. The idea was made triply attractive by the slightly improved economic situation in 1934, and by

the fact that the average price of receivers had dropped to approximately $45.

There are, obviously, millions more of these receivers to be replaced, a fact that should maintain the high level of set production for at least another year—and perhaps throughout 1936. It is reasonable to suppose that this period will be followed by a tapering off, as we approach the saturation point for radios in the home. The industry will then settle down to a definite, less erratic and permanent niche in the commercial world—until something new comes along to revolutionize the industry and render our present-day receivers obsolete once more. Ordinary progress—for certainly the industry will not stagnate—will push our present-day receivers toward obsolescence at only a snail's pace. A modern radio is well-nigh perfect. The tone quality of practically all receivers is aurally just about as fine as can be desired, while the high-fidelity models give us reproduction that rarely is appreciated outside the laboratory. Sensitivity has dug down into the noise level created by natural forces beyond our control. The modern receiver will respond to every wave length that, as far as most engineers can predict, will be practical for broadcasting purposes for many years to come.

With millions of radio enthusiasts still using receivers of pre-1931 vintage, there is little reason to believe that the purchase of a high-grade 1935 receiver will not be perfectly satisfied with his radio ten years from today.

TELEVISIONARY

Credit for the coining of this expression goes to that most versatile of radio engineers, Dr. Alfred N. Goldsmith. Television is, conceivably, the one development that may be next destined to relegate our present-day receivers to the shelves of obsolescence. Television has been dangled before the eyes of prospective "radiotricians" as the alluring prize that will lift them out of a plodding existence. However, it is doubtful that we need worry about television-induced obsolescence on the one hand, or, on the other, that we need rejoice over the immediate fortunes it will spill into our laps.

Television has been "just around the corner" for so many years, that the layman—not to mention a veritable army of technicians—has gone dizzy trying to catch up with it. Thousands have stepped in with their prognostications of television tomorrow—next year at the latest—where sober engineers have feared to tread. True—we have television today. But it is the same television that we had ten years ago, with the exception of a few refinements. The greater part of television research has been down a blind alley, blocked by physical considerations that seem permanently established and almost as invulnerable as the law of gravitation.

It is inevitable, in the writer's opinion, that some day man will fly to the moon. But he will not do it in the airplane or balloon as we know them today. Practical and popular television—television that will

flash concurrent and distant scenes upon a parlor screen with all the clarity of home movies and with no greater limitations as to scenic scope and detail—is equally a certainty of the future. But the chances are that the vehicle of transmission will not follow the lines along which most technicians have directed their talents. As to when television of this order will brush its beams across the canvas of a startled world, your guess is probably as good as mine. It may be that, even now, the solution is incubating in several laboratories. But when the idea is finally hatched, our television engineers and television technicians, diploma or no diploma, will have a lot to learn and unlearn before they can achieve wealth and fame.

It is significant that, almost without exception, every correspondence course with which the author is familiar and most radio residence courses play up the opportunities of television, featuring it as one of their fields of study. On the other hand, out of 100 recognized universities and colleges in the United States giving radio instruction of various kinds, only three of these institutions provide courses in television. (Television is necessarily touched in practically all radio engineering courses, but dispassionately and without emphasis.)

Again one must not be too harshly condemnatory of the correspondence and residence schools that ballyhoo television. Television has a strong appeal to the imagination of the layman, and, if one school, perhaps not overburdened in the matter of ethics (or maybe sincere in its belief of immediate possibilities), plays

it up, the rest must necessarily follow in the cause of self-preservation. The student will lose nothing in taking up television as it is taught in these schools. He will learn a lot concerning electronics, optics, frequency limitations of amplifiers, and physics in general, which will be of invaluable assistance to him in his radio work. The education of any radio technician would hardly be considered complete unless he were well grounded in the principles of television in its present stage of development.

However, television must be discounted somewhat drastically in an analytical consideration of the opportunities radio has to offer *today* to those who would eat. At the present writing, considerable publicity—a recrudescence as it were—is being given to television. While it is admitted that we are not "around the corner" yet, the possibilities are definitely more imminent. The technician should follow television closely, and, as a good technician, dispassionately.

"THEY ALSO SERVE—"

Unfortunately, the radio serviceman also is too often among those "who only stand and wait." It is difficult to do more than guess how many radio servicemen there are in the country. From figures supplied by the most prominent correspondence and residence schools, such institutions have turned out some 25,000 servicemen in the past five years. Untold additional thousands are self-trained—graduates from the hobby and amateur-operator classes. Yet an expert in the field, an executive with a national organization, feels

that there is room for only 10,000 servicemen, if they all want to make comfortable livings! This figure seems several times too low, but the discrepancy in opinions may be due to a variation in ideas as to what constitutes a comfortable living.

There will not be much argument if we take $40 a week—$2,000 a year—as a livable wage. Considering the cost of parts, overhead, miscellaneous expenses and depreciation, the serviceman will have to gross about double that, or $4,000 annually. There are approximately 25,000,000 radio sets in the United States. Let us assume that, on the average, they require servicing twice a year, thus providing 50,000,000 service calls. Taking $3 as an average service charge, this gives us a grand total of $150,000,000 spent per year for service work. Dividing this figure by the required gross income per serviceman, we find there is room for 37,500 servicemen.

This quotient, of course, is justifiable only on the assumption that all servicemen enjoy the same income, which, obviously, is fallacious. Some servicemen will average more than $40 a week. This makes it just that much harder for other servicemen whose incomes are necessarily forced below the average. If a minimum livable wage is assumed, as it must be, the effect of this inequality is to lower the number of servicemen to whom the industry can offer adequate support. Thus we find that there is probably room for 30,000 radio servicemen—as such. Yet, according to estimates prepared by house organs and other publications, there are between 40,000 and 50,000 (some claims go as high

as 70,000 to 80,000!) servicemen more or less actively engaged in the business. Of these, about 80 per cent are classed as independent, and the remainder are in the employ of the dealers and jobbers.

Fortunately, the serviceman is rarely entirely dependent upon straight service work for his income, and may augment it considerably by side lines such as public-address work, electrical wiring and radio sales.

It is safe to say that the really expert serviceman will rarely be in danger of starvation. On the other hand, the world is not necessarily waiting to welcome with open arms every graduate from a service school or every self-trained technician who may call himself a serviceman.

The only opening in the service field that seems to be uncrowded lies in Central and South America, where, according to one of the most prominent and conservative of the service schools, real opportunities are being offered to men who can transplant North American methods and results in those less aggressive climates.

IN EVERY PORT

A pleasant picture has occasionally been used to convince young men of the pleasures of an operator's life on shipboard. One usually sees swank young "Sparks," in full regalia, promenading up and down the boat deck with a fair damsel on each arm. Perhaps the scene is a palm-bordered boulevard on the Riviera. But the women are always there. It is never mentioned that operators are often forbidden to fraternize with the passengers; that in many instances

they are not permitted to wear their uniforms on shore; and that, on certain occasions, they must spend twelve hours a day on board the vessel when in port. However, once again we give the schools the benefit of the doubt. It could happen—and, knowing operators as well as he does, the author must admit the picture has elements of authenticity. Anyway, these are the least of the operator's problems.

All ships compelled to carry radio transmitters are adequately manned by operators; otherwise they would not be permitted to leave port. Similarly all land stations—point to point, coastal, aeronautical, broadcasting and experimental—are in charge of licensed operators. In other words, practically every available operating job is filled! Judging from a variety of factors, statistical and otherwise, which include the long nontraffic periods of many of these stations, the reductions in foreign trade, foreign travel, and shipbuilding, no startling increase in the number of commercial radio telegraphic stations is to be expected in the near future. (At the present writing there is legislation pending in Washington recommending the modification of the Federal Anti-trust laws so as to permit the amalgamation of communication interests. Such a merger would still further aggravate the unemployment situation in the affected fields. Whether this bill will pass cannot be prophesied, but the operator has been faced with similar possibilities before, and doubtless will be again.)

The situation in the broadcast field is comparable. There are, with the exception of a handful of short-

wave and experimental transmitters, approximately 600 stations. Some of these employ many operators. In Radio City, New York, about 120 operators are necessary to supervise the operation of the local circuits alone. On the other hand, there are around 500 relatively low powered broadcasters, which, with the exception of unusual schedules, rarely employ more than one or two operators. About 100 of these stations are rated at 100 watts or less; their owners are often licensed operators.

It is extremely doubtful that the number of broadcasting stations will increase, since we already have about six times as many as is theoretically desirable from the point of view of interference. It is only by dint of sharing time and apportioning power and channels in consideration of geographical location that the Federal Communications Commission has been able to squeeze these 600 into a veritable etheric Tower of Babel. Something akin to a major operation would be necessary to fit additional stations into this Procrustean bed of broadcasting. There is, of course, always recurrent talk regarding the possibility of new channels' being opened for broadcasting purposes, but we have gone just about as far as we can in that respect within the limitations of international agreement. True, this country has not as yet taken advantage of the 260–240 kilocycle broadcast band, and possibilities exist there for national coverage of unusual order. However, the realization of these possibilities to their fullest extent would limit the number of

additional stations to eight. That is all there would be room for with high-power full-time broadcasting. It is too early to do more than guess what opportunities the ultra-short waves will have to offer the operator. Certainly it is doubtful that such positions will more than absorb the present unemployed in the profession.

Aside from the technical difficulties encountered in an effort to increase the number of broadcasting stations is the consideration of public convenience and necessity, a powerful and justly used weapon in the hands of the Federal Communications Commission. Unless there is a real justification for the erection of a station, the commission will not even issue a building permit. Both our local and national broadcasting requirements are adequately met with the existing setup—a condition that becomes more evident as the modern superheterodyne, with its practically unlimited range, replaces obsolete receivers.

In 1924, there were 1,400 broadcasting stations operating in the United States! Today there are about 600. It is not unreasonable to look for a further decrease in the number of broadcasting stations, rather than an increase. Once more the improvement in radio receivers will be partially responsible. As national programs of the highest quality (not to mention foreign reception) become more readily available, the utility, necessity and public convenience of the low-power local station will be lessened—along with its value to the owner.

One school in its current literature estimates the number of licensed commercial operators at 18,000. According to government figures, the number is closer to 30,000! It is immaterial which figure you choose to believe. They are both subordinate to the more vital statement of the American Radio Telegraphists Association that there are about 9,000 operators unemployed, which is 6,000 more than were out of work in 1929. This increase in unemployment is due only partially to economic conditions. The brunt of the blame must be borne by the schools, which have been turning out operators faster than they could possibly find employment.

Only in one field of operating is the writer inclined to sense expanding possibilities (for men of special qualifications) during the next few years—and that is in aircraft. These are not so much in flying jobs, for on the majority of air lines the pilots hold radiotelephone operator's licenses and do double duty, but in the ground personnel, which will necessarily increase in numbers as the flying network spreads more and more intensively over the land. With the inauguration of transoceanic air transport, it is reasonable to believe that additional flying opportunities will be offered to the expert code operator.

In the meantime, the most encouraging thought that can be offered the operator is the reminder that his fellow brass-pounders are mortal, and that they hold their initial jobs, on the average, for only a year and a half (a little longer in hard times) before voluntarily relinquishing them for other posts or pursuits.

FIG. 1.—The maintenance of the aircraft radio equipment vital to modern air transport offers opportunities and good pay to servicemen who can meet the exacting qualifications of the airlines and for the Department of Commerce civil service positions.

FIG. 2.—These United Airline pilots are also licensed radio operators. With the exception of long over-water routes, strictly operating positions in the aeronautical field are limited to ground stations.

(*Facing p. 16*)

FIG. 3.—Learning the various phases of the electrical industry intimately associated with radio, in a modern residence school. (*Courtesy of Coyne.*)

FIG. 4.—A corps of stenographers and instructors is necessary to keep pace with the students enrolled in a large correspondence school. (*Courtesy of R. T. I.*)

THE SLIDE RULE AND THE BATON

Of the human characters playing the game of making a living in radio, the engineer is perhaps the least dependent upon the economic factors that largely govern the measure of success the average serviceman or operator may expect. He is well trained technically—usually with a cultural background broader than a page of logarithmic tables. As a rule he is an electrical engineer, which widens the possible scope of his activities. He can find a niche in almost any of the sub-fields of radio—as well as in other walks of life.

Unfortunately for many of us as individuals, and fortunately for the profession in general, we cannot all become engineers, who are only too often forced to rely upon their versatility in the scramble for livelihood. The engineering profession has for many years been overcrowded—as may be attested by the efforts of engineering societies to obtain even part-time employment for thousands of their members. The increase in the number of engineering students in colleges and universities for any given year is far ahead of the increases in other professional fields. The average increase in the number of students studying theology, law, medicine, dentistry, pharmacy, osteopathy, and veterinary medicine, from 1900 to 1930 was only 70 per cent, while the increase in engineering students over the same period was 550 per cent!

The employment of radio engineers does not necessarily parallel the prosperity of the industry as indicated by the number of receivers manufactured

and sold. The number of manufacturers involved in the production provides a more reliable index. It is only when this figure does not drop that increased production indicates more jobs for engineers. From the peak of almost 600 manufacturers in 1925, the drop was precipitate to something between 100 and 150 from 1927 on. The curve is saw-toothed, showing the ephemeral character of the majority of manufacturers. From 1922 to 1933, well over 1,000 manufacturers took their fling at radio manufacturing, and only 131 survived.

However, it is encouraging that the peak production of 1934—more encouraging than the figure itself—was the output of more factories than the number responsible for the previous record of 1929.

There are, of course, radio-engineering positions other than those associated directly with the design and manufacture of radio receivers and their components. The larger radio stations require their constant services, and the limitations here imposed are the legal, technical and economic considerations already discussed. Thousands of engineers are employed in experimental, research and development work, the magnitude of which varies with changing economic conditions. There is also the independent and consulting business. But this last is limited to the experienced engineer with proved success behind him. The young engineer with his sheepskin under his arm cannot, like the lawyer and doctor, hang out his shingle and wait for customers. Our physicians and barristers will grant he is better off!

As implied above, many radio engineers find it impossible to make a living in their chosen profession. In the past few years the writer has received many letters from graduate engineers who would like to venture forth as radio servicemen and who desire advice regarding preliminary equipment, outlay and preferred territory. Hundreds of engineers, usually ex-amateurs, take up operating. Some of them forsake engineering altogether and peddle insurance or write books.

The stick the orchestra leader waves before the microphone is a baton—not a fairy's wand. Artists, script writers, musicians and announcers are confronted, not only by the usual discouragements of those who follow the so-called aesthetic pursuits, but also by the additional limitations that prevent an indiscriminate expansion of broadcasting facilities. Like the radio technical writers, editors, salesmen, executives, factory employees and publicists, they must also bow to the always varying degree of economic prosperity.

THE SILVER LINING

The author has endeavored to present a reasonably fair picture of the radio industry—a picture that places it among the other highly competitive industries of the world, with which it bears at least the moral burden of an unemployment quota. The bonanza days are over. The gold is being excavated more slowly, and the oil no longer gushes forth, but must be pumped from the well.

At this point, one can hardly blame the reader if he asks, "Then why this book?" or, more personally, "Why do you suggest that I go in for radio?" As a matter of fact, there would be little sense in this book if conditions remained as they were in 1925. One does not need to read a book to acquire the technique of picking up a gold coin from the sidewalk. As for going in for radio, the author suggests nothing of the kind. If you have inclinations in any other direction, by all means follow them. Where your interest really lies, there are your best chances for success. If you have no inclinations at all by the time you are old enough to read this book, you are unfortunate. You will have to struggle doubly hard—find yourself—before you will succeed in radio or in any other field.

As the average child nourishes ambitions that involve cowboys or policemen, the average public-school graduate has an incipient leaning in some direction, stimulated subconsciously by innate ability and psychological qualifications—an almost unfelt force that tentatively molds the clay. The next few years are like the potter's wheel. The clay takes form. Few youths are graduated from high school—or arrive at high-school age—without a definite idea of what they want to do. Usually it is the thing they can do best. From this point on it will be difficult to remodel the clay without cracking the form. True, some clays are always plastic and can be worked over and over again. But things of timeless beauty and worth are never made from them. In pottery, such clay is known as plasticine—in life, as a Jack of all trades.

If your interest is in things technical, preferably in an electrical direction, or if, for any other reason, you feel that some inherent talent will find its most facile expression among the varied possibilities offered by radio, then by all means do justice by it. Perhaps this book will help you.

Which brings us to its *raison d'être*—the reason why its author believes that the radio industry, one highly competitive field among other equally competitive fields, offers greater opportunities to anyone interested in radio than any comparable endeavor. This is simply its appeal to versatility—to a variety of abilities or genius. In its house are many mansions. There is a place for the mechanic and the scientist, the writer and the engineer, the extrovert (the operator) and the introvert (the artist); there are places for those who work best in harness and for those who crave independence; faraway places beckon to the foot-loose and hearth fires burn for others. Psychologically, radio has a fascination all its own that lures, intriguing the imagination. *In no other field are the facilities for training so readily available.*

The radio schools, whose enthusiastic propaganda of radio possibilities we have endeavored to temper with common sense, have accomplished two very important things. They have opened the door of radio education to practically everyone, and they have emphasized (to put it mildly) the necessity for technical training in most radio pursuits. However, in their enthusiasm over the exaggerated possibilities of radio, they have neglected what seems the best argu-

ment in favor of thorough training, namely, the fact that *it is particularly essential owing to the highly competitive nature of the industry*—not because fortune is waving a frantic hand to anyone who can wave back with a diploma. When radio was not stabilized as it is now, when radio was genuinely in its infancy, when there was *less* individual and mass competition, technical training was of relatively little importance. Money—not to mention fame—of no mean magnitude was made in those halcyon days by persons whose radio training was worse than none at all. These "technicians" and "engineers" dropped out only as competition increased. Those who were wise enough to see the writing on the wall secured training in one way or another and grew up with the industry.

In a nontechnical field it is possible to achieve a moderate or perhaps even phenomenal success without special training. The day is not past, though it is on the wane, when the office boy can raise himself to an executive position in a brokerage firm or a shirt factory. But even in these relatively nontechnical pursuits, he will find his advancement more consistent and rapid, and his ability to compete with the college-trained son of the president much greater if, in the first instance, he studies banking, finance, and economics, and, in the second, learns to know textiles and salesmanship.

It should go without saying that in the technical sub-fields of radio adequate training is an absolute necessity. This fact cannot be overemphasized. Haphazard self-training, the tinkerer's knowledge of his

hobby, will be of little avail. Not only will your technical insight be unable to cope successfully with the problems you will inevitably encounter, but also you will be forced to compete with men who know radio. Other things being fairly equal, success will go to the best trained.

It is in recognition of this fact that detailed consideration will be given to the problem of training in the chapters that follow. The matter of securing an education for making a living in one or more of the various radio fields will vary with the individual in accordance with his natural qualifications, his past experience, his pocketbook, his present employment situation, his inclination, his geographical location, his previous education, his age and other factors. An effort will be made to present a sufficiently complete description of the means and methods of radio training so that every reader can fit himself somewhere into the picture.

It will be logical to consider the serviceman first—not only because he is representative, in numbers, of the largest branch of specialized radio workers, but also in view of the fact that his educational requirements and degree of training are the first rungs on the technical ladder.

Chapter II

THE RADIO SERVICEMAN

SEVERAL factors, aside from the *relatively* low order of technical requirement, contribute to the facility and convenience of training for radio service positions. There are no limitations imposed by age, education or previous experience, and a system of study can be chosen that fits both the pocketbook and the student's employment status. However, ease of training is not the only argument which makes service work attractive and which is responsible for the fact that there are a greater number of people more or less actively engaged in this field than in any other technical branch of radio.

Radio servicing may be exacting, but it is not laborious and it retains its share of the fascination associated with radio in general. Also, the semi-professional status of the serviceman appeals to the prevalent element of snobbery—a psychological factor. The work is clean, it is technical, and it requires skill; snob or no snob, the expert may be justly proud of his proficiency. It offers whatever degree of independence

the serviceman finds appealing to his personality. Genuine possibilities exist for the master hand. They may be developed along various lines—the building up of a large organization, designed exclusively for service, expansion through side lines including public-address systems and motion-picture-projector servicing, servicing of electrical appliances, the establishment of a retail or wholesale business, and, through technical advancement, extension into the engineering field.

The service business itself requires a comparatively small initial investment, and the overhead can be readily kept within limits consistent with the serviceman's success. While the field is by no means untouched, there is probably a sufficient number of territories that would welcome an expert serviceman to provide him with a wide choice of localities in which to operate. Within reason, there are no physical requirements—with the possible exception of the field of aircraft radio. To the best of the writer's knowledge, nowhere are state examinations or licenses required for radio servicing alone.

In speaking of the "relatively low order" of technical ability required of the radio serviceman, the author does not mean to imply deprecation of a serviceman's qualifications. Certainly, the necessity for adequate training must be stressed. While the serviceman need not be an engineer and his radio education need not be so comprehensive as that of an operator, his knowledge should represent intensive study and, often, years of experience. He is no screw-driver

mechanic. In addition to being well grounded on the fundamentals of electricity, magnetism and radio, he must have an intimate insight into the characteristics of various classes of receivers and the peculiarities of many individual models.

TRAINING FOR RADIO SERVICE WORK

From the experience of the writer, which includes ten years of contact with servicemen all over the world, the tabulation given below, listing the manner in which special training for service work has been acquired, would seem justified. As these figures have been previously published and read by many statistical experts in the field without challenge or criticism, it would appear that they are reasonably well founded.

Correspondence schools	50%
Residence service schools	20%
Residence training as part of regular schooling—manual training, etc	5%
Total specially trained	75%
Self-trained	25%
	100%

This tabulation is based on a number of attempted reconciliations, including personal observation and a compromise between the claimed circulations of magazines and the house organs distributed among alleged servicemen. It is assumed that there are approximately 40,000 reasonably well trained men more or less actively engaged in a regular service

business. A discrepancy of a few thousand in either direction will not alter the logic of the table (page 26).

Self-trained radio servicemen are recruited from the ranks of commercial operators, amateur operators, and broadcast fans who have taken their hobby seriously enough to look into it and find out what makes the wheels go round. Of course, the average commercial operator is the product of a training school where the fundamentals of radio have been well inculcated, though many are graduated more or less directly from the ranks of amateurs.

It may be stated here that *one's training as an amateur provides the finest foundation for any sort of radio work—from servicing to engineering.* The amateur is exceedingly well informed on radio because to him learning is a pleasure. His heart, as well as his ambition, is wrapped up in radio. Many of today's foremost engineers were amateurs twenty years ago.

The percentage of school-trained men in relation to self-trained men is steadily increasing—a consideration of some significance, though it may be partly explained by the fact that relatively few radio service courses were available a decade ago.

RESIDENCE VS. CORRESPONDENCE SCHOOLS

There is no disputing the superiority of residence training over that by correspondence. The intimate contact with the instructor, the association with students facing similar problems, the completeness of equipment, and the discipline are all conducive to a rapid and thorough assimilation of knowledge.

There is a tendency in all fields to place greater confidence in the graduate of a residence school than in an alumnus from a comparable correspondence school. In many instances, correspondence-school education is subject to ridicule. A large part of this feeling may be attributed to the greater significance of a residence-school examination. With the texts at hand, plus a number of reference works (a simple matter of perfectly safe cribbing), and unlimited time, next to no residual knowledge is required to pass a test by correspondence, regardless of how difficult it may be made and how severely it may be marked. On the other hand, working against time, with no books other than perhaps a volume of mathematical tables and formulas, the memorization of which is not required, a passing mark is certainly indicative of assimilated learning. In the Columbia University Home Study (correspondence) courses, the same texts are used as are employed in their extension and regular college curricula, often under the guidance of the same instructors and professors. A certificate is issued upon the "satisfactory" completion of the various courses; this, however, does not confer points toward a degree, as would be the case in residence study.

Obviously, this is most unfair to the conscientious correspondence-school student. The author would prefer to hire a sincere graduate of a by-mail course rather than a residence-school graduate who did not cheat merely because the vigilant eye of the instructor was on him during the tests. Unfortunately, there is no sure way of effecting this sort of discrimination, and

the correspondence-school student must suffer as a result.

Residence schools, as a rule, are cheaper, as far as tuition is concerned, than the correspondence variety. The average cost of several residence radio service courses is $75, while equivalent training by a similar number of correspondence schools averages $112. There are exceptions, naturally enough. When the residence training is costlier than the correspondence-school training, it is because the resident student receives an altogether different and more intensive instruction—usually of an engineering character. On the other hand, some correspondence courses are much cheaper than the average residence training. These courses are usually of a somewhat abbreviated nature, or they may be directed to more or less established servicemen on the assumption that they have already acquired the fundamentals of electricity and radio.

However, the economy of residence training holds only when the student is fortunate enough to live at home within economical commuting distance of the school. Of course, it may be maintained that a person has to live anyway—at home or otherwise—but in many instances, particularly in the case of youthful students, living expenses need be taken into consideration only when they are stationed away from home. Under such circumstances the cost of residence training may greatly exceed that of learning by correspondence. Living expenses will naturally vary with the location of the school and the taste, habits and financial status

of the individual. Most residence schools indicate in their literature the minimum cost of living in clean boarding houses—usually with a private family—within reasonable distance of the institution. For instance, in Valparaiso, Indiana, $4.75 a week will take care of room and board. In Washington, D. C., the cost is higher and is estimated at from $30 to $35 a month, depending upon whether the student desires a private room or is willing to share his quarters with a fellow pupil. The same figures hold for Los Angeles, California. Laundry, recreation and incidental expenses will average about $20 per month, and this figure must receive consideration in estimating living expenses.

It occasionally happens that the student can find part-time employment while attending a residence school; this provides a welcome boost through the term of tuition. Some schools feature this possibility, one institution claiming that over 70 per cent of their students pay for their room and board by means of jobs that the school has aided them in securing. However, we should not advise the prospective student to depend too heavily upon this possibility. There are not many positions these days which will pay $30 to $35 a month to an employee who attends school from 8 A.M. to 4 P.M. and which will still leave the student fit to cope with his schoolwork.

Many—perhaps most—prospective radio servicemen are forced to make a living during the usual periods of study, that is, on a daytime job; this eliminates them as possible students in most residence courses. How-

ever, in the large cities, vocational training can often be secured in evening instruction.

Where residence attendance is physically inconvenient or impossible, recourse may be had to home study. This is a thoroughly tested and effective method of attaining a radio service education. It is the opinion of the writer that, despite the great advantages of class and laboratory attendance, the student who completes a modern correspondence course to his satisfaction—*providing he is his own and severest critic*—has every bit as much chance for success as the graduate from a residence school. The reason for this is that the home-study serviceman has made good altogether on his own, without the moral support of the class and the discipline of the instructor, and he has demonstrated a conscientiousness and application that augur well for his future work.

The correspondence schools are making every effort to compensate for the desiderata of home study, as well as to provide features not found in residence courses. The lessons in most of the various courses that have been inspected have been carefully and intelligently prepared. There is every reason to believe that, in the better schools, the student examinations are thoroughly and conscientiously corrected by the distant instructor. (He does his share—the rest is up to the student.) The regular instructing staff is usually supplemented by a technical or consultation board, composed of competent engineers whose vital function is keeping the course up-to-date.

Most of the correspondence schools endeavor to make up for lack of laboratory facilities, to a slight extent, by furnishing equipment sufficient for a course of experimental work—usually kits of parts, from which oscillators, vacuum-tube voltmeters, ohmmeters, etc., can be made, and which, following completion of the course, can be built up into permanent test equipment. This practice, however, is not universal. In schools where a large percentage of the students are already holding radio jobs, it is justly assumed that equipment and facilities are available. As a matter of fact, the outfits supplied by the other schools do not comprise anything like an adequate laboratory (nor are they intended as such), and they should always be supplemented by additional equipment as the student progresses.

The majority of correspondence schools devote a part of their courses to the merchandising end of servicing—sales promotion, publicity advertising, etc., which is helpful in many instances and unessential in others. To quote the head of a prominent correspondence school: "When a serviceman enrolls with us, we assume that he has a mechanical knowledge of his profession, that he has access to service manuals and that he keeps up with current publications and trade papers. Our idea is to take him from that point and give him a practical technical education in his profession."

The correspondence schools, as a rule, go in for mathematics a bit more extensively than the residence courses, carrying the student through algebra, trigo-

nometry and geometry (the latter two subjects being elective in most cases).

Correspondence schools (as well as many residence institutions) maintain a consultation service that becomes available immediately upon matriculation and continues at the disposal of the student after graduation. This may be of benefit to the serviceman after the completion of his course, when he is confronted with unusual problems, technical and otherwise, in the field. One correspondence school has organized an alumni association, with chapters that are rapidly spreading across the country. These chapters meet at various times to discuss current problems besetting the serviceman. Such postgraduate activity is often supplemented with bulletins and house organs.

As we indicated before, there is practically no age limit or previous educational requirements predicated for radio service courses. In some instances two years of high school are desirable, but it is implied that this stipulation is elastic and instruction will be given to anyone who can convince the director that he is capable of following the course. As a matter of statistics, the average preeducation of students enrolling for service courses, both resident and correspondence, is two years of high school.

The only correspondence school that is known to provide an age limitation accepts students from sixteen to fifty years. The average age of correspondence students is twenty-six years. The correspondence schools, in general, are more elastic than the resi-

dence schools in reference to age and preparatory education.

The time required to complete residence courses is usually definitely established, ranging from three to six months. Some schools permit the student to take as long as he wishes. With the exception of engineering courses, classes can usually be entered the first of any week throughout the year. Correspondence courses can be commenced at any time, and the rapidity with which they are completed depends upon the student and somewhat upon the nature of the course. The average period of tuition is fourteen months. Unlimited time is permitted in some courses, while others stipulate a maximum of two and a half to three years.

Both residence and correspondence courses can be purchased for cash and on the installment plan. A discount, generally about 10 per cent, is allowed when the full price of tuition is paid with registration. Some by-mail courses are sold with a money-back guarantee; advantage may be taken of this, even after the course is completed, if the student is dissatisfied. In all courses, both residence and correspondence, some rebate may be had, if demanded within a reasonable time.

No school definitely guarantees a job following completion of the course. The amount of employment assistance may or may not come up to the promises implied in the school literature. However, the diploma or certificate of graduation will never be a drawback in obtaining a job, and some degree of direct help from the employment services of the various schools may be expected.

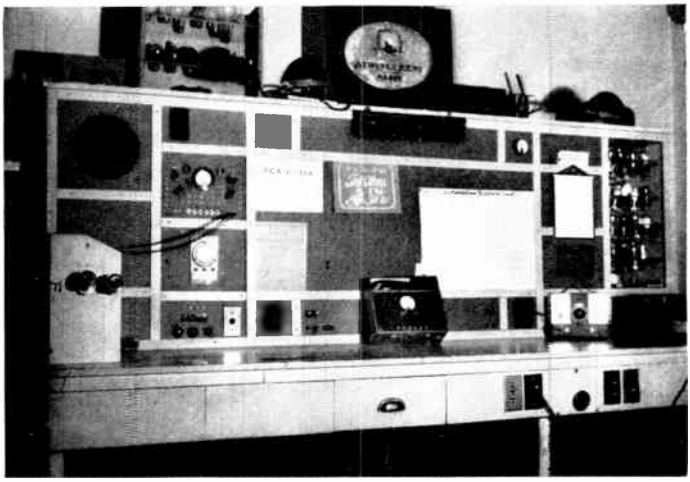

FIG. 5.—A modern service bench. By mounting the more important apparatus on removable panels, such test sets can be made to serve both as portable and shop equipment until business warrants duplication.

FIG. 6.—The business end of servicing is just as important as the technical angle—the office just as important as the shop.

(Facing p. 34)

FIG. 7.—The sound truck provides a profitable sideline to the serviceman. In order to save money, this truck has been so constructed that it can be reconverted into a coupé in short order. (*Courtesy of Radio News.*)

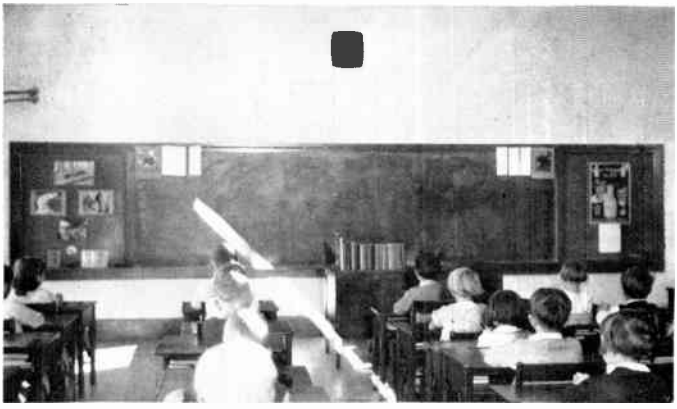

FIG. 8.—"Central schools" offer possibilities to the rural serviceman and electrician for the installation of class-room P. A. equipment. The loud-speaker is in the center—above the blackboard.

CHOOSING A SCHOOL

Deciding on the "best" radio course will be a matter of individual requirements, finances, inclination and convenience. In the foregoing paragraphs there have been outlined various features that should assist the prospective student in making a choice well adapted to his particular needs.

Several considerations apply equally to residence and correspondence schools. Do not be overinfluenced by ecstatic sales literature featuring the possibilities of television, aircraft-radio servicing and the employment service rendered by the school.

We have considered the matter of television in our introductory chapter and have pointed out the dubious opportunities offered in this field at the present time and under the systems now being taught. Television training can do the student no harm—if too much time is not wasted on it—and the insight it provides into optics and electronics contributes to a well-balanced course. However, some courses, both residence and correspondence, actually make no mention of television. Such courses should not be condemned for this neglect, as the subject of electronics almost invariably receives adequate consideration in the study of vacuum-tube and photoelectric cell theory and operation.

Many schools take advantage of the Lindbergh psychosis and exaggerate the fascinating opportunities offered in aircraft-radio servicing. Aircraft apparatus is considered in some courses—which is all right as far

as it goes. Familiarity with a wide variety of equipment builds up a background of general radio knowledge that is highly desirable in tackling specific problems and holding down a specialized job. However, breaking into the field of aircraft radio is not the easiest thing in the world.

The Boeing School of Aeronautics has set up certain standards of technical qualifications for various positions associated with flying; these standards have been adopted by at least one major air-transport company. It is quite possible that other companies will follow suit, and it is certain that they will be influenced by the recommendations of this organization, which are based on many years of experience and study of factors contributing to safety in the air.

To start with, a high-school education or its equivalent in home study or experience is required. So far so good. Proficiency is desirable in algebra, geometry, trigonometry, chemistry, physics, English, typing, mechanical drawing and machine-shop work. This is merely preliminary to intensive training in the Boeing Airline Mechanic Course, which is one of the qualifications for the position of "radio electrician." This course takes seven hours a day for twelve months and costs $800. In addition the following requirements are stipulated: "Thorough electrical experience, ingenuity, dexterity and ability to check and diagnose radio troubles; Airplane and Engine Mechanic's Licenses valuable." A degree of physical soundness, established by examination, is also insisted upon.

These qualifications are not so unreasonable as they might appear at first sight. For example, the writer knows of a case where a radio serviceman—an expert—was assigned a bonding job on an airplane. Bonding is the process of making certain that all metal parts not rigidly fastened are grounded to the fuselage, eliminating the possibility of accidental contacts within the antenna field which would result in noisy reception. The serviceman bonded a rudder cable to a flipper control tube (which he had mistaken for a longeron). The bonding was effected with a strip of brass and was efficiently soldered. If he had actually located the longeron, only the rudder would have been put out of commission. As it was the elevators were also jammed—a fact that was immediately discovered, of course, when the pilot warmed the motor and attempted to raise the flippers before opening it up. In a second instance, the author, and at least two others, narrowly escaped what certainly would have been a fatal crash, caused by a radio expert with inadequate knowledge of a J-5 motor who installed the ignition shielding.

All things considered, it is possible that some time will elapse between the student's graduation from his first radio-servicing course and the time when he will be able to make a living in the aircraft-radio field. However, the man who can qualify, in accordance with the requirements outlined above, is assured of a well-paid, permanent and probably immediate position.

As we have previously implied, too much stock cannot be taken in promises of employment upon the

completion of a course. The more definite such promises, the more they should be sniffed at suspiciously. To quote the president of a prominent radio school giving both resident and correspondence training (and a combination of both): "I would like to emphasize that, in the final analysis, we believe that the burden of getting a *job rests on the student.*) We are very careful in all our correspondence and talks with prospective students to completely avoid any promises of jobs or insinuations that we will get them jobs. We don't believe that *any* school can *honestly* make such promises." The italics are those of the authority quoted.

On the other hand, it cannot be doubted that the executives of reputable schools can be of assistance, and often are, in placing their graduates.

The choice between a residence and a correspondence school, as determined by fairly obvious factors, is easily made. Similarly, the selection of a particular residence school entails little difficulty, particularly if it is in your home town. Residence schools welcome visitors, and you should have no difficulty in determining the suitability of the course to your own needs. If you must move in order to take a residence course, the matter becomes slightly complicated. You will find the entire roster of schools advertised in a collection of three or four radio and popular semi-technical magazines. Do not be overimpressed by the spectacular. Some fine and well-established schools, as well as the fly-by-night variety, go in for advertising ballyhoo. Conversely, some of the best schools dis-

tribute literature of a sober, dignified and low-powered nature. If possible, seek the advice of a friend who may know more about such courses than you do, but do not accept any opinions that you suspect may be dictated by prejudice or ignorance.

Finances will probably govern to some extent how far away you can go and what course you decide to buy. Determine as definitely as possible, by direct correspondence, the probable living expenses and the possibility of your securing part-time employment (if the latter is an important consideration). Do not depend on the school's literature for this information. Conditions may have changed since those particular data were last revised. The question of employment will govern your choice of day or night school.

Other things being equal, choose a school as close as possible to your future territory of operation.

CORRESPONDENCE SCHOOL COURSES

During the last few years the writer has inspected a good number of correspondence courses. Five of them—the best known—form a not inconsequential part of his reference library. The large majority of such courses are well conceived and executed by technical and pedagogic experts. Unfortunately, there are courses that are worth little more than the paper they are printed upon. True, they contain most of the essential data—from Ohm's law to the equation for resonance in terms of positive and negative reactance. As a consequence, they can be sent through the mails without the publishers' being hauled into

court on fraud charges. However, it is doubtful if the average student could assimilate much in the way of radio knowledge from them, and the chances are his reaction would be such that his interest, and even his ambition, would not survive the ordeal of going through more than a dozen pages of the half legible and poorly presented material. The writer has had letters from such students, expressing dissatisfaction and seeking advice that is sought too late.

Thus, while the chances are that the prospective serviceman seeking instruction by mail will enroll with a reliable and conscientious school, since they are the most numerous, it is quite possible to be "stuck." If the student is at all doubtful concerning his own judgment in the matter, he should, by all means, consult an expert, preferably a friend, who will be able to judge from the first few lessons (if it has gone that far) the potentialities of the course. Naturally, the recommended ounce of prevention is even more desirable; most servicemen can tell you, from experience or general information, the courses that find favor in the trade. Most of these are well-known and are widely advertised in the popular science and radio magazines. As in the case of investigating residence courses, literature should be collected and critically perused.

Any course that does not permit a refund of money paid in, after inspection and usually a month or more of study, should be avoided. As mentioned above, several of the more prominent schools will repay every cent of tuition if, upon the completion of the course,

the student is not entirely satisfied. Such institutions obviously have confidence, not merely in their courses, but in human nature.

Courses of a comparable scope do not vary much in price, so there is relatively little shopping to be done on this score. Possible financial saving depends more upon the amount of radio training the prospective serviceman requires. If you are already fairly well grounded in the fundamentals of electricity and have a reasonable amount of radio experience, preferable with a service background, it is quite possible that you can safely dispense with the more elaborate and extended courses. At least one school, which appears to be well established and prospering, has prepared an adequate set of instructions, with full corresponding facilities, for just such cases. The cost is less than one-fifth that of schools which carry the beginner from A to Z.

While most of the full-length courses are based upon engineering, some stress the service angle more definitely than others. Here again the preference will differ with the individual, who should determine, as far as possible, the probable direction of his activities upon completion of his studies. Some schools prepare the way more or less directly for radiotelephone and telegraph operating—a consideration that will appeal to some students and not to others.

The more strictly service courses are usually so planned that the student, upon completing a dozen or more lessons, can begin making a little money on the side with minor service jobs. Though such a

presentation may interfere somewhat with the logical development of the course, it is often desirable from a financial standpoint, and should be considered by the prospective student. However, once again, do not let optimism override common sense. Odd pennies are not picked up so easily as sales literature might lead you to believe, particularly when you may have to compete with an expert who has completed the entire course.

While most of the full-length service curricula will start from the beginning—without consideration of previous education or training—some of them go more deeply into elementary factors than others. It is well to examine frankly your educational shortcomings and to consider the complementary value of the different courses. This is particularly true in reference to mathematics, if you are going to make the most of sound work—public-address systems, talking-motion-picture installations, and similar endeavors that more closely approach an engineering status. The amount of available mathematics is not always definitely stated in the regular school literature, and it is well to ascertain this through direct inquiry.

Some of the service courses provide data on and detailed instructions for servicing specific receivers. While this may be desirable as a matter of example, the amount of such material included should not necessarily influence the prospective student one way or the other. Later on, he will depend upon the service manuals, not his course, for diagrams and relevant details.

While the correspondence schools are usually very prompt in correcting lessons and sending out additional assignments (students are furnished with more than one lesson at a time, so that they are never out of material), other things being equal, it is logical to enroll in the nearest school. Some time, naturally, is saved, and the pupil is more likely to receive the corrected lessons while they are still fresh in the mind. This, however, is a minor consideration.

SELF-TRAINING

Fundamentally, all training is self-training. Here we use the phrase loosely to describe a more or less informal method of instruction.

With the exception of students starting from scratch, and those who are psychologically unfit for the assimilation of technical knowledge without extended consultation and instruction, there is no reason why the serviceman cannot be self-trained—at a cost considerably lower than that of a formal course. But it is essential that the student have had some experience in radio, preferably as an amateur operator, and certainly as an ardent enthusiast who has built much of his equipment.

Normal individuals fall into three psychological classes in reference to their ability to learn, but the lines of differentiation are not clear cut. In the first class—probably the lowest on the intellectual ladder—are the people who say, "I can't learn from books." This is not strictly correct. What they really mean is, "I can't learn unless someone interprets the book

for me, elaborates upon it, and makes clear to me points that may not be obscure to others." Such a person can learn radio only in residence school, where the instructor is present to answer any and all questions—often the same problem in several ways, as well as many queries that are the immediate by-products of an original question. In a correspondence school this sort of a student, who could of course be graduated, would progress slowly and with a sense of dissatisfaction. He would ask questions of his instructor, which would be answered correctly and in detail. But in many instances the answers would not be much clearer to him than the text that covered the same question. He would naturally be hesitant to press the matter further for fear of wasting time or because of pride. On the other hand, he may think that he gets the point, when he does not understand it correctly at all. An instructor in a residence school is quick to sense the fact that a pupil is doubtful or has incorrectly interpreted his explanation.

In the middle class are those students who get along fairly well by themselves. They find it necessary to ask questions, but a single answer or explanation is sufficient either to solve the problem or put them on the right track to its solution. Upon graduation, if they are conscientious, the chances are that they know radio just as thoroughly as the residence-school graduate.

In the third class, the highest in respect to ease of assimilation, is the person who merely needs to be given books to learn the static side of the subject.

After all, a correspondence course is nothing more than a big book—plus instructors who will grade you and answer questions. (Certain courses also supply equipment, which the self-training student can readily duplicate in the open market, and which the correspondence pupil will have to augment anyway.) If you can answer your own questions, you are quite capable of grading yourself.

If a knotty problem is not answered to your satisfaction in one book, you will find it satisfactorily solved in another. *This is an important point in self-training.* The writer knows of no book in which everything is adequately written concerning the subject treated. The mathematical chances are against any point's being considered the same way (with the same brevity, style, approach, detail, etc.) in any two books. *Never depend on one book.* (Since, as we have observed, a correspondence course, *per se*, is a book, it follows that outside reading is highly desirable, even essential, in such courses. The books recommended below for self-training provide excellent supplementary reading with correspondence courses. Their use is, needless to say, desirable even with residence courses, and they provide an excellent nucleus for the radio library.)

The following books are recommended for students interested in self-training: "The Art of Learning," by Walter B. Pitkin; "Radio Physics Course," by A. A. Ghirardi; "Practical Electricity," by Terrell Croft; "Principles of Radio," by Keith Henney; "Elements of Radio Communication," by John H.

Morecroft; and "Radio Servicing," by A. A. Ghirardi and B. M. Freed.

It is desirable to supplement self-training—to trim off the rough edges—by reference to some single comprehensive presentation of the subject. Used correspondence courses are available at relatively low prices, and are excellent for this purpose, as are the inexpensive and short courses in practical servicing. (A course of this type would not suffice in itself.)

THE PRACTICAL TOUCH

It is essential, in both correspondence and self-training, that the student simultaneously practice what he is reading. Most students already possess a radio laboratory of some sort before concentrating on service study. This should be enlarged from time to time as your studies progress. It is an excellent idea to invest from $10 to $20 in junked receivers, which can usually be picked up for a dollar or two. These should be repaired, ripped apart, rebuilt in various circuits and modifications, and experimented with in the variety of ways that your studies may suggest. If you do a good job of modernization, some of them can be sold at a price considerably above the purchase price.

KEEPING UP-TO-DATE

Regardless of how you obtain your radio-service knowledge—by residence course, correspondence, or self-training—it is vital that you continue to study

after the initial period of training is over. Your magazine files should grow month by month, and your library should increase consistently as good radio books and new service manuals are published. Your mental equipment should be kept as up-to-date as your test sets and analyzers!

Chapter III

THE BUSINESS END OF SERVICING

THERE is little place in a book of this nature to consider the technical side of servicing. By the time the student has qualified as a serviceman, he knows more about radio and the servicing of receivers than it would be possible to cram between the covers of this book—let alone within the scope of a single chapter. Rather it is our purpose here to suggest how best to take advantage of the possibilities offered in the highly competitive field of radio servicing, and by so doing to achieve a reasonable assurance of success. There is not even room to cover this side of the matter thoroughly through precept or example; where distinct phases of the general theme are adequately treated elsewhere, the reader will be referred to such sources. This chapter is not necessarily dedicated to the prospective serviceman, that is, the reader who has picked up this book with the idea of seeing what radio has to offer him, and who may decide that his ambitions and qualifications justify his taking a service course. It is directed largely toward

existing servicemen who are having a hard time making ends meet. Such men are in need of immediate assistance, and it is wise to consider conditions as they exist today, rather than guess about the morrow.

HOW MUCH MONEY CAN A SERVICEMAN MAKE?

This is a pertinent and often-asked question, to which, unfortunately, no more definite answer can be given than to a similar question about a doctor, a lawyer or an automobile mechanic. It all depends upon the doctor, the lawyer and the mechanic—how good they are, where they are located, the amount of competition, their ambition and a multitude of variable factors. The automobile mechanic comes closest to the case at hand. If he is content to work at odd times, probably during the summer when the local garage feels the press of tourist traffic, he will be depending on odd jobs until he is old and feeble enough to depend on the county. If he is good enough to obtain and hold a permanent position, but is unfitted, temperamentally or otherwise, for authority and responsibility, he may make from $30 to $40 a week in good times and $20 a week in less prosperous periods, with the possibility of a layoff. If ambition is coupled with ability and integrity, he may become a foreman, possibly a garage owner, branching out with the sale of accessories and the agency for one or more cars in different price classes. From then on, the limit is pretty much what he makes it.

Radio servicemen working in the employ of a retail sales organization are usually paid in accordance with

the amount of service work done and their position on the service staff. The average retail radio store will employ one serviceman. He may receive anywhere from $15 to $30 a week. Usually such a serviceman does not "make his keep," which is the obvious reason for employing him at the lowest possible salary consistent with "codes" and local conditions. He is tolerated, and that is all, by his employer, who has hired him because the receivers he sells have to be installed and because he is morally obligated to service the same when they refuse to function. A recent advertisement in a New York newspaper offered the services of an experienced radio serviceman, with knowledge of refrigerators, having his own equipment and owning an automobile, for $20 a week.

In cases where the serviceman doubles as a salesman behind the counter when service calls are few and far between, he may or may not be able to demand something extra in the way of compensation.

The best that can be said of a job of this nature is that the experience is highly desirable, and the young serviceman will develop his salesmanship, personality, tact and self-confidence while assimilating practical knowledge of receiver eccentricities. In instances where a staff of servicemen is employed, he is in line for promotion and a fatter pay envelope.

It occasionally happens that he will establish contacts that will lead to a superior position as a field serviceman with a jobber organization. This work is usually of a supervisory nature. The serviceman obtains service reports from the retailers; these are

summarized and turned over to the manufacturer for what they may be worth to the engineering department. However, in many cases, such servicemen, or field engineers, are factory trained and are recruited from the engineering staff.

The salaries associated with such positions will vary from $30 to $60 a week, depending upon the size of the organization employing the serviceman, as well as upon his technical status.

The availability of such jobs depends pretty much on the mortality of servicemen and the numbers in which they forsake such positions for other lines of work. The number of retail-store and jobber failures in the last five years would not indicate any startling expansion in this field. However, the recent increase in receiver sales (which, as we have indicated in our introduction, may continue for some years) and the looked-for improvement in general economic conditions at least add a touch of brightness to the picture.

Aircraft servicemen, or radio technicians, as they are termed, receive comparatively good salaries. But, as we have already stated, the requirements are such as to narrow the field to a relatively small percentage of all servicemen. They are started at about $125 a month, and they may make as much as $175. The work is interesting, involves considerable traveling and is undoubtedly the best of the service jobs in which the serviceman is an employee.

It is in the independent service field that the opportunities for the serviceman are the most attractive. The limits of attainment here are determined

largely by the individual's capability. That is the all-important factor and must determine the degree of success. It is quite beyond the writer's control, and all the schools in the world cannot do more than modify this factor to a minor extent. They can give you knowledge, yes, but they cannot alter the character that will determine what you will do with it. By the time you are old enough to study radio, the last plasticity in your make-up has hardened from the effects of environment.

The independent serviceman is his own boss. Everyone likes to be his own boss. But what everyone likes is not always good for him. Not all of us can get ahead on our own powers. This fact accounts for more failures in the independent service business than the depression. Thousands of servicemen survived those years of economic stress—even made an excellent living in it. It will take a lot of self-analysis and searching introspection to determine the probability of your getting ahead alone. Occasionally your instructor or employer will be frank enough to tell you the truth. The elements required include an adequate knowledge of radio, the ability to "take it," a high grade of natural intelligence, indefatigability (which is foremost of all abilities) and the knack of detecting opportunities and making the most of them. Of course, nothing much will be lost in trying, if you will analyze the results of your first year's efforts and abide by that analysis.

Thousands are forced into the independent service business by economic circumstances, regardless of

their aptitude for independent work. If you are one of them, it may well be that you are fitted for the job. Here's hoping!

THE INDEPENDENT SERVICEMAN

Independent servicemen can be loosely grouped into the following four classes—those servicing receivers belonging to individual clients, those who have taken over the service responsibilities of one or more retail stores and jobbers, those who depend in part upon closely related side lines, such as public-address work, for their livelihood, and those who also operate retail establishments selling radios, accessories, and electrical goods.

As a rule, there is no sharp line of demarcation between these classes and their success is often dependent upon a common factor of location. This should be given more serious consideration than is usually accorded it. A preferred locality, of course, is one in which there exists no competition. It is doubtful if such a territory could be found today in the radio-service field outside of the Sahara desert. Other factors must therefore be taken into consideration. Your home town or neighborhood, if the competition is not too strong or your reputation too weak, is always the most desirable location. You are known there, your acquaintances are all potential customers, the economic status of the vicinity is fairly well understood, and the cost and inconvenience of setting up a distant establishment are obviated.

If competition or other conditions are such as to indicate the desirability of setting up in business elsewhere, the serviceman should seriously consider the rural districts and the southern states. While thousands of farm homes have been radio equipped for many years, the farmer has only recently become radio conscious. In the past, the battery-type receivers designed for his use were unsatisfactory in more respects than one. Carting a storage battery to town for recharging was an expensive inconvenience; besides, failure of his "A" power often left him without radio entertainment for weeks of winter evenings—about the only time during the year when he could really enjoy it. The situation has been changed gradually as power lines have snaked their way into the hills. The development of the improved battery receiver employing the air cell has made possible reliable, high-grade and inexpensive reception, even in those fastnesses where line power has not reached. Rural territory will represent for some years to come a radio market of no mean potentiality. Living expenses, particularly in the matter of rents and seasonable foodstuffs, are considerably under urban figures, which does much to ease the financial burden of a budding business.

The southern states have been exceedingly slow to accept radio, probably owing to poor coverage and unsatisfactory receiving conditions. These circumstances no longer prevail. There has been an increase in the number of southern stations and in the power of many transmitters, insuring adequate coverage with

a reduction in the noise-to-signal ratio. Modern short-wave reception also opens new fields that are relatively static free.

Certainly the southern states are now going in for radio with definite enthusiasm. The percentage of southern homes equipped with radio is increasing at a rate far exceeding that for northern homes. Of course this is not necessarily significant, owing to the relatively small percentage of homes so equipped. The significant facts are that the South is now buying radios and that it is still far from the saturation point.

For instance, as of January, 1933, only 10.1 per cent of all the homes in Mississippi were equipped with radios. South Carolina was a little better with 14.9 per cent. Her sister state, North Carolina, was around 19 per cent and New Mexico about the same. Arkansas and Alabama were slightly over 17 per cent equipped. Georgia had 20.1 per cent radio homes. Kentucky and Louisiana were around 27 per cent. Contrast these figures with the percentage of 69 for the New England States.

THE ONE-MAN BUSINESS

The newly established serviceman, particularly when faced with competition, is going to have tough sledding for the first year at least. It is desirable, even almost essential, that he have enough capital to carry him over the initial period, or that he have a part-time job of another nature. Lawn mowing and furnace tending have often been contributing factors to an ultimately successful service business.

Building up a clientele is his major problem, and no legitimate course should be scorned in attaining this end. The methods and possibilities of advertising and publicity will be considered a little later on. Previous experience as a serviceman employee for a retailer is invaluable here, as it is possible to circularize the customers of your former employer, who already know of your ability as a serviceman. This is considered quite ethical, and, as a matter of fact, is occasionally encouraged by the retailer in hopes that eventually he may be relieved of the often unprofitable obligation to service the receivers he sells.

As mentioned in the preceding chapter, it is possible to establish service contacts during the period of training by doing simple radio jobs that should be within the capacity of most students long before they qualify as radio technicians. Such work includes antenna inspection and erection and the installation of noise-reducing devices, wave traps for the reduction of interference from a powerful local station, tone controls, etc. However, as previously implied, too much dependence must not be placed on the possibility of securing such odd jobs, for one problem is the scarcity of potential customers. The majority of set owners patronize servicemen with whom they are more or less satisfied and who are better able to do any of these jobs than a student. There are other complications. The student serviceman will rarely get an antenna installation by admitting that he is studying how to be a radio expert and has now progressed to the point where he can put up a good aerial. He must, at least by implication, pose as an experienced

serviceman. He may logically be asked to service a receiver, in which case he must either admit that he is not experienced enough, or, like Steve Brodie, he must take a chance. Either alternative invites disaster.

However, the antenna idea is probably the student serviceman's best chance for working at least part of the way through his course. By contacting janitors and by personal observation, it is usually possible to spot new arrivals in the neighborhood. Of course an established serviceman, if he is wide awake, is probably doing the same thing! Most of them will be customers for an aerial installation, and, being strangers in the locality, will welcome the first serviceman who approaches them.

There are possibilities too in the installation of special noise-reduction antennas and line-noise-elimination attachments, even among residents who are clients of other servicemen, if a bit of publicity can be secured for the advantages of such devices. Most suburban and rural newspapers will gladly run a few inches of "free" advertising in return for several lines of paid space, provided a local news angle can be obtained. An example of such a publicity item conceived and executed in the approved style, is given below:

RADIO NOISE TRACKED DOWN

SCIENTIFIC DEVICES CONQUER MAN-MADE STATIC

It is a little-known fact that most of the crackling noises that mar

radio reception are not due to natural static, but are caused by man-made devices such as refrigerators, vacuum cleaners, and other machines driven by electric motors. In many instances, this interference travels through space after the manner of radio waves, or it may be conducted along the wires of your radio set, according to Lawrence Doe, local expert on noise reduction. Such disturbances can be reduced, practically to elimination, by the installation of a special antenna system or by what is known as a "line filter." In some cases, both are used.

Mr. Doe has discovered that much of the radio noise heard in Ourville on stormy nights, which has heretofore been attributed to atmospheric disturbances, is due to leakage of the high-tension wires that pass through the village. This type of interference can also be reduced by means of the inexpensive devices mentioned above.

In these two paragraphs, Mr. Doe has put over an excellent sales talk. He has established his name and his status as an expert. He has called the reader's attention to a need that was perhaps only partially appreciated before, and the power of suggestion implies that he is the only serviceman in the vicinity who can do anything about it. Also, he has brought forth the important fact that the devices are inexpensive. It all smacks of news—and it is published as news.

It is the paper—the editor—that is saying this, not the serviceman, who otherwise might seem to be patting himself on the back!

This publicity item will be accompanied by a small advertisement, either display or in the classified columns, such as follows:

> RADIO NOISES ELIMINATED: Enjoy your radio to the fullest extent at a slight additional cost. Let an expert in this field inspect your installation. No charge for consultation and results guaranteed! Lawrence Doe, 34 Main Street. Phone 86.

Naturally, in starting an independent service business, it will be desirable to keep both overhead and the initial investment at a minimum. The cellar of the serviceman's home is usually his first shop. A good stock of spare and replacement parts can be secured for a very low cost by salvaging them from junked receivers. These parts may be used for *temporary* repairs, while new parts are being ordered. In this manner it will not be necessary to build up a large and expensive inventory until your volume of business can carry it. The slight inconvenience to your customer can often be turned into an advantage by telling him that a special part is required, that you have ordered it, but that, rather than deprive him of his radio pending its arrival, you have effected a temporary repair. (If this is the limit of your deceit in business, you will soon acquire a reputation for integrity that Caesar's wife would envy!)

It will be desirable at first to invest only in portable testing equipment. A special panel can be arranged to hold this equipment for work on the service bench, thus making a single investment serve a double purpose.

The independent serviceman engaged in a one-man business often enjoys excellent profits in the modernization of old receivers. In the course of service routine he necessarily comes across receivers of a vintage that no amount of ordinary servicing can make perform in a manner comparable to that of an up-to-date set. A new receiver is undoubtedly the logical recommendation (particularly if the serviceman will benefit from the sale). However, the sales resistance encountered is often high for several reasons. It usually happens that the receiver was purchased in the days of peak prices for perhaps around $200. This represents an investment not readily to be ignored, particularly when no substantial allowance can be made, and when cash may not be overabundant. There occasionally exists a sentimental attachment for the old set, or it may have been selected to harmonize with some special scheme of interior decoration.

The serviceman's answer to these objections is complete rejuvenation—at a price considerably under the cost of a new receiver. Pointing out the advantages of automatic volume control, all-wave reception and perfect quality should be sufficient to close the deal.

The subject of receiver modernization as a profitable possibility for the serviceman has been treated at length, with examples of sales literature, letters, adver-

tisements, publicity, etc., in "8,000,000 Jobs for the Serviceman," by the present writer. This book will be found listed in Appendix A of this volume.

Modernization of this order is obviously a matter entirely different from the procedure of a few years ago. This usually consisted of rewinding the radio-frequency coils for newer tubes and revamping the audio system for better tone. The old set is not amenable to the recommended modernization, and most of it will have to be discarded in favor of a new all-wave chassis, several types of which, equipped with speakers and tubes, are available from the various mail-order houses for around $30. It will seldom take more than an hour or so to adapt such a chassis to the old cabinet, and your customer will rarely consider himself overcharged at $5 more than the chassis cost you. In some instances, the original speaker can be retained, in which case the serviceman has a perfectly good unit on hand for future replacement jobs.

DEALER AND DISTRIBUTOR CLIENTS

As the serviceman becomes successful, he necessarily advances from the one-man business status, and hires additional servicemen to take care of the pyramiding work and expanding territory. While some service organizations concentrate on the servicing of receivers for individual clients, the process of expansion is usually stimulated by the taking over of retail-store and distributor-service departments. As we have said before, such departments are often unprofitable to dealers who would prefer to concentrate on a

sales organization, and are increasingly doing so as radio sets are improved. Such dealers are only too glad to turn all service calls over to an expert service organization, to take their share of the service profit (a profit that, perhaps, they had never realized before) and to be relieved of all responsibility. It is, of course, undesirable to raise the consumer service charge; so such an arrangement results in reduced profit to the service organization on each service job. However, as in any expanding business, this is more than compensated by the volume of business.

An excellent example of such an organization exists in Sioux City, Iowa. Starting from scratch a few years ago, this service company now covers a territory of 200 miles radius, including over 650 dealers, jobbers and distributors as clients. A large individual customer business is also conducted.

This service business is well advertised and the dealers make no pretence of doing the service work themselves. Instead they feature the fact, through signs and advertising, that their service work is done by this exclusively service organization. Arrangements are made with a local trucking service for daily pickup and delivery of receivers throughout the territory at very low rates—fifty cents per set within a radius of sixty-five miles. Shipping charges are borne by the customer, who is also charged the *wholesale* cost of all new parts, plus a labor charge of $1.50 for the first half-hour and $2 per hour for subsequent time, or $3 per hour for subsequent time with two men on the job.

The sets are picked up from and delivered to the dealers who receive 40 per cent of the charge for labor. All work is done on a strictly cash basis.

It follows that an organization of this order cannot be built up without considerable imagination, sound business sense, executive ability, salesmanship and hard work. A systematic inventory is studiously kept, and expenditures for new equipment and advertising are carefully budgeted as dictated by net profits of a preceding period.

The servicing game has two business angles—the technical and the commercial. Neither is to be scorned!

SERVICE SIDE LINES

A large number of successful servicemen, who do not expand into what might be termed the wholesale service business, derive a considerable portion of their incomes from side lines of a wide diversity. Electrical wiring is perhaps the most logical and common. Occasionally it is the electrician who goes into the radio-servicing business, rather than the radio expert into the electrical trade. It is well to remember that some states and communities require licenses before an electrician can legally practice many branches of his trade. Information regarding requirements of this nature can usually be secured from a local electrician, or, better yet, from the county clerk or the state department of taxes and finances.

The rental and sale of public-address systems is a highly profitable side line closely identified with radio servicing. The majority of such installations are made

on a rental basis, the fee varying with the locality, elaborateness of the setup, the distance the apparatus must be transported and the duration of the service. Public-address systems are gaining in utility and popularity at practically all mass meetings, both outdoors and indoors—picnics, church and social festivals, political gatherings, county fairs, baseball and football games, horse and auto races, track meets, etc.

The sound truck is a variation of public-address work that offers increasing possibilities. Any car can be converted into a mobile public-address system at a very small cost. The equipment usually consists of at least two speakers, microphone and turn-table, with panels for pictorial and billboard advertising on the sides. Lights are often provided for attractive night displays. The sound truck may substitute for a semi-permanent public-address setup on such occasions as are mentioned in the preceding paragraph. In suburban communities and small cities, it is a popular advertising vehicle and a sizable income can be realized by renting its facilities to local merchants. It is a sort of sublimated sandwich man.

While the market for permanent public-address installations is somewhat limited as to number, the profit from a single sale is excellent; one or two such jobs a year make a definite difference in the bank account. The small airports that are rapidly dotting the countryside are potential markets for equipment of this nature, as are the central schools that are replacing the little red schoolhouses.

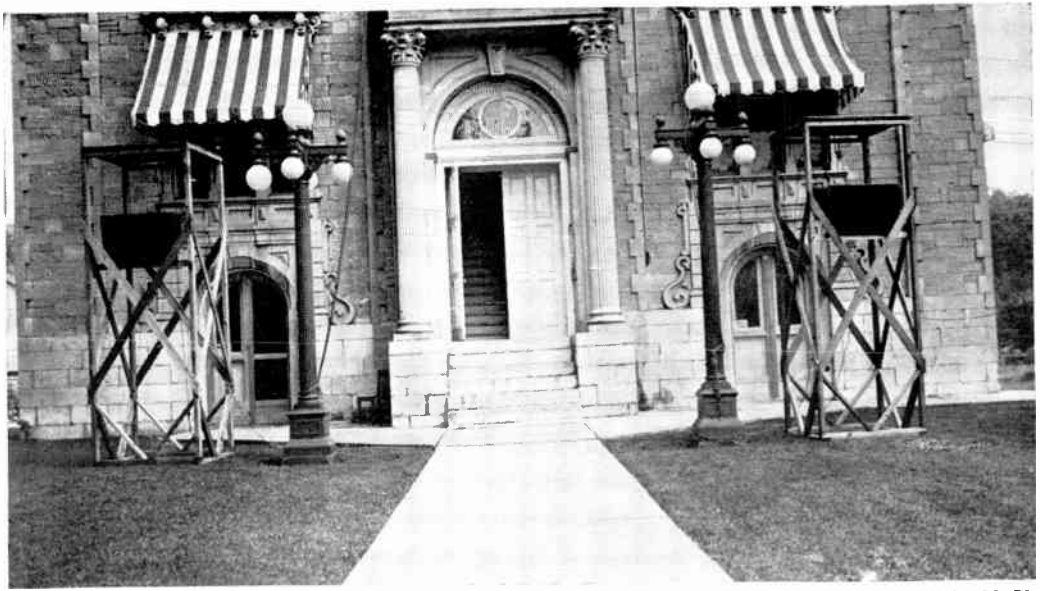

FIG. 9.—Through the enterprise of a local dealer and radio serviceman, the village of Schoharie, N. Y., attracts Thursday evening crowds with free outdoor sound motion pictures. The screen is dropped between the two speakers erected in front of the county courthouse.

(*Facing p. 64*)

FIG. 10.—Sparks' domain. The radio room aboard the S. S. Mariposa. (*Courtesy of R. C. A.*)

The servicing of sound-motion-picture equipment is closely related to public-address work and, in rural districts, usually falls into the competent hands of a local radio serviceman. The writer knows of an enterprising serviceman, who, with the cooperation of his home village, exhibits open-air talking pictures one evening a week throughout the summer months. Crowds numbering well into the thousands are attracted from neighboring towns and cities to patronize the local merchants, who, in turn, lend their financial support to the attraction.

Believe it or not, a perfectly logical side line indulged in by many servicemen is vegetable gardening, which provides a by no means negligible income during the summer, the slack months for radio servicing.

It will be observed that a rural, or at least suburban, location is particularly advantageous from the point of view of side-line possibilities. This is an additional argument in favor of the serviceman's establishing himself beyond the city limits.

The active serviceman can make many an extra dollar by writing up his service experiences for the half dozen service, technical and semi-technical magazines that purchase such contributions, as well as for the various house organs, published by resistor, condenser and tube manufacturers, which are mailed to thousands of servicemen and which are similarly in the market for short contributions. Such articles should be brief—from 100 to 500 words being the most acceptable length—and may describe anything from a new and novel bit of equipment to a specific

service job. The unusual has the better chance of being bought—the running down of a particularly baffling complaint, or a kink that saves the serviceman time and labor. A number of publications run monthly prize contests for such material. Payment varies (usually on publication) anywhere from $1 to $10 depending upon length, intrinsic value and illustrations. Photographs invariably increase the size of the check received. Several magazines will buy photographs of individual service shops when accompanied with a brief description of the layout. The preferred manner of submitting such material for editorial consideration will be discussed at greater length in Chapter IX on Radio Writing.

THE SERVICEMAN AND RADIO SALES

It is a short and almost inevitable step from the closely related service side lines to the retail sales of radio receivers and accessories. The serviceman has more opportunities than anyone else to recommend the purchase of a new receiver, and, if he has proved himself reliable, his word has weight. There is no reason why he should split profits by ordering through another dealer when he will seldom have to do more than establish his integrity by bank references to secure the privilege of retailing a line of well-known receivers.

It is recommended that the serviceman select a nationally advertised manufacturer who makes a variety of models, mantle and console type, listing from $20 up. His initial investment need not be more

than one receiver, for demonstration purposes, which in such a case should be about in the middle of the price scale. Excellent performance can be expected, but not too good to show a cheaper model to a disadvantage (obviating the possibility of disappointment should a customer order a low-priced type and contrast its performance with the demonstrator), but sufficiently impressive to sell the higher priced models.

Be careful of the claims you make in reference to foreign reception and qualify any implications of a world-wide range with the stipulation that such performance can be assured only under favorable conditions.

Side lines are quite as natural an adjunct to radio sales as to servicing. The electrical refrigerator is the most logical addition to a radio sales program, as the sales curve of this product is complementary to that of radio receivers. As the radio business falls off in the summer time, the cash register continues to tinkle to the tune of refrigerator sales—with conditions reversed as cold weather and clear radio nights set in. In some instances it is possible to secure the sales rights for a refrigerator made by the manufacturer of the radio sets you feature, a matter that may simplify financing and that may be worth considering in selecting a radio line.

THE SERVICEMAN AND HIS CLIENT

By client we mean the ultimate customer—the owner of the receiver. The relationship between the serviceman and this all-important person will depend

largely upon the character of the individual serviceman and will, in the final analysis, determine his success or failure. There is no place here for a detailed treatment of what the well-dressed serviceman should wear, how he should approach his customers and what his conduct should be within his clients' homes. This should be pretty much a matter of common sense; certainly it is given sufficient consideration in the various courses and in the books on servicing listed in the appendix of this volume.

The most important considerations in establishing satisfactory relations between the customer and the serviceman are worthy of additional emphasis. These are the excellence of the service job and the price the customer has to pay for it. If there is anything wrong with either factor, the serviceman's business will be adversely affected.

It is assumed that the serviceman is a capable technician—that he knows his radios. This automatically eliminates most of the uncertainty as to the type of work he will do. Barring circumstances beyond the technician's control, only two factors will logically lower the standard of his workmanship—poor parts and haste. Except for emergency and temporary repairs, nothing but the finest materials should go into a receiver. Frequent service jobs on the same set do not pay in the long run. The customer becomes suspicious and switches to another serviceman, and his friends may do likewise. Considerable publicity has been given to unethical practices on the part of servicemen. Your customer's confidence can best be

established by the satisfactory performance of his radio for a long period of time following its inspection by you; you will benefit directly by word-of-mouth advertising.

There is no excuse for a hasty job. Allow yourself ample time for repairs and be most conservative in your promises as to when the receiver will be returned. In anticipation of delays, it is an excellent policy to accumulate a half dozen or so inexpensive or rebuilt receivers, which can be loaned to customers pending the repair of their own sets. This consideration will be appreciated. If the press of work is such that you cannot give adequate time to each job, you are in the fortunate position of being able to employ an assistant. Keeping a detailed case card of each receiver serviced —general condition of the set, obvious repairs made by other servicemen as well as the work done upon it by you—will expedite future service jobs on that receiver.

THE PSYCHOLOGICAL ELEMENT

There is another reason for allowing plenty of time for repairs. Usually you will be able to return the receiver earlier than promised, a procedure that creates a highly favorable impression with the client. The same psychology applies in estimating charges. Give yourself a margin for the unexpected. If a reasonable bill comes to less than the amount specified, the customer will be pleasantly surprised. Under no circumstances charge more than the estimate, without consulting the client before repairs are made. You will so seldom lose

money in keeping within your estimate that it is worth while to accept an occasional financial loss rather than the loss of your client's good will. Always tell the customer what the job will cost, at the maximum estimate, before removing the receiver or starting work on it. This will obviate the unpleasant possibility of bickering after the work is completed.

If the repairs can be made quickly and effectively with portable equipment, do them in the owner's home. Everyone is impressed by watching an expert accomplish results. The tedious and less spectacular jobs should always be removed to the shop.

Never run down the merits of a customer's receiver —no matter how bad it really is, or how much you would like to sell him a new set. Compliment him upon his choice and good judgment, for which, let him think, you have the greatest respect. If you would like to interest him in a new receiver, leave one with him while you repair his own set. The contrast in performance will do more than any sales talk, no matter how high powered.

Follow up every service job a month later with a card or letter, along the following lines:

My dear Mr. ———: Just a line to ask you if your radio is working satisfactorily following the repairs we made on it a few weeks ago. If you are not thoroughly satisfied, we should appreciate your letting us know, and one of our experts will stop in at your convenience. If the fault is in any way associated with our previous work, we want to make it right—and of course at no charge to you.

Yours sincerely,

THE CUSTOMER'S BILL

The manner of charging for service work varies with the individual and the locality. No hard-and-fast rule can be recommended. Some servicemen charge by the hour for labor, plus the wholesale cost of parts. An average labor charge is $1.50 an hour on this basis. Other servicemen charge less for labor but estimate the parts cost on the retail prices. Usually there is a minimum charge of about $1.50 with, occasionally, fees for transportation and for extraterritorial service. The problem of what to charge has been considered at length in many magazines and books and by the service organizations. The subject receives detailed discussion in "How to Make Money in Radio Servicing," by the present author, where examples are given that should be of assistance to the individual serviceman in arriving at his own system of prices.

It is, however, always a good idea to have a parts catalogue on hand in which retail prices only are given. This can be freely shown to the customer, and allows the serviceman considerable elasticity in the matter of charging. In dull seasons, or on special occasions, he can promise, as an inducement for immediate service work, that there will be no charge for labor, and he can still realize a good profit on the list price of parts. Or he may reverse the procedure and offer all parts used in repairs at wholesale, showing his customer the retail price catalogue to substantiate his pledge.

The question of cash or credit is, similarly, an individual problem and one of the most delicate and hard to solve. A cash transaction is always the more satisfactory. The serviceman should endeavor to operate on this basis, both in buying and selling, until the magnitude of his turnover is such as to justify modification along the lines of big business.

Your customers should be made to understand, before you accept their work, that you operate on a strictly cash basis. This is not always an easy thing to do, for to many people the implication is that they cannot be trusted. (As a matter of fact, most persons who take that attitude cannot be trusted.) All your advertising, bills, literature, business cards, etc., should state plainly the fact that you do not extend credit. However, the psychological element should be considered, and the statement should be sugar-coated as follows:

We are able to service your radio
at a LOWER COST, because we
operate on a strictly cash basis.

If you find it necessary to deviate from this rule, always add enough to your bill so that you can offer a liberal discount for payment within ten days. This will eliminate the necessity for many dunning letters.

Letters asking for money past due are unpleasant to write and difficult to compose. Both the immediate payment of the bill and the possibility of future business may depend upon the wording. Sample epistles of this type will be found in books on letter

writing and in "How to Make Money in Radio Servicing."

ACCOUNTING

No business can succeed unless a close account is kept of expenditures and income. This is particularly true of budding endeavor, and in a one-man business it is very easy to develop lax habits in this respect.

A checking account, *if properly kept*, is probably all the bookkeeping the serviceman will need during the first year or so of operation. But the italics are important!

To start with, a checking account, altogether separate from the serviceman's personal account, should be established. During the course of his training, he will have accumulated the necessary equipment, bit by bit, so, for the sake of not complicating things at the very beginning, we shall not count the cost of this apparatus. It is, as it were, his donation to his own business. However, any equipment acquired subsequent to opening shop is an entirely different matter and must be considered in estimating profit or loss.

We shall assume that the serviceman initially deposits, say, $200 to his business account. This may be called his working capital. The first rules of keeping accounts straight are that every bill must be paid by check (except those paid out of petty cash) and correctly entered on the check stub, and every cent taken in as a result of service operations *must be deposited* in the bank with the correct notation in

the checkbook. In the matter of petty cash, a check should be made out to yourself for, say, $20. Petty cash should be kept separate from any personal money you may be carrying—preferably in a petty-cash box. Petty cash is used for incidental expenses—gasoline, carfare, postage, etc. A voucher should be made out for any money taken from the petty cash, stating the amount and purpose of the expenditure. When the petty-cash fund gets low, add the amounts of the vouchers to the remaining petty cash; the sum should equal the value of the original petty-cash deposit—$20. Make out another check, payable to yourself, for the amount of the vouchers (entering "petty cash" on the check stub), cash it and deposit it in the petty-cash box. This will bring the petty cash up to the original figure, and further withdrawals may be made.

Rent, electricity, telephone, etc., are all, of course, paid from the checking account. If the basement of your home serves as your service shop, make yourself out a small monthly check for rental—say $5. Also draw a check on the business for a proportion of the home electric-light and telephone bills. This is good business and will enable you to make a more accurate estimate of your progress as a serviceman than if these items are taken for granted and no allowance is made for them. Make out to yourself a check for wages or salary every week, as business warrants.

Assuming that the business has been conducted on a cash basis (as it certainly should be during the

period of initial development), and that it has prospered, the net profit of the business at any time will be the bank balance, plus cash in the petty-cash box, less the original working capital of $200. *Your* net profit will be the net profit of the business plus checks paid you as salary or wages. If your service endeavors have not been making money, the net loss of the business will be the initial investment, plus any additional money deposited outside of the service income, less the bank balance and petty cash.

This very simple system, over a period of time, automatically takes care of such items as depreciation, discounts, bank charges, etc., which, in more complicated methods of bookkeeping, are estimated separately. The only drawback of this system is that, in its simplicity, it cannot *anticipate* those more or less subtle charges against the business that should be considered in order to arrive at fair charges for servicing, allowances on sets turned in, etc. However, the checkbook method as outlined above, plus a little common sense, will suffice for the one-man business and will leave him plenty of time for his real problem of accumulating enough money to worry about!

When you arrive at the point where an assistant can be hired, a bit more time should be devoted to keeping accounts in accordance with stricter business practices. A method of accounting for a small business progressing beyond the one-man status has been evolved by J. E. Smith and is described in an excellent booklet entitled "Radio Accounting and Records." Here the checkbook still plays a most important part,

but it is supplemented by detailed records that admit a reasonable amount of anticipation in reference to expenses.

The writer would say that the simple checkbook is adequate for a gross income not exceeding $4,000 a year. From that figure up to $10,000 a year, the system outlined by Mr. Smith will do very nicely. For a higher gross income a standard accounting system is essential. The serviceman himself need not worry about this, for at that stage of the game he can hire a bookkeeper–telephone-operator–stenographer who is better fitted to bear the burden of figures.

Advertising and publicity and the purchase of new equipment should be budgeted, 30 per cent and 10 per cent of the net profits respectively being suggested as reasonable appropriations.

Common sense will have to dictate how much money can be spent for these essential purposes. The serviceman, by inspection of his checkbook, can ascertain how much money he is making and, on the basis of 30 and 10 per cent, can determine what amount he can expend as indicated. At the end of the first month, two months or three months, he should take the net profit of the business over that period as the basic amount from which to apportion his advertising, publicity and equipment budget for a similar future period of time.

After he has been in business for at least a year, he can *anticipate*, with reasonable accuracy, the *probable* net income, less expenditures for advertising and

equipment, over a given period—say, the three best seasonal months. To determine the amount of money to be budgeted for such purposes during these months is then merely a matter of algebra.

Let the net income (not counting the money to be budgeted for advertising and equipment) be x. Let the amount of money to be budgeted be y. The total amount of the budget will be 30 per cent plus 10 per cent of the *real* net income, which is x less the amount budgeted.

Then the *real* net income will be $x - y$, and y must equal 40 per cent of $x - y$, or $y = \frac{2}{5}(x - y)$. Simplifying, $y = 2x/7$.

If x (the net income not counting deductions for advertising and equipment) be estimated as $700, then y, the amount to be used for advertising and equipment over that period, will be $200. In accordance with the proportion, one-quarter of this amount, or $50, will be expended for equipment—new apparatus and modernization of old equipment—and three-quarters, or $150, for advertising and publicity.

PUBLICITY AND ADVERTISING

As in every highly competitive field (we are forced to use the phrase again, and not for the last time!) every legitimate advantage must be taken of modern methods of building up business. In a general analysis, these fall under the combined and related headings of publicity and advertising.

Publicity and advertising have a multitude of possibilities, including newspaper news items, adver-

tisements, circulars, handbills, broadcasting, displays, sales letters, follow-ups, public-address announcements, house-to-house canvass, word-of-mouth advertising and demonstrations.

We have already presented an example of publicity and advertising (which go hand in hand) in the case of noise reduction. Other subjects that could be given a somewhat similar news treatment, accompanied by a tie-up advertisement, are tabulated below. The news angle is given in the left-hand column, and the advertisement feature is described in the right-hand column.

New European short-wave station on the air.	All-wave sets for sale at Lawrence Doe's Radio Shop.
Police radio results in nabbing thief of car stolen from vicinity.	Police calls and all-wave features on new line of receivers sold by Lawrence Doe's Radio Shop.
Graham McNamee to Broadcast World Series, football game or championship fight.	Let Lawrence Doe put your radio in condition for the World Series, etc.
New program features promise unusual entertainment for winter season.	New tubes will put your radio in A-1 condition for the winter season.
Auto radios become popular as camping season opens.	Lawrence Doe—specialist in auto radio installations.
Breakfast music from Australia for local radio fan.	World-wide reception on new all-wave sets at Lawrence Doe's.
New battery sets for farms bring line-power results at	Air-cell sets featured at Doe's Radio Shop.

low cost. Batteries breathe air!

Journey around the world for three cents. Estimated Cost for two hours' operation of improved all-wave radios.

Come in any afternoon and listen to London at Doe's Radio Shop!

Similar combinations inspired by national and local events will occur to the serviceman. Bear in mind that it is always essential to get a news angle as well as an advertising angle. If you can think of only *one* way to write the story, the chances are there is no news in it.

Full advantage should be taken of the advertising and publicity services offered by the makers of radio parts, particularly the tube manufacturers. Many of them offer their distributors and dealers attractive letter-heads, business cards, window displays, form letters and advertising mats at cost or at prices below those at which the serviceman could obtain similar matter from local sources. In a number of instances, such material is furnished free of charge—such as displays and advertising mats. Mats are made of pressed cardboard, adequately worded and decorated. Your local newspaper makes a finished advertisement from these by pouring molten type metal over the impressions and mortising in your name, address and telephone number.

A sales promotional service, as outlined above, is often an important factor in selecting a tube or accessory line!

These matters have been given detailed attention in the author's book on radio servicing, previously

mentioned; facilities along these lines are also offered by the Radio Manufacturers Service, a service organization partially subsidized and supported by a national manufacturer, though it is nonpartisan. It offers to the serviceman merchandising facilities that otherwise would be obtainable only at a considerable cost to himself.

Your stationery and business card can and should do double duty by conveying a brief and terse advertising message.

LAWRENCE DOE

RADIO SERVICEMAN

—is static and is little more effective than your name and address.

LAWRENCE DOE

EXPERT RADIO SERVICING

—is somewhat better. But it is conventional, and what the serviceman might be expected to say about himself. Let us try this—

When your radio sends SOS—

REMEMBER

LAWRENCE DOE

Speed plus Organization mean Service

Letterheads or business cards can be made dynamic by adding a sales message at the bottom of the card or stationery. For a card—

OUR CUSTOMERS ARE OUR BEST ADS.

or—

Our work and YOUR SATISFACTION *guaranteed.*

The letterhead might carry the following sales argument—

Our guarantee is insurance of
unfailing radio enjoyment.

Another thought, old and tried, but not found wanting—

No job too big for our ability—no job too
small for our attention.

It is often desirable to do work for certain persons in a community at a reduced price, and, in some instances, free of charge. Among such customers are garage operators, clergymen, doctors, and others whose wide contacts and possible recommendations are worth more than the difference in fee. The garage man will be most helpful in establishing an automobile-radio clientele.

Your local postmaster should be consulted before you attempt circularization by mail. There are several mailing arrangements approved by the government whereby it is possible to cover any desired territory without having a mailing list of the persons to be

reached. Reduced mailing rates also apply, and your postmaster will be glad to furnish full details.

SERVICE ORGANIZATIONS

Proficiency in any endeavor is inevitably stimulated by association and intercourse with fellow workers. An exchange of ideas plus the moral support of concerted effort is always beneficial in more ways than one. The serviceman should become a member of the nearest service organization and attend its meetings. Many of these more or less local associations are affiliated with the national organization—the Institute of Radio Service Men, with headquarters at Chicago. Their official publication, the *I. R. S. M. News* contains considerable information relative to association activities, local meetings and national influences affecting the serviceman.

The purposes behind trade and professional organizations are several and sound. Their aims are often vital to the success of the associated industry and can be attained only by the efficient cooperation of those most directly affected. The primary efforts of consolidation may apply toward standardization in methods, parts and equipment, the dissemination of common knowledge and the exchange of individual experiences, the establishment of fair scales of compensation, as well as codes of ethics, and the building up of an influential organization for protective purposes.

The radio serviceman, as he exists today, is recognized by the radio-consuming public and the manufacturer as a vital factor in the industry.

Chapter IV

THE RADIO OPERATOR

OF ALL the branches of radio, operating is undoubtedly the most fascinating. Its appeal is mostly to youth, conjuring visions of distant places and adding to its own lure the perpetual seduction of the sea. It is largely this fact that has brought about the overproduction of radio operators; paradoxically, it is this fact that has been in the past, and probably always will be, the economic salvation of the field!

Operating is essentially a young man's profession. True, there are operators who grow old in harness; but it is usually because they fit in no other field of work. In good times, the average operator has had enough of the sea after a year and a half to two years of experience. Then he relinquishes his berth to another in the youthful line of recruits. Shore jobs are retained for longer periods. The pay is better and there is the chance of a career, advancing through genuinely remunerative operating jobs to widening possibilities in communication or engineering departments. This also makes room for more operators.

SURVEYING THE FIELD

If inclination—or better yet, downright interest—leads you to believe that operating offers a career, or at least a stepping stone to one, it will be advantageous first to consider the various operating positions in the light of your own preference, opportunities and the time and money you can expect in preparing yourself to fit them.

MARINE RADIO

Shipboard stations are considered in three classes, depending upon the number of passengers and crew and the distance traveled between ports. The type of service that must be furnished varies with the different classes and imposes restrictions upon the grades of operators to be employed.

Vessels of the first class are those on which a continuous watch is kept. They usually carry three or more operators.

On vessels of the second class the hours of service are not continuous, being specified by international agreement in accordance with geographical locations.

Vessels of the third class are those on which the periods of service are of even a more limited duration. Sometimes no definite hours of service are indicated.

The United States Ship Act of 1912 states that all ships carrying 50 or more persons in the crew, passengers, or both, and plying more than 200 miles between ports, shall carry adequate radio apparatus in charge of at least two operators.

Practically all passenger-carrying vessels in the transoceanic and coastal services fall into the first class. Third-class vessels are largely composed of tankers and freighters, as well as short-haul passenger ships, such as those operating on Long Island Sound. The latter are not compelled by law to be radio equipped, and carry apparatus only on well-founded general principles.

Glorified by many of the schools, and glamorous by its own right, marine radio has long been the most popular branch of the operating profession. Now it is suffering from competition by its runner-up, aircraft radio, which is also receiving its share of glorification.

The status of the radio operator as an officer has been always emphasized. There is no doubt that Sparks should rank among the licensed officers, and, in the majority of cases he does. But, unfortunately, this ranking is often nominal, and in some instances it is definitely denied by the steamship company in order to deprive the operators of the bonuses and similar privileges that are due the deck and engineering officers.

The lure of foreign ports! The fragrance of the tropical breeze rippling over drooping palms! Sparks doing his usual promenade with gold braid and a senorita's arm on his sleeve—wondering where to spend his first month's salary of $125! The chances are that the fragrance of the breezes undergoes some modification as it wafts across the stench of a tropical wharf, where the radio officer, in dungarees, is checking cargo for $75 a month. Upon completion of these

tasks he is free to sample the delights of the locality unless the master's whim keeps him on board. Besides he may have abstracts to work up; he may have to wait around for his company's inspector; or there may be maintenance work to be done on his apparatus, which cannot ordinarily be done at sea.

There is of course the glory of being Chief Radio Officer on a trans-Atlantic luxury liner. But it is mostly glory. Sparks can make more money as the one and only operator on a cargo vessel!

The advent of radio telephony on the larger liners has not opened a new field of seagoing positions as some of the schools have reported. With the passing of the experimental stage, this additional service is in charge of a radiotelegraph operator with a telephone endorsement on his license. There is no additional pay for the added duty.

However, conditions are definitely improving, as far as they affect operators now in employ—an amelioration that is due, for the greater part, to the organized efforts of the operators themselves.

Most of the modern equipment is controlled by two large companies and is furnished the ships on a contract basis. These companies, Mackay and the Radiomarine Corporation of America, also supply the operators, who, however, are in the direct employ of the steamship companies and are paid by them. On the other hand, there are many vessels operating more or less independently.

On ships of the first class, which require from three to five highly competent and experienced operators,

the average salaries run from $80 a month for the assistants to a top of $110 a month for the first operator. Some vessels may pay a little more—and some a bit less.

Salaries are usually much better on vessels of the third class, many operators receiving more than $100 a month—often $125, with the top around $140. Where the operator is required to do clerical or supercargo work, act as purser or assist the deck officers, extra remuneration *may* be his lot. Unfortunately this is not always the case.

On private yachts, the radio officer's salary may exceed the figures given above. Yachts, however, are not quite so plentiful as they have been.

With the exception of occasionally having to furnish his own typewriter and uniforms, the operator has no expenses while on shipboard. He is provided with living quarters and food compatible with his status as an officer. While he is in port, if the vessel makes no provision for maintenance on board, an allowance for expenses may be granted. He is always assured transportation to the port at which he signed on.

There is obviously no future for the radio operator who remains at sea. He merely, economically and otherwise, remains at sea! David Sarnoff, president of the Radio Corporation of America, is an ex-ship-operator.

The director of one of the most prominent residence schools in the field, whose institution is in an unusually favorable position to place its graduates with perhaps the largest of the communications organizations, is

honest enough not to encourage " . . . young men to study marine operating. We point out to applicants that opportunities are better in other radio fields."

According to another authority who is in intimate contact with over 90 per cent of the marine operators, "Newly graduated operators today have absolutely no chance of obtaining employment unless they have 'pull.' All companies in the marine and communications field are in agreement to employ experienced men with *first class* licenses when available."

The highest telegraphic rating that can be issued without previous experience in a telegraphic ship or shore station open to public correspondence is a second-class license. The chances of getting a berth are slim without experience, and the graduate cannot get experience without a job. It is a vicious circle, but it can be broken into. We shall consider the possibilities of doing this in the next chapter—methods that are logical, but, we must confess, far from infallible.

COASTAL SERVICE

Coastal stations are employed for the most part in communicating with ships at sea. The salaries paid these operators are excellent in comparison with ship wages, running from $30 to $50 a week and better, depending upon the importance of the station, the seniority and ability of the operator and his rank. The operator must support himself (and usually a family, which is often the reason for his quitting the sea) except for a gasoline or transportation allow-

ance. The average wages are about $150 per month. There are definite possibilities for advancement through the communications and engineering departments.

However, the opportunities offered the newly graduated operator are considerably more remote than his chances of getting a seagoing berth. The majority of coastal jobs are given to operators of proved ability who have experience well seasoned with a dash of salt spray. Many shore jobs require doubly skilled operators who can copy American Morse on a sounder. This, as a rule, calls for the extra-first-class commercial license, which stipulates, in addition to familiarity with the different code and instrument, eighteen months' recent experience with a first-class license.

POINT TO POINT

By "point to point" we refer to the "fixed" trans-oceanic radiotelegraphic services. In this field the personal touch is almost if not entirely lacking. Traffic is handled by machine transmitters, often at speeds up to and more than 100 words per minute. Messages are received from all over the world by individual receivers in a central station, the location of which has been selected through considerations of antenna facilities and isolation from artificially produced static. The output of each receiver is "piped" by land line to a recording machine at a central office, where the tape is translated by the operator. The radio schools do little to prepare the operator for this sort of position,

the qualifications for which are adequately described in the following paragraphs prepared from material supplied by the operating staff of R. C. A. Communications, Inc.:

"The operators at the Central Radio Office are drawn largely from the different branches of the communications service. We have quite a few men who have served one or more enlistments in the Army or Navy; some have come to us from the Radiomarine, while others have had their initial operating training in the cable service. In addition to these, there is a large number of our present operators who have been trained solely in this office.

"Those in the last group begin as junior clerks, passing through the different grades of clerical duties, and while so doing attend a school, which we have for their benefit. It is absolutely necessary, as a prerequisite for the beginner, to be proficient in touch typing because almost all our present-day operations are conducted mechanically. These youngsters first familiarize themselves with the alphabet of the continental, or international code, and then are taught the proper method of sending by hand. Later on, step by step, they are given instruction in audio reception of a Kleinschmidt perforator, this latter instrument being used to perforate the tape that runs through our automatic transmitters, which in turn actuate the transmitters at the remote control stations.

"All students, during the time that they are learning the art of radio operations, are also taught everything pertaining to traffic handling, and the meanings of

various international indicators used in our work. They are also familiarized with the routine course of messages from the time they are handed to us until their ultimate dispatch over the various circuits, and vice versa, from the time of receipt over the circuits of ultimate delivery.

"Whenever we graduate a young man from the school to our Junior Operator grade, we are quite sure that he is well fitted for the work that we expect from him. It takes about five years to make what we would call an experienced operator. The men that we have taken from outside our organization as operators, as a general rule have to be given considerable training before they come up to our standard of operating efficiency.

"Our first class operators are capable of perforating up to sixty or seventy words per minute on the Kleinschmidt, and are also able to read the recorder receiving tape, copied on the typewriter, at speeds averaging from fifty to seventy words a minute.

"The Central Radio Office School is limited to our own employees, inasmuch as the facilities are not extensive enough to permit non-employees to be trained there."

Obviously, an operator's license is not required for many point-to-point positions, where the operator never *manually* modulates or otherwise controls the radiated wave. However, the transmitters must be in charge of licensed men. Salaries in fixed services of this nature approximate those paid in the coastal stations. The chances of advancement are limited to

supervisory positions unless the operator is also a graduate engineer or the equivalent.

AVIATION RADIO

There are three aviation services of interest to the operator—the aircraft station, which is aboard the plane, the aeronautical station, which is on the ground (some of this type are used primarily for communication with aircraft, and others for point-to-point operation between distant airports), and the airport station, this last being of very low power for use in giving landing directions and transmitting local radio-range signals.

Relatively few radio operators are paid for flying, unless they also hold pilots' licenses. As far as the present author has been able to ascertain (through inquiry and personal experience), no American air-transport company, with the single exception of Pan American Airways, Inc., employs telegraphic operators on board their planes. Telephonic communication is universally relied upon in our trans-continental services, both pilot and copilot being licensed as radiotelephone operators. It is doubtful if this system will be modified. Pay load is a vital factor to the success of air transport, and the elimination of an operator means 150 pounds of mail or another 25 gallons of gasoline! With Pan American Airways, Inc., the situation is different. Since the planes span the Caribbean and circumnavigate South America, their land stations are necessarily separated

by distances greater than the reliable range of a light-weight, low-power aircraft radiotelephone transmitter. Continuous wave telegraphy is the only solution.

Few young men, starting from scratch, have the financial resources to train for both a radio and a transport pilot's license, and can secure sufficient flying time to qualify for an air-line job. The total cost of radio and flight training is over $5,000, and it takes seven hours a day for over one year. It is probably an excellent investment—and yet, let us not forget the "gorilla story."

Pan American Airways, Inc., prefers operators having first-class licenses, though second-class operators have been employed. This fact at least provides a *possible* opening for the newly graduated operator. However, the author has been in intimate contact with the operators on this system, and, as far as his own experience is concerned, their operating has been characterized by skill seldom encountered in newly licensed operators. However, if a second-class operator *can* break in, the experience will be most beneficial and should be helpful in securing employment that eventually may lead to a first-class ticket. (At the present writing the Federal Communications Commission considers only ship and coastal experience as valid in applications for an advance from the second to first class or higher.) Salaries with Pan American Airways, Inc., vary with assignment but may be regarded as substantially the same as those of coastal stations.

With the exception of Pan American Airways, Inc., many aeronautical and airport-station positions are open to holders of radiotelephone licenses. However, in some companies, such as Eastern Air Lines, Inc., the majority of operators hold first-class radiotelegraph licenses with an endorsement for telephone operation. A few positions (the only ones a new graduate might possibly touch) are held by operators possessing second-class telegraph tickets with similar telephone endorsements.

United Air Lines, Inc., favors the Boeing outline of requirements for aeronautical operators, and there are very few men at the ground microphones who do not possess engine or airplane-mechanic's licenses in addition to radio tickets. These qualifications are identical with those outlined for aircraft-radio servicing, except for the addition of the operator's license, plus excellent hearing and a good voice. It is reasonably probable that other airlines may follow United Air Lines, Inc.

Operators are inclined to protest against this setup on the grounds that they are being deprived of jobs for the benefit of any "grease-monkey" (an airplane mechanic) who can pass the relatively easy examination for a low grade of telephonic license. There is something to be said for both sides of the argument. After all, it is pretty much up to the air lines to decide upon the qualifications of their operating personnel. If they believe that a mechanic's license is desirable, then it is the operator's job to acquire one, particularly if it is a matter of improving the efficiency of his

coordination in a specialized field and increasing his usefulness in an emergency.

The average minimum for ground-station operators is $112.50 a month; the mean top is $167.50. Few of them receive over $150 a month and the average is probably in the neighborhood of $140.

THE BROADCAST OPERATOR

It is probable that broadcast stations offer more immediate possibilities in the operating field, if only because positions are open, in the smaller stations, for newly graduated operators. However, the large stations, such as WEAF and WJZ, do demand previous experience of operators in charge of the transmitters and all locally associated circuits. Of the 120 operators employed at Radio City, Bound Brook (WJZ) and Bellmore (WEAF), all had considerable experience before joining the N. B. C. New York staff, and the majority hold first-class radiotelegraph licenses endorsed for telephone. This again means prior service on board ship or in the coastal field. Once more the vicious circle! Operators having lower grades of licenses often reach the larger stations via promotion along the broadcasting networks.

Salaries paid broadcast operators vary within wide limits, in accordance with the size, coverage, prominence and location of the station—factors that determine the station's income. In the larger stations of the National Broadcasting Company, an operator is started at $175 a month, and on seniority alone can advance as an operator to over $3,600 a year. In the

other chains, the pay is not quite so good, but in many stations of 5 kilowatts and up the pay for an operator runs as high as $60 a week. On the other hand, in some of the smaller stations the operators are working for as little as $80 to $85 a month. A typical 50-kilowatt station located in central New York State pays its operators $33.65 per week for the first six months, after which they are advanced to approximately $40. A top salary of $50 a week is paid to the chief transmitter operator. The studio-control supervisor receives $55 a week. These are the salaries as they exist at the present writing, following recent increases of from $6 to $12.50 per week.

A 500-watt station in the same city employs six technicians, which include operators, on an eight-hour-day, forty-five-hour-week basis. The starting wage is $30 weekly, which is gradually increased to $42 at the end of four years' employment. Overtime, if any, is paid for at time and a half. These, too, are current figures, following recent advances of from $3.50 to $9.50 per week.

A less encouraging picture (which, alas, is also typical) is presented by a 100-watt west-coast station, where the operators have just taken a $5 pay cut and now receive a weekly stipend of $25, one of them having to announce eight hours a day.

On the whole, broadcast-operating salaries check rather closely with those paid at coastal stations. Similarly the opportunities for advancement are excellent—to supervisory and engineering positions,

FIG. 11.—A ground station in the Eastern Air Transport system. Operating positions in such stations are open to experienced men qualifying for both telegraph and telephone licenses.

FIG. 12.—Pan America is the only American air transport company flying code operators. They are experts of the first water.

(*Facing p. 96*)

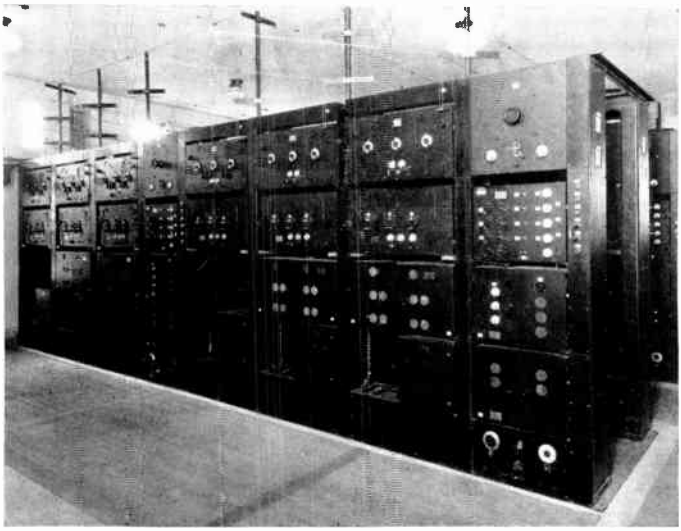

FIG. 13.—Short-wave receivers at the R. C. A. central receiving station, Riverhead, L. I. Each receiver is connected to its individual antenna for reception from different foreign transmitters.

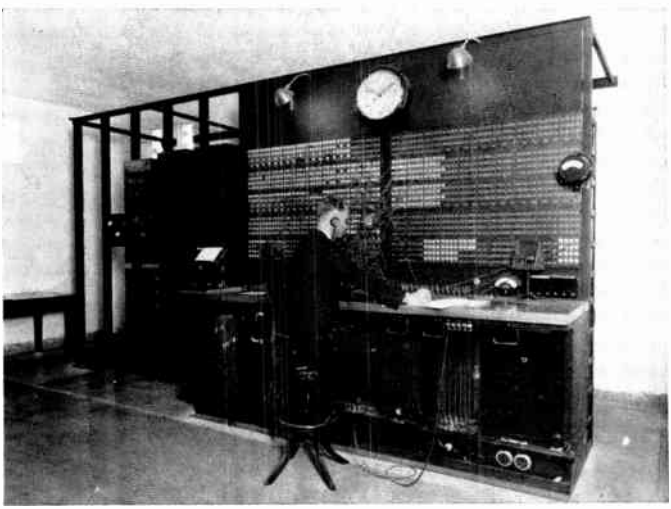

FIG. 14.—The switch board connecting the receivers at Riverhead with recording machines in New York City.

depending upon the qualifications of the operators, and via transfer to larger stations.

MISCELLANEOUS OPERATING JOBS

The operating positions considered in the foregoing paragraphs give employment to the large majority of operators working today, and, from the standpoint of mass employment, offer the greatest opportunities. There are, of course, other fields open to operators, such as police radio, transoceanic telephony, the Department of Commerce, radio schools and experimental research.

Newly graduated operators occasionally find employment in the police-radio stations, but in some instances these broadcasts are manned by members of the force who have acquired operators' licenses. There is little chance of a remunerative advance here, though the experience gained should be useful in other radio or operating fields.

A considerable corps of operators is required to maintain the high efficiency of the commercial transoceanic telephone service. In most instances the operators are licensed for both telegraph and telephone stations and have the equivalent of a high-school education. In no cases are these positions immediately open to new graduates of technical courses. The majority of operators are recruited from the telephone-company central offices, and their technical training, regardless of extent or the manner in which it was secured, is supplemented by training courses conducted by the company. The remuneration is good

and is consistent with that of other telephone employees of comparable standing, advancing steadily toward a maximum. While lifetime financial security is virtually assured, within a reasonable scale of living, there is little opportunity for real advance unless the operator is a competent engineer and preferably a specialist in the field.

The Department of Commerce employs operators in its sixty-odd stations scattered throughout the country, and in the radio-inspection service. These are civil service jobs, definitely limited in number, and start the operator at $1600 a year.

The radio schools offer employment to a handful of operators, almost invariably selected from their own graduates. There are only occasional openings here, but in many instances a first-class radiotelegraphic license is *not* required.

Experimental stations offer real opportunities to the operator if he is also a qualified engineer. Many of these operators are drafted from engineering or laboratory departments. The reverse procedure also holds, and the operator who is a creative technician and is willing to study and learn may work his way to big things. Such achievement, however, is the exception—definitely not the rule.

THE RADIO OPERATOR'S LICENSE

There are seven different grades and types of licenses issued by the Federal Government, not including the amateur grades. (Only the holder of an amateur license may operate an amateur station.

In considering, below, the types of stations that may be operated by the holders of different classes of commercial licenses, it is always understood that amateur stations are excepted.) Licenses are issued only to American citizens.

The highest grade of license issued by the Federal Government is the "*commercial extra first-class.*" To be eligible for examination, the applicant must hold a radiotelegraph-operator first-class license and must have been actually engaged in stations open to public correspondence for at least eighteen months during the two years prior to his application. He must pass code tests of not less than thirty words per minute, Continental Morse, and twenty-five words per minute, American Morse. A "word," in all radio code tests, is assumed to average five characters. He must pass a difficult written examination on the subjects required for radiotelegraph-operator first-class and radiotelephone-operator first-class licenses. The holder of this highest grade license may operate any type of radio station in any capacity.

There are three grades of radiotelegraph operator licenses—first class, second class and third class. To secure a *radiotelegraph-operator first-class* license, the applicant must show at least one year of experience on board ship or at a coastal station, and must pass code tests at twenty words per minute, Continental Morse code groups, and twenty-five words per minute, plain language, plus a written examination in radio theory, practice and law. The holder of a radiotelegraph-operator first-class license can operate any

station excepting broadcast, in any capacity, and as chief operator in certain types of telephone stations.

A *radiotelegraph-operator second-class* license will be issued to an applicant who can send and receive not less than sixteen words per minute, Continental Morse code groups, and twenty words per minute, Continental Morse plain language, and who passes a written examination similar to that given in the first-class test. No previous experience is required. The holder of a second-class ticket is licensed to operate all stations, except broadcast stations and certain other telephone transmitters. He cannot be a chief operator in a ship station of the first or second class. (After six months of certified marine service, the license can be endorsed, permitting the second-class operator to act as chief operator on vessels of the second class.) This is the only type of telegraph license for which the student should strive.

The positions that a *third-class* operator can fill are so definitely limited that, with the surplus of experienced operators available, there is little sense in taking the examination. The requirements call for a code speed of sixteen words per minute and the usual written examination, but not so comprehensive in scope.

No code requirements are indicated in the three grades of telephone operator licenses—*radiotelephone-operator, first-class, radiotelephone-operator, second-class,* and *radiotelephone-operator, third-class.* The applicant is examined in theory, practice and radio law, the examinations for the lower grades being less extensive.

The student should endeavor to secure a first-class license, and the better schools train for this grade.

The holder of a first-class radiotelephone license may operate any telephone station, regardless of type or power. The second-class radiotelephone operator cannot operate a broadcasting station, and the holder of a third-class license is still more definitely limited.

The holder of a radiotelephone license may, upon passing a code test of fifteen words per minute, plain language in Continental Morse, have his license endorsed to permit the operation of aircraft radiotelegraph stations. Upon passing the necessary examination for a specified radiotelephone license, the holder of any radiotelegraph license may have his ticket endorsed for the operation of such telephone stations as are permitted for that grade of telephone license.

THE OPERATOR'S TRAINING

The technical status of an operator holding a higher grade of license is above that of the serviceman and more closely approaches engineering qualifications. Some servicemen may take exception to this statement, arguing that the operator need be familiar with only a few receivers, while the serviceman must be on intimate terms with hundreds of them if he is to get anywhere. However, the average operator is better versed in the fundamentals of electricity and radio, must also know his transmitters, and in many instances has devoted more time to study than the serviceman, owing to the fact that code ability is acquired slowly.

Practically every operator is an expert serviceman—it is part of his business—while the reverse is by no means true. As a matter of fact, many operators, for a variety of reasons, turn to the service game and almost invariably make a success of it. The man trained as an operator has the advantage of being able to hold at least two different jobs and is therefore better fitted to circumvent unemployment.

Obviously, if time and money are not matters of immediate concern, it is worth while to train simultaneously for service and operating positions, *i.e.*, for servicing, plus code experience, radio law and the theory and practice of transmitters. Whether or not you ever even try to obtain an operating job, you will be a better serviceman for your dual preparation.

As with servicing, residence school, correspondence school and self-training are all possible methods for the development of proficiency in radio operating. Regardless of the manner of training, it is recommended that, as a first step toward securing a license of any grade or description, the student send 60 cents to the Superintendent of Documents, the Government Printing Office, Washington, D. C., for the "International Radiotelegraph Conference Madrid 1932" (30 cents), and the "Federal Communications Commission Rules and Regulations" (30 cents). These books contain a complete exposition of national and international radio law—knowledge of which is required for all types of licenses; they also describe in detail the requirements for and the service limitations imposed upon the various grades of operators.

The finest training supplementary to any course, formal or otherwise, is the ownership and operation of an amateur station. Amateur licenses are relatively easy to obtain, the code requirement being only ten words per minute. It is suggested that the student obtain a copy of the amateurs' "Radio Handbook," published by the American Radio Relay League. This tells the story of the amateur operator, gives full details on how to obtain a license, and is a liberal course on operating itself. The operation of an amateur station is the most expeditious of all methods known for developing sending and receiving speed and familiarizing the student with the technique of handling traffic.

THE RESIDENCE SCHOOLS

Again the residence school is to be given definite preference in training. Here the student gains familiarity with the equipment he hopes eventually to operate, both at first hand and in adequate texts. He enjoys the psychological acceleration of association with other students having similar aims and solving identical problems. His code work—assuming that he is training for a telegraphic license—is supervised by experts and his transmitting style developed along approved lines. He is trained directly for a second-class ticket, or radiotelephone operator, first class, if telephony is the goal. Both the code and technical examinations at the schools are slightly more difficult than those given by the radio inspectors. A student graduated from a

good residence school seldom fails in the government tests.

Owing to the intensive training at a residence school, the student is prepared for a code license at the end of six months—the time specified at most schools. This is for daytime attendance, from six to eight hours a day, about half of which are devoted to code practice. Evening schools take twice as long.

The average cost of residence courses for telegraphic licenses is slightly under $120.

Residence training fitting the student for a telephonic license will run from nine weeks to nine months, depending upon the thoroughness of the course, and the cost will vary accordingly from around $100 to well over $500. The longer and more expensive courses are of an engineering nature. It is usually possible to combine telegraphic and telephonic training at a cost only slightly in excess of the tuition in either field alone. The majority of residence courses can be started any week, though matriculation in some of them is restricted to quarterly or annual enrollment.

THE CORRESPONDENCE SCHOOLS

Correspondence training is successful in turning out qualified radiotelephone operators, particularly those courses that emphasize the engineering rather than service angle. Broadcast transmitters, speech amplifiers, antennas, attenuation pads, control systems, general broadcasting technique and fundamental electricity and radio are thoroughly covered

in the better courses of this type. By eliminating much of the service data (which, however, we do not recommend, since servicing may mean bread and butter when operating cannot buy cake), the student should be able to qualify for a first-class radiotelephone license in from six to nine months, depending, of course, upon the time devoted to study and the facility with which the student assimilates his lessons. The cost of such courses is about the same as for the more strictly service type of instruction.

The correspondence schools are to be somewhat less enthusiastically recommended for telegraphic training, but they may of course be resorted to when residence training is inconvenient or impossible. Here progress is more definitely up to the student. Code cannot be taught by mail. The best the school can do is to tell you how to teach yourself. Some code courses furnish automatic transmitters, which are helpful, but these should always be supplemented with a short-wave receiver or, best of all, the student's own amateur radio station.

The correspondence courses provide more of a general radio background, instead of preparing the student specifically for a radiotelegraphic position. Even in the service courses some sketchy attention is usually given to code—memorization, "traffic handling," etc. The cost of correspondence training for code operators is a bit higher than the regular service courses, averaging around $135. This training may, of course, be pursued during one's spare hours. By the time the regular lessons are finished—in from ten to fifteen

months—the student's code ability should be sufficient to pass him for a second-class license.

The psychological factors that determine the adaptability of the student to different forms of training for operating positions are identical with those outlined for prospective servicemen in Chapter II; the school should be chosen by the same technique of elimination.

SELF-TRAINING FOR OPERATORS

It is quite possible to train one's self to become an operator. Many commercial operators have done so, usually being graduated from the amateur class. In self-training, it is almost essential that the student operator own an amateur station. In any event, a short-wave receiver must be on hand.

Needless to say, self-training should be attempted only if the student is confident of his ability to teach himself. At least a half-dozen good books should be owned and studied. The author recommends, first, a week spent with Pitkin's, "The Art of Learning." Then, with your mental metabolism functioning according to the principles propounded in this book, go in for radio. Radio as a background should first be studied with the books recommended for a self-training radio-service course, eliminating the strictly service texts. These should be replaced with "Practical Radio Telegraphy" and "Radio Operating Questions and Answers," by Nilson and Hornung; "Radio Telegraphy and Telephony"; "Radio Traffic Manual and Operating Regulations" and "How to Pass U. S. Government Radio License Examinations" by Duncan

and Drew; and "Manual of Radio Telegraphy and Telephony" by Robinson.

The length of time required for self-training depends upon the diligence of the student, his natural qualifications and the speed with which he develops proficiency in code. The average student should be able to pass the license examination for an amateur station after three months of study and code practice. Assuming that, from this point on, he can devote several hours a day to study and operation, he should have no difficulty in securing a second-class radiotelegraph operator's license one year after obtaining his amateur ticket. Many, with luck or cramming, can do it in less time. However, I doubt the comprehensiveness and permanency of a radio education that might be obtained by self-training in less than one year and three months.

Many self-trained operators find it desirable to solidify their knowledge and experience by a short attendance in a residence school, or by reviewing a correspondence course. It is also desirable to reverse this process and supplement more formal methods of instruction by intensive independent study and amateur operating.

LEARNING THE CODE

The rapidity with which code proficiency can be obtained depends upon the natural ability of the student, the time he devotes to practice and the degree in which he is unimpeded by incorrect operating habits —physical and psychological. Considering the average

student, and assuming that the first principles of correct technique are both understood and will be studiously followed, it usually requires from two to two and a half months to develop from zero to a reliable speed of ten words per minute—the requirement for an amateur license—with a few words to spare. From ten to twenty words per minute requires another two months, and an additional seven weeks should bring one into the thirty-word-per-minute class. For still higher speeds the rate of gain declines, and it may take another six months before the operator can copy thirty-five words per minute with ease and accuracy.

One's initial efforts at learning code are best made with a key and buzzer, or oscillator, hooked up so that headphones can be used. If possible, have a friend learn with you—transmitting to each other. If you can prevail upon an operator for assistance during the first few weeks, your progress will be much more rapid. You should memorize the code as he transmits it to you, *by sound.* You will be much better off if you *never see a code chart* until you can send and receive ten words per minute. After that you will not need one anyway.

Unfortunately, facilities of this nature are not always available; if you *must* learn to code from a chart, memorize it aurally, not visually. Identify the letter *a* as *dut dah,* which is a vocal approximation of how it sounds in the headset, rather than as dot dash. Pay just as much attention to the punctuation and conventional signals as you do to the alphabet and

numbers. You will be examined on these at the same speed as plain language. Never transmit much faster than you can receive. Ability to copy and send should be developed simultaneously. One can, with a couple of weeks' practice, send twenty words per minute—but it will be undecipherable hash. It will probably not be much better six months later when you can copy that fast.

Occasional supervision by an expert operator is highly desirable. It is extremely easy to get into bad keying habits and very difficult to get out of them. It is next to impossible to recognize these defects when transmitting to yourself. The consistent perpetrator of poor grammar is never aware of his ain'ts and misplaced nominatives.

The proper method of handling the key should be learned from the very start. But do not make a fetish of it as the majority of instructors do. Hold the key any way that is most comfortable for *you*. No special curve of the fingers is either desirable or necessary. Some operators use a "double-decker" key—a small knob superimposed upon a larger knob. The fingers grasp the upper knob lightly and rest on the "platform" of the lower knob, an arrangement that the author personally finds conducive to restful, effortless transmission. One of the best and fastest straight-key operators the author has ever known never "holds" the key at all; his first and second fingers, move as one, beating a tattoo on the top of the knob.

Only the main principle of keying technique should be religiously observed. The operator should send with

the forearm rather than the wrist. But the writer is not of the opinion that the wrist should be held absolutely rigid. A slight amount of flexibility relieves strain and contributes to rhythmic timing.

It is desirable that the student learn to operate a "bug"—the "Vibroplex" or semi-automatic key—at the same time that he is acquiring precision with the straight key. This is to prevent his desecrating the ether with practice when finally he is on the air. Probably the large majority of commercial high-speed operators use the "bug."

Similarly, the prospective operator should learn to copy on the typewriter at the same time that he is developing his longhand speed. If you have never used a typewriter before, this offers the opportunity of acquiring the touch system, as your typing speed will progress at about the same rate as your copying. If you are already a fairly expert typist, but do not type by touch, every effort should be made to acquire this system; once again your typing will keep time with your increasing code speed. However, in most instances where a typist is reasonably fast in the sight system, it is impossible for him to acquire touch-typing speed—not because of psychological and physical habits, but because such typists have occasion to use their machines daily and cannot afford to slow down their typing speed for the several months necessary to acquire proficiency in the new system. Many operators are *not* touch typists. Regardless of experience or method, the student should learn to copy on the "mill." While you will use longhand

when taking your government examination, much commercial traffic, and all high-speed telegraphy is taken down on the "mill."

Mechanical transmitters are often useful in learning the code, mostly because they can be depended upon for lengthy sequences of punctuation, conventional signals and numerals. The "Teleplex" has the added virtue of being able to record your own transmitting and send it back to you, the defects of which may then become apparent in contrast with the performance of a professional "fist."

However, instructors agree that the mechanical transmitter can never replace hand sending for training purposes. The short-wave receiver is an indispensable adjunct. Many commercial transmitters send repetitions of simple letter groups, including their call letters, which are usually the first recognizable signals. Also, it is almost always possible to find some station transmitting slowly with each word repeated. Many amateur stations send prearranged code schedules for the benefit of student operators. Information regarding these schedules can be obtained from the American Radio Relay League, Hartford, Connecticut, and from the Candler System Code Guild, Chicago, Illinois.

In the cases of students who find extreme difficulty in gaining speed, the trouble is probably due to bad habits—psychological and operating. A month or two of code work with a residence school will probably do much to correct matters. The Candler system also provides special correspondence training for backward

code students. The lessons form a code course and are aimed at developing that automatic coordination of mind and muscle essential to expert operating.

The writer recommends that the operator have a 50 per cent margin of safety on code speed before taking the government examination. The fact that one can copy twenty words per minute at home does not mean that the performance can be duplicated under the mental strain of an examination. However, the student who can honestly do thirty words per minute will hardly be bothered by twenty, even under unfavorable conditions.

AN EYE FOR THE FUTURE

The student operator who would enhance the possibilities of his being employed should obtain some training in reading tape and teletype operating (*see* Appendix), and he should anticipate the future by detailed study of facsimile transmission systems.

We have already considered the training required for tape translation and the possibilities of this operating branch.

Teletype communication is widely employed in the police and aeronautical fields. The machines, in many instances, are supplementary to the radio systems and are in charge of the same operators.

It is reasonable to believe that, in the not distant future, practically all commercial telegraphic communication, except a few specialized services, will be by facsimile. Fast facsimile services are definitely to be established within a year, and will be supervised

by licensed operators. While radio operators are obviously not essential to the operation of facsimile apparatus, it is probable—and desirable—that licensed men will be employed. They are, in the first place, technical experts, knowing the radio fundamentals that remain unchanged in picture transmission, and it is only natural that the new system will absorb the personnel from the old. Consideration of emergencies provides an additional recommendation for operators skilled in other forms of communication. Also, it is quite possible that the Federal Communications Commission may so classify facsimile transmission as to make licensed operators necessary.

Chapter V

SITUATION WANTED!

IF YOU have had your license for any length of time, you will probably have gained adequate knowledge, through your association with other operators, of the actual mechanics involved in securing a berth. This chapter can be of little assistance to the experienced man. It is really written on the assumption that the majority of readers will be only potential operators or the holders of low-grade tickets with the ink still wet upon them. Such novices might find a few words on the procedure useful.

We have had occasion to make rueful mention of the vicious circle that demands experience as a prerequisite of an operating job that would provide the necessary experience! This situation is bound to exist as long as there is a large number of experienced operators available, and there are probably several thousands of them among the 9,000 licensed operators who are unemployed at the present time.

But operators are mortal. Some day they must be replaced by other operators. Thus there are two ways

FIG. 15.—Translating tape in the R. C. A. radio central, New York City. Special training is required for these positions in the point-to-point services.

(*Facing p. 114*)

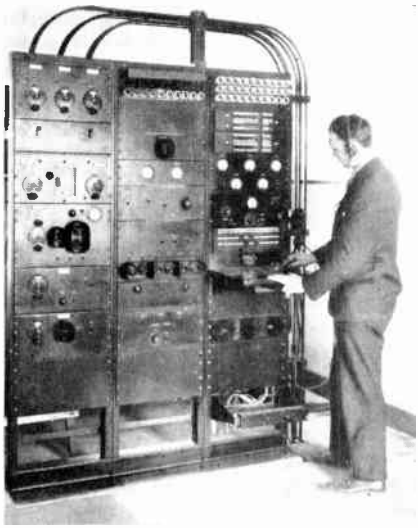

FIG. 16.—The type of receiver used by the American Telephone and Telegraph Company for transoceanic telephony. It is being monitored by an operator who is probably experienced in both Morse and Continental.

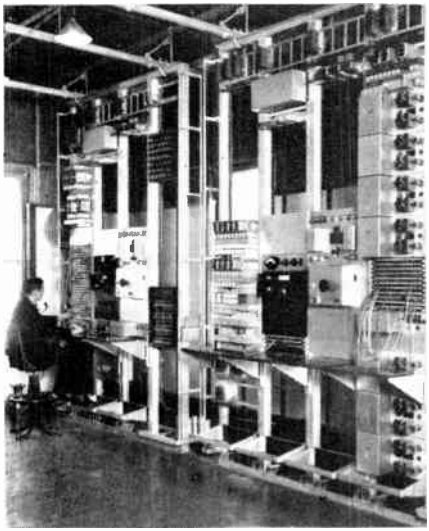

FIG. 17.—Connecting the radiotelephone circuit with the land-lines. Operators for such positions are trained in the Bell Laboratories' own school.

of breaking the vicious circle—by obtaining experience that provides the desired qualifications or by breaking in without experience. It has happened both ways. The former method is a matter of intelligent perseverance, the taking advantage of every opportunity that will contribute experience or otherwise enhance the probability of landing better jobs—or at least *a* job. The latter is luck, pure and simple, or "pull." Both luck and influence will also speed up the process of the first formula!

The operator should not be satisfied until he possesses every possible qualification, short of experience, before he risks the disappointment and discouragement that will almost inevitably accompany his initial efforts at securing employment. He should be satisfied with only the highest types of licenses he can secure without that *bête noire*, experience. This means he should be able to display a radiotelegraph-operator second-class ticket with an endorsement that shows he has passed the examination for a radiotelephone-operator first-class license. This makes him available for the widest possible range of jobs—ship, shore, aircraft, broadcasting, etc. His chances of securing immediate employment, while by no means certain, are much more probable.

If he has been fortunate enough to study one or more foreign languages in high school, or has otherwise acquired a familiarity with another modern tongue, he should brush up on his linguistic ability so that he may mention this valuable qualification in making application for a position. He should also be able to

indicate that he can furnish a typewriter, uniforms and an automobile when required. An ability to copy teletype and tape will often throw the balance in your favor. As we have advised, your course of training should include instruction in these subjects.

THE BURDEN OF EMPLOYMENT

In a previous chapter we quoted the president of a prominent radio school who said, " . . . the burden of getting a job rests on the student." Few radio operators are employed after the manner of butlers, stenographers and chauffeurs—via the situation-wanted and help-wanted ads or the ordinary employment agencies. Radio operators obtain their jobs in a variety of ways other than these—by personal contacts, through registration with the personnel departments of the companies that either use operators themselves or supply equipment that must be manned by them, by promotion or transfer within the industry, with the aid of operator organizations, and through the assistance of the more prominent schools, some of which, in good times, are successful in placing a reasonable percentage of their graduates.

In considering the matter of training in the preceding chapter, we mentioned several operating positions that are occasionally open to inexperienced men. Such jobs are in police radio and with the smaller broadcasting stations. The possibility of such positions' existing within traveling distance should be investigated by the unemployed operator through application in person or by mail, giving full details

and mentioning the fact that your possession of a second-class telegraphic license with a first-class radiotelephone endorsement widens your usefulness and qualifies you for almost any contingency.

It is in marine radio that one grows dizzy running around the vicious circle holding on to one's own coattails. But, peculiarly enough, it is here that Lady Luck often appears on the scene and gives the inexperienced operator his chance—usually in a case of emergency. Ships may wait for tide, but time and tide cannot wait for an operator. When the "beach list" (the waiting-list) has been temporarily exhausted, perhaps under conditions dictated by labor strife, the inexperienced operator is given a berth. Needless to say he hangs on to it! However, the operator should be wary in the matter of concerning himself with labor disputes and accepting berths which are opened by virtue of such crises. Where these conditions exist, it is well to consult the American Radio Telegraphists Association before signing on.

The operator should register with the chief operator of the various radio companies (or with the steamship companies operating independently) and with his local organization if he is a member of the union. The chances of getting a berth will be increased if the applicant can state that he is ready to sail on short notice. He should check his baggage near the office (if practicable, he should park himself at the office with his baggage!) and, when he is not on the scene, it should be possible to reach him, day or night, by telephone. A complete list of radio-operating and

independent shipping organizations, with their addresses, is given in the Appendix.

Many newly licensed operators have been known to offer their services to shipping companies gratis—particularly in the southern ports—in order to gain experience. This is what may be popularly described as "a good idea at the time." It is a practice worse than frowned upon by the profession. While you may be able to afford working for nothing (in other words, you are a person of relatively independent means), you are withholding a job from someone who definitely depends upon that work for his livelihood. Incidentally, you are lowering the standards of the game and are earning an unenviable name for yourself among your fellow operators.

THE UNION OPERATOR

There is no place in this book for a partisan consideration of open and closed shop. However, the operator will do well to investigate the situation for himself and decide to what extent he may expect individual and group aid from the operators' national organization, the A.R.T.A.—the American Radio Telegraphists Association—with headquarters at 22 Whitehall Street, New York City. Many operators are opposed to unionization on the basis that it tends to lower the professional status of operating, placing them on a common plane with the nontechnical fields of labor. On the other hand, it can be shown that many of the so-called professional benefits today enjoyed by the operators are due to the efforts of the

organized men. Where the union has not been able to function, the remuneration of the operator and his standing more closely approximate, or are even lower than, those of unskilled labor.

Some companies definitely discriminate against union men, while others are 100 per cent with the organization. Mackay and the Radiomarine Corporation run open shop. It is estimated that well over 90 per cent of the marine operators are members of the organization and that about 25 per cent in the broadcast, point-to-point and airways fields also belong.

A subscription to *Arta*, the official organ of the association, costs $1 a year. The newly licensed operator will find the perusal of several copies well worth while, in providing him with a general knowledge of operating conditions and opportunities, as well as in helping to determine his own attitude in regard to organization.

In any event, a close association with other operators in all fields should be maintained, as many positions are obtained through the personal recommendation of those already on the job or as a result of inside information regarding a probable vacancy.

Chapter VI

THE ENGINEER

THE yearly increase in the number of engineering students during the last quarter of a century—an augmentation that is out of proportion with increases in other scholastic fields—is undoubtedly partially responsible for the existing unemployment among engineers. However, it is by no means a reliable index of present conditions, or of the future. While the widening technological character of modern life may be largely responsible for the rising matriculation in engineering courses, the appeal of such training to common sense has had much to do with the relegation of the Greek alphabet to the less classic order of engineering symbolism. Thousands of graduate engineers are pursuing nonengineering endeavors through choice, not necessity—thousands who had never seriously considered the possibility of a technological career. An engineering education is probably the finest background for the *art* of living, regardless of the occupation in which the *mechanics* of living is carried out.

The misconception that science is dull, drab and prosaic is rapidly being dispelled by the wonders it creates—wonders beyond the imaginings of those who would decry engineering on "aesthetic" grounds. There are, of course, engineers who cannot see beyond the slide rule. But this is an innate quality of the individual, not of his training. Imagination, like the shape of one's nose, is a matter of heritage, and, unfortunately, is without the possible benefit of plastic surgery. The person whose imagination is not stimulated by the sight of the George Washington Bridge to contemplation of the scientific imagery behind it would probably stand in front of da Vinci's "Last Supper" and see in it only a pretty picture—if he even considered it a pretty picture. The immortal Leonardo, by the way, was an engineer.

Poe betrayed the science he learned at West Point—the engineering that made possible the wild logic of his stories—when he spoke of science as "Thou vulture, whose wings are dull reality." There can be as much beauty and art in a differential equation as in a sonnet by Petrarch, even though the former does make more sense.

Radio engineering provides a scientific background for living of bright imaginative color. If its study is undertaken with the mind definitely focused on an engineering career, the opportunities are doubly attractive in that the graduate radio engineer is almost invariably also an electrical engineer.

WHAT IS AN ENGINEER?

The engineer may be defined as a practical technician who possesses a thorough insight into the science in which he specializes and into closely related sciences. By a thorough insight we mean a fundamental—a mathematical—insight. The natural phenomena that underlie all sciences can be perfectly understood, controlled and operated upon only by mathematical dissection. It is not sufficient to appreciate the simple arithmetical fact that, to secure the greatest power output from a given "machine"—from an electric motor to a vacuum-tube circuit—the load impedance must be equal to the internal impedance. The fundamental mathematics of maxima and minima must be understood to remove the last vestige of parrot-like comprehension, so that the theory may be applied to different but analogous conditions.

You may be told that higher mathematics is not essential, that it will never be employed in everyday engineering and that the college-trained engineer forgets his mathematics the first year out of college. Such statements are particularly insidious because they sound logical enough and have in them some element of truth. No mind or memory is perfect. Something must be forgotten. The author recalls a dinner, some years back, with Greenleaf Whittier Pickard, a physicist of note, one of the foremost of radio-engineering pioneers and at that time president of the I. R. E. He confessed to the writer that he had

recently unearthed a mathematics notebook of his college days. He was amazed to find that, in the course of a dozen or so pages of finely lettered equations, he had theoretically estimated the mass of a peak in the Green Mountains by a process of which he could make neither head nor tail!

Like Robert Browning considering one of his more obscure passages. The poet said that when he wrote those lines, only he and God had understood the meaning—"but now, only God knows what it's all about."

The point is, some mathematics is necessarily forgotten—hence the desirability of a bit of surplus. But no engineer ever forgets his essential mathematics. There must be residual knowledge. Any engineer worthy of the name keeps up-to-date by reading his journals and technical papers and attending engineering meetings. The engineering presentation—aside from occasional nontechnical papers—that can be assimilated without knowledge of calculus and the mathematics of complex quantities (which involve imaginaries) is rare indeed. As a matter of fact, no real engineering text, the comprehension of which is essential to engineering students, can be intelligently studied without a thorough groundwork in higher mathematics. The prospectus of the R. C. A. Institute courses in mathematics rightly observes that "the mastery of calculus stamps the student as ready to be an engineer rather than an ordinary technician." Knowledge of higher mathematics is as essential to the engineer as is the study of anatomy to the

artist, though neither subject may appear at first glance to be necessary.

If you would be an *engineer*, you simply cannot get away with the mathematics that suffice for servicing and operating jobs. This does not mean that various "engineering courses" which imply that higher mathematics is not necessary do not provide some engineering training. They may merely be deficient in this one respect. In those cases the desideratum must be compensated by the student by independent study of higher mathematics.

THE COLLEGE-TRAINED ENGINEER

Having established more or less of a definition of what constitutes an engineer, we may consider the methods by which the student attains that dignity. Most of our engineers are college-trained men, and there are very few persons who will not concede that the standard four-year college course, with the usual majoring, provides the best primary training for the engineer. Such courses are thorough; the student is not rushed; he is given an excellent and highly desirable general science background in which mathematics is even more than adequately covered.

It is maintained by many that our average four-year college course features curricula not at all essential to the engineer. They contend that, by the elimination of such elements, an adequately trained engineer can be turned out in two years, as is done in some colleges. True enough—but such subjects as foreign languages, medieval history,

economics, English literature, etc., if they can be afforded, should not be discarded as "unessential."

The engineer has an excellent start toward the attainment of any heights for which he may aspire. In the process of his advancement and in the maintenance of his ultimate status, he will be confronted with social and cultural problems as well as technical ones. Successful engineers are usually men of versatile accomplishments, whose imaginations are by no means circumscribed by a book of logarithmic tables or the slide rule. Many of them can add a Ph.D., along with lesser degrees, after their names.

Dr. Alfred N. Goldsmith has always fitted in well with the writer's idea of what an engineer should be. An incident comes to mind, an historic one, back in the days when WJZ was installed in the long-since-demolished Aeolian Hall. It was the occasion of the first studio broadcast of a light opera featuring a stage cast—"The Student Prince." The writer was in the control room along with Dr. Goldsmith and a group of other engineers. Dr. Goldsmith was not particularly interested in the broadcast. To him, it was a *fait accompli*. He had spent the afternoon tramping the Jersey woods, collecting unusual specimens of thorns, some of which were several inches in length. With his back to the oscillograph, he discoursed upon the display of his finds.

Degrees are conferred on the completion of all four-year college courses. While there are engineers, fully worthy of the name, who do not possess the distinction of a degree, it has genuine value. Alone

it cannot make a good engineer, but it immediately identifies the possessor as one who has been adequately trained. It is a matter of credential, which facilitates the securing of a position and the entrance to the higher grades in engineering societies.

The four-year college course is recommended only to the youthful student who is fairly fresh from preparatory school. He should take the science course and major in electrical engineering. Upon being graduated he will be entitled to either a B. Sc. or an E. E. degree, or both. To the best of the writer's knowledge, no college gives a degree of "radio engineer." However, the electrical-engineering student who desires to specialize in radio is usually permitted to devote his last college year to the study of that branch of electrical science.

No specific recommendation of colleges can be made. The college is always a matter of convenience, personal inclination and finance. In passing, however, it may be said that there are colleges giving free engineering courses, and scholarships are available for practically all universities. Arrangements can occasionally be made whereby the student can work for part or all of his tuition.

Seventy-nine colleges and universities now offer radio engineering and technical courses. A full list will be found in "University and College Courses in Radio," by Cline M. Koon. This pamphlet is published by the United States Department of the Interior, Office of Education, and can be secured free of charge by writing to the Department and requesting Circular 53.

For the man who is already established in the radio field—an ambitious serviceman, for instance, who has saved or otherwise acquired sufficient financial resources, and who desires to progress in the engineering direction—a two-year college course is highly recommended. There exists no psychological reason why a person as old as forty should be hesitant about taking up engineering—or anything else, for that matter. While it is true that the facility with which one learns decreases with age, the slope of the curve is partly compensated by other factors, *i.e.*, qualities that improve with age, such as mental discipline, one's sense of responsibility, conscientiousness, etc. Taking all things into consideration, one's *effective* capability for the assimilation of knowledge drops only 15 per cent between the ages of twenty-two and forty-two.

While the entrance requirements for two-year courses normally stipulate high-school graduation, it is usually not absolutely essential, providing the student is willing to make up the deficiency by taking extra courses. Two-year training provides an excellent general science background through the study of physics and chemistry, and the student is carried well into the intricacies of differential equations. Upon graduation, a degree of Bachelor of Science in Radio Engineering is conferred.

Tri-State College, Angola, Indiana, and the Indiana Technical College at Fort Wayne specialize in two-year engineering courses. There are four terms each year—summer, fall, winter and spring—and the student may matriculate at the beginning of any term.

Both colleges assist students in financial need to secure part-time employment.

It is estimated that eighteen hundred dollars should see the economical student through the average two-year course—covering living expenses, tuition, incidentals and a reasonable amount of recreation.

ONE-YEAR COURSES

For the student who cannot spare two whole years from the serious business of making a living, there are several nine-month residence courses in radio engineering, which, with a bit of supplementary study on his part, should make a sound and excellent engineer of him. The entrance requirements for these courses are elastic, and no engineering degrees are conferred.

Abbreviated courses of this nature necessarily result in the still further elimination of desirable subjects. In every case they should be supplemented by the study of physics, general science and, if possible, chemistry. To the author's knowledge, in relatively few of such courses is mathematics carried through calculus, supplementary study in mathematics being absolutely essential in most instances. Tuition fees run from around $100 to well over $500, and the matriculation dates vary from quarterly to annual admissions.

To those living within convenient distances of the large university cities, there are numerous night classes in the technical institutes and colleges where the desired sort of training can be assimilated. Columbia University Extension, for example, offers several

courses in electrical engineering, radio communication, physics, general science, chemistry and mathematics, with credits that may lead, eventually, to the coveted degree. In all cases of such residence courses, primary instruction is available to satisfy the entrance requirements for the more advanced courses.

CORRESPONDENCE SCHOOL TRAINING

With plenty of initiative and outside supplementary work, there is no reason why the ambitious student cannot obtain an engineering education from a correspondence school. It goes without saying that he should select a course that is engineering in nature, rather than designed to fit the graduate ultimately for a service or strictly operating job. None of the correspondence courses give adequate attention to mathematics or general science; therefore additional study is necessary. No degrees, of course, are conferred.

The self-trained engineer is a possibility and an actuality. The author knows of several men who have had no formal training since their high-school days and who are holding responsible engineering positions. They are reliable, occasionally even brilliant, technicians. Successful training of this sort is, for obvious reasons, even more limited in the engineering field than in service or operating work. Such students are, definitely, in the minority.

Only a man employed in an engineering or experimental laboratory—preferably with some radio manufacturer—has much chance of progressing via correspondence or self-training. Here he benefits by

association with engineers. He assists them in their research; he acquires a familiarity with equipment and practice. He has always before him the immediate possibilities of advancement.

The actual mechanics of self-training is pretty much a matter of studying adequate texts. The student, regardless of how he studies, should also read the technical magazines and journals and should affiliate himself with the Institute of Radio Engineers and the American Institute of Electrical Engineers, attending their meetings religiously when possible. The requirements for the lower grades of membership can be met by any sincere student, and meetings of local chapters are held throughout the country. Full information regarding both institutes can be obtained by writing to the secretaries at the same address, 33 West 39th Street, New York City. The Radio Club of America, with headquarters at 11 West 42d Street, New York City, is also worthy of attention from the student engineer.

There are many texts suitable for self-training, as well as for work supplementary to residence and correspondence courses. Those recommended in our chapter on radio servicing will do well for elementary study. They should be followed with works of a definitely engineering nature, such as "Radio Engineering Principles," by Lauer and Brown; "Radio Engineering," by Terman; "Principles of Radio Communication," by Morecroft; "Theory of Thermionic Vacuum Tube Circuits," by Peters; "Thermionic Vacuum Tube and Its Applications," by Van Der Bijl; and "Principles of Electricity," by Page and Adams.

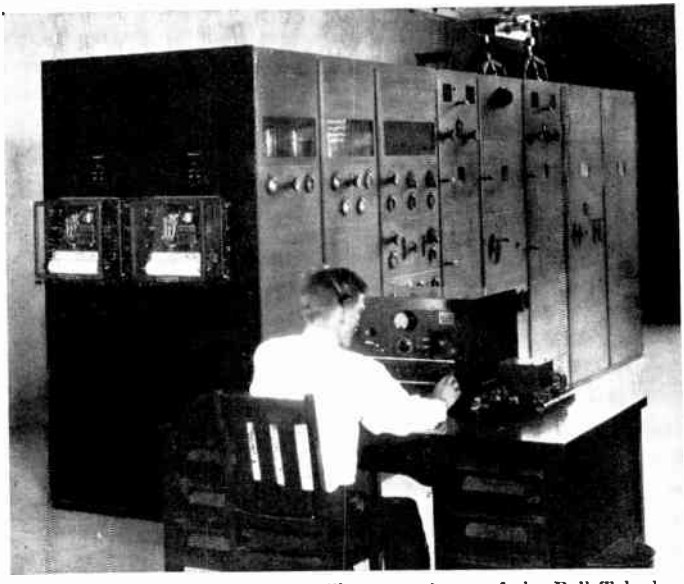

FIG. 18.—One of the Lawrenceville transmitters of the Bell Telephone Laboratories in charge of licensed operators who have qualified for both telegraph and telephone stations. In addition, the operator in the photograph is an experienced Morse man.

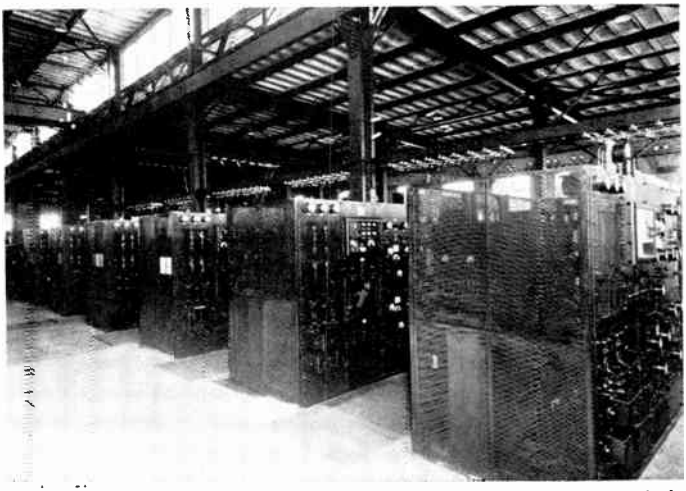

FIG. 19.—Transmitters at the R. C. A. Rocky Point transmitting central. These are in charge of a technical corps comprising operators and engineers—the latter usually being licensed operators.

(*Facing p. 140*)

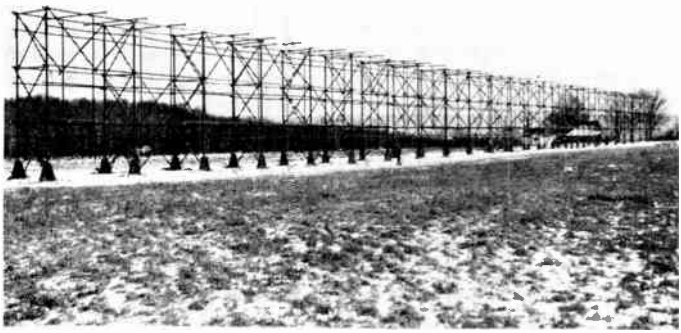

FIG. 20.—A directional receiving antenna of the type used for trans-oceanic telephony by the Bell System. Antenna design is a specialized field in radio engineering.

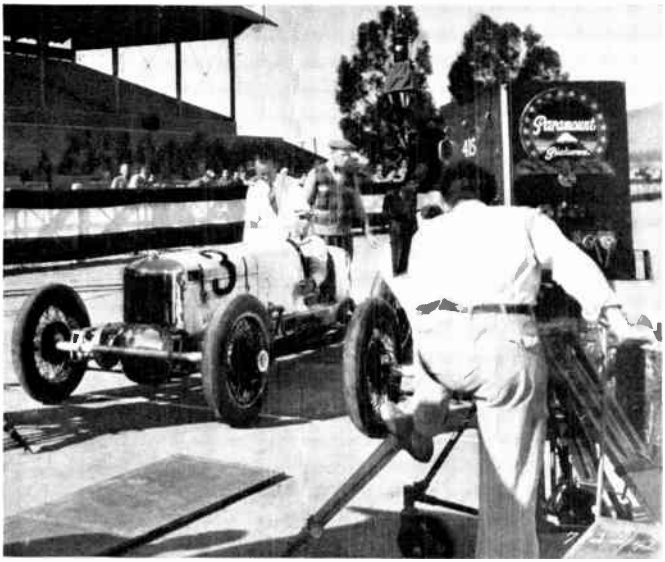

FIG. 21.—Making a sound picture. Fascinating but most exacting work, requiring training plus experience. Richard Arlen is at the wheel.

These books should be further supplemented by the simultaneous study of general science and mathematics. As we have made repeated mention of such supplementary work, it will be well to give detailed consideration to it at this point.

By "general science" we refer broadly, but not loosely, to the results and descriptions of scientific investigations into the realm of natural phenomena—from anthropology to relativity. Such studies, as well as mathematics (which we are perhaps falsely differentiating from general science), are best pursued at an adequate residence school. Of interest to the student is the recent announcement by the R. C. A. Institute's School of Communication Engineering regarding courses in mathematics considered from a communications point of view, carrying the student from arithmetic through operational calculus.

Home study is next in favor as a means of acquiring the supplementary education. The home-study department of Columbia University offers adequate courses in mathematics, psychology, chemistry, economics, drafting, astronomy, biology and physics. A kit of apparatus is available for the proper study of the last named.

Self-training is a quite feasible method of assimilating the necessary science and mathematics. The following texts are recommended, not merely as authoritative and fundamental, but, in most cases, as excellent reading. They should be studied only after a liberal education with Pitkin's "The Art of Learning":

"Elements of Astronomy," by Fath (McGraw-Hill); "Astronomy," by Baker (Van Nostrand); "The Outline of Science," by Thomson (Putnam); "The Rise of American Civilization" and "Whither Mankind," by Beard (Longmans); "Man's Own Show, Civilization" and "Why We Act Like Human Beings," by Dorsey (Harper); "Introduction into Crystal Analysis," by Bragg (Van Nostrand); "The World of Atoms," by Haas and Uhler (Van Nostrand); any standard high-school texts on chemistry and physics, to be followed by a college physics textbook such as "Physics for Colleges," by Sheldon, Kent, Patton and Miller (Van Nostrand); "The Science of Human Behavior" and "Personality and Conduct," by Parmelee (Macmillan); any elementary text on biology; "Mysticism and Logic," by Russell (Longmans); "Dreams of an Astronomer," by Flammarion (Appleton); "Foibles and Fallacies of Science," by Hering (Van Nostrand); "Flights from Chaos," by Shapley (McGraw-Hill); and "Relativity and Space," by Steinmetz (McGraw-Hill).

In mathematics we are in the field of exact science, and the texts must be studied rather than read. We recommend "Practical Mathematics for Home Study," by Palmer, as an excellent background. The various sections of this book should be supplemented by good high-school texts on trigonometry and analytics and, say, "College Algebra," by Wentworth. "Practical Calculus for Home Study," by Palmer, and "Calculus Made Easy," by Thompson, should take all the dreadfulness out of this thoroughly

interesting, essential and entertaining subject. As Dr. Thompson says, "What one fool can do, another can." All this can be well solidified by reference to and study with "Mathematics for Engineers," by Dull. To liven things up a bit at this point, we suggest "Recreation in Mathematics," by Licks. In order to tie all this in with electricity and radio, we recommend "Engineering Mathematics" and "Alternating Current Phenomena," by Steinmetz, and the "Elements of Electricity and Magnetism," by Thomson.

It will take you several years to work through these books—but you will find it worth while. Once again the fact cannot be overemphasized that no single book can be depended upon to cover adequately even a single phase of a subject. It has been inscribed in letters of jade that he who would be enlightened must kneel before two idols.

In conclusion we leave you this thought from a pamphlet published by the Engineering Foundation: "Although a school or teachers may help you greatly, no school can make of you a successful engineer or a fine man, or prevent you from becoming one. That is up to you."

Chapter VII

HORIZONS AND THE ENGINEER

TO QUOTE Dr. Alfred N. Goldsmith: "A prospective engineer should first decide, so far as he can, whether he is an aggressive individualist of a determined and extremely ambitious sort, or whether he is a really cooperative person who fits well into a definitely planned and clean-cut organization. It is hard to judge the fact, but perhaps his friends, in a moment of confidence, may give him a useful hint as to his actual classification. The extreme individualist will generally get on better by considering a personal career; and the more socially-inclined engineer fits better into a large organization.

"Again, the prospective engineer should consider whether he has a highly original type of mind and is interested in the future and in radical developments, or whether, on the other hand, he has the more sober and plodding type of mind which addresses itself to existing knowledge and tries to improve the details of present-day products or methods without any major modification. Again, it is well for the young engineer

to be very frank with himself. If he is highly original, he belongs either by himself or in one of the larger research laboratories. In general, if he is more inclined toward improvements and details, he will be at home in a moderate or large sized organization in its development of commercialization division."

There are no bounds to the possible social, economic, cultural and scientific advances of the engineer other than those imposed by the qualifications with which nature endowed him. His immediate horizon is only where the blue begins. True, this can be said of the radio serviceman, the operator or the plumber; but the engineer is more definitely on his way to the goal the world acknowledges as success.

A JOB OR A POSITION?

It may be maintained by some that engineers never get "jobs," but obtain "positions." The engineer should consider his first situation as a "job." Perhaps then he will not feel so badly when he loses it. At any rate, he will, in all probability, be paid much less in his first "position" than many another man who is simply holding down a "job."

Some engineers are fortunate enough to fit themselves into the economic scheme of things immediately upon being graduated. Almost invariably this is due to influence of one form or another—influence that should be promoted and taken advantage of by the student engineer. In the course of his training, the incipient engineer will make many contacts—with his instructors, part-time employers, members of the

alumni and of engineering societies and fraternity brothers who will precede him in graduation. These associations should be cold-bloodedly analyzed for their future job-getting possibilities and cultivated accordingly. We are not recommending that one should shake hands a second time only through selfish and ulterior motives. But the ultimate problem of making a living should not be blissfully ignored until the sheepskin is tucked under the arm. As a matter of probability, the most beneficial influence will be created when personal inclination is combined with economic expediency.

Without influence, and barring luck or a bonanza of technological development, the burden of getting a job devolves upon the individual. He should register with the employment department of the engineering societies with which he is affiliated, indicating the extent to which personal emergency exists. Other things being equal, preferment is accorded those requiring immediate assistance. The majority of jobs secured in this manner at the present time are temporary. Some of them are nontechnical, in which instances the engineer at least can eat until the opportunity is made, or presents itself, for him to practice his chosen profession. If he possesses an operator's license, he should proceed as recommended in Chapter V. Many lucrative and responsible engineering positions in the communications and broadcast fields are available through promotion from the operating personnel. In some positions of higher technical responsibility an operating license is in-

dispensable. In recognition of these facts, the curricula of well-balanced college engineering courses include code and practical training, which qualify the graduate for second-class telegraphic and first-class telephone licenses.

The conventional methods of job hunting should not be scorned. The engineer should register with the larger employment agencies, particularly with those specializing in the placement of technological personnel. The want ads will bear religious scanning, as engineering positions are occasionally advertised.

The art of cultivating useful contacts should never be dropped, even after a position has been secured. The engineer who is destined to be successful has, fairly early in the game, a definite picture of the direction in which he desires most to progress. Associations that will facilitate promotion or transfer toward the desired goal should be established and nurtured.

The engineer should so map his employment program (once it ceases to be an unemployment program) that time will be permitted, after a year or so in the field, for post-graduate studies. A lone B.Sc. degree is more often the mark of engineering mediocrity than no degree at all.

THE ENGINEER AND THE SET MANUFACTURER

There are over twenty million radio homes in the United States. In the majority of minds, the job of the radio engineer is most closely associated with the manu-

facture of receiving sets. A fairly complete analysis of the engineer in this field has been presented in the January, 1935, issue of *Electronics*, from which the following statistics are taken.

There is room, in this branch of the industry, for approximately 1,000 men who can qualify as "radio engineers," and, as such, they are in line for promotion. The number of engineers employed, and their salaries, increase, as would be expected, with the prominence of the manufacturer, as indicated by his annual production of radio sets. Among the 35 manufacturers making 10,000 sets a year, the average salary of the chief engineer was $3,600. Assisting him were one senior engineer, one junior engineer and two laboratory assistants, who received annual salaries of $2,780, $2,160 and $1,300 respectively. There were 70 manufacturers with yearly productions between 10,000 and 100,000 radio sets. Their chief engineers averaged $5,650 a year, one department head $4,200, three senior engineers $3,260, four junior engineers $2,380 and five laboratory assistants $1,350. Ten manufacturers exceeding this production paid their chief engineers, on the average, $7,150. Four department heads received $4,850, seven senior engineers $3,300, eight junior engineers, $2,470 and twelve laboratory assistants $1,480.

These figures, of course, convey no accurate idea of the extremes, particularly the top salaries. There are several engineering positions in the set-manufacturing field that pay as high as $25,000 a year, not counting bonuses.

THE BROADCAST ENGINEER

There is a growing tendency on the part of the broadcasting companies to employ graduate engineers for positions that formerly were held by men of lower technical qualifications, such as operators. It does not necessarily follow that the operator is being crowded out of the field, but it does mean that the real opportunities exist only for those of an unusually high technical ability. It must be remembered that they are competing with engineers who may have operators' licenses! Such operators as survive *are* engineers—without benefit of degree.

The engineers being favored in the broadcasting field are those who have specialized in communications engineering during the period of training. The engineering setup of a large station is usually divided into groups, such as: Master Control, Studio Engineering, Field Engineering, Engineering Maintenance and Construction, and Transmitters. These groups are usually under a supervisor and an assistant supervisor. The only groups where licenses are definitely required are in Field Engineering and Transmitters. Hence, the primary consideration is one of technical ability. Salaries range from $45 to $80 a week, including supervisors and assistant supervisors. At the top of the engineering group, really in the executive category, is the chief engineer whose yearly salary may top $6,000.

A key station in the Columbia Broadcasting System employs a technical staff of 61, including operators.

About 60 per cent of the engineers hold commercial licenses, for the greater part first-class telegraph, first-class telephone, or both.

Salaries at the smaller broadcasting stations are often poor, a chief engineer at a 100-watt station receiving perhaps $30 a week. He will doubtless double as operator, so at least a first-class telephone license will be required. The compensation is experience, and without this an application for an engineering position in a large station will probably be obscurely filed or dropped into the waste-paper basket.

FIXED STATION ENGINEERS

As in the broadcast field, the point-to-point systems are giving preference to graduate engineers in the more responsible technical positions. They are divided into the classifications of transmitting and receiving engineers. The former are responsible for the operating of a transmitter in accordance with the schedules of the traffic department. A senior transmitting engineer may bear the entire burden of responsibility in the absence of the engineer-in-charge or assistant engineer-in-charge.

Receiving engineers must answer for the maintenance and operation of receivers in the central station, as well as for the land lines connecting with the central office. They also monitor the transmitters of the same system to determine frequency stability. In a manner similar to that of his transmitting counterpart, the senior receiving engineer is responsible for the

satisfactory functioning of the whole setup during the absence of the engineer-in-charge or his assistant.

The qualifications for such positions have been indicated by R. C. A. Communications as follows:

"Foresight, judgment, resourcefulness, industry and cooperation.

"Knowledge of radio engineering and associated branches of electrical engineering, and detailed knowledge of plant which he supervises.

"Knowledge of radio laws and regulations, and possession of a Radiotelegraph and/or Radiotelephone Operator's license.

"A large majority of these men have graduated from recognized engineering schools, or started with us in the days when radio plant operation was comparatively simple. The latter have been able, in various degrees, to keep up with the requirements of the service. Practically all of the transmitter and receiver men engaged during the past two years are engineering graduates, and they apply on their own initiative in sufficient numbers to make it unnecessary for us to contact agencies or college 'placement bureaus.'

"After they have become thoroughly familiar with operating practice, these men are transferred when required to the Research Division, or are promoted to the position of engineer-in-charge or assistant engineer-in-charge.

"The engineer-in-charge and his assistant must have executive ability and knowledge of business practice, accounting, radio laws and structural engineering, as well as what is generally known as radio engineering."

HOLLYWOOD BOUND

The sound technician deserves a place in this chapter, not only because he must be an expert of the first water, and is often a graduate engineer, but also because he should be removed as far as possible from our chapter on radio servicing where he definitely does not belong, despite the efforts of many schools to associate him with that order of technological proficiency. The potentialities of the talking-motion-picture field rank next to those of radio in general, and television in particular, in the matter of ballyhoo. Similarly, a boom period is responsible for the enthusiasm. When cinematography became wedded to sound, the hybrid art looked to the radio field for an army of engineers and pseudo-engineers—some of whom did relatively nothing except cash amazingly good pay checks that Hollywood, with its usual profligacy, tossed into their laps. The tradition lingers —but only the tradition.

It is possible that many of the schools have in mind the less alluring and far less technical end of the game—sound-movie projection—the possibilities of which have been acknowledged in Chapter III. But the average prospective student envisions Hollywood only in its glamorous aspect; where (to quote Carl Dreher, Director of Sound for R.K.O., who wrote on this very subject for the Academy of Motion Picture Arts and Sciences) " . . . neither the climate nor the scenery nor the presence of national heroes and heroines can compensate for the lack of personal income."

One school dangles before its graduates the possibility of "bossing the stars"! If the author were certain this included Jean Harlow and Mae West, he would sign on the dotted line himself.

Less enticing are the baits of relatively easy training in a new and unlimited field, with salaries often over $100 a week! The author knows of no radio residence or correspondence course that provides an altogether adequate training for sound recording. It is undoubtedly in appreciation of this fact that the studios and producers work closely with the manufacturers of recording equipment.

The talking-picture industry today is neither new nor unlimited. It was very well established by 1930, at which time it accommodated 949 sound employees distributed among 19 producers. At its best, there is room in Hollywood—which means the industry—for about 1,000 recording experts. This would indicate a definitely limited field, rather than otherwise. As a result, there is considerable unemployment among sound men, and the situation is aggravated by the fact that Los Angeles affords relatively few jobs in allied fields for sound men waiting for a picture connection. When an opening occurs, there are often candidates who have prior rights of eligibility in other departments of motion-picture companies, as well as men specially trained by the manufacturers of reproduction equipment.

Before discussing the matter of salaries, which everyone must concede are phenomenally good, it would be well to consider the setup of a sound

organization associated with a reasonably large producer.

The overlord of sound is usually called the director, and he is paid from $12,000 a year up. There are, at the present writing, only five of these jobs in Hollywood. Directors of sound seem to like their work, and it is hardly worth while waiting around for one of them to die. The chances are that, in the case of mortality, one of the supervisors will step into the empty shoes. There may be three such supervisors in a company, a recording supervisor, one in charge of installation and test and a projection supervisor. These men make around $10,000 a year. The director of sound and his immediate assistants, the supervisors, are, as a rule, college men. The actual mechanics of recording is in the hands of one or two transmission engineers (who must have first-rate technical educations) and a corps of other highly qualified men known as first recordists, assistant recordists, mixers and rerecordists. Sometimes the nomenclature varies and we have a first soundman, a second soundman and assistant soundmen.

The first recordist, or first soundman, is in charge of the picture; he operates the amplifiers and controls the mixing, if any. The second soundman is on the stage, supervising the microphones and the booms. The assistant recordist or assistant soundman is in charge of the recording mechanism. A rerecorder is the person responsible for remedying any curable defects in the original recording. He also mixes dialogue and underscored music and injects sound effects; and

the finished sound track is as much the result of his labors and ability as that of the recordist who shot dialogue on production.

Transmission engineers average between $4,000 and $5,000 a year. A first soundman, in a typical studio, is paid $135 a week, but is considered lucky if he works forty weeks out of the year. Some first recordists, however, receive less than half of that, with no better prospects of consistent work. The average yearly income of the skilled and experienced first soundman—one who has made at least fifty pictures—will be around $5,000 a year. A newcomer, no matter how brilliant, has no chance of breaking into this class.

Second and assistant soundmen earn around $60 a week—when they work—and their yearly incomes average between $1,000 and $2,500 a year.

Obtaining a foothold in Hollywood is pretty much a matter of ability and influence. As we have already recommended, both should be cultivated simultaneously, so that, when you are technically prepared for the job (if you insist on Hollywood), the necessary wires can be pulled to get you there. Otherwise you have less chance of getting into the movies than the winner of a local beauty contest.

There are, of course, commercial outlets for a specialized form of talking picture in sales, advertising and publicity campaigns. Some of these are made under the supervision of Hollywood experts, others by totally independent firms. The field is not large,

however, and what has been said above in general applies here.

The expert who feels a definite calling for this sort of work will do well to associate himself, in almost any capacity, with a manufacturer or research laboratory associated with talking pictures, such as R.C.A. Photophone and Western Electric, thus paving his way for the acquisition of needed experience and an ultimate recommendation for the coveted position. This is just another way of reiterating—establish useful contacts and build them up to influential proportions!

OTHER FIELDS OF ENGINEERING

So far, in considering engineering possibilities, the discussion has been limited to fields concerning which it seemed desirable to say the most, from the points of view of popular appeal and opportunity. The extent to which the things we have said apply to other branches of radio engineering should be obvious to the reader.

The radio-tube manufacturers employ many radio engineers, the salaries and situation, aside from the indicated specialization, being comparable to those obtaining in the set-manufacturing field. The great research laboratories, such as General Electric, Westinghouse and Western Electric find places for many young engineers. There is rarely anything spectacular about the work or the salaries. The latter increase consistently from time to time, the conscientious worker always being assured, from the day of his

employment to the day of his pension, of economic security, if not affluence. Many engineers are fitted for this sort of work—and no other. This brings us back to Dr. Goldsmith again:

"There is no single place which is Utopia for all engineers, and so much depends on a fair appraisal by the young engineer of his capabilities and limitations and his wide adaptation of his plans to his particular capabilities, that any general statement would hardly be helpful. Perhaps the best compromise suggestion is that the more a man knows, the better he is fitted to face the future. Accordingly, thorough university training, followed by at least some experience in a well-equipped laboratory, shop or factory, should be a help to every engineer."

Chapter VIII

THE MIKE'S THE THING!

THE nontechnical end of broadcasting probably offers less opportunities to the average person than any other of the radio sub-fields, despite the fact that its crying need is for better writers, more artists of the first water, directive talent and a combination of courage, insight and intelligence that will raise the sponsored program out of the slough of distasteful and often stupid advertising.

The average person is not big enough to hack through the coils of mediocrity that stifle broadcasting.

The physical limitations of broadcasting provide another factor that circumscribes its job-offering possibilities. The broadcasting station has been compared with a magazine for the purpose of justifying commercial programs. It has been pointed out that the sustaining features, as well as the entertainment content of the sponsored programs, correspond to the editorial matter in a publication, while the commercial plug is the advertising upon which both mediums depend for their support. This argument is quite

all right, as far as it goes. But if we carry it farther, the comparison becomes a contrast.

There are, in the United States, some 4,700 magazines. In good times, with people spending more money for entertainment, the number of magazines always increases, while those already established add to the number of pages in each issue. More writers, illustrators, editors, typesetters, electrotypers, printer's devils, etc., are employed. Theoretically, by expansion, the publication industry can, at any time, find a place for everyone associated with it. Also, except for accidental similarities and occasional treatments of the same subject, *there is no duplication of material in these magazines.*

The situation is diametrically reversed in the broadcasting field. There is certainly not room for many more than 600 broadcasting stations in the United States—a situation we discussed in our opening chapter. Theoretically, each broadcasting station has 96 "pages," since there are 24 hours in a day and the minimum broadcasting unit is a 15-minute program. However, the hours between midnight and 6:00 a.m. may be discounted as valueless. The only hours that are really worth big money to the broadcasting station and all those concerned are the 20 "pages" between 6:00 p.m. and 11:00 p.m. (These hours correspond to "preferred positions," and their values are by no means the same on different nights of the week.) The sustaining "pages" thrown in now and then throughout the day may represent a loss to the station and may pay the artists little, if anything.

The point is that the number of "pages" can never be increased above 96, any more than the number of "magazines" (the stations) can be jacked up much over 600.

It may be maintained that the broadcasting station is a daily "publication," in contradistinction to the magazines. This is true, but we also have 1,900 daily newspapers, which can be added to if necessary, just as the number of pages can be increased.

To reduce the already limited individual opportunities in the broadcast field still further, all important programs are sent over the networks to as many as 100 stations. Such a program may well employ a cast of 100 persons (not to mention the writers, production men, etc.); a single-chain broadcast of this magnitude can therefore be considered as theoretically shutting the doors on over 9,900 jobs. While the fallacies of this argument are apparent, they are not serious. Chain broadcasting definitely decimates the number of radio artists who would otherwise be drafted for our national entertainment. A similar effect may be attributed to the ever-widening utility and popularity of "spot" broadcasting by means of electrical transcription.

Paradoxically, the numerical limitations observed will probably be the salvation of broadcasting. With a relatively limited field and a veritable army of aspiring artists from which to choose—instrumental, dramatic, vocal and literary—there will inevitably be a sifting, with the finer talent ultimately triumphant. Not that mediocrity will ever be altogether eliminated—genius will probably starve as long as morons can clap—but

the level must slowly rise toward the never-quite-attainable perfection.

This leaves no place in the picture for the average person. However, he or she will probably not be convinced of this fact until the knees are calloused begging for auditions and the last cent has slipped, still hopefully, into the coffers of some school promising a radio career. It is not even an encouraging outlook for the genuinely talented. For the ins are in and the outs are—out. The process of sifting will be a slow one. This is merely another way of saying that discouragement, heartache and the interminable waiting for the dawn, or at least some ray in the blackness they say precedes it, are the inalienable prerogatives of the artist, whether he would starve by pen, palette or microphone.

THE ANNOUNCER

The blithe lad who so facilely switches allegiance from cosmetics to cigarettes or coffee, being neither artisan nor artist, provides a natural bridge for our transition from the technical side of radio to what are ordinarily considered its more aesthetic aspects. The announcer's job with a large station is probably the most felicitous in the entire radio field. That is probably why the waiting list looks like a breadline, and, indeed, many aspirants for fame as announcers do double duty in both. The remuneration is usually excellent. The salaries vary, depending upon whether or not the announcer is permitted to accept outside fees from the sponsors of the programs on which he appears. This is

a matter of policy—a moot point between the two principal chains. The Columbia Broadcasting System maintains, with perfect logic, that the announcer, just as any of their other sound effects, is part of the service rendered their clients, who may take their choice on a first-come first-served basis. Among all the CBS announcers, only David Ross receives remuneration other than a regular salary check. Columbia announcers are therefore started at relatively high wages around $50 a week.

We understand that the initial NBC salaries are somewhat less than this, but the announcers are free to charge sponsors of commercial programs whatever the traffic will bear for their services. Graham McNamee at times makes over $1,000 a week. The same policy is followed by the Bamberger Broadcasting Company, and the lowest weekly salary paid a WOR announcer is $35. This, of course, is increased with service, experience and popularity, and is often augmented by substantial donations from the sponsors.

REQUIREMENTS OF AN ANNOUNCER

The key stations almost invariably stipulate previous experience as announcers. The general requirements are good diction, facile command of English, flawless grammar, a cultural background, a college education or the equivalent, a speaking knowledge of at least two foreign tongues, an excellent voice, preferably with unusual qualities, adaptability, tact, a familiarity with the theater and music, and that elusive something called a radio personality.

Announcers are placed on the waiting list following successful auditions. Owing to the number of applicants, auditions are granted only to candidates who have been authoritatively recommended, talent scouted by the station itself and that coming from other stations or networks. In the National Broadcasting Company, announcers are hired by the supervisor, from a long waiting list that is limited to the outstanding candidates from the commercial staffs of their chain stations. Unless a more intimate contact exists, all requests for auditions should be made by mail, stating in full your experience and other qualifications.

THE ARTIST

With the exception of the small local station, broadcast artists—musicians, vocalists and actors—are hired in exactly the same manner as they would be for concert or stage appearances—through the various representatives, agencies and bureaus. The stations' own lists of available artists are, in effect, and often in actuality, "bureaus," from which not only the broadcasting companies but any other interested parties can secure talent. To gain a place on such a list will be the particular aim of the aspiring artist.

Here, also, the entry is by means of an audition, and the army of applicants is such that exactly the same considerations that limit the auditions of announcers obtain in the case of the artist.

To quote a director of auditions: "Year after year, the National Broadcasting Company listens to thou-

sands of singers, comedians, whistlers, banjo players and more or less talented artists of all kinds, each one filled with the conviction that he is the coming star of the air. But of those thousands, the number who make good on the air is very, very small." In 1934, 1,805 persons were given auditions by the National Broadcasting Company. Of these, only 13 were classified as excellent, and 256 passed as "good."

Thus auditions are limited to those whose qualifications, almost invariably stated in writing and by mail, are passed on by the auditions staff. Approximately 5,000 auditions were denied by the National Broadcasting Company during 1934. As Samuel Kaufman puts it, "Getting an air break remains one of the most difficult achievements in radio." However, the National Broadcasting Company holds out at least the following encouragement: "The hunt for new talent is constantly going on. Sustaining stars win commercial programs, and the spot they leave open must be filled by someone else. Commercial sponsors and advertising agencies are always in the market for fresh voices, new personalities. The era of wholesale auditions has passed, but the road is still open to those who really have something to offer."

Efforts to secure auditions with the large stations by other than the approved methods are usually futile. Everything conceivable in the way of trick and strategy—from waylaying the president of the broadcasting company to picketing the studio reception room—has been attempted, with no noteworthy results.

Untold thousands attempt to break into broadcasting via the amateur night—a process which, needless to say, is still more discouraging. Yet it *has* been done.

Even in amateur nights, auditions are not given to everyone who asks for them. They are definitely limited as to number, and all requests, in writing, must state the applicant's qualifications. One popular amateur show is besieged with no less than 1,000 requests a day for auditions! Another receives 1,500 a week. Of this last number, only 40 are selected for auditions—less than 3 per cent. From these, a half-dozen or so are picked for the broadcast, two of whom receive temporary and nominal remuneration. Nothing in the way of permanent employment is implied. Over a period of time, around 100,000 requests for auditions were sent in to one amateur hour. About 1,000 of these got as far as the broadcasting microphone and 5 of them secured professional engagements of a more or less lasting nature!

Amateur hours happen to be pretty much in vogue at the present writing, and, while their popularity is bound to wane, there will undoubtedly be a recrudescence from time to time. The ambitious amateur tries them all—one after the other—until he gets a break or is cured.

There is no intention in the foregoing to derogate amateur hours. They are doing a definite good, regardless of the degree to which they are commercialized, and the false hopes which that commercialization demands. After all, broadcasting is one vast amateur

hour. It is not much more difficult to break into non-amateur broadcasting than it is into an amateur hour. The requirements for auditions are similar. As a matter of fact, some general broadcasting in which the artist is not paid is, technically, of amateur character. Between those graduated from amateur hours and those who climb the sure but rather slow way up from smaller stations, radio must ultimately benefit by an influx of talent—occasionally genius.

The sad part about amateur hours—a thing remarked upon by almost everyone listening to them—is that, invariably, artists are heard who, superficially, are superior to professionals. A baritone, for instance, is heard singing "Gunga Din"—singing it better than a well known and highly paid artist did it the night before. However, the listener should not forget that this amateur is probably singing the one song he can do best—perhaps the only thing he can do well! That is not enough to justify his stepping immediately into the shoes of, say, Lawrence Tibbet. The amateur has talent, yes. But has he ability? There's a difference. Talent is potential; ability, kinetic—talent in action. Can that amateur sing "Rolling Down to Rio" or "Danny Deever" as well as he did "Gunga Din"? Can he sing in German, Italian, French as well as in English? Is he an actor, with dramatic ability commensurate with the vocal possibilities with which nature endowed him? Can he die as Valentine in Faust in a matinee and, with the same artistry, as Emperor Jones or Scarpia five hours later?

We can only hope that the amateurs—all broadcasting aspirants—with the highest talents gain the recognition leading, not necessarily to immediate success, but to an opportunity to develop their latent possibilities into a genuine contribution to the art of broadcasting. We believe this is inevitable.

Of the various artists, the opportunities are probably least encouraging for the musicians, since so many qualified professionals have been made available through growing use of recorded music in the smaller theaters. The only exception seems to be the musician who can play tunes on a rubber hose, a beer bottle or some equally original and unconventional instrument; such performers are favored by the amateur-hour programs.

THE SUSTAINING PROGRAM

Sustaining programs—the programs that the station supports and puts on the air when time is not taken by commercial or other interests—fall into three classes: those that employ salaried talent on the station's staff, those conceived by the station but in which outside talent is used, and those that originate wholely outside the studio.

There is, of course, little opportunity for free-lance talent in the first group. However, should it occur for one reason or another than an extra-staff artist is required, the station will in all probability have recourse to its own artists' bureau. It may or may not

pay this artist, though the chances are it will. The pay ranges from $15 up, according to ability and popularity, and the station may actually pocket part of that $15 as the artists' bureau fee for placing the performer. The sum that the artist receives is for one broadcast and usually includes two rehearsals.

In the second classification, the artist bureau again functions, and the amount and probability of remuneration are once more variable. However, it should be said that the majority of outside artists appearing on the sustaining programs of the large stations are paid for their efforts. Where a key station rents such programs to other stations, some profit may accrue; in such cases there is no reason why the laborer should not be worthy of his hire.

The third type of sustaining program is somewhat different and is less profitable to the performers. It is usually conceived and executed by two or more free-lance artists who are experienced broadcasters. The station will put the act on the air in the hope, shared by the artists, that it will attract a sponsor. While the station, as well as the artists, admittedly will benefit by the sponsor, it often assumes the attitude of doing the performers a favor in permitting them to display their talents to a possible patron—a favor that should be adequate recompense for the sustaining feature.

With the exception of artists who have made a name for themselves in fields other than radio and who are in demand, the way to radio fame and fortune, *i.e.*, to sponsorship, is through the sustaining program.

SPONSORED PROGRAMS

The sponsor is to station and artist alike what the butter-and-egg man is to the blonde chorine. The sponsors support the stations and can afford to pay the artists salaries commensurate with the merit or popularity (there is a difference) of their performances.

Sponsored programs are conceived by an executive in the sponsoring organization, by his advertising agency (with or without free-lance assistance) or by the broadcasting company. In any case they are whipped into presentable shape by the agency or the station staff. Many of the larger agencies maintain elaborate radio departments, having just about everything but the antenna. Their program and production talent is recruited largely from the broadcasting stations. This specialized service (which practically duplicates what the broadcasting station can do, at an added expense to the sponsor) was founded on the undeniable fact that programs conceived by the stations were becoming more and more stereotyped. It was argued that independent efforts would result in something *new* to offer both the clients and the radio audience. Unfortunately, the advertising agencies seem to have fallen pretty much into the same rut as the broadcasting stations, and they appear incapable of thinking beyond terms of rustic (perhaps rusty would be the better word) character sketches, domestic life programs, news commentators, stooge dialogues and light opera revivals. Thus, while high-class entertainment is available at some time during

almost any evening, fresh talent, combining new ideas and the courage to break away from the old, is desperately needed.

If the basic idea for a program is turned over to the production department of a broadcasting station, it will be built up by the station's own continuity department along the lines suggested by the agency or sponsor. The artists will be drafted from the artists' bureau of the broadcasting company and an outside star may be called in. The act will be rehearsed (for which the bureau artists will probably not be paid) and the sponsor will be given an audition of his prospective program. If he likes it, all well and good. If he does not, it will be modified, or a new act will be conceived, prepared, rehearsed and presented. The sponsor may turn down several programs, as he might reject various sales and advertising campaigns suggested by his agency. He may even decide, after considerable cost to the station and no remuneration to the artists, that his product is not the type to be promoted by radio.

The procedure will be approximately the same if the program building is left entirely to the agency. The majority of the artists will be supplied by the bureau of the broadcasting company—but the larger agencies will pay them for rehearsals—and the agency may go outside its own organization for free-lance literary talent.

RECORDED PROGRAMS

"Electrical transcriptions" are slowly gaining in popularity with the listeners, but more rapidly

with the sponsors. There is every indication that in time they will replace a large number of our chain broadcasts.

The audience's objection, past and present, to this type of program, has been largely psychological and has been unduly emphasized by the generally known fact that, according to law, all such programs must be announced as electrical transcriptions. The listeners seem to feel that the government demands this announcement for their protection—to prevent deception. To them it is comparable to the pure-food laws which require that adulterants, artificial coloring or flavoring ingredients and imitations be stated on the labels of foods so characterized. As a matter of fact, the stipulation of this announcement is a technicality based upon an obscure angle of copyright ethics and law.

The perfection attained in electrical recordings and reproduction is such that few listeners would realize that they were not listening to a direct studio broadcast if no announcement to the contrary were made. Some discerning ears might suspect the fact from the superiority of the broadcasting technique. No recording is released until it is perfect in every respect. The program can be rerecorded several times until all slips have been eliminated. A flaw in a direct studio program necessarily goes on the air—and the occasions are rare indeed when some error does not come through the loudspeaker! The direct studio program is only page proof; the electrical transcription is a finished book.

Some persons, still reacting on psychological grounds, decry the recording as lacking the intimate time factor. They would hear the artist as she is singing, not weeks later and with the help of a machine. It is bad enough, they reason, that one cannot be actually in the studio or in an orchestra seat before the concert stage! In his own home, from his loud-speaker, the listener hears the program before he would were he actually witnessing the broadcast. It takes longer for sound to span the footlights than for radio waves to travel thousands of miles!

As for the machine—it is little different from the familiar broadcast setup. Unless you are listening to a key station of a network, a recorded program reaches you through a far less complicated machine than that used by any chain program!

Electrical transcriptions appeal to the sponsor for many reasons. First of all, there is the degree of excellence that it is possible to attain by such methods. The sponsor can hear what he is paying for exactly as it is going to sound on the air. Secondly, the recorded program may be less expensive. If the star need only be available at his or her convenience—need not cancel a trip to Europe or other engagements—an otherwise exorbitant fee is eliminated. Often the number and location of the stations spot broadcasting the recording are such as to effect economy by obviating the necessity for expensive land-line facilities.

Elasticity is an advantage peculiar to the electrical recording. If the sponsor desires to cover the nation

which has four time zones, at the same preferred local time, the single recording is far cheaper than four separate broadcasts. Also, it almost invariably happens that the same time is not open in the stations located in the various territories he wishes to cover, thus limiting the utility of a chain program. However, the recording steps in where the network cannot function and the broadcast is "scattered" over a period of an hour or two from all stations required to provide adequate coverage.

The electrical transcription also permits the use of individual station announcements which may be made highly effective in associating the product and the program with local sales campaigns and dealers.

With the exception of substituting the recording organization for the broadcasting company, the mechanics of building up a program for electrical transcription is essentially that of a direct studio broadcast. The same artists are available, and similar cooperation between the recording company, the agency and the sponsor prevails.

WRITING FOR RADIO

While there is no room in this chapter for detailed consideration of broadcast writing (a subject worthy of several books), it is perhaps desirable to present an abbreviated sketch to emphasize the necessity for a new and wholly different technique. Few persons, even among writers, appreciate the differences in technique, aside from manuscript mechanics, required for the successful presentation of the various dramatic

mediums—stage, fiction (in the narrow sense of a book or magazine story) and radio. It is difficult to realize these differences because the audience is rarely analytical and usually witnesses, reads or listens for entertainment. The net result or effect of the three mediums, if successfully attained, is identical, though the manner of achievement varies.

On the stage, for example, the scene is set to represent the interior of a house. There are doors right and left, and windows backstage. As the curtain rises, the stage is dark. The windows can be seen only as squares of blue fire as a thunderstorm rages. Suddenly an oblong of blue appears to the left, as a door is opened. Two figures are silhouetted for the moment; then the door is slammed. A beam of a flashlight sweeps the floor, then up to the face of a girl. A man speaks:

THE MAN: Are you very wet, kid?

THE GIRL: Not so bad. Here, let me have the light. You take this. (She hands him a small bag. He opens it and selects a jimmy.)

THE MAN: Probably need it. As I remember, there's a bolt on the other door. (The girl flashes the light around the room, disclosing furniture covered with dust protectors. It is apparent that no one has lived in the house for some time. The roving flashlight stops on the door to the right. Without a word to each other, the two move toward it.)

THE GIRL: Do you really think they left him—that he's in there—dead?

(Before the man can answer, there is a brilliant flash of lightning, accompanied by a clap of thunder. The girl screams. The flashlight goes out as it drops from her hand.)

THE GIRL: I'm sorry—that struck close. I dropped the flashlight.

THE MAN: Where the—

(Another flash of lightning shows them both on their knees, groping. The man picks up the flashlight.)

THE MAN: Hell—it's busted.

THE GIRL (her voice tense): Maybe the bulb is just loosened.

(During the last few seconds, a widening slit of light shows that the door to the right is being slowly opened. The man whirls—)

THE GIRL: Oh Bob—my God—look—look!—

In story form, the writer might treat the scene somewhat as follows:

At each turn of the narrow path they waited for the next flash of lightning. The door step at last! Though the rain was warm, Mary shivered, as Bob's skeleton key probed tentatively at the old lock. The creak of the hinges could be barely heard above the roaring rush of the rain. The door closed behind them. They were in at last. It was safe, now, to use the light. Bob flashed it in her face.

"Wet, kid?" he asked.

Mary blinked her eyes free of the rain and forced a grin. "Not so bad. Let me have the light. You take this." Bob passed her the flash, his free hand groping for the bag. He opened it and found a jimmy. "Probably need it," he explained. "As I remember, there's a bolt on the other door."

Mary flashed the light over the room. The beam flitted from the cloth-covered furniture to the dust-laden mantle and chandelier and then came to rest, as if held by some fascination, on the door at the far end of the room. They moved toward it slowly, and, Mary thought, with an exaggerated and needless caution.

But she was surprised to find herself thinking anything at all, surprised that her voice was steady as she asked, "Do you really think they left him—that he's in there—dead?"

The room was illuminated by the sudden glare of lightning. Bob's answer was drowned in the snap and roar that followed. The old walls rattled. Mary screamed, dropping the light. The darkness after the blinding flash was doubly black.

Mary swallowed. "I'm sorry—that struck close. I dropped the flashlight."

It was a relief to be doing something. On hands and knees they groped for the flashlight. The nickel plate glinted in a sullen glow of lightning. Bob pressed the catch.

"Hell—it's busted."

Suddenly Mary was afraid of the dark. She felt the fingers of panic at her throat. "Maybe the bulb is just loosened," she half prayed.

Mary was facing the second door. A vertical strip of light shot upward from the floor—widened as the hinges creaked. Bob whirled as he sensed, rather than saw, the faint relief from darkness. Once more the girl screamed, but it seemed to her that she was choking on her words, as a person crying for help in a nightmare:

"Oh Bob—my God—look—look!—"

The dialogue is practically the same in both versions, but in the story form the scene and atmosphere must be painted in words. Nothing can be left to intonation; so emotion and manner of speech must be indicated as well as action. The radio adaptation entails a still further modification. The *dialogue* must be made to supplement sound effects in describing *setting*, *atmosphere* and *action*. Also, it must be "keyed" at the very start so that the radio audience is never in the least

doubt as to who is speaking. On your loudspeaker, the scene will sound something like this:

Thunder rolls against the background of wind and rain. A door is heard creaking, the sound of wind and rain becoming louder as it is opened, then subsiding as the door is audibly slammed. A man speaks.

BOB: Are you very wet, Mary?

MARY: No, Bob—not half so wet as I am blind from the lightning. A little shivery though. Cold I guess. Here—you take the bag, I'll hold the flashlight.—Oh, Bob—what a spooky place. The furniture's all covered. Look at the dust. No one's lived here for years—

BOB: Never mind the dust, kid. Let's have the light over here, I can't find the jimmy.—Ah—here it is. As I remember, there's a bolt on the inside of that other door. Okay, let's go. Flash the light right straight ahead of you. Fine—hold it.

MARY: Is this—this the door?

BOB: Yep—that's it all right.

MARY: And do you really think they left him—that he's in there—dead—behind that door?

(Thunder crashes before Bob can answer. Mary screams. The sound of something falling.)

MARY: I'm sorry, Bob. Forgive me. That lightning struck close. I dropped the flashlight—wait, I'll help you find it. It must have rolled—

(Another crash of thunder.)

BOB: I see it. At least that lightning's good for something. The devil!—it's busted.

MARY: Oh, Bob, it's my fault. It seems even darker now. Maybe—maybe just the bulb's loosened—Bob!—Bob!—what's that?

(Sound of a door creaking.)

BOB: It's getting a little lighter—

MARY: Quick, Bob, behind you! There's a light in the next room. Oh my God, Bob!—the door's opening—

It is of course possible for a writer to acquire the technique peculiar to the radio drama by analytical attention to radio programs. However, as the effects are secured so naturally, points of artistry on the part of the writer are likely to be overlooked. The student who would study Poe's "The Fall of the House of Usher" as a superlative example of "single-effect" achievement is usually so carried away by the flawless flow of the tale that he fails to note how every word is chosen for effect and becomes as significant to the somber picture as an etcher's finest line is to his design. It is only upon rereading the story again and again that the microscope comes into focus. A radio program, however, can rarely be listened to more than once.

The writer recommends that the aspiring author of broadcast drama read several of the excellent books on the subject—in particular, "How to Write for Radio," by Seymour and Martin. This might be supplemented by Firth and Erskine's "Gateway to Radio," which contains some advice as to marketing and an excellent appreciation of the advertising situation.

THE MARKET

The majority of radio scripts are written by continuity writers on the staffs of the various broadcasting companies and stations. However, they do read and often buy free-lance "radarios," which may be anything from a fifteen-minute one-act skit to a weekly radio "strip." Contributions should be ad-

dressed to the continuity departments of the various companies and should be accompanied by a self-addressed and stamped envelope. The staffs have their shoulders eternally to the wheel turning out material for most of their sustaining programs and many of the sponsored hours. Fresh material, which will lighten their labors, provide new ideas and permit them to turn out better work themselves by devoting more time to individual jobs, is welcomed.

The situation is somewhat different in the case of the advertising agencies that have radio departments. They may carry only a few radio accounts and can therefore proceed at a more leisurely pace. Their scripts are less in the nature of hack work—though one might not always guess it from the results. While the agencies do employ outside talent, they are, as a rule, free lances of experience and established reputations (with the agencies and broadcasting companies—the radio audience rarely hears of them). They remain free lances only because independence is the air they breathe, or because they believe their recognized ability can command more money in that field. Often they are graduates from continuity departments, and invariably they have turned down offers of staff positions.

The unestablished free lance will rarely get anywhere with the agency. His contribution will be read by members of the continuity department and passed upon by them. If it is no better than they can do, they will, justly enough, reject it. If it is a definitely superior idea, it may receive a similar fate on the grounds that

there is no sense in permitting an unknown writer to flaunt their mediocrity before those higher up—and perhaps the sponsor.

The sponsor should never be approached except, perhaps, as a last resort, or if some excellent contact exists. The free lance will probably be referred to the agency "who takes care of such matters," whereupon the agency, in all probability, will turn down the script. They may also remind the sponsor that his present program is designed to complement specific magazine and newspaper advertising, that experimentation is hardly desirable and that in any event the agency is quite capable of taking care of continuities. It is always poor psychology to go over anyone's head if matters eventually may depend upon that particular head!

We have already intimated the developing possibilities of the recorded program. The free lance should not neglect the potentialities of this market, which, at present, is largely represented by R. C. A. Victor, Brunswick and World Broadcasting—all in New York City.

So far, we have considered dramatic writing for radio broadcasts. Other literary forms are associated with the art, such as the preparation of various addresses. These too demand a technique alien to that of stump or stage speaking. The radio writer should be versatile in his trade; also many of the precepts applicable to radio elocution hold in the more dramatic forms of presentation. The writer recommends Cline M. Koon's "The Art of Teaching by Radio" as an

excellent résumé of the technique of the spoken word in radio; it also includes an extensive bibliography.

Free lances may be divided into two classes—those who are endeavoring to break into radio, preferably via the broadcasting companies, and those who are well-known. It has never been an easy matter to gain entry into the writing game, and in radio it is particularly difficult owing to staff competition. Remuneration rarely, if ever, approaches that of other writing fields, even for the experienced free lance. The author sold a short story to a national magazine. It attracted some attention and favorable comment. A broadcasting station offered to purchase the radio rights for one-fiftieth what the writer received for the original sale of the story! In justification of this proposal, the broadcasting company mentioned several fairly prominent writers who had accepted similar propositions (which would indicate that even established writers will not scorn an extra penny—and it wasn't much more than that).

The experienced free lance can afford to accept what may seem to be disproportionate payment for his work, because it usually means a contract for some months at what is an excellent weekly salary. Though he will not receive nearly so much for a series of twenty-six half-hour radio sketches as he would for the same number of short stories, no author since O. Henry has been able to write one salable story a week over a period of months.

Radio script, once the technique becomes automatic, is not laborious. Dialogue is the only consideration

that requires the least analytical attention, and to the experienced writer dialogue is the easiest part of writing. Background, atmosphere, scenic descriptions, action and facile transitions put the writer's literary ability to a test and retard him to perhaps less than 1,000 words on slow days. However, in the radio script, except what is worked into free and easy dialogue, all this is taken care of in brief, terse, non-literary directions for sound effects, with no meticulous attention to the rhythm of words, diction, sentence balance or other attributes of "fine writing."

The beginner, who has sold radio scripts to a broadcasting company, should engineer the contacts he has made so that eventually he may find a place on a station's staff. The experience he will gain there and the demands placed upon his productive ability will be invaluable to him in subsequent free-lance work, in the attainment of promotion within the company or perhaps in opening the way to a better position elsewhere.

Both the novice and experienced free lance have woes in common. A sponsor, usually through his agency, has no qualms about holding up a script for months and then turning it down. He may demand a half dozen or more scripts and reject them all. Ideas have been stolen, too, and it is desirable that the writer register his work with the Authors' League of America. So far, with few exceptions, the radio writer has created and labored under a cloud of anonymity. In the past this has been largely recompensed by the fact that he could not be blamed, personally, for the

FIG. 22.—The transmitter room at WJZ, supervised by engineers and operators usually licensed for phone and code stations.

FIG. 23.—Boris Minnevitch and his Rascals before the mike at WOR. Harmonica artists are plentiful in this era of amateur nights.

(*Facing p. 172*)

FIG. 24.—As seen from the control room. The operator is monitoring a Radio City broadcast.

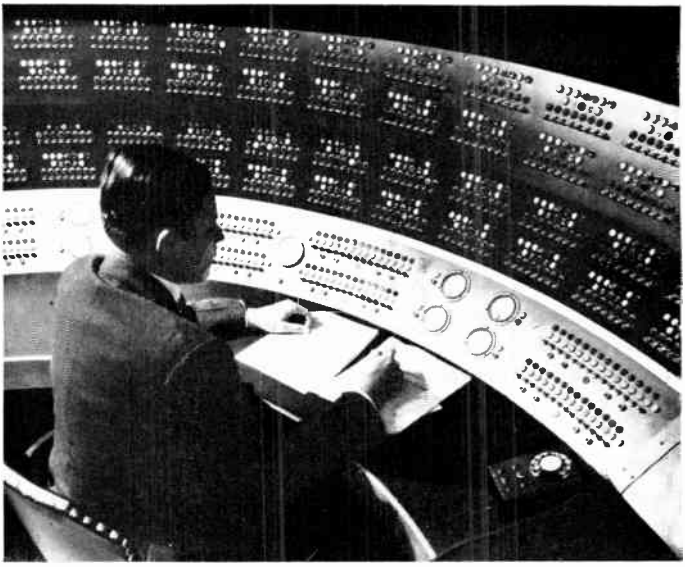

FIG. 25.—A section of the main control desk of the NBC's Radio City headquarters. The lights represent the different studios and the 85 stations in the country-wide network which the operator controls.

mediocrity of the ideas imposed upon his pen by those for whom he wrote. It is probable that this situation will be modified in the future and that the writer will be given at least as much publicity as the announcer who introduces the program he has created. It is only fair that he should receive merited praise—or, perchance, blame, which ordinarily would attach to the poor announcer and the actors.

BROADCASTING SCHOOLS AND COLLEGES

Among our universities and colleges there are thirty institutions that include courses in broadcasting among their curricula. Some courses are more comprehensive than others, but all told, they cover the following subjects: radio speaking, voice training, diction, microphone technique, radio continuity writing, writing and adapting radio scripts, announcing, singing, acting, directing, program building and the analysis of listener reactions. Further information regarding these courses and the colleges that give them will be found in "University and College Courses in Radio," by Cline M. Koon.

There are numerous voice-culture studios that devote particular attention to broadcasting. Among these are many "gyp" schools, and the aspiring artist is warned against them. The more they guarantee—the scale rising from auditions to actual appearances on the air—the warier the prospective student should be. Usually they have a "studio," consisting of a piano and a microphone. The latter may or may not be connected, through a cheap public-address system, to a

loud speaker. Singing into this microphone may constitute an "audition," and you will doubtless be assured that your voice has marvelous possibilities, but needs training—real microphone training, such as that particular school provides. When it promises time on the air, the school usually hires fifteen minutes a week from some small station (charging the students heavily) and puts three or four of them on one program.

Do not pay anyone for the privilege of broadcasting. Such a procedure is about as profitable as publishing your own book.

THE SMALL STATION AT THE BOTTOM OF THE LADDER

Throughout this chapter the implication should have been fairly obvious that the gateway to radio, for the multitude, is the small station. Such broadcasters are located in relatively small cities and communities—far away from the country's art centers. There is relatively little competition, home talent is not merely tolerated but welcome and the would-be announcer, artist and writer will almost invariably be given a chance. Success established at a small station justifies an opportunity at a larger one. The doors are opened for auditions, and the record of one's past experience, however humble in wattage, is a recommendation assuring the prominent companies that at least there is a chance they will not be wasting their time and yours in determining what you can and cannot do.

Chapter IX

RADIO WRITING

BY "RADIO writing" we mean the preparation of manuscripts for publications using radio material, drawing the distinction between this type of writing and "writing for radio," *i.e.*, for broadcasting.

This chapter is not intended for the established author. He knows a great deal about the subject, and he is probably holding one of the many radio-writing jobs. These positions demand experience, but fortunately we are running into a circle that is not completely vicious. Experience can be gained by free-lancing—the school from which many of our radio writers have been graduated, and which, in many cases, still contributes to their livelihood. Temporarily we shall narrow the definition of free-lancing to describe manuscripts independently conceived and executed, for which, when accepted, the writer is paid by the publication. The possibilities of free-lancing will be indicated by analyzing the contents of radio magazines and departments.

Thirty-five radio magazines are published in the United States. There are about 4,700 other publications, outside of daily newspapers and Sunday-newspaper publications, of which perhaps 5 per cent run some radio material. A large majority of the 1,900 daily newspapers carry programs and other radio material at least once a week. Of the 70 Sunday-newspaper publications, apart from the usual Sunday supplements, perhaps 10 per cent run radio news and columns.

Many of the large dailies indulge in a weekly splurge on radio. For instance the *New York Sun* devotes three pages, sometimes four, to radio every Saturday, carrying technical, semi-technical, radio-news, broadcast and short-wave material. Papers of medium circulation usually run several columns of radio copy on Wednesdays or Saturdays.

This would indicate a potential market for radio material of well over 6,000 publications and an existing market of about 2,000. Let us forget about the potential market as we analyze the *existing* market.

Numerically, this market is quite encouraging. At first glance the existence of thirty-five radio magazines—weeklies and monthlies—would seem to offer a fairly substantial outlet for radio writers. Of these, twenty-three are definitely trade publications. Of the remaining twelve, some are out-and-out broadcast-fan magazines, while others, though falling into the consumer category, have some trade circulation. At least two of the magazines, being official organization mouthpieces, do not pay for contributions. The

New York Sun really should be classed with the consumer radio magazines. It is an exception to the general newspaper rule that features radio material in the same manner as the movies and stage.

In our analysis, we shall take first a hypothetical radio magazine. It is based however, on facts and represents a combination of the three most popular of the semi-technical publications. It will run 72 to 100 pages and have a circulation of around 100,000. It has been designed to appeal to the serviceman, short-wave and broadcast fans, the radio experimenter and the set builder. It will comprise, all told, between twenty-five and thirty articles and departments.

About two-thirds of this material will be prepared by the staff and three or four contributing editors. Members of the staff will write under different names. There will be several descriptions of new receivers, written by members of the magazine staff, by someone in the regular employ of the manufacturer whose set is being described or by a writer hired by the manufacturer for this purpose. In any event, the magazine will send out no checks for these articles. The material on broadcasting will be compiled by a contributing editor from publicity copy for which the magazine does not pay. Trade notes are reported in similar fashion. There will be an article on a new 50,000-watt broadcasting station, with excellent illustrations of the studios, transmitters, control rooms and towers—all of which are submitted by the broadcasting company, prepared exclusively for this magazine for absolutely nothing, except the publicity.

There will be perhaps three articles for which checks are sent out to the writers, for amounts varying from $25 to $100, depending upon the length of the article, its intrinsic value, the reputation of the author and the condition of the editorial budget for that month. One of these checks will go to an established technician, probably working at an engineering job, who therefore is not to be classed as a free-lance writer. Of the remaining two checks, one goes to a free lance whom the editor engaged for this particular article, and the other to an author who was lucky enough to send the editor the type of article he happened to need.

Not a very encouraging picture for the free lance. It is even less encouraging with other magazines, some of which depend altogether upon their staffs and rehashed publicity material. The independent highly technical publications will buy material from free lances occasionally, but they do not pay well for it. Many "outside" articles are assigned by the editors to specialists in certain fields. However, they are always glad to receive manuscripts from technicians who have something to say, usually as a result of experimental and development work. A similar condition exists with the trade publications. They will buy material describing unusual sales campaigns, window displays, etc. However, all trade publications depend largely on publicity material, which, of course, they receive gratis. It is a universal custom to keep the editorial budget as low as consistent with maintaining a reasonable standard. Sometimes the reasonableness of the standard is not conducive to enthusiasm. In

free-lancing to industrial publications—in which group may be classed the technical and trade magazines,—it will be well to follow the suggestions given later on for the submission of copy.

The newspapers offer scant opportunities for free-lancing, occasional exceptions being made to established writers. In the average paper, the radio editor is almost wholly responsible for the sheet, which usually consists of rewritten publicity.

Radio editors are writers—that goes without saying. It is also true of their associates, the contributing editors and the perpetrators of the publicity material that takes up space that otherwise might be employed to the benefit of the free-lance writer. Such editors and writers are of course paid for their efforts. However, these are jobs to which the free lance cannot aspire until he is qualified by experience.

PUBLICITY MATERIAL

The type of publicity we are discussing can be divided into two classes—industrial and broadcasting. Industrial publicity refers to items and articles regarding trade conditions and descriptions of new developments.

Industrial publicity may be prepared and submitted by the trade organizations or by the manufacturers. Material coming from the first source is always more reliable, is nonpartisan and is welcomed by most editors. An analysis of tube sales by such an organization will be far more favorably received than a "news"

item submitted by the publicity department of the Thermiotron Tube Company to the effect that a recent tour of its president, Harry Carey, showed that tube sales were in for a new boom and that the cantilever-grid suspension of the super-life Thermiotrons had been creating favorable comment throughout the industry. More often than not, the manufacturer's publicity is written and released by his advertising agency, the consideration being that the advertising agency, controlling a number of accounts, has more influence with a publication than a single manufacturer.

Publicity articles describing new apparatus or developments are usually written by the manufacturer or the advertising agency, particularly if they are short items. In the case of a new receiver, the manufacturer may enlist the services of an established free-lance writer and pay him from $50 up to write one or a series of articles on his product. If the receiver is a good one, the manufacturer is virtually assured of publication—certainly if the way is greased with a bit of paid space. The magazines are glad to publish such articles as they bring in advertising and fill editorial space with well-known names at no cost to the publication. While this field is by no means the gold mine it was some years ago, it is more lucrative than writing for the magazines themselves. But, as implied, the free lance must have something of a following in order to justify himself from the standpoint of popularity. Moreover, the necessary commercial contacts can be made only as the writer's name becomes a familiar one and his radio associations become comprehensive.

BROADCASTING PUBLICITY

This type of publicity relates to programs and artists. Most of it comes in the form of releases from the networks, although it is often prepared by the advertising company handling the account and by the press agents of the artists. The editors prefer the first source; it is usually more reliable, it is written from a better news angle, and the responsibility for any statements is more definitely fixed. A veritable army of writers is employed in turning out material of this nature. In the larger broadcasting companies the director of press relations—or whatever he may be called—receives an excellent salary.

THE FREE LANCE

There are relatively few radio writers who are making a living by free-lancing. But it can be done. Such writers are men who have established reputations and built up a following. They are, as a rule, more or less definitely associated with two or more publications, are recognized experts and authorities in one field or another, and, in the case of technicians, usually have manufacturing or similar contacts that result in fairly consistent and remunerative publicity work.

The majority of writers who feel that radio is their field usually direct their free-lance activities toward either industrial or broadcasting publicity with the hopes of eventually acquiring a permanent position in the radio-writing field.

While, as we have intimated, it is *possible* to make a living with the pen in radio, it certainly cannot be done at the start. However, odd dollars can often be picked up, and these are manna to the serviceman, operator and young engineer; the experience may also lead to more remunerative writing if one's ambitions lean in that direction. The possibilities are greatest in the semi-technical field.

It is probably better to start with the less pretentious efforts—short articles and items of not more than 200 or 300 words, inspired by your everyday service and experimental work. The quasi-technical magazines, such as *Radio News*, *Radio Craft* and *Popular Mechanics*, feature departments that buy write-ups of this nature. The subjects cover an almost infinite range from the description of a unique soldering-iron holder to the photograph of a service shop. Payment (on publication) will vary from $1 to $10, depending upon the length of the article, merit, type and number of illustrations.

Needless to say, the manuscript should be typewritten, on one side of the paper. Many good ideas have been returned unread to the contributor because they were submitted in almost unworkable forms. Editors are busy men. Every manuscript, even those contributed by experienced writers, is edited, if only to the extent of indicating type directions to the compositor. This should always be borne in mind in preparing a manuscript, and everything should be done to facilitate editorial labor. A good-looking manuscript lowers the sales resistance by half. The

editor is impressed by its professional appearance, which suggests that the author is probably an experienced writer, and he is influenced by the fact that his own job has been simplified.

Always use a good grade of 8½ by 11 watermarked bond paper—costing at least $1.50 a ream. Erasures can be neatly effected on good paper. Under no circumstances make corrections in ink or cross out words. The author would even go so far as to frown upon a word inserted above a line, to patch up an omission, in one's initial contribution to a new market. (Once you are in, some liberties can be taken, but sloppy work should never be tolerated.)

There is no arbitrarily correct way of preparing a manuscript. The author prefers the following form:

Type, single space, your name and address in the upper right-hand corner of the first page with the number of words beneath.

On longer manuscripts, the name, address and length may be typed in the center of a separate sheet, which is not numbered and which precedes the first page. This keeps the manuscript clean; the name and address sheet can be replaced each time the manuscript is sent out. All titles and subtitles (which include those that may head various paragraphs throughout the text) should be typed flush with the left-hand margin, not in the middle of the page. This makes it easier for the editor to make any changes and notations as to type. The text should be double spaced. *Three spaces should be left between paragraphs.* Where a subtitle is employed in the text, it should be

separated from the preceding paragraph by four spaces, and from the paragraph it introduces by three spaces. Allow generous margins—right, left, and bottom.

Each page should be numbered, preferably at the top center or right. A decoration is effective; for instance page two might be typed –*2*–. This is a minor point, yes, but a lot of minor points in one direction have weight. The author numbers his sheets a half-inch below the top, and then ratchets six spaces to the first line.

Study the style of the magazine to which you expect to contribute. Note its individualities. Do they spell out "Figure" or abbreviate, "Fig."? Do they use a period after their captions or subtitles? Does the editor prefer figures such as "50" to spelled-out numbers, as "fifty"? Is 1000, 2000, 3000, etc., the custom, or is the form, 1,000, 2,000, 3,000, insisted upon? Which of the forms, 45 volt "B" battery, 45 volts "B" battery or 45-volt "B" battery, is preferred? Are quotation marks used, or is it merely a B battery? Are prices of parts and the names of manufacturers mentioned? Observe and make a list of the abbreviating conventions the editor prefers: Kc., kc., k-c or kc; m.a., ma, ma., or m-a; A-C (used as an adjective) A.C., AC, a.c. or a-c. When in doubt, follow the standard procedure of the I.R.E., which will be found in the Reports of the Committee on Standardization, and in several texts. The abbreviations kc, ma and a-c are approved by the I.R.E. Many editors prefer other forms. However, they are buying your story

(we hope), and the less work you make them, the closer you conform with *their* standards, the better the chance of a sale.

The size of the photographs furnished depends upon the size of the engraving that is to be made and whether minute details of the photograph must show clearly when reproduced. Commercial photographs are usually 5 by 7, 8 by 10 or 11 by 14. If possible none smaller than 5 by 7 should be submitted, and glossy rather than dull prints should be furnished. Do not send negatives.

No writing or marks of any kind should be made on the face of the photographs. Identifying numbers and necessary instructions should be written lightly on the back using a soft pencil. It is preferable that the photographs be not mounted. The desired point of insertion of the illustration should be marked in the manuscript so that photographs if necessary may be sent separately and well protected against possible damage in transit. Photographs and drawings should be wrapped separately and properly marked.

Drawings should be executed on individual sheets of paper—the same stock as the text—except in the case of blueprints and in instances where a larger drawing may be necessary. Draw with a fairly hard pencil rather than with ink. A drafting job is not necessary; your original, even if a masterpiece, will probably never be reproduced, from considerations of style and the proportion of reduction. Even a neat freehand drawing will do, the main point being to spread the drawing or diagram so that the details are clear.

A separate sheet of suggested captions should be prepared, keyed by figure numbers with the text and the illustrations. Your captions may not be used (the factors of space and make-up being editorial considerations) but they will always be helpful.

Never fasten the pages together with any sort of a perforating clip. The common wire clip may be slipped over the upper left-hand corner of the manuscript. On manuscripts sent flat, a gray or a blue folder (about the weight of a filing folder) is most effective and will protect the manuscript.

Manuscripts up to five pages may be folded twice, and those of from five to ten pages folded once, provided no photographs are folded. Longer manuscripts should be sent flat. Always enclose a self-addressed and stamped envelope for return (unless you know the editor well, and the article has been discussed and ordered). A short note, addressed to the editor, should accompany your contribution, suggesting that your article will be particularly suited to a certain department.

Manuscripts must be sent first-class mail. The envelope should bear the plea—PLEASE DO NOT FOLD. This, however, is seldom as effective as a piece of corrugated cardboard inside.

LONGER ARTICLES

Short items may be contributed to the magazines without any preliminaries. They are easy to write, and a person with no particular ability can describe a coil-winding machine or an insulation-stripping device.

Neither style nor manner of presentation is important, since the editor's pencil can whip a few neatly typed paragraphs into printable shape in short order.

The editor should be consulted before you prepare a longer and more ambitious article. Write him a letter, telling him, in as few words as possible, the sort of article you have in mind. He will be glad to indicate his degree of interest, and, if he believes he can use the story, he will suggest the logical length. If it discusses a receiver or a piece of apparatus, he will probably ask that the article be submitted to the laboratory of magazine for approval. Even if the idea appeals to his editorial mind, his willingness to have you prepare the story should not be construed as a promise to purchase.

Long articles require a certain degree of craftsmanship, but hardly more ability than that of a reasonably well educated serviceman, if he will follow a few simple rules. The article should be subdivided into five parts:

1. The opening paragraph which explains why the article was written—its justification.
2. A description of the apparatus itself, with reference to diagrams, etc. The theoretical action should be made clear in this section.
3. A list of the parts required.
4. Constructional details.
5. Operation.

The experienced and facile writer may, of course, indulge in literary license, but simple and logical presentation is not to be sacrificed. After all, it is the

reader who should be considered. Some articles will not fit into this arbitrary outline, but it will help in the average case.

An example may indicate the procedure more clearly. Let us assume that John Smith, a serviceman and experimenter, has developed a novel method of controlling regeneration in a tuned radio-frequency receiver, so that the sensitivity is fairly constant over the entire broadcast tuning range. The magazine laboratory has tested the receiver and found it practicable. Mr. Smith will perhaps call the article "An Equi-gain, High-fidelity Receiver," with the subtitle, *Simplified Equalization of Feedback over a Wide Frequency Range.* He might start the article as follows:

While many receivers have recently appeared in circuit or kit form for the home construction enthusiast, few if any of them have given adequate consideration to the problem of maintaining approximately equal efficiency over the entire tuning range. Receivers that have been sensitive and sharp, on the higher frequencies, have no dx qualities on the longer waves where, it necessarily follows, they tune broadly. When the characteristics are reversed, instability and oscillation are to be expected on the short waves. In the receiver described below, the author has endeavored to approximate the equal sensitivity performance engineered into the better class of manufactured receivers.

The action of the equalization system is best considered by referring to the circuit diagram, Figure 1 . . .

Following the theoretical consideration, the list of parts will be given, and then by constructional details. Data on alignment and operation will conclude the article.

In some instances, the magazine will make its own photographs while testing the receiver and also a picture wiring diagram if such is to be used. The writer should supply whatever additional illustrations he believes essential and should be guided by the precedent set by similar articles in the same magazine.

ARTICLES FOR BROADCAST FANS

It is a bit more difficult to break into the free-lancing game on the broadcast end, mainly because this field is more adequately covered by publicity releases which are rewritten by staff men.

The free-lancing of semi-technical matter will often lead to contacts that will give the aspiring writer a chance to glorify our programs and radio stars. It is also possible to enter this field via the short-wave column. The newspapers are slowly beginning to recognize the appeal of short-wave listening, particularly since the all-wave feature has been widely advertised. If you have a facile pen, a short-wave receiver and a few ideas, you may be able to sell the radio editor of your local paper (if he runs any sort of a radio page at all) a weekly column of, say, 1,000 words on short-wave radio, including program criticism, log of stations, reception conditions, etc. Once a contact such as this is established, it can be developed into something more definitely along the lines of your ambition.

Writing of this order requires more skill and training than the preparation of simple items for a service department. Several texts on writing should

be studied. Even persons of considerable natural talent will perfect their ability much more rapidly by a bit of self-training in this respect—a recommendation that is also extended to the semi-technical free lance who would take his work seriously. The author suggests "Writing for Profit," by Donald Wilhelm; "Writing Journalistic Features," by Perley L. Reed; and "Technical Writing," by T. A. Rickard.

THE FAN MAGAZINES

We refer to the broadcast listening fan and his bibles, borrowed in style from the popular movie magazines. These place the radio stars on pedestals, describing their hobbies and lives, how they eat, drink and make love (as long as they are on the pedestal). Most of the material used in these publications is rehashed publicity. Occasionally feature articles are written by sob sisters who are experts in the reading of souls, and whose facile pens are dipped in pink lemonade. It is quite possible for the broadcast free lance to achieve these heights.

RADIO BOOKS

There is, naturally, as great a variety in radio books as in radio articles and magazines. Books in this field are rarely if ever written until some degree of background has been established to justify the author's ambition in this direction. Also, such books, unlike fiction, are seldom written and submitted to a publisher without some preliminary correspondence.

If you have an idea for a radio book, it is desirable that you first communicate with a publisher, indicating your past experience and qualifications (unless he knows you personally or by reputation) and telling him what you have in mind. If the idea appeals to him, he will probably ask for an outline. If he is still favorably disposed toward the book, he may ask for a sample chapter or two, before he can be convinced that you are capable of writing it. He may suggest an expert collaborator.

The ideas for many books come from the publishers themselves, who are always on the *qui vive* for possibilities. For instance, "Broadcast Advertising," by Frank A. Arnold, was originally a series of lectures delivered at the College of the City of New York, prepared with no intention of subsequent publication.

Some publishers specialize in technical books, and the reader will experience no difficulty in compiling a list of them from the bibliography in the Appendix. These publishers should be considered in preparing a book along technical and semi-technical lines. On the other hand, works of a less technical flavor, dealing with the conventionally aesthetic side of broadcasting, such as radio plays and program construction, provide matter of potential acceptability to most publishers. In marketing a book of this latter type, an experienced literary agent may be valuable.

Chapter X

CONCLUSION

IN THE preceding chapters we have considered radio positions for which the individual deliberately trains—one might say with malice aforethought. That particular job is his target and he aims for it—or at least in its general direction. There are, however, some berths in the radio field that persons obtain more or less without premeditation, either because the job requires no particular knowledge or ability or because the individual has some unusual qualification. The average factory hand falls into the first category, while the radio salesman and the executive are examples of the second.

Factory help is largely recruited from the ranks of the unemployed, rather than by transfer or promotion, and openings are announced through various mediums—word-of-mouth among employees, employment bureaus and organizations, classified advertisements, "Men Wanted" signs and direct word to previous employees who have been let off.

It is seldom that previous experience is required or considered except in the case of former workers reemployed. A worker whose last job was operating an eyeleting machine in a shoe factory may be set to work stacking condenser plates. A foreman, or someone delegated by him, will show the new employee how the work is done, and by the time the clock is punched reasonable proficiency will have been developed. The pegging machine will take care of the accuracy. The pay, by time or piecework, is just enough to inhibit the more overt manifestations of communism. During the spring slump, if he is lucky, the erstwhile stacker of condenser plates will be operating a spot welder in a wire-fence factory.

There is absolutely no chance of promotion for such workers in the radio field unless ability above that of an automaton can be demonstrated, combined with a knowledge of radio. The foreman is always on the lookout for assistants who can work in a supervisory capacity, and who can train newcomers in their elementary mechanical tasks. The employee who becomes an expert in his particular job and who has ideas merits and often receives attention. He may be called into the laboratory for consultation, or his proficiency may catch the eye of the production department.

The intelligent and ambitious workers in a radio factory (and they are the only ones who will read this book) are more fortunate than their fellows in, say, a factory making clothespins or a manufacturing chemist's firm. There is nothing one can learn about clothes-

pins that is likely to lead to promotion, while the things one should know about industrial chemistry to warrant advancement in the latter field have never been presented as a course of study available to the average person punching a clock.

On the other hand, the radio-factory employee can and must study radio if he ever expects to be more than an automatic soldering iron. The author recommends a used correspondence course for two reasons. The contexts of the good ones are so written that they can be assimilated by a person who has not even been graduated from grammar school. They can be bought outright or rented at a very low cost. The correspondence feature obviously does not hold for used courses—the student is 100 per cent on his own. This lack must be borne in consideration of expense. The popular science and radio magazines carry advertisements—usually in the classified sections—offering these courses on either a sale or rental basis.

The earnest student will do well to attend night school, supplementing his general education and specializing in such studies as will forward his progress in radio.

THE RADIO SALESMAN

The majority of salesmen in the radio field, whether in over-the-counter retail business or representing a manufacturer, are persons whose association with radio has been of some duration, often in other branches of the industry. They combine at least a fair general knowledge with ability in salesmanship. The man

already in radio who feels that he has the makings of a good salesman should by no means ignore any opportunities to develop what may be his vocation. He has probably already established contacts that will facilitate his transfer into the desired sub-field.

Salesmanship has learned much from psychology (in return for having contributed to that science), and knowledge that has heretofore required years of experience to obtain may be acquired from books on salesmanship in a relatively short time. Not that books can ever replace experience—in any field—but they can and do shorten the period of apprenticeship. The author suggests that the radio technician who is seriously interested in sales work treat himself to a concentrated course in salesmanship, either in one of the many schools that include this subject among their curricula, or by extensive and assimilative reading. Your local librarian will be glad to recommend books on sales psychology.

The process is occasionally reversed. It happens, fairly often, that a man is drafted into radio from an altogether different field merely because he has a well-earned reputation as an excellent salesman. It appears, therefore, that salesmanship is the *thing*. However, there are few, if any, salesmen who will deprecate the truism that the salesman should know his product. Radio is a relatively complicated product. Its merits and qualities are not merely matters of color and strength.

It may be maintained that little technical knowledge is required of the man who sells a radio for $50 in a

retail store; it is implied that if he were a better salesman, he might sell a $100 set instead. On the other hand, if he knows radio, he will be able to interpret technical reasons for the superiority of the higher priced receiver in terms that will be intelligible to the layman; he may thus sell the more expensive instrument, but by different technique. Of course, "hot air"—an abracadabra of dynes, regeneration, automatic volume control and class A pentodes—might have the same immediate effect, but, in the long run, it is no substitute for genuine knowledge. The customer often looks to the salesman for technical advice. If the salesman is not well informed, this will lead eventually to a dissatisfied purchaser, a complaint —and probably a new salesman. Most retail-store owners appreciate this fact, and you will rarely encounter a radio salesman who cannot talk intelligently on receivers, directional effects or noise-reduction antennas.

In the case of a salesman representing a manufacturer, a technical background is of even more consequence, for his contacts will be largely with technical people. He will probably learn his major sales points from the engineering department, and he may have to sell his product to the engineers of another company. Invariably the qualities or performance of the product he is trying to sell will depend upon technical points that he will have to understand in order to make others understand them.

So, reversing our advice to the technician who would be a salesman, we say to the salesman, *learn radio.*

The salesman is a busy man. He rarely has time, particularly if he travels, for any sort of formal course. We suggest that he read the books recommended in self-training for service work (Chapter II), eliminating those of a strictly service character, unless his particular sales job is intimately related to service problems.

THE RADIO EXECUTIVE

Probably the majority of radio executives have arrived at their present stations via promotion from less responsible positions. Usually their association with the radio industry has been one of long duration. Often they are engineers. In any event, executives falling within this class are technically proficient. They probably know radio as well as Charles M. Schwab knows steel.

As sometimes happens in the case of exceptionally able salesmen, an executive is occasionally drafted from other industries for reasons of executive ability, political or industrial influence or the money that he can put into the business. It is possible that these considerations will more than compensate the lack of a technical radio background. This is more likely to be true in cases of very large organizations where an executive may have a "cabinet" of minor executives with technical training.

However, in smaller organizations the lack of a radio background may seriously curtail the efficiency of an executive. Like the salesman, he will have to deal directly with technical men, many of whom are quite incapable of interpreting engineering data in

terms of the significant nontechnical facts—not to mention those who may impose their mediocrity upon his ignorance. The wisdom and rapidity of an executive's decisions are largely functions of his fundamental radio knowledge. The author has known a half-dozen or so nontechnical executives whose value to their organizations would have been considerably greater had they spent as much time in acquiring the fundamentals of radio as in assimilating the technique of the brassie or the informative double. Their lack of information was only less serious than their misinformation. Yet they were almost pathetically eager to find out just what does make the radio wheels go round.

Few executives, if any, will read this book. They are already making a good living in radio.

AFTERTHOUGHT

It may seem to the reader that, in the preceding pages and chapters, the actual mechanics of making a living in radio has been subordinated to a more general theme of securing the training essential to such pursuits. If such relegation exists, it should not militate against the definite purpose of this book.

The process of securing employment, the matters of remuneration, possibilities and opportunities are all variable factors, varying with individuals, economic conditions, geographic and political influences. On the other hand, the only factor that is not a variable is the necessity for an adequate education. True, all the training in the world will not necessarily make

you successful in radio—or in any other field of endeavor. But the converse is certain. Without the background of knowledge, no one can ever get much farther along than a false start. Even genius is no substitute for education. Genius merely takes to it more readily.

Appendix A

BIBLIOGRAPHY

THE following bibliography contains detailed notes on the books to which reference has been made in the preceding pages. Brief reviews are given, that the reader may determine more or less accurately just how the various volumes fit in with his educational requirements. The data on each book are presented in the order of title, author, number of pages, publisher and price. The majority of these books are available at large public libraries. They may be purchased directly from the publisher, and in many instances will be sent free on approval. Some of the government-published bulletins can be had without cost. It is suggested that the reader write to the publishers mentioned for complete book catalogues.

This bibliography, as the author has already stated, is by no means the final word on all that has been written on radio. It is merely a list of books that seems to him reasonably adequate as supplementary reading in accordance with his recommendations in the previous chapters. There are many other good books on the various subjects covered, and the reader should make a conscientious effort to discover them.

ELEMENTARY ELECTRICITY AND RADIO

PRACTICAL ELECTRICITY—by Terrell Croft. 674 pages. McGraw-Hill Book Company, Inc., New York. $3.

A masterpiece of its kind, which should be read by everyone interested in the technical side of radio who has not had an engineering education in college. With application, the average holder of a public-school diploma can read and understand every word in this text, and can be graduated from it with an insight into electricity that will put to shame many whose knowledge has been gained in more formal ways. "Practical Electricity" contains the finest non-mathematical analysis of alternating-current circuits the author has ever read. Some mathematics is, of course, employed. But the approach to it is so gradual and so perfectly stepped that the student, starting with simple arithmetic, will be astonished, at the end of the book, to find himself on easy, familiar terms with sine curves, wattless current and vectorial representations.

RADIO PHYSICS COURSE—by Alfred A. Ghirardi. 961 pages. Radio Technical Publishing Company, New York. $4.

While this volume is designed primarily as a text for servicemen, it is an excellent all-round book for the radio student, written by an instructor who knows, not merely his subject, but his students. It bears out its title in a wholly satisfactory manner. The person who has mastered it (and it is not beyond the scope of the average high-school pupil) will find himself well grounded in radio, with knowledge that should be more easily retained because the fundamentals—the "physics"—have been adequately detailed. The subject of television is sanely considered, and, while many will object to Mr. Ghirardi's lack of enthusiasm on this point, the manner of treatment is such as to indicate to the advanced student the general soundness of the entire book. Public-address systems and sound movies—important service side lines—receive ample consideration. Review questions at the conclusion of each chapter provide a desirable check upon progress. The excellent cross-reference index is a major feature.

PRINCIPLES OF RADIO—by Keith Henney. 477 pages. John Wiley & Sons, Inc., New York. $3.50.

An elementary text that is comprehensive and approaches its subject from an engineering point of view. With the exception of one or two equations, every paragraph of the book can be understood by the conscientious student who has a working knowledge of first-year algebra. At the same time, "Principles of Radio" merits a place in the library of any technician.

ELEMENTS OF RADIO COMMUNICATION—by John H. Morecroft. 269 pages. John Wiley & Sons, Inc., New York. $3.

An excellent supplementary text for reading with Henney's "Principles of Radio." Much of the same material is presented in a different way, a fact that will be particularly helpful to the self-training student. Elementary algebra will again suffice for the mathematical background.

RADIO SERVICING

MODERN RADIO SERVICING—by Alfred A. Ghirardi and B. M. Freed. Radio and Technical Publishing Company. $4.

A commendable text which, with a bit of supplementary reading and practical work, amounts to a liberal course in radio servicing.

PERPETUAL TROUBLE SHOOTERS MANUAL—by John F. Rider. John F. Rider, 1440 Broadway, New York. Vol. 1, 1,000 pages, $7.50; Vol. 2, 800 pages, $6.50; Vol. 3, 1,070 pages, $7.50; Vol. 4, 1,060 pages, $7.50; Vol. 5, 1,200 pages, $7.50.

These manuals present authentic circuit and service data on practically all receivers made in the United States from 1919 on—from the one-tube gadgets to the most modern all-wave superheterodynes. Resistance and capacity values are given as well as correct voltages, current ratings, alignment procedures, intermediate-frequency peaks, etc., for individual receivers.

SPECIALIZED AUTO RADIO MANUAL—by John F. Rider. 350 pages. John F. Rider, 1440 Broadway, New York. $3.50.

Complete instructions for installation and servicing of automobile radios, with circuits and other data on specific receivers.

SERVICING SUPERHETERODYNES—by John F. Rider. 288 pages. John F. Rider, 1440 Broadway, New York. $1.

A text devoted to a single subject that has heretofore been accorded only an abbreviated chapter or two in radio books. This is probably the first time the superheterodyne has received adequate consideration in its modern modifications and from the service point of view. We recommend this book to the student halfway through his training, and, needless to say, to the practicing serviceman.

THE CATHODE RAY TUBE AT WORK—by John F. Rider. 320 pages. John F. Rider, 1440 Broadway, New York. $2.50.

An excellent work on a thoroughly modern subject. It brings the cathode-ray tube from the laboratory to the service bench, providing the serviceman with a new tool that contributes much to the speed and accuracy of his work.

HOW TO MAKE MONEY IN RADIO SERVICING—by Zeh Bouck. 130 pages. Teck Publications, Inc., 461 8th Avenue, New York. $1.

A text on the business end of servicing, covering sales promotional ideas, service side lines, publicity, advertising, letterheads, business cards and the principles of successful merchandizing.

RADIO ACCOUNTING AND RECORDS—by J. E. Smith. 30 pages. N. R. I. Publications, 16th and U Streets, N. W., Washington, D. C. 30 cents.

This booklet describes a system of accounting for the small business suffering from that pleasant ailment known as growing pains. The system of accounting it outlines may be applied to any business grossing between $4,000 and $10,000 per year.

8,000,000 JOBS FOR THE SERVICEMAN—by Zeh Bouck. 24 pages. Tobe Deutchmann Corporation, Canton, Massachusetts. 25 cents.

A booklet that contains detailed data on the possibilities of modernizing old receivers. Typical examples of modernization are described and illustrated and the sales-promo tional end of the business is thoroughly considered.

RADIO OPERATING

THE RADIO AMATEUR'S HANDBOOK—Prepared and published by the American Radio Relay League, West Hartford, Connecticut. 244 pages. $1.

The amateurs' bible, containing about everything one needs to know to break into the amateur operating game. For its size, it is an unusually comprehensive text, covering the theory and practice of receivers, transmitters and aerials. It includes no mathematics. With a little supplementary reading, it should carry the average reader straight through from learning the code to securing his first amateur license.

RADIO TELEGRAPHY AND TELEPHONY—by Rudolph L. Duncan and Charles E. Drew. 1,046 pages. John Wiley & Sons, Inc., New York. $7.50.

Written specifically for the student operator. This is a book of many pages, not merely because of its comprehensiveness but also because the authors have endeavored, with notable success, to make the various theoretical points clear by the descriptive method, rather than through recourse to mathematical short cuts. The student with an elementary knowledge of algebra should experience no difficulty in assimilating this text. It should, however, be read with several other books, preferably Henney's "Principles of Radio" and Croft's "Practical Electricity." It contains a highly useful appendix.

ROBISON'S MANUAL OF RADIO TELEGRAPHY AND TELEPHONY—by Rear Admiral S. S. Robison. 791 pages. United States Naval Institute. $4.

A standard text, in all its various revisions, primarily prepared for naval operators, and widely adopted by their commercial brothers. It is a bit more technical than some of the books on operating theory and practice. While operators in general will benefit greatly from studying this work, it is recommended in particular to those leaning in an engineering direction. A speaking acquaintance with calculus is desirable in following some of the formula derivations.

RADIO TRAFFIC MANUAL AND OPERATING REGULATIONS —by Rudolph L. Duncan and Charles E. Drew. 187 pages. John Wiley & Sons, Inc., New York. $2.

A book that answers most of the questions of the novice operator regarding his duties and the technique with which they are carried out. The scope of the book is perhaps best indicated by the following outline of the contents: Learning the Code—International Abbreviations and Their Use—Correct Calling Technique—Clearing of Traffic—Conventional Abbreviations—Radio Laws and the Operator—Accounting for Money—The Operators Responsibility to the Ship's Master and the Operating Company—Duties outside of Operating—Censorship of Radiograms—Watches—Conduct of the Operator—Types of Messages—Approved Forms—Check—Code Addresses —Distress Messages—Service Message Abbreviations— Franked Messages—Rates—Traffic Returns—Abstracts —Computing Charges—Logs—Inventories—Inspections— Care of Apparatus—Requisitions—Forwarding Charges —Ship and Shore Tolls—Radio Compass Stations—Time Signals—Weather Bulletins and Press. This is a manual that will clear up many points not covered in the technical texts.

RADIO OPERATING QUESTIONS AND ANSWERS—by Arthur R. Nilson and J. L. Hornung. 389 pages. McGraw-Hill Book Company, Inc., New York. $2.50.

Questions after the manner of those asked in government examinations, with the answers given in the detail and

technique approved by the Federal examiners. All necessary subjects are covered including commercial transmitters, receivers, broadcast stations, motors, generators, batteries, auxiliary apparatus, radio laws and regulations. Amateur operating also receives attention, as well as police radio, airways, meteorology and teletype.

This is not a textbook in the ordinary sense of the word; it is intended principally to solidify the student's knowledge, gained elsewhere, along the lines demanded by the radio inspector.

APPOINTMENT TO POSITIONS IN THE BUREAU OF AIR COMMERCE DEPARTMENT OF COMMERCE. (Form AB-22.) The Department of Commerce, Washington, D. C.

The requirements are outlined for the civil service positions offered by the department in the radio field, *i.e.*, for radio engineers, radio operators, radio electricians and airways keepers.

INSTRUCTION BULLETIN D-7. Office of the Assistant Director of Aeronautics, Department of Commerce, Washington, D. C.

A complete manual on the abbreviations used and the conventions employed in the Department of Commerce teletype system.

MATHEMATICS

PRACTICAL MATHEMATICS FOR HOME STUDY—by Claude I. Palmer. 606 pages. McGraw-Hill Book Company, Inc., New York. $4.

A book that will carry the grammar-school graduate from a review of arithmetic through algebra, geometry, trigonometery and logarithms. This is the first step in home study toward mastery of radio.

COLLEGE ALGEBRA—by G. A. Wentworth. 530 pages. Ginn and Company, Boston. $2.

An unusually good text which, by virtue of its thoroughness, may be used effectively for home or self-instruction.

While it contains an excellent review of elementary algebra, it should not be studied until a high-school text has been mastered, or at least the algebra section of Palmer's book reviewed above.

CALCULUS MADE EASY—by Sylvanus P. Thompson. 300 pages. The Macmillan Company, New York. $1.25.

A book that will take the terrors out of a subject that can be made easy or difficult, as the author wishes. Dr. Thompson's subtitle is perhaps the work's best review—"Being a very simple introduction to those beautiful methods of reckoning which are generally called by the terrifying names of the differential calculus and the integral calculus." It should not be essayed, however, until the way has been smoothed by Palmer's "Mathematics for Home Study."

PRACTICAL CALCULUS FOR HOME STUDY—by Claude I. Palmer. 443 pages. McGraw-Hill Book Company, Inc., New York. $3.

Written by a genius in the art of making things plain to those who must depend largely upon themselves for instruction. His more elementary book should be studied first.

MATHEMATICS FOR ENGINEERS—by Raymond W. Dull. 780 pages. McGraw-Hill Book Company, Inc., New York. $5.

Really a handbook of engineering mathematics—arithmetic, algebra, trigonometry, geometry, calculus, probability, etc., considered in applications to engineering problems. Highly recommended as a reference work as well as a text in clearing up obscure points in other works. Several months spent with this book should result in the solidification of the young engineer's mathematical training; the veteran will find the same period of study invaluable in revitalizing his knowledge of mathematics that may have been slipping away from him.

ENGINEERING MATHEMATICS—by Charles P. Steinmetz. 321 pages. McGraw-Hill Book Company, Inc., New York. $3.50.

A classic, written by a man, part of whose genius was the ability to pass on to others much of his own vast knowledge. The student who has a reasonable mastery of calculus should experience little difficulty in assimilating the contents of this remarkable book, which contains the most lucid teachings on complex quantities, hyperbolic functions, Diophantic equations and the Fourier series the author has ever read.

RECREATIONS IN MATHEMATICS—by H. E. Licks. 165 pages. D. Van Nostrand Company, Inc., New York. $1.50.

This book demonstrates that the subject of mathematics is far from dull. From arithmetic to calculus, from poetry to engineering, it is one of the liveliest books that has ever whiled away, without wasting away, a winter's evening. If the relevant chapters are read by the student simultaneously with the study of the indicated subjects, the process of getting ahead in mathematics will be made much more interesting.

RADIO ENGINEERING

RADIO ENGINEERING PRINCIPLES—by Henri Lauer and N. L. Brown. 301 pages. McGraw-Hill Book Company, Inc., New York. $3.50.

An excellent text that can be recommended to the student as soon as he has completed "Calculus Made Easy." No better introduction to Terman and Morecroft could be written.

RADIO ENGINEERING—by Frederick E. Terman. 750 pages. McGraw-Hill Book Company, Inc., New York. $5.

At first glance it would appear that Professor Terman has made a relatively nonmathematical approach to his subject. Such, however, is definitely not the case. He has merely expanded many mathematical analyses into the more readily assimilated and retained form of verbal explanations. However, mathematics is employed extensively in many footnotes and wherever necessary throughout the text. The book should not be approached without a back-

ground of engineering mathematics. It is an altogether adequate work, which can be recommended, as its author suggests, to students having a technical training equivalent to that of a college senior in engineering.

MEASUREMENTS IN RADIO ENGINEERING—by Frederick E. Terman. 400 pages. McGraw-Hill Book Company, Inc., New York. $4.

This book covers comprehensively the subject of radio measurements, including laboratory apparatus and procedure.

PRACTICAL RADIO COMMUNICATION—by Arthur R. Nilson and J. L. Hornung. 754 pages. McGraw-Hill Book Company, Inc., New York. $5.

A thorough presentation of principles, systems, equipment, and operation, including short-wave and ultra-short-wave radio.

PRINCIPLES OF RADIO COMMUNICATION—by John H. Morecroft. 1,001 pages. John Wiley & Sons, Inc., New York. $7.50.

A radio-engineering classic. A complete text for the college student as well as a valuable reference work. While higher mathematics are essential to the complete understanding of a book of this nature, Professor Morecroft has succeeded in presenting the greater part of his material in such a way that it can be readily assimilated by the high-school graduate.

THEORY OF THERMIONIC VACUUM TUBE CIRCUITS—by Leo J. Peters. 226 pages. McGraw-Hill Book Company, Inc., New York. $3.

THERMIONIC VACUUM TUBE AND ITS APPLICATIONS—by Van Der Bijl. 391 pages. McGraw-Hill Book Company, Inc., New York. $5.

Both of these books are mathematical presentations of a subject vital to radio engineering. However, they are well within the capability of the student who has mastered "Calculus Made Easy" and who has followed Steinmetz at

least through complex quantities. These books should be used to supplement the chapters on vacuum tubes in the more comprehensive radio engineering texts.

RADIO ENGINEERING HANDBOOK—edited by Keith Henney. 583 pages. McGraw-Hill Book Company, Inc., New York. $5.

A reference work comparable to other engineering handbooks prepared in the encyclopedic style. Twenty-two specialists in their individual sub-fields have compiled a most comprehensive book. It is in no sense a text. Mathematics—trigonometry, calculus and complex quantities—is employed freely. This book will be of use only to technicians of the higher order—engineers, laboratory experts, writers and editors. To them, it is invaluable.

ALTERNATING CURRENT PHENOMENA—by Charles P. Steinmetz. 480 pages. McGraw-Hill Book Company, Inc., New York. $5.

While this book was written largely for students of electrical engineering, the radio specialist will find in it much of fundamental value, particularly in familiarizing himself with the mechanics of complex quantities. This book should be read only by the student who is satisfied that he has coped reasonably well with "Engineering Mathematics."

PRINCIPLES OF ELECTRICITY—by Leigh Page and N. I. Adams. 620 pages. D. Van Nostrand Company, Inc., New York. $4.25.

A highly technical book suitable for students who have covered college physics and for whom differential equations hold no more terrors than the multiplication table. Hardly to be recommended to those who believe that "principles" means something easy.

ELEMENTS OF ELECTRICITY AND MAGNETISM—by J. J. Thomson. 406 pages. The Macmillan Company, New York. $2.50.

"Elements" from an engineering and scientific point of view. Probably the finest work on this subject, but the

prerequisites are a good knowledge of differential and integral calculus, and at least high-school physics.

NONTECHNICAL BOOKS

THE ART OF LEARNING—by Walter B. Pitkin. 409 pages. Whittlesey House, McGraw-Hill Book Company, Inc., New York. $2.50.

A delightful and stimulating book, which we highly recommend to all who would learn anything, by any method, at any time. More fascinating than most novels and definitely more considerate of one's intelligence.

UNIVERSITY AND COLLEGE COURSES IN RADIO—by Cline M. Koon. (Circular Number 53.) United States Department of the Interior, Office of Education, Washington, D. C.

A listing of 100 colleges giving various radio courses, including engineering, television, advertising, law, education and broadcasting.

HOW TO WRITE FOR RADIO—by Katharine Seymour and J. T. W. Martin. 232 pages. Longmans, Green & Company, New York. (Out of print, but can be borrowed from most large libraries.)

This book traces the evolution of the continuity from the elementary sequences of the early broadcasting days to its present and probably more or less permanent stage in which it represents an altogether new technique of writing. The authors have done a conscientious and excellent job in showing how such material should be prepared. Practically every program on the air today is the product of this specialized form of writing; in this book the varied techniques are organized in logical groups and each is given detailed consideration. One cannot close its covers without having gained a fuller appreciation of just what goes into a broadcast. It provides a liberal education conducive to a higher plane of program enjoyment.

GATEWAY TO RADIO—by Firth and Erskine. 312 pages. Macaulay Company, New York. $2.50.

A book for the prospective radio writer that should be read with "How to Write for Radio." "Gateway to Radio" is courageous in many respects; it correctly analyzes the advertising situation as it exists today, and estimates the future possibilities of recorded programs.

BROADCAST ADVERTISING—by Frank A. Arnold. 283 pages. John Wiley & Sons, Inc., New York. $3.

The student of writing for broadcast programs must understand the sponsor's point of view and that of his representative, the advertising agency. These are well put forth by Mr. Arnold who was an advertising man before he became associated with the National Broadcasting Company as Director of Development.

THE ART OF TEACHING BY RADIO—by Cline M. Koon. 92 pages. (Bulletin, 1933, No. 4.) Government Printing Office. 10 cents.

While treating primarily the technique indicated in the title, this book outlines various first principles of radio elocution that are applicable to the radio drama. This book is recommended to every student interested in writing for radio. An excellent and extended bibliography is included.

THIS THING CALLED BROADCASTING—by Alfred N. Goldsmith and Austin C. Lescarboura. 362 pages. Henry Holt & Company, New York. $3.50.

A historical chronicle of broadcasting that follows its technical, aesthetic and commercial development. While the mechanics of broadcasting has altered somewhat in the few chaotic years since this book was written, the fundamentals had been established at the time and the book is still reliable. It should certainly be read as a background by anyone particularly interested in the technique of microphone presentation.

Appendix B

RADIO OPERATING POSITIONS

With the exception of ships equipped by the Radiomarine Corporation of America, operators are furnished to practically all lines by the American Radio Telegraphists' Association, with the national office located at 10 Bridge Street, New York City, and the New York local office at 22 Whitehall Street, New York City. The ARTA is particularly strong on the west coast. Application for an operating position on the Great Lakes should also be made through the organization.

ARTA offices have been established at the following addresses: Boston, Massachusetts, 344 Atlantic Avenue; Baltimore, Maryland, Stewart Building, Gay and Lombard Streets; New Orleans, Louisiana, Godchaux Building; Miami, Florida, Box 1830; Wilmington, California, 326½ Avalon Boulevard; San Francisco, California, 52 California Street; Portland, Oregon, 208 McKay Building; Seattle, Washington, Room 310, Pioneer Building, First and James Streets.

Applications for berths may also be made by the individual to: Pan American Airways, Inc., 122 East 42nd Street, New York City; Tropical Radio and Telegraph Company, Pier 3, North River, New York City (also, United Fruit Company, Pier 9), and New Orleans; National Broadcasting Company, 30 Rockefeller Plaza, New York City (also branches in principal cities); Columbia Broadcasting System, 485 Madison Avenue, New York City; Mackay Radio and Telegraph Company, 33 So. Williams Street, New York City (and principal cities); International

Telegraph and Telephone Company, 67 Broad Street, New York City; Radio Corporation of America, R. C. A. Building, New York City (and principal cities); Radiomarine Corporation of America, 75 Varick Street, New York City; 420 Atlantic Avenue, Boston; 223 Erie Street, Buffalo, New York; R. C. A. Victor plant, Camden, New Jersey; 460 Water Street, Baltimore, Maryland; 222 Brewer Street Norfolk, Virginia; 1599 St. Clair Avenue, Cleveland, Ohio; 512–516 St. Peter Street, New Orleans, Louisiana; 2820 Avenue D, Galveston, Texas; Station WPA, Port Arthur, Texas; 274 Brannon Street, San Francisco, California; and 1008 Western Avenue, Seattle, Washington.

British subjects may apply to: Marconi Wireless Telegraph Company, Ltd., 17 Williams Street, New York City, and Montreal, Quebec, Canada; Canadian National Railway, Radio Department, Montreal, Quebec, Canada; Grand Trunk Pacific Railway, Telegraph Department, Winnipeg, Manitoba, Canada.

Appendix C

COMPANIES SPECIALIZING IN THE MANUFACTURE OF ELECTRICALLY TRANSCRIBED PROGRAMS

The expanding utility and popularity of the electrically recorded program call for the publication of the following list of transcription companies, supplementary to the mention of R.C.A. Victor, Brunswick and World Broadcasting Company referred to on page 170:

Audisk Corporation, San Francisco, Calif.; Carlos F. Borocosque, 2419 Charitan Street, Los Angeles, Calif.; MacGregor and Sollie, Inc., San Francisco, Calif.; Standard Radio Inc., Hollywood, Calif. (Chicago office, 1512 Lake Michigan Building); Radio Transcription Company of America, Hollywood, Calif.; R. U. McIntosh and Associates, Los Angeles, Calif.; Kasper-Gordon Studios, Inc., Boston, Mass.; Radio and Film Methods Corporation, 101 Park Avenue, New York; American Radio Features Syndicate, 555 South Flower Street, Los Angeles, Calif.

Program ideas and scripts should be addressed to the continuity departments.

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