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and

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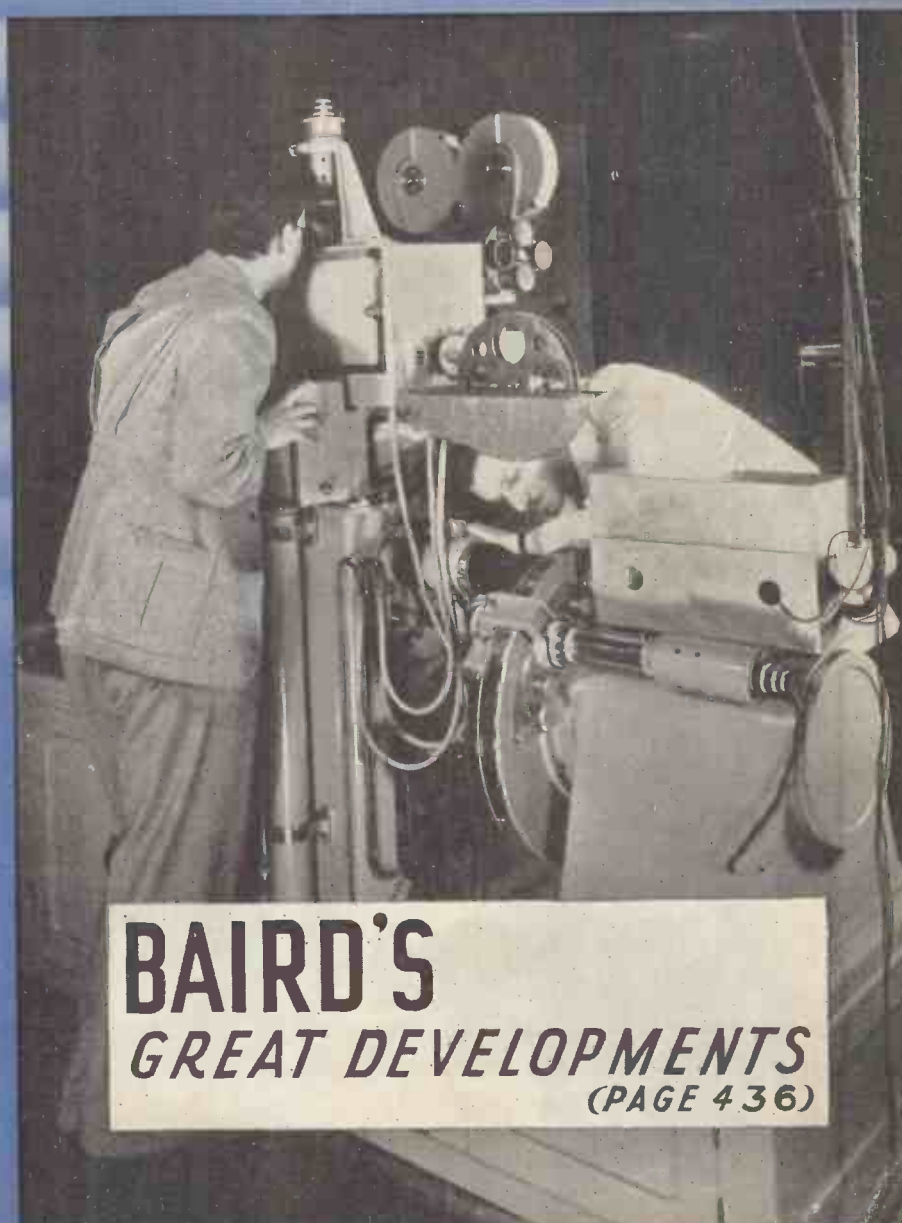

BAIRD'S
GREAT DEVELOPMENTS
(PAGE 436)

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TELEVISION and SHORT-WAVE WORLD

Special Features

TELEVISION AND SHORT-WAVE WORLD

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COMMENT OF THE MONTH

Television and Radiolympia

IN view of the imminence of the television service it is remarkable that the Radio Manufacturers' Association is not able to make any statement with regard to the place that television will take in Radiolympia.

On the eve of going to press all we know definitely is that there may be television apparatus on the stands where the ordinary radio apparatus is displayed, but with regard to television demonstrations the Radio Manufacturers' Association tells us that it has no information whatever; and we have nothing to add except to pass on a rumour that has reached us to the effect that members of the R.M.A. interested in television have been invited to stage a demonstration at Radiolympia, but under such conditions as will ensure that the public will be unable to tell which make and system of receiver is in use. It seems an extraordinary rumour, but we are told there is something in it.

We cannot imagine, though, that any television manufacturer will be so kind-hearted as to provide Radiolympia with a television receiving demonstration and be willing to hide his own particular identity under a bushel.

An Opportunity for the Wireless Retail Trade

SO far as we have been able to ascertain, the wireless retail trade has taken practically no steps towards making arrangements for the sale and servicing of television receivers. Rather it has adopted a "wait and see" policy, most probably as a result of constant anti-television propaganda with which it has been so consistently fed during the past eighteen months; the wireless retail trade, like a considerable section of the public, does not believe that television is here though the quite unbiased account which we give in this issue of the Baird activities (to mention but one concern) should be sufficiently convincing. The large stores have realised the potential opportunities which are developing and we suggest that it is high time that the wireless trade did the same.

As a service to our readers we propose publishing a list of traders who intend taking up the sale and servicing of television receivers and we shall be glad therefore to hear from those who have this intention. During the first few months of the B.B.C. television broadcasts the publicity value of television demonstrations would be enormous to dealers in suburban districts.

BAIRD TELEVISION UP-TO-DATE

WE SEE MANY AMAZING DEVELOPMENTS

BAIRDS BUILD THEIR OWN TRANSMITTERS

GREAT ACTIVITY AT THE CRYSTAL PALACE

THE BAIRD PICTURE WILL SATISFY THE PUBLIC

ONE of the many remarkable features of present-day television development is that, comparatively speaking, there is only a very minute section of the public who are aware of what is being done and what has been accomplished. In Great Britain there may be a matter of five hundred or so, most of whom are in some way connected with the industry. With a public television service so imminent this may seem an unfortunate state of affairs because it will take some time to educate the public up to the possibilities of television. There have, of course, been reasons for this hush-hush policy, and those responsible for television development have thought it wise to maintain it until development had reached such a stage that it could be truly said that television is here.

As a result of a personal visit to the Baird laboratories at the Crystal Palace we are now able to disclose some of the activities of the Baird Company. Those who know the interior of the Crystal Palace would hardly recognise that very considerable portion occupied by Bairds. A cursory walk round reveals room after room, some in darkness except for intensely bright flickering lights, others brilliantly floodlighted, mechanical workshops with rows of lathes and drilling machines, a glass-blowing department, pumping room for evacuating cathode-ray tubes, a wireless department for producing the special components required for television, a small generating station, and test laboratories. Some years ago J. L. Baird wrote that television research involved practically all the sciences, but even he could not have foreseen how deeply it would be necessary to delve into every branch of science before it would be possible to obtain the results which have now been secured.

The Research Staff

The Baird staff at the Crystal Palace numbers approximately three hundred and it is worth noting that though television receivers for sale to the public are now in course of production, the efforts of this large staff are largely devoted to development and research. All the apparatus used with the exception of valves and the large glass bulbs for making cathode-ray tubes are made in the Baird workshops. An example of the type of product manufactured entirely at the Crystal Palace, which we saw, was a highly developed intermediate film scanner, intended, either itself or in replica, to fill an order from the Continent.

Every avenue of television development has been explored by the Baird Company and, where results have warranted it, research has been pursued until results of a high order have been obtained. This policy has led the company to adopt and concentrate upon three systems for transmission and one for reception.

Transmission embraces :—

(1) *The electron-image camera, which as readers know, has no moving parts, and can be used either for direct pick-up of indoor and outdoor scenes and for scanning films.*

(2) *The intermediate film system for actual scenes.*

(3) *The disc scanner which is intended solely for film transmission*

The Baird receivers of which there are two types in course of production, employ the cathode-ray tube, the main difference between the two being in the size of the screen ; the large receiver has a screen diameter of approximately fifteen and a half inches, and the smaller one is about twelve inches.

The Electron Image Camera in Operation

We were first shown the electron image camera in operation. In appearance it resembles an outsize in box cameras mounted on a substantial tripod. It was simply pushed through a gap in the curtains of a window overlooking the Palace grounds and there on the screen of the receiver appeared the view with an amazing amount of detail. As the camera was swung round, so there appeared a panoramic view on the screen of the receiver. A quite remarkable feature of this apparatus is that it can be made to act as a telescopic camera; that is, it is possible to secure pictures of distant objects telescopically with a mere alteration of the controls. For example, there was a clock tower about a third of a mile away which normally occupied quite a small portion of the screen, but with a small adjustment of the controls this could be made to fill practically the whole picture

I CANNOT let this article go to press without adding my own personal word.

I have to confess that I was immensely impressed by my visit to Baird's. It was difficult to relate all the wonders I saw there, to the crude apparatus and equally crude results which my old friend, John Logie Baird, showed me in his Soho attic I don't know how many years ago—but certainly twelve or more.

Very earnestly is he to be congratulated on the remarkable development with which his name must always be associated.

I was most courteously received by Captain West, the Technical Director of Messrs. Baird Television Limited, who, at a great expenditure of time and trouble, took care that I should have everything explained to me. He and his staff of scientifically-trained young men did everything they could to allow of my forming my own impression of what Baird's were doing and could do. To say that I was surprised at their manufacturing activity is not to indulge in any exaggeration whatsoever.

I was not surprised at the Baird picture. It had progressed in quality since I last saw it, but I was prepared for that. Baird's have something very real and very good to give the public and I am convinced that the public will want it when it sees it.

B.E.J.

THE WONDERFUL ELECTRON-IMAGE CAMERA

area. The image dissector depends to some extent upon the brightness of illumination of the scene, but although the day was cloudy and dull there was no lack of brightness or of detail in the picture.

It was also demonstrated by this apparatus how a change of definition could be made and the effect of interlacing and sequential scanning. With twenty-five pictures per second the amount of flicker observable is very slight, and it appears to depend to some extent upon the illumination of and the type of scene being televised. With a frame frequency of fifty there was not even a suggestion of flicker, but with approximately the same frame frequency using interlaced scanning there was a shimmering effect, which though only slight, rather produced the impression that the picture was being viewed through a heat haze. We understand that the Baird Company hope to go up to a frame frequency of fifty with straight scanning which, of course, will eliminate any suggestion of either flicker or shimmer. Incidentally, as a matter of interest, the shimmer is caused by the impossibility of meshing the two sets of scanning lines perfectly accurately.

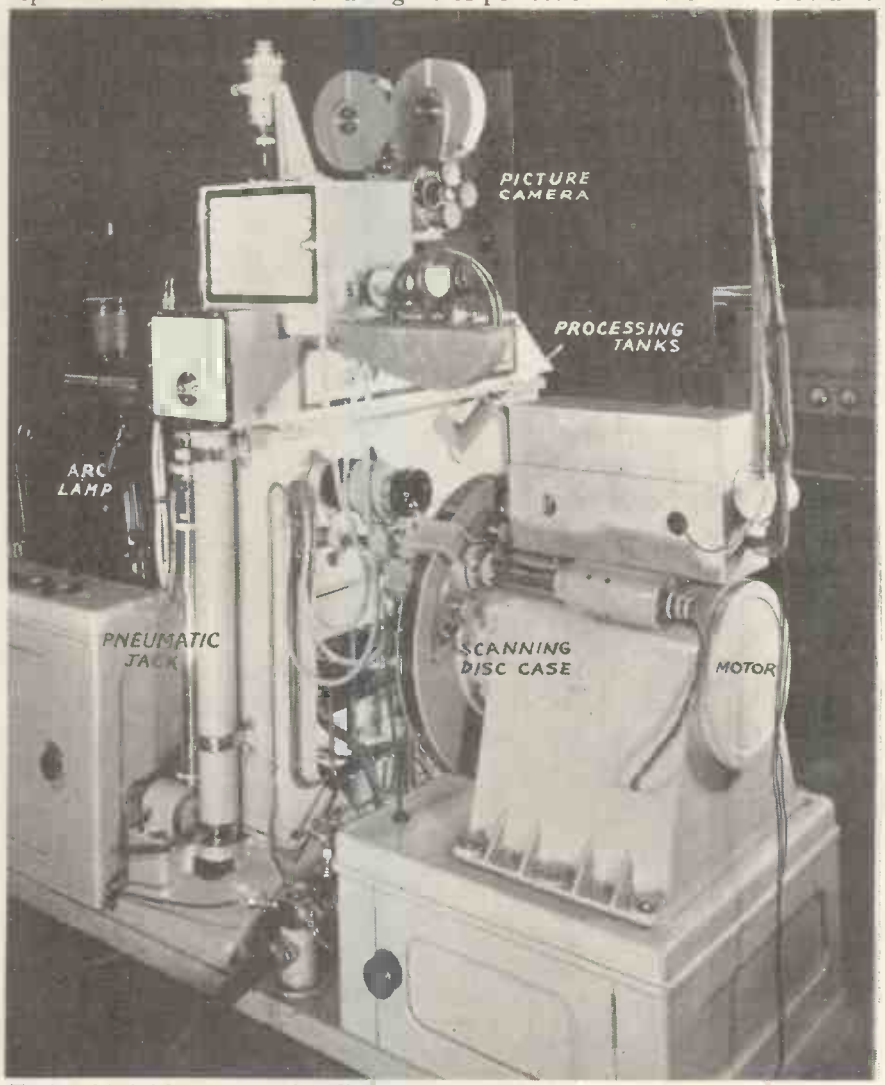
The Intermediate Film Scanner

From a constructional point of view the intermediate film scanner is the most interesting piece of apparatus which the Baird Company are producing. The latest design bears very little resemblance to the original apparatus of this type and the whole machine is a remarkable example of precision engineering. The entire assembly is completely self-contained and it weighs approximately half a ton. Readers will recollect that the intermediate film system operates by the exposure of a film in an ordinary film camera, its subsequent development, fixing and washing and then final scanning.

Early intermediate film scanners used the same film stock over and over again, the emulsion after scanning being cleaned off and the film re-emulsioned. Baird engineers, however, found that, although rather more costly in operation, better results were obtained by the use of fresh film stock. Accordingly this machine has been designed to operate in this way. Not only does this eliminate many possible sources of trouble but it also reduces the time factor which is now approximately thirty seconds or so from the exposure of the film to its projection on the screen of the television receiver.

Results that leave nothing to be desired are being obtained with the intermediate film system and we were given the opportunity of facing the film camera and then walking round into the next room where, after a few seconds interval, our pictures appeared on the screen of the receiver. It was also curious to observe both the object scanned and the received picture at the same time for, of course, owing to the time lag the two did not correspond.

The intermediate film system has now been brought to such a degree of perfection that the results obtained



The Baird high-definition intermediate-film scanner showing processing tanks, scanning and H.F. synchronising unit, sound reproducing head and camera. This equipment is designed for 240-line definition.

are comparable in every way with those of other methods, in fact in the ordinary way it would be quite impossible to tell that it was being used. This system does, of course, provide direct pick-up of any scene which is capable of being filmed in the ordinary way. Although the gear cannot be described as portable there appears to be no reason why it should not be mobile if mounted on a suitable conveyance.

There are many exceedingly ingenious ideas incorporated in this machine which is a beautiful piece of work finished off in black and chromium plating. The entire film system can be lifted clear of the tanks by

A RADIO TRANSMISSION BY THE BAIRD SYSTEM

allowing compressed air to pass into two cylinders; with the film system lifted in this way the tanks and film are readily accessible for replenishment or re-threading. The film is scanned when in a wet condition, actually in fact during its passage through a glass sided vessel filled with water.

A Radio Demonstration

The demonstrations so far described were made by a line from one part of the building to another, but the Baird engineers have appreciated the desirability of carrying out receiver tests under the same conditions that will obtain when the receivers are in the hands of the public. It has, of course, been impracticable to

The Baird intermediate-film apparatus in readiness for taking a 'shot.'

make radio transmissions of television which in respect of power would be the same as those which will be put out from the Alexandra Palace, so a 10-watt transmitter has been built and a receiving post established at such a distance that the conditions correspond as nearly as possible with those of the coming service.

This receiving post is in an ordinary house in Anerley and the receiver was installed under conditions that one would expect would ordinarily be the case with any private house. An outside aerial was used and the only other connection to the receiver was the mains supply. We were given the opportunity of seeing the same transmissions *via* radio that we had previously seen on a closed circuit. There was no noticeable difference in the results and if anything, the impression was formed that the radio transmission results were slightly better than those obtained by line. Although trams were passing within fifteen yards and the house is situated on a main road carrying a great deal of motor car traffic, the amount of interference to the picture was scarcely appreciable and it was only revealed by the appearance of almost pin-head specks of light which were only perceived by careful watching.

Simple Receiver Control

Although there are six controls and an on-off switch on the receiver the control is simplicity itself. Synchronism is automatic and once the adjustments have been made the picture will come in by the mere operation of the on-off switch. The actual controls are shown by the diagram and it will be seen that they are devised for obtaining the most suitable results by adjustment of contrast, focus and brightness. As the effects of turning these controls are readily seen by the appearance of the picture, adjustment presents no difficulty whatever, particularly as the actual tuning of both sound and vision are accomplished with one knob. The demonstration amply proved that Baird television receivers can be placed in the hands of the quite uninitiated and results guaranteed.

Television Sets in the Making

A tour of the production departments at the Crystal Palace was no less interesting than the demonstrations that were given. Of prime interest was the manufacture of cathode-ray tubes which, with the exception of the large glass bulbs, are made entirely by the Baird Company; incidentally they make the largest tubes in the world. The glass bulbs are first chemically washed, an operation which requires great care; the next operation is baking. The fluorescent screen is sprayed on to a coating of adhesive and in order to ensure that this is the correct thickness it is gauged by passing light through it on to a photo-electric cell; by this means an even coating of a prescribed thickness is assured.

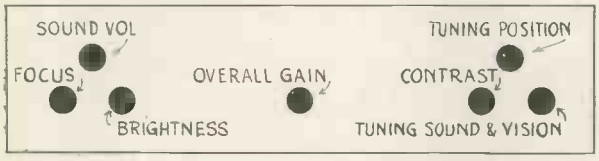
Assembling the Cathode-ray Tube

The tube electrode assembly is built up in two separate departments—one where the various metal parts are spot welded together and the other where the glass parts are made and the metal parts assembled on to them. The assembly is then sealed into the bulb and the latter is then put on to the vacuum pumps. A rough vacuum is first obtained by means of mechanical oil-immersed pumps when the tube is sealed up in an air-tight metal container to which is compressed air at three atmospheres pressure is admitted; this is a safety measure calculated to eliminate the risk of a weak tube getting through. The final pumping is done by mercury pumps situated below the tube racks. As the pumping proceeds tests are carried out by means of a portable test equipment which can be wheeled up to each tube rack in turn. Finally the tube is put through a series of electrical tests in another department before being passed as suitable for installation in a receiver.

In addition to cathode-ray tubes the Baird Company also make image dissectors, which, of course, calls for highly specialised work. One problem is the welding of the optically perfect end on to the tubular portion of

the dissector without distorting this end piece. The production of these dissector tubes has called for a great deal of intensive research work, and it is interesting to note that the Baird engineers have evolved a method of making the electron image visible so that focusing can be carried out under the same conditions as with an optical image.

The Baird Company are also making the components used in their receivers. This has been found necessary owing to the necessity of using components suitable for the extremely high frequencies involved; ordinary commercial wireless components have been found quite unsuitable. At a later date we hope to describe the Baird receivers in detail, but the photo-



Arrangement of controls of Baird receiver.

graph on this page will give an idea of the appearance. As mentioned before there are two types, the chief difference between them being the size of the screen; the large receiver provides a picture 12 ins. × 9 ins. and the small one 10 ins. × 7½ ins. Both in appearance resemble a radiogram, and when closed none of the controls are visible. The cathode-ray tube is placed vertically, being supported by felt-lined cradles. The end of the tube is covered by a safety-glass window, to protect the tube in case anything heavy is dropped on to it. The picture is seen by reflection from the end of the tube in a mirror fitted to the underside of the lid of the cabinet which when the lid is open is held at an angle of forty-five degrees. All parts of the receiver are easily accessible either from the back of the cabinet or through flush fitting doors at the side. These re-

The Baird sound and vision receiver. Since this photograph was taken an additional control has been added.

ceivers are actually in production and will be available to the public before the transmissions from the Alexandra Palace start.

Daily Television Transmissions from W6XAO.

IT is stated that the Don Lee experimental television station, W6XAO, Los Angelos, has commenced a series of high-definition television transmissions which will be made for four hours daily, divided into two sessions of two hours in the afternoon and two hours in the evening. The object of these transmis-sions is to enable the public to witness demonstrations of high-definition television. A cathode-ray receiver is being used and the subject matter is taken from news reels and short films. No details of the receiver and system are available, but it is stated that the principles involved are a radical departure from other methods. The definition is 300 lines and the picture frequency 24 per second.

Mr. Harry R. Lubcke has been responsible for the development of the system. He is the television director of the Don Lee Broadcasting System. When inaugurating the demonstrations, he said: "The advantages of the television enthusiast are far greater than were those of the amateur dialer in radio's early days," and he contends that a moderately-skilled person will be able to construct a receiver to receive the programme from W6XAO.

Reduction in Valve Prices

Members of the B.V.A. controlling Cossor, Mazda, Osram, Marconi, Mullard, Ferranti, Ever-ready and Brimar valves announce a decrease in the price of radio valves.

Almost every valve of the popular type has been decreased in price. Typical examples are as follows. General purpose battery triode from 5s. 6d. to 4s. 9d. Small power valves, 7s. to 6s., and super power from 12s. to 10s. All screen-grid battery operated valves are reduced from 12s. 6d. to 11s., while battery H.F. pentodes and the small battery L.F. pentode are reduced by 2s. 6d.

Those buying triode-pentodes and class-B valves will save 3s. 6d. and 3s. respectively, while the Q.P.P. valves are reduced from 22s. 6d. to 17s. 6d. In future mains operated triodes will cost 9s. 6d. instead of 13s. 6d. and A.C. and A.C./D.C. pentodes and screen-grids will be 5s. cheaper. All large L.F. pentodes will now cost 13s. 6d., as compared with the old price of 18s. 6d.

An innovation is the grouping of 250 and 350-volt rectifiers at 10s. 6d. with the large 500-volt rectifier at 15s.

These are but some of the reductions and readers are advised to obtain the latest handbook from any valve maker for further details.

The Radio Amateur Call Book

We have received a copy of the summer edition of the Radio Amateur Call Book handled in this country by F. L. Postlethwate, G5KA, 41 Kinfauns Road, Goodmayes, Essex. This edition is even more comprehensive than usual, including all W10's, high-frequency press and weather stations, a long list of commercial broadcasters with wavelengths, international pre-fixes the "Q" code and almost every amateur station in the world with full address.

It is invaluable to the short-wave listener and transmitter needing correct addresses for QSL cards, while the actual composition of the American districts is given.

The price of this book of 310 pages is 6s. post free.

TELEVISION STARS OF TOMORROW—WHO WILL THEY BE?

By PAUL HOBSON

How many of the artists who were prominent in the old 30-line television fare will "star" in the B.B.C.'s high-definition programmes now about to begin? The writer of this article frankly admits he is guessing, but some of his conclusions are convincing.

INCREDIBLE as it may sound, more than 1,700 people were televised in the 650 odd programmes broadcast by the B.B.C. under the now obsolete 30-line system.

In anticipation of the new régime which is to begin in a few weeks' time, those old programmes and the old performers already are well nigh forgotten.

Yet several of the old-time artists faced the television beam no less than twenty, thirty, and, in one case eighty-five times, and it is reasonable to suppose that some at least of them will find a prominent place in the B.B.C.'s forthcoming high-definition programmes.

Who are these stars? What inkling, if any, can be gained from a survey of the past as to the programmes of the future?

The role of prophet is proverbially dangerous, but I venture to think that a few outstanding names can safely be deduced from the special requirements of the television screen and the particular suitability to the medium of the acts of certain individual artists.

It was not surprising, for instance, that dancing occupied so large a place in the B.B.C.'s 30-line programmes. By its essentially visual nature, this form of entertainment obviously is practically barred from the ordinary wireless fare, and the small amount of tap dancing which has been broadcast aurally from time to time invariably has met with a decidedly mixed reception.

Television Ballet

But the early televiewers saw numerous examples of practically every school of dance, and as far back as 1933 were favoured with a memorable sight of the members of the Russian Ballet.

These included the great Leonide Massine himself, master of choreography and dancing, together with Irina Baronova, Alexandra Danilova, Helene Kirsova and others. That brilliant dancer Karsavina, as well as Adeline Genee, also appeared in the television studio.

The outstanding personality in this direction, however, was Lydia Sokolova—a well-established television star of whom no doubt we shall see more now that the B.B.C.'s improved service is ready.

LAURIE DEVINE

"... a certain television star of tomorrow."

It was Sokolova who arranged the first full-length television ballet produced by the B.B.C. more than three years ago. That was a version of "Cleopatra," and it was evident even to the uninitiated that the task of adapting ballet to the restricted conditions of the television studio then available was no easy one.

Sokolova faced the old television beam more than a dozen times. She always took extraordinary care that all the details of period dresses used in her television shows were minutely correct.

My personal impression of Sokolova, with whom I have had many conversations, is that she is one of the keenest enthusiasts about this new kind of entertainment in the country. She recognises in television a revolutionary means of enabling the masses to enjoy the beauty of the ballet, which hitherto has been to a large extent the privilege of the exclusive few. Television, in short, will make ballet lovers of us all.

Assuredly we shall see a lot more of Sokolova on our new television screens. Plans for the development of television ballet, I am told, already are well in hand.

If you paid a chance visit to the B.B.C.'s old studio, likely as not you would have met Laurie Devine, who was billed by the B.B.C. as "The Television Prima-Ballerina." She was televised more than eighty times—more than anyone else in the world.

Here is another certain television star of tomorrow.

Tall, dark and with "mesmeric" eyes, this versatile girl not only is a dancer of outstanding ability, but can play the piano, oboe, drums, trombone and xylophone. She has a good singing voice and has taken parts in comedy and "straight" plays.

Laurie was born in the sawdust ring, and began her career as a contortionist. London first acclaimed her in C. B. Cochran's spectacular revues, and she was appearing at a London music-hall one night in September, 1932, doing performances of Italian, Russian and Central European dancing, when Eustace Robb, the B.B.C.'s former television official, happened to "spot" her. Robb asked her to repeat the same performance as a television act, to which she agreed.

Laurie's Dilemma

In one of her dances on the stage, Laurie wore a wreath of flowers. Usually these were red roses. She obtained some particularly nice red roses for her first television rehearsal, only to discover on getting to the studio that anything red was taboo for television artists, as that colour did not come out well on the receiver screen.

THE "ZOO MAN" GETS HIS CHANCE

So she had to get a wreath of *black* and white roses made specially!

Artists who previously had not appeared before the microphone owing to the essentially visual nature of their performances were in great demand in the early days of the B.B.C.'s 30-line television service.

Naturally, under the new high-definition system, this will again be the case.

Dixon and Pal, a popular music-hall turn featuring a sea lion, was one of the very first of these novelty acts to face the old television beam. Mr. Dixon brought Pal along to Broadcasting House in a taxi.

A Thirsty Performer

Unaided, this sagacious animal waddled into the lift and made his own way along the passage to the television studio. While waiting for his "call," Pal was fed liberally with numerous sardines and herrings.

Announcing this programme was Freddie Grisewood, the B.B.C.'s popular London announcer, whose cheery voice is familiar to all wireless listeners.

Freddie told me that Pal was "quite the nicest sea lion he had ever spoken to," but revealed in a burst of confidence that the hot, dry air of the television studio seemed to distress Pal so much that at intervals this clever performer had to be taken out into the adjoining dressing room where he was periodically drenched with a bucket of water!

Novelty acts of all kinds, such as jugglers, conjurors, cyclists and cartoonists, but especially those featuring animals, undoubtedly will find a large place in the B.B.C.'s new television programmes.

HARRY HEMSLEY
Televised thirty times under old system.

But the most outstanding animal television programmes produced by the B.B.C. under the old régime were contributed by Mr. David Seth-Smith, who is the curator of the Zoological Gardens, London. It is already decided that these interesting shows will soon be repeated, and, I understand, may become a fortnightly feature.

Seth-Smith is a tall, sturdily-built man, who has a quiet, cultured voice and a merry twinkle in his eye. He is well-known as "The Zoo Man" in the ordinary radio programmes in which he has broadcast more than sixty times.

His first television broadcast consisted of an exhibition of live animals and birds which he brought from the London Zoo—the very first time, he assured me privately, that any of the treasures had been allowed out. The exhibits included several parrots, various snakes, four monkeys and—an alligator. They arrived secretly at Broadcasting House in a lorry, accompanied by four uniformed attendants.

Terrifying Monster

The star turn of this Zoo show was the alligator.

Shown first as a big close-up, merely the head being visible, the alligator opened and snapped his dangerous looking jaws. This made an arresting picture, of course, on the receiving screen.

Phew! How were they managing to control such a terrifying monster in the studio?

Televiewers who asked themselves that natural question were quickly disillusioned. Soon after, in a long-shot view, the reptile was seen nestling fondly in his keeper's arms. He was only a baby alligator, scarcely 18 ins. long, and delightfully tame!

A full-blooded music-hall show was first introduced to televiewers early in 1933, in the shape of Sandy Powell's "Televariety," which consisted of sketches, dancing and broad humour. The artists made their appearance through a curtain which closed to show a monster gramophone record—Sandy's sales were nearing the 4,000,000 mark at that time.

STAINLESS STEPHEN
Will appear in first of the new programmes.

A large number of individual variety artists and well-known radio stars appeared in the old-time television programmes, including Wynne Ajello, Anona Winn, Olive Groves, Jane Carr, Ronald Frankau, Roy Royston and Alice Delysia, but usually there was considerable difficulty in fitting in their studio appearances with engagements elsewhere.

Some, apparently, did not regard television very seriously, so that at present it is difficult to forecast how many will ultimately blossom out as new television favourites.

In my opinion, however, televised music-hall or cabaret should quickly become the most generally popular entertainment, and will, I hear, form practically half of all the B.B.C.'s new programmes so far scheduled.

Television Comedians

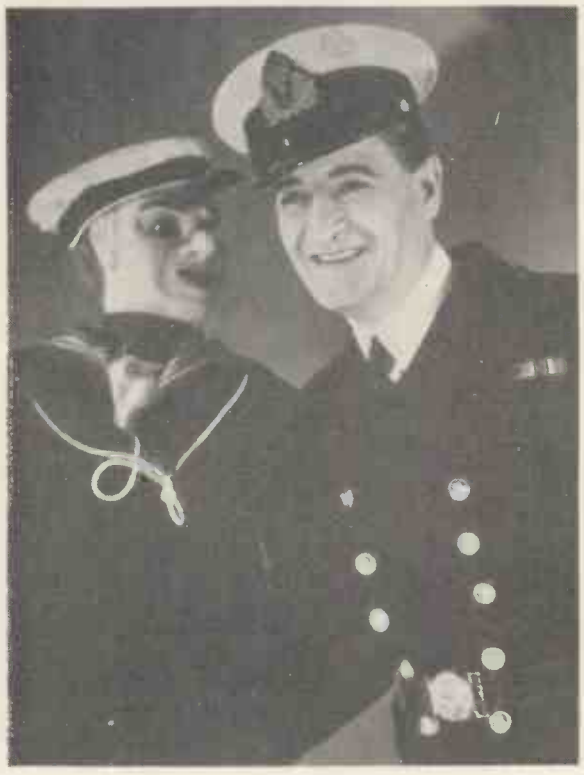
Roy Royston may be mentioned as a clever performer who always made careful preparations for his television performances—he appeared more than a dozen times—which no doubt will stand him in good stead. Jeanne de Casalis is another potential television star.

Many of the comedians best known to ordinary listeners, such as Leonard Henry, Tommy Handley, Gillie Potter, Clapham and Dwyer, Alexander

TELEVISION OPERA COMING

and Mose, Will Fyffe, and the Western Brothers, either have not yet appeared in the television studios or, at any rate, were not conspicuous. A little bird has whispered the name Stainless Stephen as a " cert " in one of the first high-definition programmes. Arthur Prince, the ventriloquist, and " Jim," also are likely to be seen quite soon.

Harry Hemsley was televised about thirty times in the old days,



AUTHUR PRINCE and " JIM "

This famous ventriloquist and many novelty acts, such as conjurers, cartoonists, trick cyclists and acrobats, will be featured in the new television programmes.

and can be indicated as a star of whom televiewers are likely to see quite a lot in the immediate future.

Harry is full of amazing anecdotes about Elsie, Winnie, Johnnie and his other radio children, who are quite as real to him as actual kiddies.

Here is the best television story Harry told me about them.

In one of the B.B.C.'s Christmas television programmes, Harry, as Father Christmas, produced from his bag a clockwork engine. He wound it up to show the imaginary Johnnie how it worked, but the wheels got caught in his long whiskers.

For a minute or two Father Christmas could not stop the engine, and, meanwhile, his whiskers were being wound up into the machinery.

" I was in a terrible dilemma," Harry confided to me, " but luckily I had the presence of mind to let the children help me out of my difficulties."

" Look at Daddy Christmas," said Winnie artlessly. " What *is* the matter with him?"

" I'll tell you what's the matter with him," whispered Johnnie confidentially to Winnie. *" I believe he's getting too old for his job."*

Hermione Gingold, who in private life is the wife of Eric Maschwitz, the B.B.C.'s Director of Light Entertainment, was a frequent contributor to the old television programmes, and should find fresh opportunity for her talent under the new regime.

Chestnut haired, pretty and vivacious, this clever girl has appeared some hundreds of times in the ordinary radio hours. Hermione, in fact, is probably our most versatile wireless actress, for she has taken part in Shakespearian and other " straight " plays, musical comedies and variety programmes, whilst her radio character " Mrs. Pullpleasure " is widely known not only to all listeners, but to all the old televiewers.

One of Hermione Gingold's television acts resulted from a visit with Ronald Hill to Bertram Mills' Circus at Olympia. There they saw the famous " Giraffe-necked " women, whose necks were encased in a pile of metal rings.

Ronald went home and wrote the music and lyrics of a new song he entitled " Giraffe-Necked Women " and which soon attained some popularity. Hermione made this song the basis of a television performance in which she appeared in appropriate native costume with a series of thick rings round her neck—exactly like the giraffe-necked women at the circus.

Hermione's Secret

" Soon after my television show," Hermione told me, " I received several sympathetic letters from enthusiastic lookers-in, asking what it felt like to wear those massive rings round my neck. One of them said that I really ought not to have endured the torture they must have occasioned merely to please televiewers."

Then, with a mischievous twinkle in her eyes, Hermione explained to me that the heavy looking rings she wore round her neck in the television studio actually were made of soft, close-grained rope painted to resemble brass !

Definitely we should see more of Hermione Gingold on our new television screens.

The strictly musical items broadcast in the B.B.C.'s 30-line television programmes were not particularly notable. Televiewers saw and heard a large variety of individual musicians and vocalists ranging from Beatrice Harrison to Margaret Bannerman.

A Disappointment

Maria Sandra and Gavin Gordon are two artists with exceptional histrionic ability as well as fine voices who established themselves as television favourites in the old days.

Even opera was tried. The first television opera was a condensed version of *Carmen*, with Sarah Fischer, Heddle Nash and Frank Sale in the cast, and dances by Elsa Brunelleschi.

But perhaps the most disappointing thing about the musical side of the B.B.C.'s television programmes during the 30-line regime, was the

HENRY HALL'S TELEVISION DEBUT

complete absence of any famous dance bands in the studio.

This omission, I am assured, may be remedied almost immediately.

Nowadays, even the most inveterate high-brow must admit that, so far as the majority of listeners are concerned, dance bands easily hold first place in popular appeal.

In the case of classical music, listener interest is largely confined to the music itself, except in the instance of really outstanding performers, but dance band fans favour one band or another largely on account of the personality of the leader, musicians or crooner, and this alone is a strong argument for including a large proportion of dance band items in the new television programmes.

Crooners Again!

Some of the favourite radio crooners were televised as solo acts, but televiewers have not yet seen the B.B.C. Dance Orchestra in action, Harry Roy and his band, Lew Stone, Roy Fox, Carrol Gibbons, Charlie Kunz, Geraldo, or indeed any of the well-known dance bands which, as I have ventured to suggest, would come near the top of any popularity ballot among the rank and file of televiewers.

Henry Hall and the B.B.C. Dance Orchestra, I am told, will be one of the first dance bands on the television screen. Dance bands in the new programmes, however, will appear in special settings.

It is safe to prophesy that when television properly gets into its stride, the most successful dance music outfits will be the stage show bands which at present do not appear at the best in aural broadcasting alone. It is generally conceded that the bands of Jack Payne and Jack Hylton are pre-eminent in this field, and when televiewers can see as well as hear these combinations, they may be confidently expected to attain a new and enormous popularity.

Rates of Pay

I believe that by far the most serious factor in the past which prevented the evolution of many outstanding television features was the restricted studio space, a trouble which has now been entirely overcome. But another factor undoubtedly was the small remuneration offered to television artists.

The famous comedian who was paid say £15 for a 10-minute music-hall turn in the ordinary radio variety programmes, was in the past paid no more than £3 for the same act in the television studio.

The inevitable result of this discrepancy in rates of pay was that while numerous artists were televised once, merely for the novelty of the experience, they soon began to whisper that until the B.B.C. revised its ideas about fees the whole thing was a joke.

It is true that Eustace Robb induced an amazing number of really prominent artists to be televised, but try-out performances gradually diminished, and the last hundred or so of the B.B.C.'s 30-line programmes were supplied almost exclusively by the " regular " television artists.

These " regulars," many of whom I have mentioned, helped in no small degree by their painstaking efforts and considerable sacrifice of time and thought, to evolve the new television technique and build up a permanent basis for television programmes of the future, and it would be surprising if the services of those who are still available were not recognised in the B.B.C.'s television programmes now about to begin.

Here I must conclude this sketchy survey of yesterday's television as a possible guide to the nature of visual broadcasts of tomorrow. I have already been assured by responsible B.B.C. officials that all of the old programmes which showed promise are being scrutinised afresh, with a view to adapting them to the new conditions.

Surely one fact emerges with increasing clarity. A new medium of entertainment, culture, education and dissemination of news definitely has been found. The dim, flickering outline I once saw in John Baird's tiny Soho workshop at last has become a mighty effulgent beacon lighting the world of men. Whither shall it guide us? What new miracles are at hand?

Our Short-wave Reception Contest

We promised, in preceding issues, to publish the names of the winners in this competition in the present number of TELEVISION AND SHORT-WAVE WORLD.

We very much regret to have to state that the competition has been a great disappointment. We can only conclude that the trouble and expense involved in obtaining verifications served to discourage readers from doing their best and we have been compelled to decide that the entries do not justify our awarding the prizes offered.

Needless to say, we have not come to this decision with any pleasure, and we are hopeful of arranging another competition in the near future to give our keen short-wave readers an opportunity of saving their reputation.

All credit to the readers who did submit their entries, but in nearly all cases the unfortunate fact has to be faced that the readers travelled the path of least resistance and made no determined effort towards an outstanding result. Where there was an extremely encouraging and painstaking effort one of our fundamental rules had not been observed!

Better luck next time!

A New Short-wave Oscillator

A new valve for short and ultra-short wave working has just been released by the Ediswan Electric Co., Ltd., and designated the ESW204. It has a maximum anode dissipation of 250 watts and a maximum filament emission of 2A.

The characteristics are as follows:

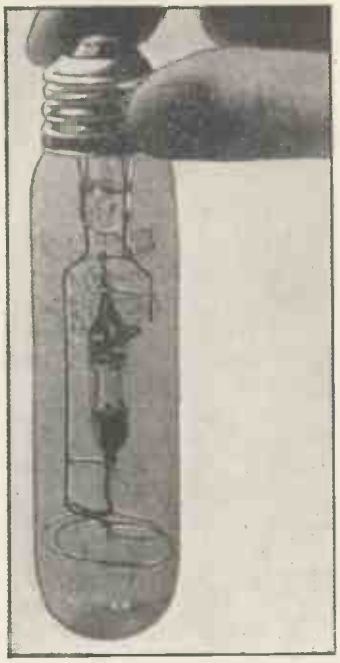
Filament volts, 11.
Filament current, 6.5 A.
Max. anode voltage, 2,000.
Impedance, 9,000 ohms.
Amplification factor, 20.
Max. dissipation, 250 watts.

This valve is of the carbon-anode type with both anode and grid connections brought out through the top of the bulb to tungsten rods. Maximum dissipation is permissible down to 60 megacycles without over-heating. The list price has been tentatively fixed at £15.

A NEW LIGHT SOURCE FOR TELEVISION

BY DR. LEE DE FOREST

We are indebted to "Radio Craft" (U.S.A.) for the following information on the development of a new and very intense light source which it is expected will be suitable for television purposes.



The new Westinghouse mercury-vapour lamp which produces the most intense artificial light so far developed.

THERE are two classes of light source suitable for mechanical systems of television, one where the light source itself is modulated at television frequencies and the other where the light source is of fixed intensity and modulated by a Kerr cell or other practical inertialess light valve. From the first division, the arc lamp may be excluded on account of its inconstancy. High-intensity tungsten point lights of the incandescent-filament type may be developed, but because of the extreme brilliancy at which it is necessary to burn such filaments their life is apt to be far too brief to meet the requirements of home television.

Most promising in its division now appears to be the high-intensity, high-pressure quartz capillary mercury vapour lamp on which Philips Company of Holland has been at work for some years. In this country (America) the General Electric and Westinghouse Co.s are each developing this type of high-pressure mercury vapour lamp with every promise that this source shortly will be available for television purposes.

The Light that Rivals the Sun!

In the air-cooled variety the intensity of the capillary vapour stream is approximately that of the electric arc crater or 85,000 candle-power per sq. in. But where the capillary is water-cooled by being encased in an outer glass tube through which a rapid stream of cold water is maintained flowing, high mercury pressures (20 atmospheres) are obtained; and a light intensity value *equal to that of the sun's disc*, or some 250,000 candle-power per sq. in.!

The lamp illustrated measures about $5\frac{3}{8}$ ins. × $1\frac{1}{4}$ ins. overall, the actual light element being only $1\frac{1}{2}$ ins. × $\frac{1}{2}$ in. in diameter. It is operated from a transformer which delivers 250 volts at the secondary, and the mercury arc is approximately $\frac{1}{2}$ in. long, a striking contrast with the usual mercury-vapour lamps in which the arc is of varying lengths from 5 ins. up. Thus the ideal "point source" is approached more closely than ever before in this type, which makes its use in television of the greatest interest. As with other lamps of the mercury-vapour type, the starting time is 3 to 4 minutes, before full brilliance is attained.

Modulation

Whereas a water-cooled device of this nature would scarcely be practical in a home, the less brilliant, air-cooled high-pressure mercury-vapour source appears to give sufficient brilliancy even after the light passes through (Nicol prisms, or equivalent) and a Kerr cell, and necessary lenses, etc., to illuminate with acceptable brilliancy a screen area of at least 4 sq. ft.

While the most obvious use of this new mercury vapour lamp would be as a fixed source with light valve modulation, it is not at all uncertain that the brilliancy of this source cannot be directly modulated at television frequencies. If so, this latter arrangement will afford many advantages over the fixed source with Kerr cell and polarising devices.

Electrical Interference with Broadcasting.

A committee appointed by the Institute of Electrical Engineers have come to the conclusion that, given the power the Post Office can eliminate all interference to radio providing it is of the locally generated type.

On the average over 40,000 complaints are dealt with each year from listeners who have suffered interference caused by lifts in buildings, trolley buses and trams, domestic appliances of all kinds, neon display signs, and medical apparatus. All these different sources of interference have been dealt with by the addition of condenser-choke filters of a simple kind. The biggest difficulty has been obtaining the permission from the owners of the apparatus and deciding who shall pay for the filters.

If legislation were introduced to line up with other countries the Post Office would be able to eliminate, within a year or so, most of the interference to radio and television.

Manufacturers would be compelled to fit suppressors to all equipment likely to cause interference for the cost of these suppressors, when bought in quantities, is only a shilling or so, which would not affect the price of the apparatus.

Listeners who complain of crackling spoiling the radio programmes do not realise that it may come from the traffic sign at the street corner or from the local barber who has invested in a new hair dryer.

It is the intention of the committee to approach the Government with a view to granting the power to the Post Office so that in the near future radio interference from such equipments can be dealt with legally.

Aircraft and Television.

Television may soon play a part in landing aircraft during fogs by supplying the pilot with a picture of the landing ground and the exact position of the plane. Direction finders at the aerodrome log the position of the plane which is passed on to a television transmitter. This picture is passed on to the plane while a lamp lights up behind a plan of the ground mounted on the plane. By means of these two checks the pilot can tell his exact position and also the best direction in which to land.

FACSIMILE TRANSMISSION BY MICRO WAVES

By George H. Eckhardt

An operator transmitting a message in facsimile over the new R.C.A. ultra-short wave radio circuit between New York and Philadelphia.

THE entirely satisfactory demonstration of the Radio Corporation of America's new ultra-short wave radio circuit between New York and Philadelphia, a distance of some ninety miles, would seem to mark the beginning of a new era in the field of radio communication. The circuit operates on a wavelength of 3 metres, and is unique in that it employs two relay stations which are automatic and unattended. Drawings, type matter, handwriting and other visual material are transmitted in facsimile, along with the simultaneous operation of automatic typewriter and telephone channels. The system is completely secret in that it could not be picked up and " unscrambled " by any stations other than those of the R.C.A.

Automatic Repeater Stations

The automatic repeater stations are located at New Brunswick, N.J., and Arney's Mount, near Trenton, N.J. Since the range of 3-metre waves is virtually limited to line-of-sight, the points of reception and transmission were selected to give the most distant optical horizons.

Each of the repeater stations employs two different transmission wavelengths, one for each direction. The two terminal stations each use one sending wave, making a total of six wavelengths, or frequencies, for the complete circuit.

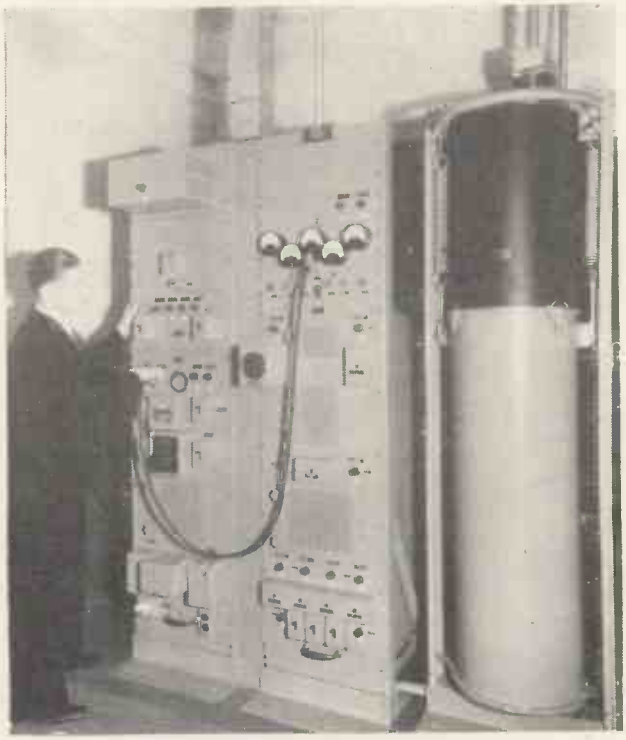
Should it be desired to extend the circuit beyond either terminal point, these six micro-waves could be used over and over again in the same sequence. Thus two waves of the same length would be generated at points about one hundred miles apart, and would not interfere with each other because of the line-of-sight limitation of their range.

The schematic diagram of the circuit—which, by the way, was actually sent by facsimile over the circuit—explains the placing of the repeater stations. Station W2XBN, in New York, has its aerials placed on top of a 600-ft. building. This station transmits at a frequency of 95,000 kc. At New Brunswick, 30 miles distant, is station W2XBM with an aerial placed 250 ft. high. W2XBM (in transmissions southward toward Philadelphia, picks up the 95,000 kc. signals, and retransmits them at 90,000 kc. Then at Arney's Mount, situated on a high hill, is the aerial of station W3XAP which, in the transmission southward to Philadelphia, picks up the 90,000 kc. signal, and retransmits it at 104,000 kc. Arney's Mount is 36 miles from New Brunswick and 25 miles from Philadelphia. The Philadelphia station, W3XAO, is situated on top of a building about 500 feet above sea level.

In transmissions northward, Philadelphia sends at 89,500 kc. This is picked up by Arney's Mount station and retransmitted at 94,500 kc., which in turn is picked up by New Brunswick and retransmitted to New York at 99,500 kc.

One of the most interesting engineering features of the new circuit is the method by which the unattended repeater stations may be turned on or off from either one of the terminal stations by radio. The receivers at each of the four stations are always alive and ready to catch impulses from their assigned transmitters. When it is desired to make the circuit ready for traffic, New York or Philadelphia, starts up its transmitter and sends a certain musical note which the receiving circuits

The ultra-short wave aerial on top of an office building in New York.



Transmitter used for 3-metre waves in ultra-short wave radio circuit between New York and Philadelphia.

are pre-set to " recognise." At the unattended receiver at New Brunswick the tone passes through electrical filters. Electrical circuits " accept " the tone and relays are actuated, turning on the power for the " south " transmitter, which, when in operation, passes the tone on *via* radio to the Arney's Mount station. There the operation is repeated.

When the tone signal reaches the Philadelphia station, the transmitter at that city is also automatically turned on, and the tone starts on its return journey, back to New York. Operators in New York know that when the tone comes back to them from the "north" transmitter at New Brunswick, the entire circuit is in full operation and ready for traffic. The constant presence of the tone keeps the relays closed, and the circuit in an operating condition. When the tone is withdrawn from the circuit, relays click in the same succession over the round trip to Philadelphia, and one by one the transmitters are automatically turned off. Philadelphia has the same control over the circuit as New York.

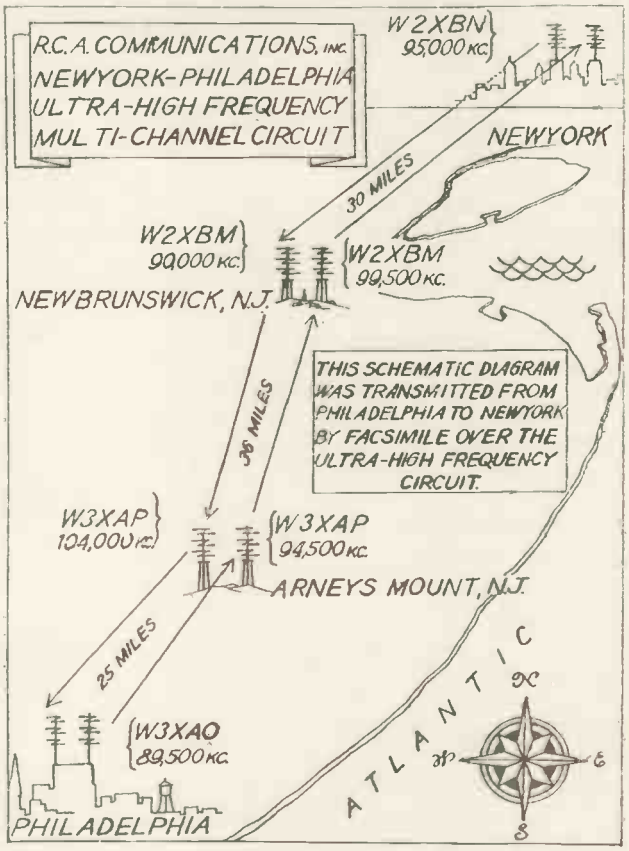
120-line Definition

The facsimile apparatus operates at 120 lines to the inch. The heart of the receiver is the "acorn" valve, so-called because of its minute dimensions, and in the transmitters there are new power valves specially designed for micro-wave service. These special valves—along with the antenna, transmitter, receiver, facsimile and terminal control apparatus were all developed in a group of R.C.A. laboratories, each specialising in a special phase of the work.

David Sarnoff, president of the Radio Corporation of America, said: " We find that the ultra-short wave portion of the radio spectrum gives us a medium of almost unbelievable possibilities. We cannot only send messages in facsimile as fast as present equipment will allow, but we can send two pictures simultaneously, and on the same radio wave we can also add two automatic typewriter channels and a telegraph channel. Of course, this means that we do all those things in both directions at the same time.

" The possibilities of multiple transmission are still not exhausted. Perhaps this single illustration will give some idea of the traffic handling possibilities of the circuit. If we were concerned only with communication on a word basis, we could, with increased power and filter systems, operate enough automatic typewriters to carry a total of 12,000 words per minute in both directions between New York and Philadelphia.

" Such flexibility, in being able to accommodate so many separate services simultaneously, offers important



Reproduction of an actual diagram transmitted from Philadelphia to New York.

commercial advantages. But we intend to continue this development further with the object of creating new devices for higher speeds of transmission on the individual channel. There would be little point in our using the new system merely to add another hundred or two automatic typewriter channels between these two cities when adequate wire facilities for such services already exist. We cannot be content merely to duplicate present practice at this stage of radio's development. Now that we have the circuit we shall turn again to the laboratory to find out how best to make use of it. Of course radio wants its share of telegraphic traffic, but it looks also at the much bulkier mail bags."

Scannings and Reflections

By THE LOOKER

London's Viewing Rooms

UP to the time of writing, about twenty applications have been received by the B.B.C. for information relating to the equipment of public viewing rooms. How many of these will mature it is impossible to say yet, but I am assured that the interest that is being shown goes far beyond the point of curiosity and that in some cases plans for these viewing rooms have already been got out. I think that the recommendation of the B.B.C. that the audiences should be limited to about thirty persons is a wise one for, of course, at a given distance there is a limit to the amount of detail that the normal eye can see. Experiment has shown that in the case of a picture ten inches square with 240-line scanning a viewing distance of six feet is the most suitable; with a distance of less than five feet it is easily possible to discern the line construction of the screen. The viewing angle also has an important bearing on the matter and obviously it will be impossible to seat every member of an audience in the position for optimum viewing if the number is not limited.

The Broadcasting Programmes and Television

When the B.B.C. recently outlined its programme plans for the autumn and winter, Mr. Cecil Graves, the B.B.C. Programme Controller, said that in the scheme of construction on which these were based no account had been taken of any effect which the television programmes might have on the broadcast programmes. It appears, therefore, that the television programmes will be absolutely independent of the sound transmissions and that no attempt whatever will be made to obtain any measure of balance between the two.

Television Rehearsals

One would have naturally assumed that more time would require to be devoted to television rehearsal than in the case of sound broadcasting. However desirable this might be it will be impracticable, and it has been calculated that a rehearsal time of three hours to one of actual presentation will be all that is possible. Monitoring on a closed circuit will, of course, be essential, and it will be appreciated that three hours per day presentation with the rest of the time devoted to rehearsal will only permit of this ratio. In the case of sound broadcasting a ratio of eight to one is allowed for the more elaborate productions, but of course these rehearsals can proceed irrespective of any transmissions that are in progress.

Television in Russia

Reliable information on television developments in Russia is difficult to obtain. For a considerable time low-definition transmissions have been made from Moscow, but these appear to have been experimental and have not been worked to any schedule. It is now reported that the construction of a high-definition transmitter has been commenced which if successful will be used to inaugurate a regular service early next year.

THE LONDON TRANSMISSIONS

The following is a summary of the arrangements made for the television transmissions from the Alexandra Palace :—

The Baird System will use 240 lines, sequential scanning, 25 pictures per second. Marconi-E. M. I. will use 405 lines, 25 pictures per second, interlaced scanning to give 50 frames per second, each of 202 1/2 lines. Receivers can be constructed capable of receiving both types of transmission without undue complicated adjustment. The format for both systems will be 4×3.

The vision signals with either system will be radiated on a frequency of 45 Mc/s (6.7 metres), and the associated sound signals will be radiated on a frequency of 41.5 Mc/s (7.2 metres). The power of the vision transmitters will be 17 kilowatt peak during periods of maximum modulation, while the sound transmitted will have a power of 3 kilowatt, 90 per cent. modulation, Copenhagen rating.

Direct television will be given by the Baird System by means of intermediate film and the image-dissector, while the Marconi-E. M.I. Company will use the Iconoscope camera (Emitron). Film transmissions will also be given, the Baird Company using mechanical scanning and Marconi-E. M. I. the Emitron.

Three programme periods are contemplated daily at :—3.0—4.0 p.m. 6.15—7.15 p.m. 9.30—10.30 p.m.

Programmes will be provided by one system at a time, the two systems working alternately week by week.

Still Hush-hush at the Palace

The B.B.C. still continues to maintain a close guard on the Alexandra Palace. The would-be intruder cannot do more than get inside the door before he meets with a severe rebuff. Dates for a Press visit have been fixed tentatively on two occasions, but each has been cancelled later and the excuse given that it is not considered that the work is sufficiently advanced for public inspection. From information which has come to me, however, it is now certain that the work is practically complete and that it is really only the finishing details that remain. The aerial is up, but the feeder connections have not yet been made. The two main studios are also completed; these are so arranged that they can be divided into three smaller sections by means of curtains when only a small space is required. All the transmitting gear is now at the Palace and some of it has actually been in operation on a closed circuit.

Television and the Cinema

The alarm that was recently expressed by the cinema trade generally regarding the potential rivalry of television appears to have subsided to some extent. The conclusion seems to have been reached that it will be a very long time before it can rival the film and that its immediate future is in the home where it will no more adversely affect the cinema than does any other form of home entertainment. Cinema exhibitors however do not propose to withdraw their objections to the broadcasting of news-reel items supplied by film concerns.

Opinions Made in America

It is rather a curious point that when any information on television is sought by outside interests re-

MORE SCANNINGS . . . . . .

course is always had to America for opinions on the state of the art. Whether this is due to the hush-hush policy that has been persisted in here or not I do not know, but it seems a curious state of affairs for the television problems that America has to face differ radically from those here. The difficulties of putting it on a commercial basis in that country are stupendous and these alone are sufficient to prevent an unbiased opinion being given.

Television in the Provinces

A short time ago the Sheffield City Council passed a resolution instructing the Town Clerk to write to the B.B.C. for an assurance that the claims of Sheffield would be given consideration in connection with the national system of television broadcasts, and that representatives of Sheffield would be afforded an opportunity to collaborate with that body.

The B.B.C.'s reply pointed out that it is not at the present time possible for a definite commitment to be made as to the establishment of a station in any particular area, and that as the planning of additional stations is not the function of that body alone, but also of the Television Advisory Committee, the Council's offer of collaboration had been passed on to that committee. The Town Clerk communicated with the Advisory Committee, and he has received a reply containing the following:—"As you are no doubt aware, the London television station is not yet in operation, and until some experience has been gained of the working of that station it will not be possible for the Television Advisory Committee to give serious consideration to the question of opening additional television stations in other parts of the country. You may, however, rest assured that when the time comes to consider the erection of further television stations, the claims of Sheffield will be duly borne in mind by my Committee."

No Television at B.B.C Training College

It is understood that no television instructional courses are to be included in the curriculum of the proposed B.B.C. training college which it is now officially stated is to be instituted. The idea, it appears, is to train a reserve staff in the various spheres of sound broadcasting.

Television and the Radio Trade

Advertisers Weekly asks: "Isn't the radio trade falling over backwards in its anxiety not to allow television to disorganise radio sales?

"In the not very distant future American and other foreign television sets will begin to flood the English market. Against that time the British radio trade will have built up an impression in the public mind that they are technically unprepared, sceptical, and almost hostile to a form of entertainment which the consumer will take up with an enthusiasm beside which their interest in radio will seem half-hearted."

The G.E.C. and Television

Speaking at the annual general meeting of the General Electric Co., Ltd., the Chairman and Managing Director, The Right. Hon. Lord Hirst of Witton, in the course of his speech, said:—"You will, I know, expect me to make some reference to the advent of television. The recommendations of the Selsdon Committee have been very largely adopted by the Postmaster-General, and the public is now awaiting the announcement of public transmissions. Your company is ready with its receivers immediately these transmissions commence, and you may rest assured that we shall be able to take our place in the arena when the moment arrives."

Television Inventions

The British Patents Office reports that there was a large increase during 1935 in inventions relating to television, particularly in respect of the development of cathode-ray receivers, the reduction of flicker by interlaced scanning, transmission of cinema films, and short-wave wireless transmitting and receiving apparatus for use in television.

Frequencies of Billions!

Giving evidence before the U.S.A. Federal Communications Commission, Mr. David Sarnoff, president of the Radio Corporation of America, said: "Beyond the ultra-high frequencies lie the micro-waves, frequencies that oscillate at the rate of a billion cycles a second, wavelengths measured in centimetres instead of metres," Mr. Sarnoff continued:—

"Once we have conquered these microwaves we shall have opened a radio spectrum of almost infinite extent.

"Instead of numbering the usable channels in a few scant thousands, radio will put millions of frequencies at the command of communications services of all kinds. There will not only be an unlimited array of mass communications services, but an unlimited number of individual communication connections.."

Sponsored Programmes

As a result of the decision of the Government to exclude advertising in any shape or form in broadcasting, the B.B.C. plans with regard to certain sections of the television programmes will have to be modified. The original idea was to include such features as fashion parades and demonstrations with a limited amount of publicity to the organisers concerned. How far the veto will affect these programmes it is difficult to say at the present time, for this class of programme will of necessity be a feature of the television broadcasts. It will be remembered that the Ullswater report in connection with sponsored television programmes said, "—that any increase in its use should be limited to the initial stages of television broadcasting," and it was upon this that the B.B.C. plans were based. Actually there is a certain amount of publicity going out on the sound broadcasts—the quoting of makes and numbers of gramophone records, for example—and it may be that some such loophole will be found in the case of television.

The Moscow Television Canal

Mention was made in these notes recently of the use of television for the control of the locks of the Moscow-Volga canal which is in course of construction. Television, it is understood, will permit of the lock-keepers seeing the ships in advance of their approach. The first section of this canal has now been opened.

Twenty-three Public Televiewing Houses in Berlin

During the Olympic Games, which will be held in Berlin from August 1 to August 16, the Post Office have decided to increase the number of public televiewing rooms and halls from the present eight to twenty-five. Some of these will be situated at Potsdam. By this means it is hoped to give as large a part of the

population as possible a chance to see the main events in the Olympic Stadium by means of television.

Concrete Pit for Olympic Television Engineers

A concrete chamber sunk below the surface of the arena in the Olympic Games' Stadium will be used by the German television engineers to house the apparatus required for televising the events. 180-line and 25-frames-per-second pictures will be used, and the signals will be broadcast from the Berlin Witzleben television station.

Short-waves and the Olympic Games

In order to broadcast in all languages to every country taking part in the forthcoming Olympic games a new transmitter is being erected at Zeesen near Berlin.

It will be one of the largest and best equipped stations in the world and will ultimately be used for the German colonial service. The wavelengths for this station will be picked from those channels allocated for German short-wave use so as to make sure that the programmes will have a world-wide coverage.

All-wave Receivers

For the first time the British set makers are to go after the short-wave and export market now held by America. Next season well over 100 receivers, marketed by 30 different makers, will be available.

Several American stations are to take advantage of this forthcoming short-wave interest by issuing full programmes for publication in this country. American advertisers with agents in Europe are finding short-wave listeners a potential market for their wares so programmes suitable for European consumption can be anticipated.

5-metre Prospects

Earlier in the year several 5-metre transmissions from California were received in Eastern America a distance of between 2,500 and 3,000 miles. Although this was purely freak reception, regular transmissions from W6CNE in Canoga Park, California, are now being received in the New York area on single-valve receivers. As the power used is no more than 45 watts—less than the current taken by the average electric lamp bulb—it seems quite possible that long distance 5-metre reception will soon be an accomplished fact.

Large Pictures with Cathode-ray Tube

At the great " Germany " exhibition which opened on July 18 a striking development in projection reception of high-definition television was demonstrated daily by Telefunken. This firm has seemingly solved the hitherto difficult problem of producing a large picture for high-definition television reception using the cathode-ray tube.

On a ground glass screen roughly 80 by 100 cms., television reception is shown which can be watched in comfort by up to 300 people.

The method employed is briefly as follows: A small cathode-ray tube made of heavy heat-resisting glass and fitted with an entirely flat screen is placed behind a normal optical system of lenses which enlarges by projection the television reception pictures on the screen of the tube from 6 by 8 cms. to the size already mentioned. The secret of the success of this method lies in the great accuracy and brilliancy of the small picture on the screen of the new tube. It is stated that a high tension of 20,000 volts is required.

On the Short Waves

Those who have been troubled by the lack of results on the short waves during the past two months will be glad to know that this is not due to any fault in the receiver or transmitter.

Conditions at the moment have not been worse for over five years and rarely have all bands been so affected. Listeners in all parts of Great Britain have found the 160-metre band useless owing to noise except for very local working. Most amateurs have failed to find any worth-while stations on 80 metres while the 40-metre band has been so erratic that it has been impossible to arrange any advance schedules. Stations on this band have been known to fade out during a short contact of 15 minutes or so while skip has been up to 100 miles.

The severe storms have made reception on 20 metres almost impossible even to those with multi-valve receivers. These conditions do not show any signs of changing.

Television Make-up

Instructions have been issued to the television staff to wear contrasting colours such as white flowers or bright edging with black materials. Blues should always be the predominating lip-stick colour as this registers as a dark shade.

The Director-General has mentioned that all rehearsals should be full-dress with correct make-up.

U.-S.-W. Developments

So much is being done just now to develop ultra-short-wave working that one begins to wonder where it is all going to end, and how the balance will lie, in the future, as between these and the so-called medium and long waves now used for ordinary broadcasting. Only a few years ago the waveband below 100 metres was considered to be of so little use that it was handed over to the amateurs. Now most of the really long-distance transmissions " belong " there.

High-definition television is, of course, responsible for a good deal of the recent progress reported in the region below 10 metres, but lower down the scale comes what is perhaps the most fascinating field of all. I refer to the so-called " micro " waves, which are measured in centimetres but are now being used to cover distances of 30 miles and more.

Somewhere here one begins to get a glimpse of the time when we shall all carry vest-pocket sets, tuned to a " personal " micro-wave, and responding automatically to a call-code, something like the watch-dog sets used at sea for the S.O.S. signal. The prospect of being kept constantly in touch with home may have its appeal.

The German Radio Exhibition

The German Radio Exhibition opens on August 28 when it is expected that a great deal of space will be devoted to television apparatus and demonstrations.

This angle of television has been fostered by the German manufacturers in an endeavour to increase the public interest. It will be remembered that last year the television booths were destroyed by a terrible fire that almost wiped out the entire exhibition.

This year the exhibition will run concurrently with Radiolympia which opens on August 26.

TELEVISION AND SHORT-WAVE WORLD

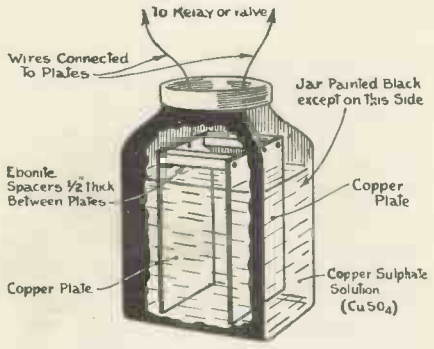
AUGUST, 1936

AN EASILY-MADE PHOTO-ELECTRIC CELL

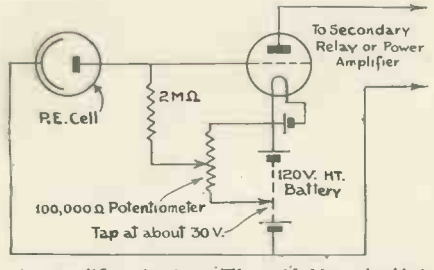
By William Watt

Details of a simple photo-voltaic cell that can be made at home

AMATEUR experimenters' work is often hampered by the prohibitive cost of components. Such a component is the photo-electric cell which, except for its high price would provide the amateur with many and varied interesting experiments. A simple type of photo-electric cell, however, can be made at a nominal cost, and although not so efficient as the commercial article, it will serve many of the purposes required of it by the experimenter. This cell is particularly suitable for measuring light intensity and while not being as fast in action or as responsive to high frequencies as the commercial article, it has the advantage of not requiring a polarising voltage from an additional battery as it is in reality a special type of light sensitive battery.



Sketch showing the construction of the photo-voltaic cell.



An amplifier circuit. The grid bias should be adjusted to be just sufficient to limit flow of anode current. The valve employed should have a high mutual conductance.

The materials required are:—One square glass jar, two plates of "pure copper," about 4½ ins. by 1¾ ins. by 1/32 in. thick, and a small quantity of copper sulphate. The dimensions are approximate; the larger the area of the plates the higher the output of the cell. Three sides of the jar are painted with "dead drop black" paint, leaving one side of the jar transparent to act as a window to allow the light rays to pass.

The copper plates are immersed in the jar in a solution copper sulphate ($CuSO_4$) or blue vitriol—11 grammes to the ounce. The solution is made by dissolving the $CuSO_4$ crystals, which are obtainable from any chemist for a few pence, in distilled water, the proportion of the solution being one in four, i.e., one ounce of $CuSO_4$ crystals to four ounces of distilled water.

Before immersing the plates in the solution leads are, of course, fixed to each plate by soldering or putting a small bolt through the top of each plate and fastening the leads on to them. Stiff copper wire should be used for the leads so that it can be bent to separate the plates when in the cell; under no circumstances must the plates be allowed to touch each other. Care must be taken to see that the level of the solution is well below the soldered joint.

The plates can be prevented from touching each other by spacing them with two pieces of ebonite or glass, the whole being firmly clamped together by a rubber band.

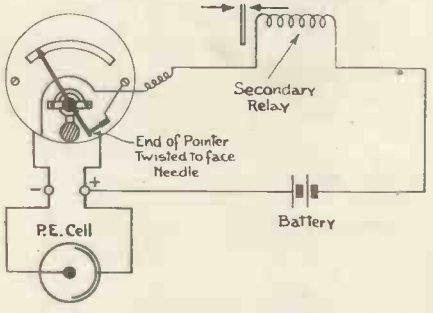
The plates can now be immersed in the solution and they are so placed that the flat side of one of them is directly facing the window so that the light rays passing through fall on it.

The theory of the cell is based on the fact that there is a difference of electrical potential between the illuminated plate and the one that is not exposed to light, thus causing a current to flow within the cell, or, in other words, "if one of two similar electrodes immersed in an electrolyte is illuminated, an e.m.f. is produced owing to movements of the ions in the liquid reducing the resistance of the cell.

The experimenter will, of course, realise that the current produced by this cell, or for that matter, any type of photo-electric cell, is very minute, being only a few micro-amperes, and it has to be amplified before it can be put to practical use. There are two methods at his disposal for accomplishing this, one utilising an ordinary triode valve, and the other taking the form of a mechanical type of relay, of which there are many and varied forms

The nature of the actual experiments to be carried out will, of course, decide to a certain extent the method of amplification to be adopted. For measuring different light intensities there is a meter on the market which has a very sensitive movement calibrated in foot-candles and which can be operated direct from the cell without amplification. Readings up to 250 foot-candles can be obtained from this particular meter.

For other experiments the writer advises the use of the mechanical type of relay in preference to thermionic valve amplification as the cell has a low internal resistance which makes it not altogether suitable for valve amplification. This does not imply that it is totally unsuitable and the diagram illustrates a circuit which it was found worked quite well.



A simple type of relay used in conjunction with the photo-cell.

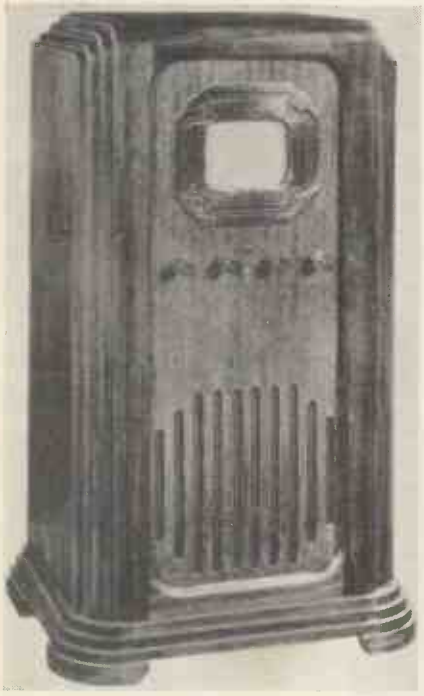
No difficulty should be experienced in rigging up satisfactory relays; it is possible to utilise movements taken from old milliammeters (0-5 milliamp. range), voltmeters, cutting out the internal resistance, of course, or even the earpiece of an old headphone.

Relays of this type are only capable of "breaking" quite small current, and are generally used to drive more powerful relays.

PHILO T. FARNSWORTH ON THE FUTURE OF TELEVISION

The following is an abstract of the evidence given by Mr. Philo T. Farnsworth, Vice-President of Farnsworth Television Inc., and well-known research worker, before the Federal Communications Commission which has been sitting in Washington, U.S.A., to decide the future of television in America.

MR. FARNSWORTH, in giving evidence before the Federal Radio Commission, dealt in the first place with the locating of television transmitters in order to avoid interference. He said: We believe that it is essential in allocating these ultra high frequency bands to television stations to take full advantage



The Farnsworth combined vision and sound receiver which it is proposed to market at less than $250

of the properties of directivity. If the properties of directivity are not taken into consideration, it is doubtful to us whether it would be possible to place even two stations in principal cities without objectionable interference. If the properties of directivity are given due consideration, for example, by locating television transmitting stations towards the circumference of the populated area to be served, and directing the signal towards the centre of such area, the interference will be confined to one direction. For the coastal stations the energy may be directed seaward and this will permit substantially all the channels to be used in every coastal city.

We recognise that in many instances locating television transmitters near the outskirts of a city would be a disadvantage. This would be true, for example, in New York, Philadelphia and Chicago. This disadvantage is partly offset by the decreased attenuation that will result near the transmitter. Furthermore, in many cities a better total coverage will be obtained by such location of the station outside of the area of high buildings.

For cities located inland the desirable directional pattern that should be used will be determined by the location of surrounding cities.

The use of directive receiving antennæ will be useful in attenuating the interfering signal with respect to the desired signal. Such receiving antennæ are simple and economical to build and use and in a great many instances they will be used anyway to increase the sensitivity of the receiver and give better service. We recognise that future allocation problems will be difficult and we do wish to point out that directivity will be as important a factor as is frequency band width in determining the number of possible television stations for a given area.

A New Transmitting System

We are very doubtful whether the present system of amplitude modulation will be the ultimate method used in television. At present, although the television modulating frequencies cover a band of two-and-a-half million cycles, 95 per cent. of the transmitter power is confined to frequencies below one hundred-thousand cycles. If we attempt to so distort the television impulses to give a greater percentage of power in the high-frequency part of the band, we develop a video signal which has very large voltage swings, but which has comparatively low power content. This imposes a requirement on transmitter design which is impossible to obtain using standard tubes. For example, a transmitter designed for 1,000 watts average power would have to be capable of transmitting instantaneous peak power of the order of 100 kilowatts. For this reason, no one in the past has seriously considered this type of transmission. Recently, however, we have developed tubes which have the fundamental properties of developing practically any required peak power so long as the average power is kept within their dissipation rating. We therefore intend to experiment with frequency distortion at the transmitter and suitable frequency compensation at the receiver. If the system can be worked out practically, as it at present appears it can, the effectiveness of a given power radiated by the transmitter will be increased in direct proportion to the increase in the power radiated at the high side-band frequencies.

To give a quantitative idea as to the magnitude of such possible improvement, we may consider the type of image which results in the largest component of high-frequency power at present, namely, an image consisting of very fine print. Even with such an image, the total power in the band frequency from 100,000 cycles to two-and-a-half million cycles is less than 10 per cent. of the total.

1,000 Megacycles !

We look to the future with complete confidence that the very high frequencies between 100 and 1,000 megacycles will be commercially useable within a very short time. We have under development in our laboratory tubes that may be used as oscillators and amplifiers without loss of frequency up to 500 megacycles or higher. These tubes are of the cold cathode multipactor variety. We hope to make tubes of this type available to our licensees for experimental purposes within the next few months. At the present time we are attempting to develop a tube which will deliver

THE AMATEUR CONSTRUCTOR AND TELEVISION

an output of 500 watts up to 500 megacycles. When we have succeeded in this it will be possible to build economical one-kilowatt transmitters for the band between 100 and 500 megacycles. This illustrates how the by-products of an important development such as television may open up new frontiers of scientific achievement.

Receiver Control

It is thought by many that the receiver developed for television at present is too complicated for use by the public. There are only three essential controls on our television receiver. One of these controls tunes the ultra-short wave receiver. Another control adjusts the intensity of the visual image. The third control is for focusing of the cathode-ray spot. We are confident that with a very small amount of further development, we can eliminate the focusing control, leaving only two controls for the complete visual part of a television receiver.

In adopting a fixed spacing between sound and vision carriers, it is contemplated that the tuning of sound and vision ultra-short wave receivers will be accomplished with one control. We therefore have only one additional control, namely, that for regulating the intensity of the picture in what is for all practical purposes the present television receiver. We do not feel that even at the present time the cost of television receivers would be prohibitive. Our receiver at present consists of three units:

1. A combined sound and vision ultra-short wave receiver.
2. A television scanning chassis.
3. A regulated power supply.

Receiver Costs

The total number of tubes required in these three units at the present time is nineteen. We hope in the very near future to reduce this number to fifteen. We believe, therefore, that the costs estimated for television receivers are entirely too high. We do not feel that it is at all unreasonable to expect that the cost to the public can almost at once be less than $250 each. It is perfectly true that since a television receiver must always include both sound and vision receivers, the combination will always cost more than a simple sound receiver.

As to the cost of television transmitters, we have had manufactured for us by one of our licensees a complete television transmitting station, and the cost is but a small fraction of any of the figures which have been so widely published. Television studios, as is the case with sound studios, may be elaborated to any desired degree. It would hardly be fair to take as the cost of a sound transmitting station the cost of the plant at Radio City.

The Amateur Constructor

We believe that amateurs can and should be permitted to share in the development of television by building their own television receivers. It is our belief that television presents no more difficulty to amateur receiving set builders than did radio in 1921 and 1922. Of course, there will be no crystal set days, but there will be manufacturers of cathode-ray tubes, there will be manufacturers of component scanning units, there will be published circuit diagrams of useable short-wave receivers and I should not be surprised to find amateurs building television receivers, competing favourably with those developed in the large laboratories.

We take issue with the testimony which has been given by other television workers in their belief that television must be born a finished service. We do not want to misinterpret their statements as meaning that television will not make further progress after it has become a commercial service. It seems to be the general belief, however, that the baby must be born with a beard.

Public Interest

While we recognise fully the force of what has been said as to the necessity for caution leading to the inauguration of television, we question whether it is within our ability to control its progress. We submit that with the public desire for television what it is, once experimental stations are operating on regular schedules, uncontrolled manufacturers will produce television sets for public consumption even though of an inferior quality. Does anyone suppose that the Courtland Street gentry will not find a way to offer cheap television receivers of the bootleg variety just as soon as experimental broadcasting is regularly on the air? It may well be, therefore, that receiver manufacturers and broadcasters may be forced to start television sooner than they expect.

During the past ten years, since the public first began to hear about television and to envisage it as a home entertainment service, it has been steadily becoming an explosive entity.

The flame of public interest has been fanned by publicity until it is about ready to burst into a conflagration. Whether it will do so as a result of the added impetus that is now given to television experimentation, is a matter of conjecture, but it is our opinion that after the public learns that a few hundred television receivers are operating, even though under experimental field conditions, it will be difficult for any group to delay its commercial exploitation.

Technically Ready

Engineers and inventors have been working fifty years in developing television. They now pronounce it a technical reality, although still capable of being improved. In its use now there will arise a new art combining the theatre, motion pictures, radio broadcasting, newspapers, advertisers, educational institutions, etc. These interests must make their contribution to its full utilisation in the same scientific spirit as its creators have done technically. To delay is to let opportunity pass into the hands of those more alert. To vigorously tackle the problems, all of which appear capable of solution, is to liberate this great new force for the progress and welfare of mankind. Television's advent is timely. Technical developments have increased leisure for many which may be constructively filled by the proper use of television. It will be a tremendous stimulus to its own immediate industry and to others by increasing human desires.

Our Policy
"The Development of Television."

MECHANICAL SCANNING AND HIGH-DEFINITION PICTURES

By R. L. ASHMORE

The success that has attended the efforts of some of those who have been developing mechanical scanning for the new high-definition service has led to renewed interest in this class of receiver. The following notes are not intended to indicate a solution of the many problems that have to be met, but rather as a résumé of some of the attempts that have been made and an indication of the lines which seem to promise success.

THE simplest of all scanning devices is the disc, and at the outset will be useful to consider whether this could play any part in the new order of things. Owing to the fact that there is no optical leverage effect obtainable with the disc scanner the picture even with the old thirty-line system was necessarily small, and even assuming that the use of this device was practicable for high-definition television the picture would still be of minute dimensions. A generous size would be a picture three-quarters of an inch high and rather less than an inch wide, and to produce this a disc about 6¼ ft. in diameter would be required and the size of the holes would need to be 1/340-inch square. For a picture frequency of 25 per second the speed at which the disc would have to be driven would be 1,500 revolutions per minute. To drive such a disc at this speed would require a considerable amount of power because of air friction. The greatest problem, however, would be the provision and maintenance of the exceedingly small scanning holes, which would rapidly become choked with dust. Attempts have been made to overcome this difficulty by the use of film, which is entirely black except for the small scanning aperture; whilst this method the very small amount of light which would pass through the holes. It appears, therefore, that the disc in its simple form must be ruled out for high-definition pictures.

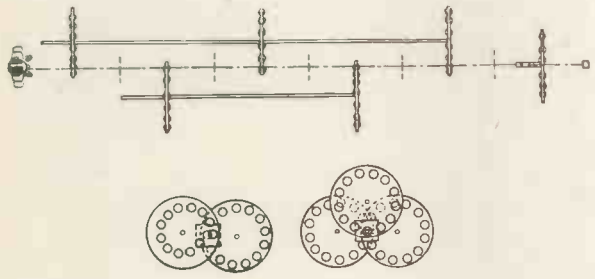


Fig. 1.—Schematic diagram of Baird optical lever.

Although it may not even suggest promised success for a lower definition, it has not been found practicable for anything above 120 lines. There is also the further disadvantage of a solution it is interesting in the above connection to consider the device due to J. L. Baird, which he termed an optical lever. This optical lever was designed to overcome the difficulty of driving large discs at high speed and yet use a large number of scanning lines. Fig. 1 (above) shows the scheme in plan and elevation and it will be seen that a series of discs are used which are provided with lenses. The lenses of the first disc produce virtual images midway between that and the second disc. The lenses of the latter, which cross the optical axis of the lenses in the first, in the opposite direction pick this first image up and produce a virtual image midway between this and the next disc, and so on. It will be understood that though we start with a stationary object we finish with a series of rapidly recurring images due to the relative motions of the discs, and thus the speed of traversal of the images is increased with each successive stage, the speed of traversal at each being doubled. The real disadvantage of such a system is that a considerable amount of light would be lost in passing through the successive lens stages.

The Mirror Drum

The mirror drum is the next most obvious type of scanner, and a little calculation will show that in its ordinary form this would be quite impracticable both as regards weight and size, not to mention the difficulty of construction. One very difficult feature in the latter respect would be the accurate setting of the mirrors to the correct degree of angularity to produce a scan which would be a very small fraction of a degree in the case of 240 lines.

The whole problem really appears to be bound up in the amount of modulated light that can be made available. If this is sufficient then scanning devices can be reduced in size and consequently there is no difficulty in driving at high speeds, or alternatively using some sort of multiplying arrangement. Scanning can also be simplified by the use of two scanners, one for the lines and the other for the frame frequency.

A multiplying system, which although it does not provide a practical solution, suggests some interesting possibilities, is shown by Fig. 2. It consists of a plaque consisting of a series of mirrors set angularly in respect to each other, the number of mirros of which the plaque is composed being a suitable multiple of the number of mirrors on the drum to produce the required

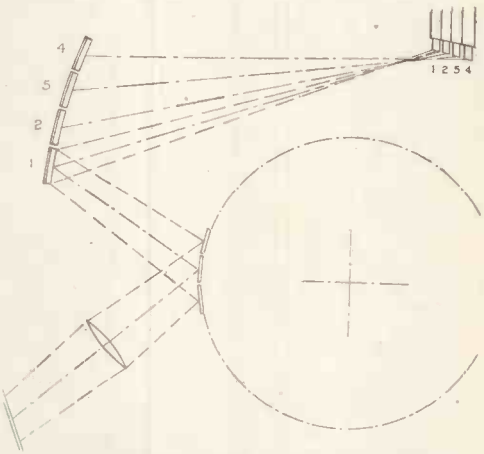


Fig. 2—This sketch shows how by the use of four mirrors the number of scanning lines is multiplied.

SCANNING MULTIPLYING SYSTEMS

number of scanning lines. For the sake of simple explanation we may take the case of one of the old thirty-line drums, the first and last mirrors of which had an angular separation of 12 degrees. The explanation will be simpler to understand if we assume that with a thirty-mirror drum it is wished to produce 120 lines. Obviously in this case the angular separation required would be 3 degrees and this can be obtained by the use of four extra stationary mirrors, which compose the plaque.

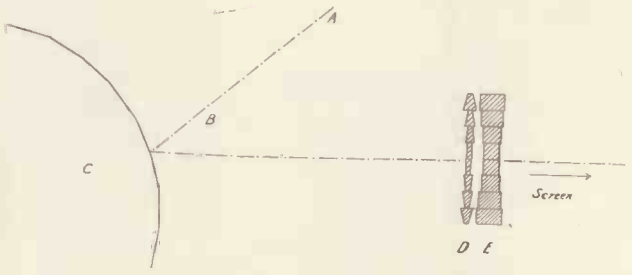


Fig. 3.—A plan view showing the relative positions of ray divider and mirror-drum for horizontal scanning.

Reference to the diagram will show that the light ray upon reflection from the drum is caused to strike the top mirror from whence it is reflected on to the screen. The four separate reflectors of which the plaque consists are capable of adjustment to a different reflecting plane in two directions. When by the rotation of the drum the ray travels over the surface of the lowest reflector a line will be traced on the screen. The second reflector is so adjusted that the ray is displaced by a quarter spot width, the third by half, and so on. In this way each mirror on the drum is caused to produce four lines.

A somewhat similar scheme to the above was described in the May, 1935, issue, which avoids making the path of the light rays oblique, which is the case when mirrors are used. This arrangement employs a series of small angle prisms and the scheme is shown by Fig. 3. It will be seen that eight of these prisms are used in conjunction with a drum carrying thirty mirrors.

The drum rotates horizontally, that is it has its spindle vertical to suit horizontal line scanning. The dotted line AB indicates the axis of the optical (and modulating) system. C is the mirror-drum—adjusted to a ratio of *eight* times (in the direction of a line) that of the desired high-definition picture ratio.

D is the prism " ray divider " consisting of a series of small angle prisms across which each patch of light in passing is made to go across the screen in eight contiguous lines. E is an associated row of adjustable-inclination glass plates, that is, a row of eight plates, the first of which are inclined (by the different amounts required) toward the drum in order to raise (i.e., displace upward) by the appropriate amount the rays passing through them to make the top lines of each " bundle " of eight lines while the last plates are inclined (by the different amounts required) away from the drum to lower (i.e., displace downwards) the bottom lines of each " bundle."

For a picture-frequency of 25 per second the motor will have to run at 1,500 r.p.m., but there is no difficulty in this. This is an ingenious scheme, but there are certain disadvantages associated with it which seem to preclude its practical use.

The Mirror Screw

A certain amount of success has been obtained in high-definition scanning by the use of the mirror screw. Up to the present a definition of 180 lines has been achieved, but there does not appear to be any reason why this figure should not be exceeded. With definition of this order it has been found necessary to employ a double mirror screw built up of segments covering 720 degrees and this, of course, means employing exceedingly thin mirrors. Such a screw requires to run at twice the angular velocity of the single mirror screw, the speed for 25 pictures per second being 50 revolutions per second.

One of the disadvantages of the mirror screw is the small viewing angle possible, though this has been improved to some extent by the use of curved mirrors. Another disadvantage is the weight of the screw assembly with the probable difficulty of keeping a heavy rotating mass in synchronism.

From time to time oscillating mirrors have been suggested for producing mechanical scanning, but all the schemes employing this type of scanner have been discarded by those who have tried them. It appears that difficulties arise in keeping the various mirrors of such a system vibrating in synchronism because of their inertia. It should be noted, however that in the systems tried it was necessary to use comparatively large mirrors on account of the difficulty of modulating more than a very small value of light; with the now improved methods of light modulation it is possible that mirror size and consequently inertia can be considerably reduced.

From the above general outline it will be clear that there is no real difficulty in scanning by mechanical means, but there is difficulty in handling sufficient values of light to produce a bright picture; increased light with ordinary schemes such as have been outlined means heavier moving parts with their consequent disadvantages, but as present developments have shown, undoubtedly there is still a very wide field open for the reasearch worker.

Ediswan E.S.100 Output Valve

A new valve by Ediswan for public address and modulating work has been released.

It has the following specification:

Filament volts, 6 V.
Filament current, 3 A.
Maximum anode volts, 1,000 V.
Impedance, 1,750 ohms.
Amplification factor, 5.5.
Max. dissipation, 100 watts.
Optimum load, 7,000 ohms.
A.C. output, 30 watts.

Free circulation of air is essential as the bulb dimensions are small, but owing to the use of hard glass in normal circumstances there is little danger of overheating. It is an ideal valve for high power modulations as two in push-pull will deliver approximately 70 watts. The price is £10.

RECENT TELEVISION DEVELOPMENTS

A RECORD OF PATENTS AND PROGRESS
Specially Compiled for this Journal

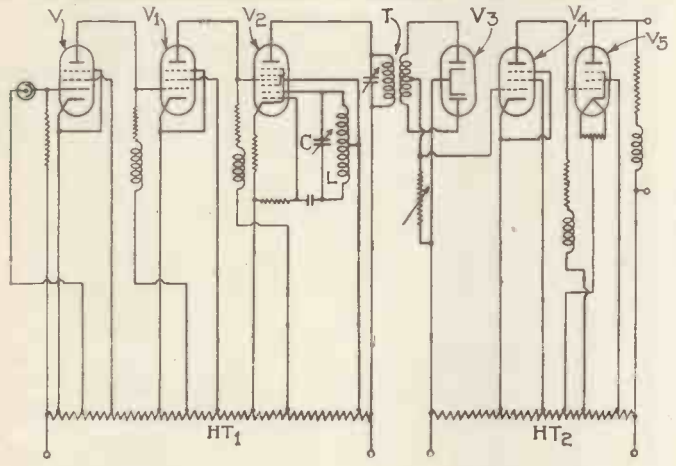
Patentees: Scophony, Ltd., G. Wikkenhauser and J. Sieger :: D. M. Johnstone and Baird Television, Ltd. :: Telefunken Ges fur drahtlose Telegraphic m.b.h. :: R. A. W. Watt and L. H. Bainbridge-Bell :: J. D. McGee and G. S. P. Freeman :: E. W. C. Russell.

Television Amplifiers

(Patent No. 444,058.)

A wide band of frequencies, extending down to zero, is amplified by a circuit which consists of two direct-coupled amplifiers V, V1 connected through a heptode valve V2. The latter generates the carrier-frequency in a tuned circuit L, C and modulates it with the amplified picture signals from the valves V, V1. The modulated signals are then passed through a transformer T to a double-diode rectifier V3, the output of which is fed to a second stage of amplification consisting of two direct-coupled valves V4, V5.

One advantage of the arrangement is that the two sets of valves V, V1, V2 and V3, V4, V5 can be fed from two separate sources of high-tension, HT1, HT2, neither of which need have the high value that would be required to secure the same degree of amplification from a " straight " series of direct-coupled amplifiers.—(*Scophony, Ltd., G. Wikkenhauser* and *J. Sieger.*)



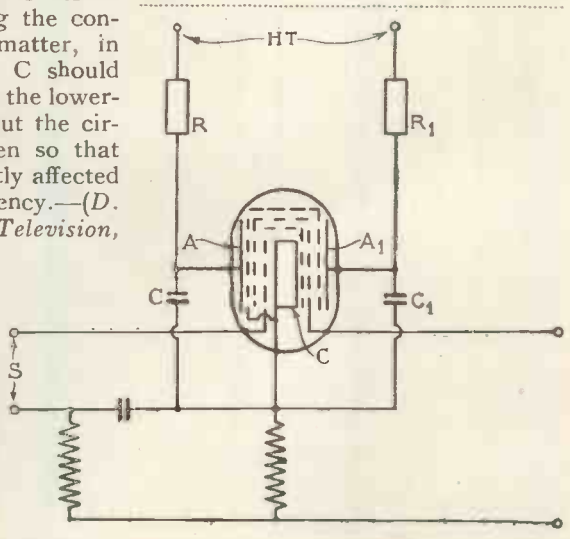
System of amplification avoiding the need for high values of high-tension supply. Patent No. 444,058

Time-base Circuits

(Patent No. 444,133.)

Instead of using two separate valves for the line and frame scanning voltages, both are generated by the same valve. As shown the valve is of the three-grid type with a divided anode A, A1, the two halves being symmetrically arranged on opposite sides of a common cathode. The M.S.P4 type of valve can be adapted to serve the required purpose.

Synchronising impulses are applied to the terminals S and cause the " line " condenser C to be discharged through the valve at high frequency, and the " frame " condenser C1 to be discharged at low frequency. The anode-cathode path containing the condenser C1 is in shunt with that containing the condenser C. It does not matter, in practice, if the condenser C should happen to be discharged by the lower-frequency condenser C1, but the circuit components are chosen so that the latter can only be slightly affected at the line-scanning frequency.—(*D. M. Johnstone* and *Baird Television, Ltd.*)



Generating line and frame scanning voltages with one valve. Patent No. 444,133

" Iconoscope " Transmitters

(Patent No. 444,151.)

In the Iconoscope type of transmitter the mosaic surface on which the picture to be televised is first focused, and then scanned by the electron stream, is liable to be damaged by the incessant bombardment to which it is subjected. In order to overcome this difficulty, the picture is first focused, line by line, through an aperture A, upon a photo-sensitive cathode C located at one end of the cathode-ray tube.

The electrons emitted from the cathode C are next focused by electrodes E, E1 upon a " compound " mosaic surface S, which is faced by a row R of small insulated electrodes. The resulting electric charges set up between the electrodes R and the " mosaic " of photo-sensitive cells form an " electric image " of the original picture. This is scanned by an electron stream, coming from an anode K at the other end of the cathode-ray tube, and the resulting picture signals are fed to the first valve V of the amplifier.—(*Telefunken Ges. für drahtlose Telegraphie m.b.h.*)

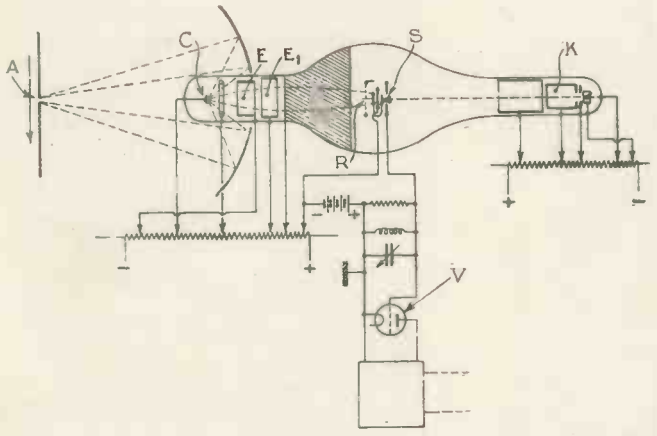
Cathode-ray Tubes

(Patent No. 444,173.)

Normally the electron stream in the

cathode-ray tube shown in the drawing passes through a central slot between two anodes A, A. But under the influence of an applied impulse, the stream will swing to one side, and by impacting against one or other of the anodes will set up a current in the external circuit.

This is passed first through the amplifier A1 or A2 and then back to the coil L or L1, so that the resulting magnetic field increases the original deflection of the stream. The arrangement can be used as a relay, or to indicate when an aeroplane flies "off course." The feed-back or reaction effect of the coils L, L1 naturally increases the sensitivity of the device.—(*R. A. W. Watt* and *L. H. Bainbridge-Bell.*)



Method of avoiding damage to Iconoscope screen. Patent No. 444,151

Television "Records"

(Patent No. 445,068.)

A television programme is "bottled" in permanent form on a strip of paper, from which the original scene can be reproduced as and when desired in a television receiver.

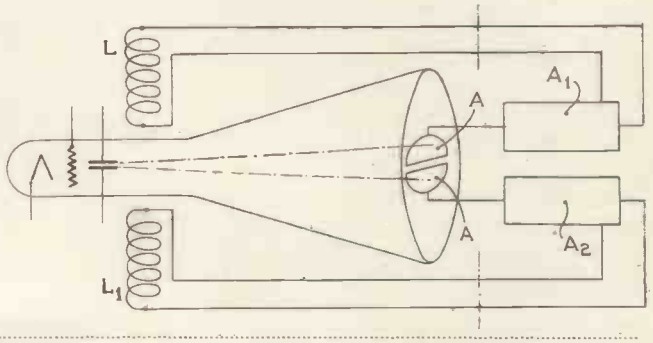
The output currents from the scanning device used in transmission are first amplified, and then applied to modulate a source of light, so as to produce a photographic variable-width "track," similar to that used in recording speech for the cinema theatre. This is next converted into a stereotype which is, in turn, used to print the "record" on paper, the original "track" appearing as a series of parallel columns.

In order to reproduce the original picture, the paper record is wrapped round a drum and is subjected to a strong light-beam of constant intensity. The light reflected back from the paper record is applied to a photo-electric cell, and the resulting currents are, after amplification, fed directly to the television receiver. Synchronising impulses are recorded side by side with the signal track.—(*E. W. C. Russell.*)

Iconoscope Transmitters

(Patent No. 445,485.)

The sensitive "mosaic cell" electrode of a cathode-ray tube of the Iconoscope type is supported by a backing-plate of mica, which holds it flat in position and free from vibration. An additional framing-plate of mica is mounted partly in front of the sensitive electrode. The arrangement is designed to safeguard the photo-sensitive cells from bombardment by stray corpuscles, and from damage due to the effect of X-rays produced inside the tube.—(*J. D. McGee* and *G. S. P. Freeman.*)



Modified construction of cathode ray tube for use as a relay. Patent No. 444,173

Summary of Other Television Patents

(Patent No. 445,313.)

Method of balancing-out undesired capacities in a push-pull valve-transmitter operating at from 50 to 80 megacycles.—(*G. W. White* and *Baird Television, Ltd.*)

(Patent No. 445,372.)

Cathode-ray tube for television, in which a cellular anode is closely associated with a cellular electrode acting as a photo-sensitive cathode.—(*A. B. Shorney.*)

(Patent No. 445,413.)

Cathode-ray tube for television fitted with a photo-sensitive electrode and a closely-associated screen to receive the emitted electrons.—(*F. C. P. Henroteau.*)

(Patent No. 445,428.)

Time-base circuit for a television receiver.—(*Radio Akt. D. S. Loewe.*)

(Patent No. 445,498.)

Light valve arranged between two internally-reflecting prisms so that the emerging ray returns along a path closely parallel to that of the incident ray.—(*E. Traub.*)

(Patent No. 444,633.)

Electrode assembly for a cathode-ray tube, in which the various component parts are made of conical shape to facilitate accurate assembly.—(*Radio Akt. D. S. Loewe* and *B. Wienecke.*)

(Patent No. 444,774.)

Superhet receiver for handling combined picture and sound signals.—(*L. R. Merdler* and *Baird Television, Ltd.*)

(Patent No. 444,775.)

Cathode-ray tube having deflecting-electrodes which are coated with an electron-emitting material, such as barium oxide.—(*F. J. G. v.d. Bosch.*)

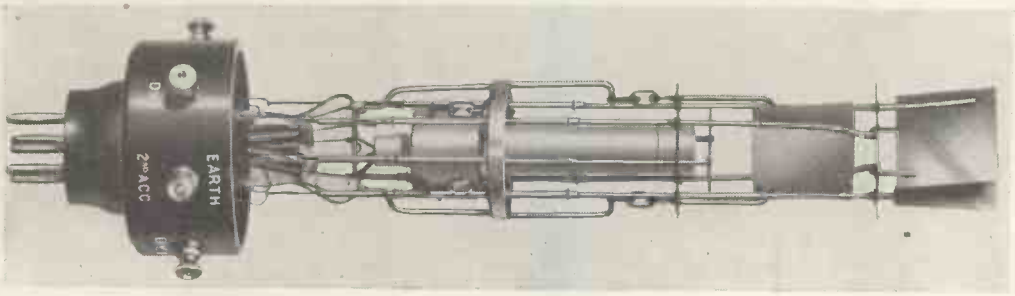
(Patent No. 444,881.)

Receiver for sight and sound signals in which both signals are heterodyned by a single oscillator valve, the frequency of which lies between the two signal frequencies.—(*Radio Akt. D. S. Loewe.*)

(Patent No. 445,140.)

Filter-circuits for separating the two kinds of signal in a combined television and sound receiver.—(*General Electric Co., Ltd.*, and *D. C. Espley.*)

FOR THE BEGINNER



LOOKING AFTER YOUR CATHODE-RAY TUBE

By J. H. Reyner, B.Sc., A.M.I.E.E.

A CATHODE-RAY tube is still a somewhat precious piece of apparatus. One has the feeling that it would be nice to start everything gradually, for the sudden application of thousands of volts seems fraught with unpleasant possibilities. After a little experience, of course, this feeling wears off but, even so, the cost of the tubes is such that it is of necessity some little time before one handles them with reasonable assurance.

Within the past year I have had some dozens of tubes through my hands. I have been able to find from practical experience what is and is not good for them, how long they last, what precautions may be taken against accidental damage and so on. Some of the experiences will perhaps be of interest.

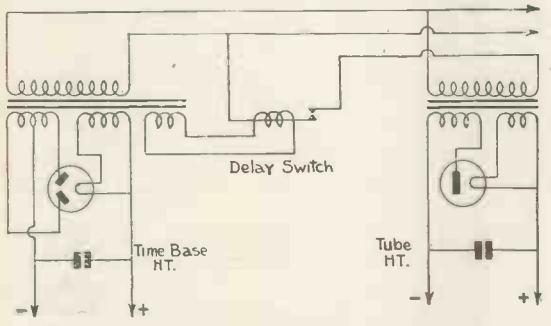


Fig. 1.—Use of thermal delay switch for avoiding burns.

Life

Probably one of the most important factors is that of the life of the tube. The old gas-filled tube was known to have a limited life because the bombardment of the cathode by the gas ions ultimately destroyed the coating. The high-vacuum tube was supposed to have overcome this difficulty.

Unfortunately, the early experience did not fulfil this promise. After a life of a few hundred hours only—sometimes less than 100—the brilliance of the picture began to fade. It could be restored by increasing the temperature of the cathode (i.e., by pushing up the filament or heater current), but this only hastened the end as one might expect, for the modern coated cathode does not like being overrun. Investigation showed that the tube had in fact lost emission despite all reasonable precautions. The actual total cathode current was not more than 100 microamps., whereas the cathode itself would yield several milliamps. without any distress. It was noted, however, that tubes with a three-gun construction had considerably longer lives, and this ultimately led to the solution.

The evacuation of a large bulb such as a cathode-ray tube with relatively large masses of metal inside is not as easy as with a small valve, and there is inevitably a small trace of gas left. Consequently, when the tube is working there will be a small drift of positive ions towards the cathode, resulting in a bombardment of the coating.

Now the relative severity of this bombardment depends upon the potential gradient near the cathode. If there is a powerful electrostatic field here, the positive ions will move with a high velocity and will be quite destructive in their effect. If the electric field, however, is reduced in intensity the destructiveness is greatly minimised. The actual energy contained in the particles is proportional to the square of the velocity, so that if the potential gradient is halved, the destructiveness is reduced to one-quarter and the tube will, other things being equal, last four times as long.

Three-gun Construction

The use of a three-gun construction having the first anode at a potential of a few hundred volts only above the cathode, followed by a second at something around 1,000, the third anode being at the full 3,000 odd volts enables us to achieve this desirable feature of low potential gradient near the actual cathode, and there is

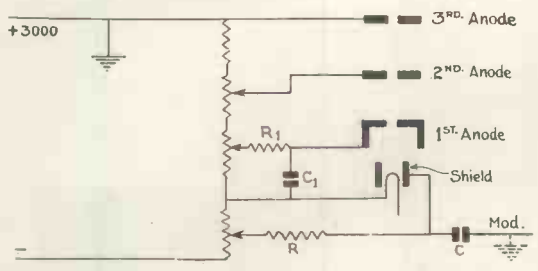


Fig. 2.—Circuit for reducing surge when switching on.

PRECAUTIONS WHEN USING THE CATHODE-RAY TUBE

therefore a tendency to adopt this form of construction fairly universally. It does not follow that a two-gun construction must have a short life. If the design of the tube is such that the first gun only has to operate at a potential of a few hundred volts, it may (and probably would) be quite satisfactory.

The question of direct or indirect heating does not seem to make much difference. I have had a directly-heated transmitter tube operating at 6,000 volts on the third anode, which has run for over a thousand hours without any sign of loss of emission. This tube is again a three-gun type with only 400 volts on the first anode. After this lapse of time, however, the screen in this tube is beginning to show marked deterioration, but this is because the spot of light produced with 6,000 volts on the anode is really very intense, and it

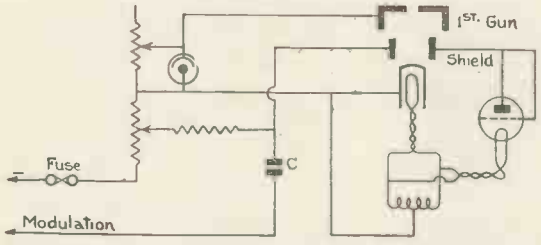


Fig. 3.—Protective circuits for avoiding over-voltage damage.

is to be expected that some tiring of the fluorescent material would result after considerable time.

Avoiding Burns

The tube H.T., of course, should never be switched on without some scanning voltage on the deflector plates. Even a receiving tube has to use a very intense spot in order to generate a reasonably bright picture, and if this spot is allowed to remain stationary on the screen it will cause extremely rapid deterioration of the fluorescent material at that point. This is known as burning and although it may not appear as any noticeable physical defect on the screen, that particular point will be much less sensitive than the remainder of the screen, so that when a picture is produced there will be a little dark spot where the burn has taken place.

The scanning voltage is usually applied from an amplified time base operating off a separate eliminator, and it is often convenient to provide some form of electrical interlock so that the main tube H.T. cannot be switched on until the time base is in operation. A simple thermal delay switch operated off the time base H.T. transformer will serve the purpose as shown in Fig. 1.

Surges

When a tube is first run up it will usually be found that the image comes up very bright and then dies away again to normal value. This is usually due to the charging of the isolating condenser on the shield. A typical circuit is shown in Fig. 2, the shield being supplied with steady voltage through the leak R while the modulation is supplied from the output of the receiver throuugh the condenser C. Since the receiver side of this condenser is effectively at earth potential, it will be clear that this condenser has to charge to practically the full H.T. voltage, but it will do so slowly owing to the time constant of the condenser and leak, which must be long in order to ensure adequate low frequency reproduction. As a result of this it is possible for the H.T. voltage on the main anode to rise to the full value while the shield is still only very slightly negative, which results in a large beam current and a very bright picture momentarily. As the condenser C charges up, the shield falls negative to its proper amount and the picture intensity becomes normal.

These sudden surges may produce some destructive effect. The actual emission from the cathode will still be well within the capabilities of the tube, but in a two-gun tube particularly there will be a momentary heavy ionic bombardment which may result in the shortening of the life. One method of overcoming the trouble is to connect a corresponding condenser and leak to the first gun, as shown at C_1R_1, the time constant of this chain being made the same as CR. The first gun will then remain practically at a low potential for an appreciable time thereby preventing any beam current flowing.

Excess Voltage

There is one other form of trouble in which some precaution is desirable. If through some breakdown, accidental mis-connection or similar fault, the full H.T. voltage is applied either to the first gun or to the shield, the tube will almost certainly be wrecked. This is because the first gun and shield, being intended to operate at relatively low potentials, are placed quite close to the cathode. The application of several thousand volts to such an electrode would result in such a powerful electrostatic force that mechanical damage would result.

To avoid this, it is desirable to connect a neon lamp across the first gun and cathode. Any sort of fuse is quite inadequate for even momentary application of the voltage and is sufficient to do the damage before the fuse has had time to blow. A neon lamp, however, designed to strike at, say, 500 volts, with a tube normally operating at 400 volts on the first anode will take no current at all under correct conditions. Should the voltage rise, however, the lamp will immediately strike and draw a relatively large current and the voltage drop on the rest of the potentiometer network will be such that the voltage on the first anode will be quite small and therefore safe. Lamps to strike at various voltages suitable for protection of cathode-ray tubes in this manner are made by Messrs. Ionlite, Ltd.

A similar arrangement may be used for the protection of the shield, or alternatively, the scheme of Fig. 3 may be used. Here, an ordinary 2-volt battery valve is connectetd with its filament in parallel with the tube heater and its anode connected to the shield. Normally, the shield is negative and therefore this valve carries no current at all. If, due to a breakdown of the isolating condenser C or some other fault, the shield receives a positive voltage, this valve will start to conduct and will absorb the energy for a sufficiently long time to permit the fuse in the circuit to blow.

STUDIO & SCREEN

A MONTHLY CAUSERIE on Television Personalities and Topics

by K. P. HUNT
Editor of "Radio Pictorial"

WHEN Gerald Cock, the B.B.C.'s Television Chief, was busy a few months ago making a selection from the 1,122 applicants who answered his advertisement for the two positions of television announcer and hostess, I attended a meeting of newspapermen to whom he explained the difficulties of his unenviable task.

After telling us about the many qualifications that the successful candidates should possess, he confided with that characteristic smile of his:

"Believe me, it will not be the B.B.C.'s fault if we don't get two perfectly marvellous young ladies."

Gerald was right.

Last week I had a chat at Broadcasting House with Miss Jasmine Bligh and Miss Elizabeth Cowell, who recently were appointed television hostess-announcers, and I quickly came to the conclusion that no better choice could have been made.

Both these pretty and charming young ladies have what already is known as a "television face," and both have enjoyed a great variety of experience which fits them admirably for their new work.

Wardrobe Secrets

Miss Cowell has dark brown hair and dark eyes. She was educated at St. Felix School, Southwold, Suffolk, and, although only 23 years old, has travelled extensively and speaks French and German fluently.

She claims no previous practical experience of the world of entertainment, apart from a little amateur theatricals, but prior to taking up her television post specialised in dress design and display. For some time she was employed as a mannequin. It is certain that her experience of dress designing will prove of great use in this new sphere.

Naturally, I asked Miss Cowell to tell me in detail about the 60 dresses which, according to reports in various daily newspapers, the B.B.C. was arranging to purchase for use of the television hostess-announcers.

"That silly story about the B.B.C. providing us with a wonderful wardrobe," she told me emphatically, "is

D. H. MUNRO,
Television Productions Manager.

just bunkum. There is not an iota of truth in it. The fact is that we are going to choose our own clothes for the television programmes, but in doing so will be guided as to design and colouring by the special requirements of the television studio."

Miss Cowell is very interested in ballet, and as this form of entertainment is likely to assume considerable prominence in the B.B.C.'s new television programmes, this will stand her in good stead.

Miss Bligh is a complete contrast to her colleague; so far as appearance goes. Her hair is light brown and her eyes hazel. She, too, has travelled considerably, not only on the Continent, but in America.

She is 22 years old, but already has three years of stage and film experience to her credit. She played in "Julius Cæsar" at His Majesty's Theatre, and in the Charlot revue "Please."

"Do or Die"

I asked Miss Bligh what made her apply for the position. She told me that whilst she thought her previous experience qualified her for the post, the real reason was "simply the spirit of adventure."

"And now I am in the job," she said determinedly, "it's a case of do or die."

I understand that the original scheme was to have a television hostess and a television announcer, but it has now been decided to combine the two positions, and these two talented young ladies are therefore now known as hostess-announcers.

They will make their appearance at Alexandra Palace alternately, and while one is announcing the other will be acting as hostess to the artists.

This latter duty will consist principally in helping fresh visitors to get accustomed to the unusual atmosphere of the television studios, but after a time, no doubt, it will resolve itself chiefly into making everyone feel at home—and carrying around a bottle of aspirins for those poor artists who find the television ordeal a bit too much for their nerves.

Since their appointment a couple of months ago, Miss Bligh and Miss Cowell have been gently "broken in" to the routine and technique of ordinary broadcasting. They have appeared in plays, acted as announcers, and have been heard with various

TELEVISION COLOUR PROBLEMS

dance bands, such as Geraldo's. They will not begin their normal duties at Alexandra Palace until the regular daily programmes are in operation, but I was told at Broadcasting House that they will actually be seen very early in the experimental transmissions which are about to start quite soon.

Exactly what make-up is to be employed by television artists has yet to be gone into in detail, and I understand that a permanent make-up expert for Alexandra Palace will be appointed within a few days.

Jasmine Bligh and Elizabeth Cowell, hostess-announcers in the B.B.C.'s new television programmes.

Here is an intriguing piece of news.

During the experimental transmissions, Miss Bligh and Miss Cowell will be used as make-up models to test the efficacy of various colours. Their faces will be made up in all kinds of ways and the best selected by actual test.

Colour registration in the new high-definition system is not the same as in the old 30-line transmissions, and it is evident that a good deal of experimenting will be necessary before a final technique is evolved.

Most pale colours, light brown, white, red and orange, register as a light tone—more or less white. The only colours which register really black, are black itself and dark blues. The appearance of dark brown, dark green and dark purple on the receiver screen is rather deceptive, as these all turn out to be more or less a medium grey.

Mr. D. H. Munro, who has been appointed Productions Manager in the B.B.C.'s television department, told me that nothing very definite can be said at the moment about clothes for television artists.

" Every piece of material which we contemplate using is being submitted first to rigorous tests," he told me, "and until we have the result of those tests, it is impossible to lay down any rules."

" But so far as anything can be said at the moment," he went on, " to obtain the best results artists should try to dress in a manner that will give a strong contrast in light and dark colour registration, and bold contrasting patterns on dresses or properties are always preferable."

Beginning his career with the B.B.C. as an announcer, Mr. Munro later became a producer in the Drama and Variety Departments. In the early days of the B.B.C. he was assistant station director at the Aberdeen station. He fitted up many of the B.B.C.'s studios, and, by the way, was chiefly responsible for the development of the first D.C. panel technique.

One of the outstanding features in his career was that he was responsible for the first three Christmas Day broadcasts. I found him tremendously enthusiastic about television; undoubtedly he is throwing himself heart and soul into the work.

The Word "Go"

I met Mr. Munro in his Broadcasting House office. From a roll-topped cabinet he produced a schedule of programmes which he carefully did not allow me to see.

" There you are," he said with an air of satisfaction. " There are the first television programmes. ' I'm all ready to start at the word ' Go.' "

The actual contents of those first programme schedules, at the time I saw Mr. Munro, were a very closely guarded secret. But in the course of conversation I managed to elicit some morsels of information which throw some light on what lookers may expect to see on the screens.

I gathered that each evening broadcast will be divided into three parts. First, entertainment; second, news; and third, general interest items. The three hours of transmission daily, as already announced, will be 3 p.m.-4 p.m.; 6.15 p.m.-7.15 p.m.; 9.30 p.m.-10.30 p.m., at any rate to begin with.

In each of these programmes, I gathered, the entertainment section will occupy at least one-half of the direct as distinct from film transmission, the remainder consisting of the news and the general interest items. Under the designation " entertainment " comes cabaret, vaudeville, ballet, drama and dance music. It is unlikely, I was told, that any plays will be produced which last more than 20 minutes.

Televising Fashions

As to what constitutes "general interest " items, I was given some rough headings as a guide to the sort of thing we may expect. The first was " The Zoo To-day." A little bird whispered in my ear, by the way, that these zoo broadcasts very likely will be a regular fortnightly feature.

Other general interest items would concern fashion. Mr. Munro is very keen on televising fashions, but it is extremely difficult to arrange this without introducing the advertising

FILM THAT WILL MAKE HISTORY

element, which the B.B.C. has to avoid. At the present moment, certain problems in this connection have not been solved and no programmes have been definitely arranged.

A feature entitled " Uniforms of the Service " was proposed, but unfortunately this has had to be ruled out because the red colour of the uniforms makes it impossible. Other general interest items which can confidently be expected are vision broadcasts of cartoonists at work. Mr. Tom Webster's name was mentioned.

Physical training will also form a part of these general interest programmes, travel talks, learning to fly, and even house furnishing, with special stress, I heard, on help for newlyweds !

So far as I have been able to ascertain, none of these items will last more than 10 minutes at a time. It is rather trying to concentrate upon the television screen for one item any longer than this, not so much as a result of actual eye fatigue, but a peculiar psychological effect.

B.B.C.'s Film

Mr. Munro told me that no full-length dramas or original productions will be attempted at all, and that those which are televised in the early programes will probably be of the humorous variety. The three separate hours of programmes will be given for six days of the week, with none on Sundays.

Arrangement of details and the order of the programme matter will be different at each of the thrice-daily sessions.

I was also told that in all probability a film interlude will be given between the live transmissions in each programme. There is a double purpose in this. One is to give variety to the lookers-in, and the other is to allow time for a change of scene in the studio.

The films to be used will be short, general-interest films, not feature films. Nothing very much can be said about this at the moment, because the B.B.C.'s relations with the film companies are still indefinite.

For the first few weeks, I learned, the film interlude will in all probability consist of the B.B.C.'s own film describing the development of television itself. This had been given the title: " Television Comes to London."

The two hostess-announcers were " gently broken-in " at Broadcasting House.

Major L. G. Barbrook, who has been appointed Film Assistant in the B.B.C.'s television department, began making this film last November. He actually began filming in the fog, because he wanted to get the new station in all stages of its construction.

This unique and interesting film describes all the work and preparation prior to the beginning of the high-definition system, not only pictorially, but with the aid of a very full running commentary.

It will be televised many times during the first few months of the new transmissions so that people who are looking-in for the first time will not miss seeing it. I understand it will be a two-reeler, and as broadcast will last about 20 minutes.

Most Exciting

At Broadcasting House the other day I induced them to show me a few snippings from this film. The film had then only just been finished, and had still to be cut up, edited, and titled. I am not sure, therefore, that any of the pieces I saw will actually be in the finished film, but the few frames I held up to the window light to inspect showed a man dangling on a wooden trolley affair in mid-air. He was being hauled up by ropes, and it looked most exciting.

I was also told that the musical accompaniment to this film is extremely good. For instance, you see a man climbing up a mast. He goes higher and higher, and all the time the accompanying music gets louder and louder, ending in a sort of musical climax. This accompaniment, by the way, is a well-known symphony which seemed to match the film in an extraordinarily effective way.

Production Team

In between programme items, lookers will see an interval signal consisting of a clock face which, incidentally, will show the correct time ! This " signature picture " will also include an announcement indicating which system, E.M.I. or Baird, is being employed. These two systems will be alternated weekly. The details of programmes will be published, to begin with, in the B.B.C.'s official organ and in the daily papers, and each item will be given an identifying number which will correspond with similar numbers which will appear on our receiver screens.

Under Mr. Munro as Productions Manager are four other producers—Mr. Cecil Lewis, tall, striking, formerly well-known to listeners as " Uncle Caractacus "; Cecil Madden, tall and fair, formerly in the B.B.C.'s Empire Programmes Department; Stephen Thomas, a distinguished stage director; and Dallas

GERALD COCK'S TELEVISION CREED

Bower, also young, who comes from the films as a director, and who was an associate of the famous Bergner.

Apart from the stage managers, Mr. Harry Pringle and Mr. Peter Bax, the other prominent member of the Alexandra Palace staff is Mr. Hyam (" Bumps ") Greenbaum, who has been appointed Television Musical Director. In private life he is the husband of Sidonie Goosens, the talented principal harpist of the B.B.C. Symphony Orchestra.

" Bumps," has held a variety of important musical appointments in his time, but I think nothing has pleased him so much as to be M.D. of the world's first television orchestra. This jovial man is an extremely accomplished musician, and I know he has gone to extraordinary trouble in forming his television orchestra. At the moment of writing this, he is still holding auditions.

I understand that the television studio orchestra will consist of 20 players. Although it will be essentially a serious orchestra, it will include at least one saxophonist. Evidently this combination must be very versatile, for its work will be similar to that of the B.B.C. Theatre Orchestra.

Mr. Greenbaum's particular difficulty has been that the best musicians are not always the best looking ! In a television orchestra which everyone sees, there can be no greybeards, and I am sure that when Mr. Greenbaum's final choice makes its bow on the television screen, it will be hailed as a veritable band of Apollos.

No survey of B.B.C. television personalities would be complete without mention of Mr. Gerald Cock who, of course, is the real live-wire of television.

Leslie Mitchell, the B.B.C.'s new television announcer.

Very quick and alert, this much travelled man has been in turn mining engineer, prospector, film director, ranch owner and explosives expert. He is in the early forties. Some people, by the way, speak of him as the best dressed man in the B.B.C.

Mr. Cock's greatest disappointment in life, I gathered, was that he sold his Hollywood ranch a bit too soon. It stood on ground which to-day is the famous Sunset Boulevarde: Thus, what is now one of the most expensive parts of Hollywood, where land is at a high premium, was once Mr. Cock's ranch which he bought for a comparative song.

Mr. Cock has already announced what may be called his creed regarding the new development of which he is in charge. He has decided that no television programmes will touch in any way upon religion. He will have no controversial matters in the programmes. He has set his mind against suggestiveness of any kind, and no publicity will be allowed other than that absolutely necessary for programme interest. My impression after chatting with Mr. Cock was that he has boundless faith in the future of television.

The various members of the B.B.C.'s television staff are actually moving into their new offices at Alexandra Palace during the second week of August, and it is possible that the first test transmissions will be broadcast before these notes are in print. These experimental transmissions will continue throughout the autumn.

Looking-in Rooms

At least a score of well-known London stores are expected in the very near future to open public looking-in rooms to which their customers will be invited in order to see what the new television looks like. It is now practically certain that at least a dozen places in London will be available where the new programmes can be seen. The objection has been made against these public looking-in rooms that no more than 30 people can possibly look-in at a time on one screen. There is no reason, however, why more than one receiver cannot be installed in a room.

Everything goes to show that as soon as the B.B.C.'s high-definition programmes begin and these public looking-in rooms are available, television will be the talk of the town.

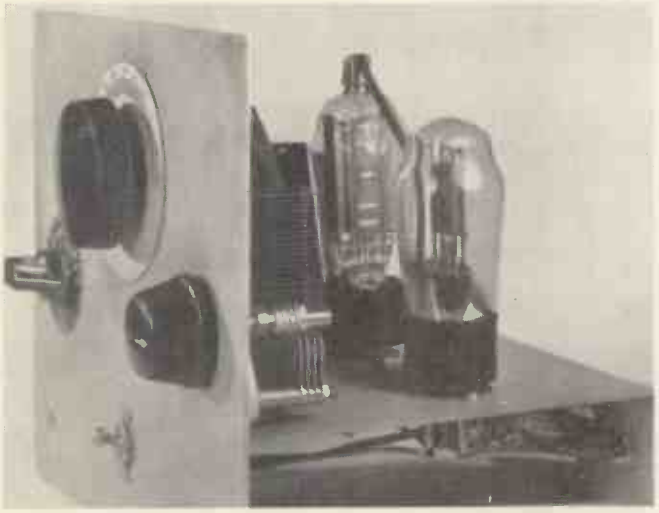
Next month, and thereafter, I hope to devote this article briefly to notes and news about actual performers in the programmes.

An Inexpensive Two-valve Short-wave Receiver

Elsewhere in this issue are details of cheap short-wave converter. Those, however, who prefer to construct a complete receiver can do so for a matter of a few extra shillings. This two-valve battery-operated set has world-wide coverage and costs well under 30/-. It has been designed for the beginner by **Kenneth Jowers,** *and a blue-print of the exact wiring connections is available.*

A BATTERY-OPERATED two-valve receiver, providing it is carefully constructed, cannot fail to bring in a varied assortment of short-wave stations. The old difficulty that always confronted the beginner, accurate tuning, has been overcome in this set in quite a simple way.

On the front panel are four controls. To the left is a band-setting condenser fitted with a simple tuning scale calibrated from 0 to 10. This condenser has a capacity of .0001-mfd. and covers a comparatively wide band of wavelengths. In the centre, fitted with a large knob, scale and cursor is the band-spreading condenser with a capacity of .000015-mfd.



A good idea of the panel lay-out can be obtained from this illustration. The switch is bolted through both panel and chassis.

Most of the connections are beneath the baseplate, so giving the finished receiver a commercial appearance.

Tuning

The idea of this condenser is to simplify the method of tuning. Briefly the arrangement is as follows. The band-set condenser is set at 1 and then the band-spread condenser is used to cover this first division on the band-set condenser. The band-spread condenser will broaden the tuning and so make an expensive slow-motion tuning drive unnecessary. Between 47 and 50 metres some dozens of American and Continental stations send out programmes at all times of the day. This 3-metre wave-band occupies less than half a division on the band-set condenser, so that it will be almost impossible accurately to tune-in these stations without interference. The band-spread condenser is set at zero, that is with the plate completely out of mesh and then the little left-hand condenser adjusted until the receiver tunes to about 46 metres. The first station on the band at about 47 metres is then found and then the condenser taken slightly out of mesh. The band-set condenser can then be ignored, tuning being carried out by means of the single plate band-spread condenser, which will give the effect of widening the waveband so that it covers nearly 60 degrees on the scale instead of merely half a degree on the band-set condenser.

Controls

It should be obvious, even to the beginner, how simple this makes tuning. All of the well-known wavebands can be tuned in the same way. The band-spread condenser should always be set slightly below the minimum wavelength wanted, and then tuning is done on the band-spread condenser.

The other two controls on the panel are the on-off switch in the centre and the reaction condenser to the right. Incidentally the reaction and band-set condensers are of a similar type and capacity, but there is no need for a calibrated dial on the reaction condenser.

The circuit of this receiver is very simple, merely a screen-grid detector valve resistance coupled to a triode power valve. Maximum sensitivity is obtained from the detector owing to the fact that a high value anode resistance has been made possible, and also that owing to the fact that very smooth reaction is obtainable by merely varying the voltage applied to the screen of the detector to give maximum gain.

A standard simple constructor coil has again been used, the full details for which will be found in the constructional article on the short-wave converter elsewhere in this issue.

The Grid Circuit

Referring again to the detector circuit, there are one or two points which should be stressed. Firstly, the .0001-mfd. grid condenser has a 2-megohm grid leak in parallel with it. This value is important and must not be any larger. In certain circumstances, due to valve variation, a .00005-mfd. condenser will give even better results.

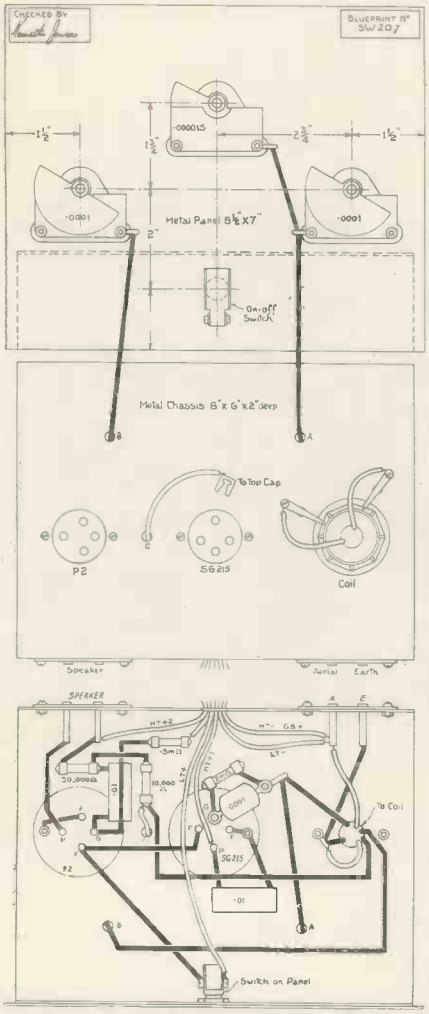
Instead of using a high-frequency choke, which is often a source of trouble to the beginner, owing to lack of oscillation caused by resonance, a 10,000 ohm ½-watt resistance has been used, which has proved very effective over all of the wavelengths covered by this receiver. The external anode impedance is actually the second resistance having a value of 50,000 ohms.

Signals from the detector are fed into the grid of the power valve through a R.C. circuit having a 01-mfd. coupling condenser with .5-megohm grid

A Blue-print :: Connections :: Chassis Making

leak. The earthy end of this leak goes directly to 4½ volts negative grid bias.

Also the screen of the SG215 is by-passed to earth by a .01-mfd. condenser. This condenser is of the tag type and should be connected between the screen pin and chassis without any additional wires. There are two high-tension tappings, H.T.+1 requiring between 90 and 120 volts, and H.T.+2 requiring between 50 and 80 volts. The maximum voltage available should always be applied to H.T.+1 with a limit of 150 volts, but the screen voltage should always be determined by experiment, for this depends to a great extent on the anode voltage applied.



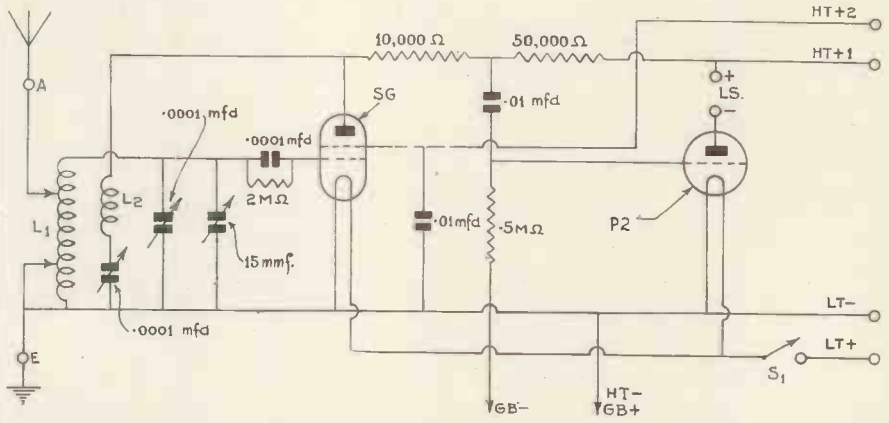
A full sized blue-print can be obtained from TELEVISION and SHORT-WAVE WORLD, Chansitor House, 37-38 Chancery Lane, W.C.2 price 1/-. Ask for blue-print number SW207.

Construction should not worry the beginner, for there is the minimum amount of wiring, while the components can be mounted easily. Perhaps the only trouble will be cutting the two holes for the valve holder. A carpenter's brace with a 1¼-in. centre bit will do this. A small hole should be drilled to indicate the centre of the valve hole and then if the actual hole is cut out with the brace and bit a clean hole will result. Actually the metal should be cut half way through on one side and then half way through from the other side.

Four ½-in. holes are needed on the panel and these should be made with a twist drill. Leave the fourth hole for the switch until the chassis has been bolted to the panel, then cut through both the metals together. In this way the holes will coincide.

Reference to the illustration of the sub-chassis wiring shows that most of the components are wired directly from point to point without the need of any extra wires. However, any connections that need to be made between coils and condenser should be of 22-gauge tinned-copper wire covered with sleeving.

When fitting the aerial, earth and loud-speaker terminal strips drill large holes of at least 5/16 in. so that the connecting socket cannot possibly touch the chassis. H.T. negative and G.B. positive are joined together and soldered to the nearest fixing bolt on the chassis.



The cost and quantity of the components has been kept to the very minimum. This receiver is capable of receiving stations from all over the world despite the low cost.

L.T. positive comes directly off the switch on the panel. This switch incidentally, should have its connections to the bottom so that the receiver is switched on when the lever is in a downward position. A flexible lead terminating in a thimble cap comes off the junction of 10,000-ohm resistance, .01-mfd. condenser and the 50,000-ohm resistance. This junction point can be quite clearly seen in the blue-print.

For those who intend to make their own chassis, a strip of aluminium 8 in. wide and 10 in. deep will be required. This is bent back and front to a depth of approximately 2 in. The panel is of 16-gauge aluminuim, which is most important, otherwise the panel has a tendency to whip. This panel is approximately 8½ ins. by 7 ins.

Another point which should be remembered is that all three condensers

Components for INEXPENSIVE BANDSPREAD S.W. RECEIVER

CHASSIS AND PANEL.
1—Cadmium plated 8 by 6 by 2in., 18 gauge(B.T.S.)
1—Cadmium plated panel 8½ by 7 in., 16 gauge. (B.T.S.)

CONDENSERS, FIXED.
1—.001-mfd. type 665 (Dubilier).
2—.01 type 4511 (Dubilier).

CONDENSERS, VARIABLE.
2—.0001-mfd. type VC100X (Raymart).
1—.000015-mfd. type VC15X (Raymart).

COIL.
1—To specification (Home made).

DIALS.
1—Type 1044 (Eddystone).
1—Type 1026 (Eddystone).

HOLDERS, VALVE.
2—4-pin type chassis (Clix).

PLUGS, TERMINALS, etc.
5—Wander plugs type 1046 marked GB-, GB+, HT-, HT+1, HT+2 (Belling-Lee).
2—Spade terminals type 1025 marked LTx, LT-. (Belling-Lee).
1—A and E strip type P51 (Bulgin).
1—L.S. strip type P54 (Bulgin).
1—Anode connector type 1175 (Belling-Lee).

RESISTANCES, FIXED.
1—2 megohm type HW54 (Bulgin).
1—10,000-ohm type HW15 (Bulgin).
1—50,000-ohm type HW23 (Bulgin).
1—500,000-ohm type HW31 (Bulgin).

SUNDRIES.
2—ozs. 22 gauge tinned copper (Peto-Scott).
1—oz. 24 DSC wire (Peto-Scott).
3—lengths sleeving (Peto-Scott).
1—3 in. length ribbed former 1¼ in. dia. (Peto-Scott).
2—Crocodile clips type CR5 (Bulgin.)
24—6BA brass round head nuts and bolts. (Peto-Scott).
2—Yards 2 mm. rubber covered wire. (Peto-Scott)

SWITCH.
1—Type S80 (Bulgin).

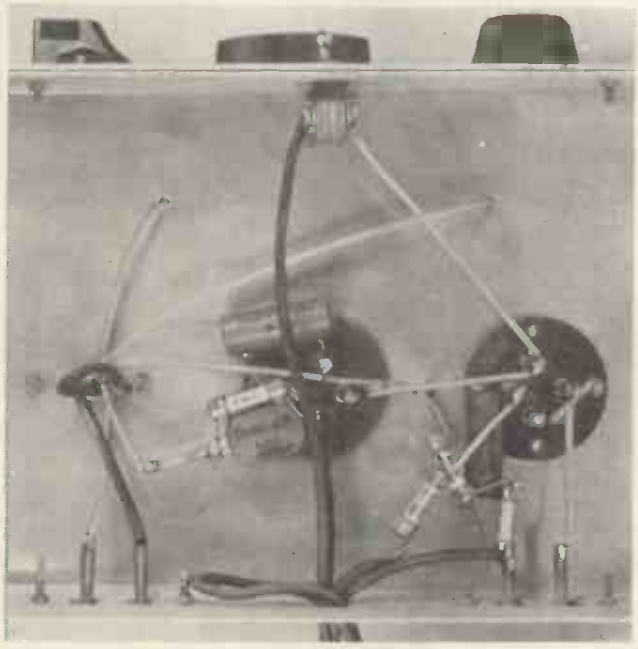
ACCESSORIES.

ACCUMULATOR.
1—Type DTG (Exide).

BATTERY, HIGH-TENSION.
1—100 volt type Winner (Ever-Ready)
1—9 volt type Winner (Ever-Ready).

VALVES.
1—Type SG215 (Hivac).
1—Type P2 (362).

HEAD-PHONES.
1—pair super sensitive (Ericcson).



Just how few wires are needed is clearly shown by this photograph. The resistances are interconnected in the wiring.

mounted on the panel automatically make earth contact to the metal, so that there is only one connection to each condenser, that being to the fixed plate. Besides reducing the number of wires this also effectively prevents hand capacity, making the receiver almost as simple to tune as the broadcast set.

With 120 volts high-tension and 60 volts on the screen, the total anode current is no more than 5 ma., so that the smallest capacity battery will be suitable. The total filament current is .3 A, well within the capabilities of the small glass-cell accumulator. This receiver will bring in stations from approximately 18 to 100 metres. thus including most of the amateur and commercial channels. It is ideal for reception of C.W. stations owing to the smooth reaction and the efficient band-spreading, while background noise is low even for a two-valve receiver.

A blue-print showing point to point connections is obtainable from the Blue-print Department of TELEVISION AND SHORT-WAVE WORLD, 37 Chancery Lane, London, W.C.2, price 1s. A blue-print is almost as good as having the original receiver to copy, and it will ensure that the receiver functions perfectly from the time it is first switched on.

A Sensitive Receiver Circuit

G6WQ Operated by A. C. Webb is well known for his fine telephony transmissions. This article describes the receiver he uses for DX reception. It is simple and cheap to build.

A SENSITIVE circuit for short-wave reception which is not generally known has been used with great success at this station. It enables the high impedance and magnification factor of the screen-grid valve to be used to full advantage.

As can be seen from the illustration reaction is obtained by coupling back from the screen-grid and not from the anode, giving the added advantage that either capacity or resistance control may be used at will. In both circuits reaction is very smooth even on the ultra-high frequencies. Tests show that with suitable coils oscillation is easy and smooth down to about 9 metres.

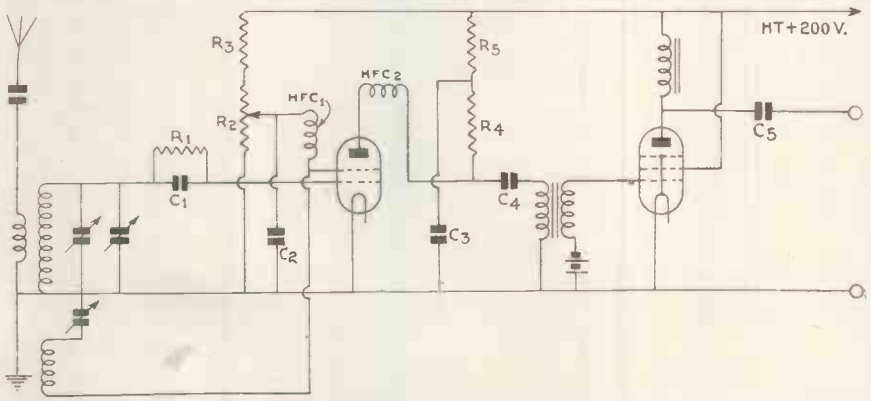
The aerial is coupled to the grid of the screen-grid valve through a small fixed capacity and primary coil. A band-setting condenser of the new Eddystone 140 m.mfd. tank type is used as a band spreader with a small variable capacity in parallel with it. The reaction condenser is of the pre-set type and should be adjusted for each waveband.

It should be noted that two totally dissimilar high-frequency chokes are used. This is most important. The value of the anode resistance R4 is entirely dependent on the H.T. voltage, but for guidance it should have as high a value as possible consistent with obtaining effective reaction. With an input of 220-volts R4 should be approximately 100,000-ohms.

The detector valve is coupled to a small pentode via a resistance and condenser network. C4 is approximately .01-rfd., while the L.F. transformer should be of the high ratio type such as the Ferranti AF6.

Considerably more than the average 2-valve set volume can be obtained with this circuit, which owing to negligible noise level and extreme detector sensivity is ideal for use on all amateur bands.

Several variations of the circuit are possible, such as having resistance contral, so eliminating the screen grid choke H.F.C.1 and the capacity controlled condenser. This would mean feeding the high-tension to the screen-grid valve directly through the reaction coil. It has been found, however, by experiment that the normal capacity control arrangement is most sensitive to weak signals.



Notice how reaction is fed into the screen circuit instead of the anode. This enables the maximum gain to be obtained from the screen grid valve.

Eddystone 6-pin plug-in coils are suggested, for these tune from 9 metres upwards, but the remainder of the components depend mainly on personal taste.

Transmitting for the Beginner

The Crystal-oscillator

This article on the Crystal-oscillator is continued from the July issue. Previous articles on transmitting for the beginner will be found in the April and June issues.

By Basil Wardman, G5GQ

RECENTLY, another American valve has been manufactured, a class B mains valve, in which are an indirectly-heated cathode and two separate triodes. One

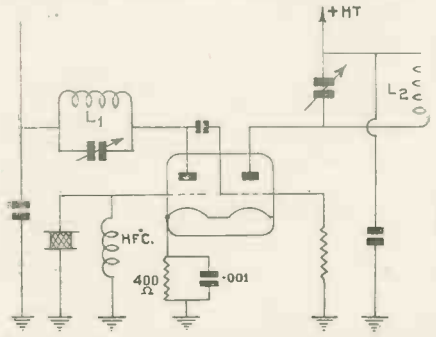


Fig. 6.—This is the "Jones" exciter unit using the type 53 valve. An illustration of this unit can be found on page 211 of the April issue.

of these is used as a crystal oscillator and the other as a doubler (Fig. 6) This is called the "Jones Exciter," after the designer, and gives considerably more output than the Tritet. The type 53 valve is used with a 2.5 volt filament supply and the type 6A6 with a 6.3 volt supply. Coil values are quite conventional and can be as suggested in the first article of this series.

For the beginner the Jones exciter is probably the best, as it gives greater output than the Tritet, is easier to use and is easier for band switching.

The output of either of these circuits should be sufficient on the second harmonic to drive a neutralised P.A. to 40 watts, or to drive a 200-watt pentode to almost full output. As with all crystal oscillators, the circuit should be entirely screened to prevent coupling with the amplifier.

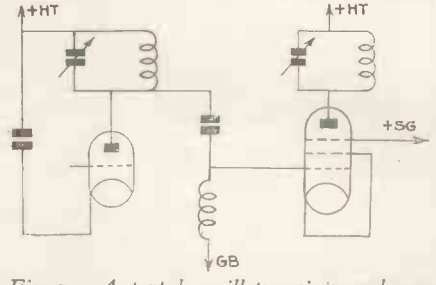


Fig. 7.—A pentode oscillator gives much more drive for a fixed input than the conventional triode valve.

Coupling

The coupling between the crystal circuit and its amplifier is most important, because large losses can occur here owing to mis-match of impedance and the grid-input capacity of the amplifier valve. If a pentode amplifier is used direct capacity coupling may be used (Fig. 7), because there is usually more than sufficient drive available and so losses may be tolerated in the interests of simplicity. If the drive is only just sufficient there are three alternative circuits. The first (Fig. 8) employs tuned transformer coupling, but it is rather difficult to arrange satisfactory coupling between the two windings over a number of wavebands and so this system

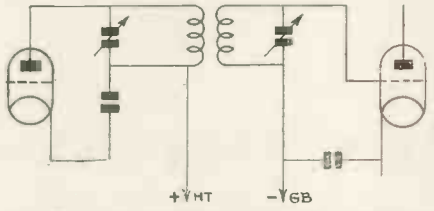


Fig. 8.—Tuned-transformer coupling is a little too difficult for the beginner.

has been modified into what is known as link coupling (Fig. 9), in which the two windings of the transformer are separated. A fixed winding of from one to five turns (according to the band) is then coupled to each of these trans-

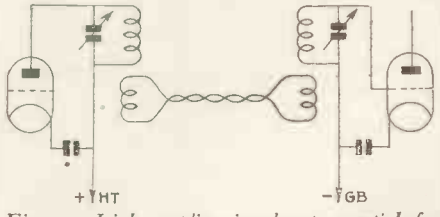


Fig. 9.—Link coupling is almost essential for rack-built transmitters.

former windings, and the two extra windings are joined together by means of a length of flex. This flex constitutes a low-impedance transmission line and may be up to ten feet long without introducing serious losses, enabling the crystal and P.A. units to be well separated.

Adjustment is similar to that of the tuned transformer, i.e., the crystal unit is tuned to resonance and then the grid of the amplifier is tuned to resonance (maximum deflection of the grid meter). Both these circuits are very useful for coupling a single-ended doubler to a push-pull amplifier (Fig. 10).

The final type of coupling in general use is that shown in Fig. 11. Here again separate grid and plate coils are used, but these are coupled by means of a small condenser. The position of the tappings is determined by minimum plate current on the crystal unit and

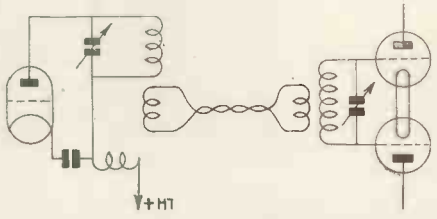


Fig. 10.—A push-pull amplifier should always be link coupled.

maximum grid current in the amplifier. The idea of this arrangement is that the tapping points are where the two impedances most closely match, with a consequent maximum transfer of energy between the two circuits. The coupling lead should be as short as possible.

With the last three types of circuit it is usually a matter of choice which to employ, but frequently when a transmitter is unstable with one type, alteration to another type often cures this without having to make many mechanical alterations to the set.

Finally, with any type of coupling, do not make it too "close," otherwise trouble will occur with interlocking of circuits, high H.T. current and poor output.

Treatment of the above subjects has, of necessity, to be brief, but it is hoped that sufficient information has been given to enable the beginner to set up

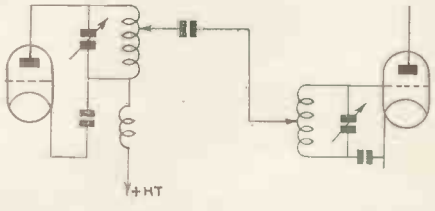


Fig. 11.—Accurate impedance match is obtainable with this arrangement.

a small C.O.-P.A. unit and to conduct a few experiments on it whereby he can realise the meaning of various meter readings, and why the output is, or is not, what it should be.

TELEVISION AND SHORT-WAVE WORLD

A Low-noise-level S.W. Super-het Receiver

By Kenneth Jowers

EXPERIMENTS during the past few weeks with some commercial receivers have proved most conclusively that the noise level in the average receiver originates in the intermediate-frequency stages. This point first came to light after trying a "Super-Pro" receiver which included R.F., I.F. and L.F. controls. Even when conditions were particularly bad, the R.F. and L.F. controls could be advanced to maximum position still keeping a completely silent background. 50 per cent. of the I.F. gain caused a terrific background noise level.

Tests with other commercial receivers showed that the I.F. amplifier caused most of the noise, also that most parts of the world could be received with only the merest fraction of I.F. amplification. The final results were that good pre-selection was of more value than I.F. amplification, particularly under bad operating conditions.

American Supers

The Americans have introduced a number of small super-het receivers using the minimum number of valves. These have all proved satisfactory, particularly as regards noise level, but when it came to actual sensitivity, comparative results with the 1-V-1 were rather illuminating. It seems that an ideal amateur receiver is one having super-het selectivity with straight set noise level, the low-frequency amplifier being apparently of little importance.

A circuit I have evolved is shown above, and it warrants careful attention. Only three valves are used, but these are of the multi-electrode type, so that actually the receiver consists of five stages. First of all there is a conventional R.F. amplifier using a battery-operated high-frequency pentode. This has variable-mu characteristics, the bias being obtained by means of a potentiometer across a 16-volt bias battery.

The aerial circuit is quite standard except that no coupling condenser is used as selectivity is increased and grid damping obviated by the use of a loosely-coupled primary coil. Two variable condensers are shown, one being a band setter and the other a band spreader.

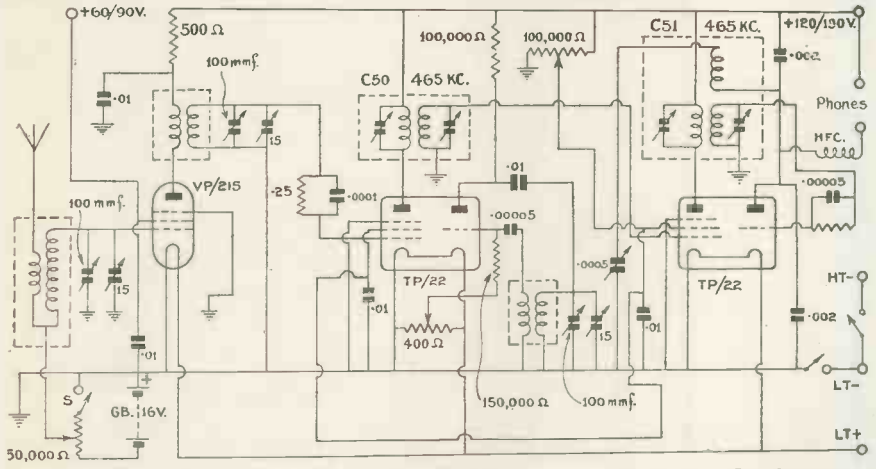
In the anode circuit of the pentode is a high-frequency transformer with a tuned secondary, the whole of which, excluding the condenser, is carefully screened.

A Triode-Pentode

The detector oscillator circuit consists of battery-operated triode pentode. This valve is actually two complete sets of electrodes forming a triode of average impedance and an H.F. pentode. The pentode valve is used as a leaky-grid first detector and, providing the constants for the grid leak and condenser are as shown, results will be satisfactory.

A 465 kc. I.F. transformer constructed with Litz wire couples the first detector oscillator to the I.F. amplifier. This I.F. amplifier is again half of a triode pentode using the triode as the second detector. Reference to the circuit will show that the radio-frequency amplification can be controlled by the potentiometer across the bias resistance, while intermediate-frequency gain is governed by a 100,000-ohm potentiometer across the main H.T. supply giving grid voltage to the screens of the TP22's. In this way when conditions are favourable, maximum R.F. gain can be used with as much I.F. gain as possible without the noise level increasing.

Headphones must be used for the output from the TP22 triode is only in the region of 150 milliwatts. Greatly increased I.F. gain and selectivity can be obtained without increasing noise level by the use of regeneration. The C51 I.F. transformer is supplied with a third winding which is normally intended for variable selectivity. However, by a coincidence, this happens to work quite satisfactorily, as shown in the circuit, providing a .0005-mfd. regeneration condenser is used.



Although battery-operated valves have been used in the experimental hook-up, A.C. valves are equally as good but give slightly more background noise.

Selectivity

This regeneration gives selectivity aproaching that of an average crystal filter and is ideal for C.W. reception. Those stations who operate, or those readers who listen, on the 40-metre band will appreciate a receiver of this kind, for QSA5 contacts are possible by careful manipulation of the R.F. and regeneration controls.

In the original model the three 100-mmfd. band-setting condensers were of the Raymart VC100X type. This overcame the possibility of error in coil matching, for by having separate band-setters standard plug-in coils can be used. The band-spreaders were linked together so giving single dial control on all amateur bands.

With a little screening the receiver was used for duplex working, and with the exception of the 160-metre band operated satisfactorily. On the lower frequencies a 1.7 mc. trap had to be connected in series with the aerial lead.

While this arrangement does not omit the I.F. amplifier it is suggested that the gain in the I.F. stage be kept as low as possible. For real D.X the I.F. volume control need only be set at approximately 2 o'clock with the R.F. volume full on. Under such conditions weak signals can be copied quite easily.

Perhaps the most interesting point as far as the amateur constructor is concerned is the low cost of such a receiver. A careful calculation of the cost of the components used will show that this receiver compares very favourably with an ordinary 1-V-1, while those who wish to use American A.C. valves will probably find the receiver even cheaper than the battery version. The total high-tension current measured on the experimental model was 6.2 m/a at 120 volts and with all volume controls at maximum. When operated normally with the I.F. reduced the average current was 5 m/a. Terrific R.F. gain can be obtained by applying 175 volts H.T. from a power rack, but the voltages on both TP22's must be kept to 120 to 150 volts.

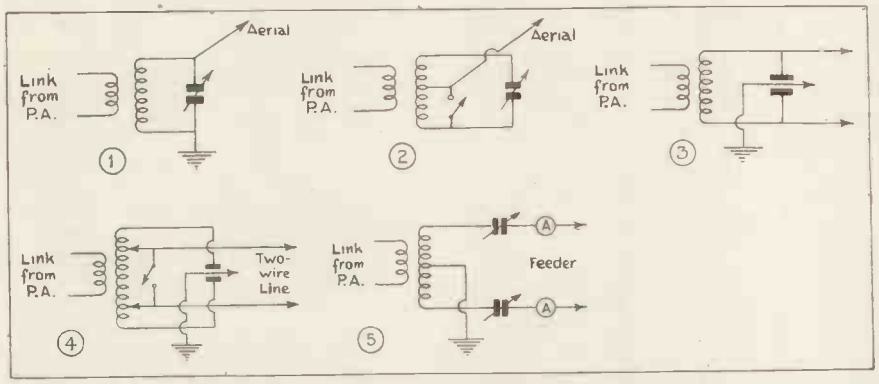
(*Continued in third column of next page.*)

Aerial Coupling Circuits

By G2TA

Link-coupled aerial circuits are becoming increasingly popular in America. Here are five suitable circuits for the experimenter.

LINK coupling between the P.A. tank coil of the final amplifier and a separate aerial tank circuit is deservedly popular for it reduces harmonic radiation, gives better balance on a push-pull stage, prevents the feeder radiation from altering the stability of the various amplifiers in the transmitter and tends to improve the effective "Q" of the anode tank circuit of the final amplifier.



These five circuits cover most of the coupling arrangements used in a modern transmitter. We suggest that more attention be paid to this end of the transmitter.

The higher the "Q" of the aerial tank, the more the harmonic radiation will be reduced. For guidance the "Q" of the aerial tank should not be less than three, but preferably higher than five. "Q" calculation can be obtained in exactly the same manner as for the P.A. tank circuit.

Condenser Values

One of the simplest aerial arrangements is shown in Fig. 1. If the tank is feeding an off-centre Hertz aerial the shunt impedance across the tank will be the same as the characteristic impedance of the feeders, generally in the neighbourhood of 600 ohms. To obtain a "Q" of five the reactance of the condenser at operating frequency should be 120 ohms. At 7,000 kc., that is on the 40-metre band, this will require a condenser capacity of .00019-mfd. while at 3,500 kc. twice this capacity is required. These values of capacity are larger than would be convenient in the average amateur rig, therefore a second arrangement shown in Fig. 2 has been devised. This circuit reduces the required capacity by three-quarters, although the R.F. voltage, for any given power output, is doubled. Consequently twice the plate spacing must be allowed.

The feeder is tapped across one half of the total turns, making the impedance across the entire coil four times the impedance from feeder to ground, or 2,400 ohms across the tank for a conventional 600-ohm line.

For a "Q" of five the condenser reactance is 480 ohms, so only .000048-mfd. of capacity is required for 40 metre working. The capacity is independent of the power output of the transmitter, which is a point of difference between the aerial tank and anode tank, for the power output of a transmitting valve is closely related to the reflected load impedance into which the valve works. Giving an extreme example, a 1,000-watt transmitter would not require any more capacity in a given aerial tank than a 10-watt transmitter, although the voltage spacing would have to be much greater.

The effective R.F. voltage across any tuned circuit is always equal to the square root of the power in watts, times the shunt impedance in ohms, so giving the formula $E = \sqrt{PZ}$ where E equals voltage, P watts and Z ohms. Continuing the examples, 1 kilowatt of power across a 600-ohm feeder represents an effective voltage of 775 volts. The voltage across 2,400 ohms for the same power is twice this value or 1,550 volts.

The peak voltage can be about twice the effective voltage, particularly if harmonics are present or if the carrier output is speech modulated. So for this reason the aerial tank tuning condenser should be rated at two to three times the peak voltage which should normally be present in that circuit.

If it is desired to use smaller capacity condensers to tune the aerial circuit the feeder can be tapped still further down the tank coil. This steps up the impedance across the complete tank circuit in accordance with the usual formula where the impedance ratio is equal to the square of the turns ratio.

If an end-fed aerial is tapped directly to the aerial tank coil the circuit of Fig. 1 should be used, as it is not advisable to tap down the coil. Figs. 3 and 4 are suitable for two-wire non-resonant transmission lines, while Fig. 5 is the best method of link coupling a Zepp aerial to the final amplifier.

"A Low-noise-level S.W. Super-het Receiver"

(*Continued from preceding page*)

Switches are essential in both H.T. and L.T. circuits so as to prevent high-tension drain through the screen potentiometer. So as to reduce the number of panel controls it is suggested that both the potentiometers be of the type fitted with an internal toggle switch.

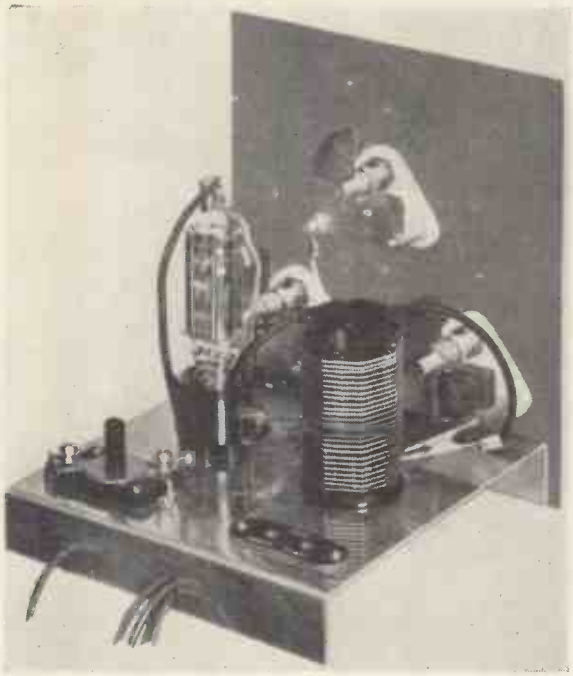
Grid Values

Considerable difficulty was experienced in obtaining the correct values for the first detector grid condenser and leak. Ultimately the best value leak was found to be 150,000 ohms, while the grid condenser has a value of approximately 50 mmfds. An ideal condenser for this purpose is the Eddystone 65-mmfd. type 978 air-spaced trimmer.

Experiments are now being conducted with a high-gain super of a similar type for mains working and although at the moment tests are being conducted with American valves owing to cost and smooth operation, it is hoped that ultimately British valves will be found quite suitable. Most of the English pentodes tried have had very high slopes so that unless the receiver was completely screened instability resulted. In addition to this, owing to the increased gain the British valves gave slightly higher noise level. This, however, was merely due to design.

The few who are able to purchase large commercial receivers find it is rarely possible to use the entire gain, and as the majority of amateurs can only afford a small sum they keep to flatly tuned straight sets. It is becoming obvious that with the amount of congestion on the amateur bands at the present time super-het receivers will be almost as essential as crystal control, so to that end the small low-gain super should be considered.

A Short-wave Converter for One Guinea



Constructors should have little difficulty in assembling the converter from this close up view. The tips of the crocodile clips must be filed down so that they do not touch adjacent wires when in use.

This short-wave converter, designed by 2BZN, is intended for the broadcast listener wishing to hear short-wave stations with the minimum of expense. It can be used in conjunction with any standard broadcast super-het or straight receiver having one or more high-frequency stages.

RECENTLY I have received a number of inquiries regarding the cost and simplest way of hearing short-wave stations. Most readers know that a gadget can be obtained to convert a family receiver so that it will tune in the short-wave stations below 100 metres, but unfortunately these readers generally have the impression that the conversion is likely to prove expensive.

I have devoted considerable time to designing an efficient easy-to-operate short-wave converter at the very minimum cost, and by carefully choosing the lowest priced but efficient components have been able to design a single valve unit costing less than a guinea, including a coil that will tune from 18 to 100 metres.

Although this unit is battery operated it is flexible insomuch as it can be operated from its own power supply or from a common power supply when used with a battery receiver.

It must first be realised just how this type of converter operates. A standard superhet broadcast receiver consists usually of a detector-oscillator followed by one or more intermediate-frequency stages at a long wavelength. Signals are received in the detector circuit and a separate oscillator coupled to it produces a high wavelength signal which is amplified by the intermediate-frequency stages. The effect of this is to give extremely high gain.

When the converter is connected in front of a super-het receiver the single valve in the converter acts as an autodyne detector-oscillator and as the tuning coil is suitable for short-wave working the wavebands covered are between 18 and 100 metres. The original first detector now becomes the second detector so that a super-het plus short-wave converter really makes use of three detectors. The results on such an arrangement are highly efficient and stations from all over the world can be received with the minimum of difficulty

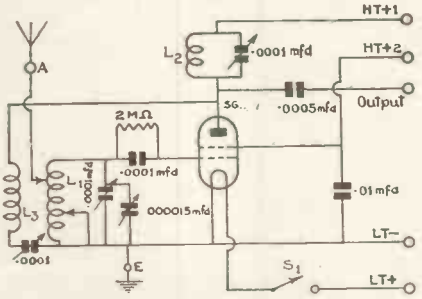
With a straight receiver having a high-frequency stage the converter is connected in front of the receiver. The high-frequency amplifier is tuned to a wavelength of about 2,000 metres and is used as an I.F. amplifier following the detector-oscillator circuit in the converter. Those readers who now have a straight set, of for example four valves, will, with the converter added, have the equivalent of a five-valve super-het.

Battery Operation.

This converter has been designed for use with a battery-operated receiver so that a common power supply can be used for both converter and receiver. If an A.C. operated broadcast receiver is used, a separate power supply will have to be obtained to drive the converter. However, as a small 60-volt high-tension battery and the smallest size 2-volt accumulator will be sufficient, the cost is not likely to be excessive.

The circuit of the converter is shown above. It consists of a screen-grid valve used in a circuit more commonly recognised as the Reinartz oscillator. The principal component is the tuning coil which is constructed on a 3 in. length of 1¼ in. diameter ribbed former. Wind on 25 complete turns of 22-gauge tinned-copper wire and space the winding to take 2 in. Close to the top end of the winding make a small slot 1/16 in. wide and deep, and in this slot wind on approximately 18 turns of 24 d.s.c. wire. This last slot winding is for reaction the top end of the winding goes to the anode of the screen-grid valve, the bottom end being connected to the chassis through a .0001-mfd. reaction condenser. This lead is taken to the fixed plates of the reaction condenser for the moving plate automatically makes contact with the chassis *via* the spindle.

The grid or major winding has connected across it a .0001-mfd and a .000015-mfd. condenser for band-setting and band-spreading. As constructors will appreciate, tuning on short-waves is extremely sharp and without a good slow-motion dial rather difficult. By having a band-spread condenser the converter can be tuned to within a metre or so of a station, fine tuning being carried out by the band-spreading condenser. For example, the .0001-mfd. condenser will probably tune the 50-metre commercial band from top to bottom



The valve in this circuit is the Hivac SG215 which has proved to be most efficient. A poor valve will ruin reception.

in about three degrees of the tuning scale, but by setting the condenser at 47 metres, or thereabouts, the whole commercial band, consisting of 3 metres is spread over 60 degrees of the band-spreading dial.

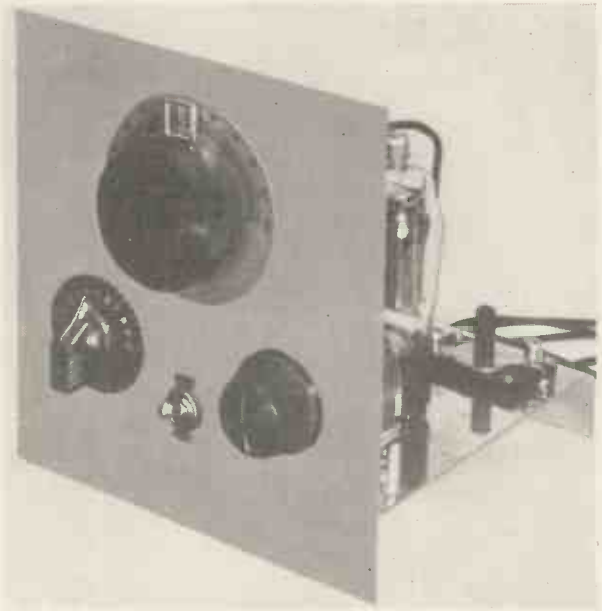
Beginners should remember that the three condensers mounted on the panel only have one connection each, which is taken to the fixed plates, as the earthy side of the condenser automatically makes contact with the chasis *via* the metal panel. If, of course, the con-

Converter Matching :: Construction :: Operation

structor were to use a wooden or insulated panel the moving plates would have to be earthed independently.

A feature of this converter is the tuned circuit marked L2 in the anode of the screen-grid valve. Normally in this position a high-frequency choke is recommended simply to provide a more or less correct impedance for the screen-grid valve, not taking into consideration the wavelength to which the succeeding receiver is tuned.

If, for example, the broadcast set is tuned to 1,800 metres, which is a good average, L2 when tuned by the .0001-mfd. preset condenser, should tune to a similar wavelength. This results in quite a big increase in signal strength. The inductance, L2, is wound on a paxolin former 1 in. by ½ in. and consists of 400 turns of 40-gauge d.s.c. wire, the turns being wound on in layers until the correct number have been obtained. Those who have a spare I.F. transformer could use the primary instead of this home-constructed coil, providing it is of the 110 kc. type. L2 is mounted underneath the chassis directly beneath the present condenser.



On the left is the band-set condenser with the band-spreader in the middle and the reaction to the left. The on-off switch beneath the centre condenser cuts off the power supply.

The .0001-mfd. grid condenser has one end soldered directly to the grid terminal of the valve holder, the other side going to the bottom end of the grid winding, also to both fixed plates of the band-spread and band-setting condensers. Across this condenser is soldered a 2-megohm grid leak of the ½-watt type.

What is normally the anode terminal of this valve holder now becomes the screen, for the anode of the valve is at the top of the bulb. A voltage equal to half of the applied anode voltage should be connected directly to this screen-grid terminal. It is also by-passed to earth by a .01-mfd. condenser connected into circuit by its own wire ends.

The output from the converter is fed into the grid circuit of the broadcast receiver through a .0005-mfd. fixed condenser and a long flexible lead terminating in a wander plug is used to connect the converter to the broadcast set. The aerial and earth connections on the converter are made to the terminal strip which can be seen in the illustration; into these two sockets should be plugged the aerial and earth, which have to be removed from the broadcast set. This leaves the earth terminal on the broadcast set blank.

The chassis and panel are in two pieces and it can be purchased already drilled from Messrs. B.T.S. The chassis is 6 in. square turned down front and back approximately 1 in. and it is of 18-gauge metal. The panel is of 16-gauge metal and is approximately 7 ins. by 6½ ins. Of the holes on the chassis the most important is that for the valve holder, which is 1¼ in. in diameter and should be cut with a carpenter's centre bit. A ¼-in. hole must be drilled beneath the coil to take the connections while two ¼-in. holes are needed beneath the aerial and earth terminal strip. In the centre of the panel a 7/16-in. hole is necessary for the band-setting condenser, while arranged symmetrically on either side are two more 7/16-in. holes for the band-spread and reaction condensers. Between these two is mounted the on-off switch for which a ½-in. hole is required.

Battery Leads.

Four long leads, about 18 ins. in length, are required for the batteries. H.T. positive is connected to one side of the pre-set condéner. H.T. positive 2 goes directly to the anode pin on the valve holder. L.T. negative is soldered to the nearest bolt on the chassis, while L.T. positive is joined to one side of the on-off switch on the panel.

The coil must be fully understood if satisfactory results are to be obtained. Refer again to the theoretical circuit. The whole coil is across the main tuning condenser. For high wavelengths the flexible connection which is joined to earth is left blank while the aerial connection is tapped on three or four turns down the coil. The correct point is found when the converter oscillates quite freely all round the tuning scale. For shorter wavelengths the earthy connection should be tapped up the coil, so reducing the number of turns in use. The whole coil tunes to 80 metres, half the coil 40 metres, while approximately 4 turns will enable the unit to receive the 19-metre commercial broadcasting.

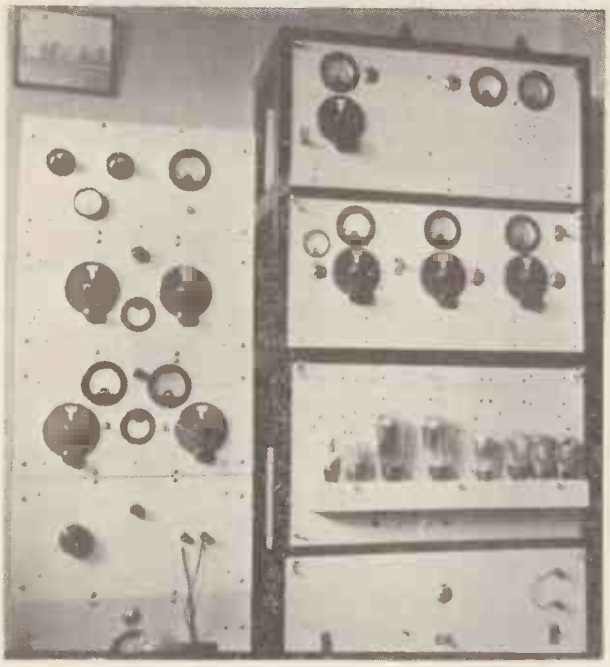
Operation.

In operation the broadcast receiver is tuned to the end of the long waves with all volume controls at maximum and reaction just below the oscillating point. The receiver is then ignored and all tuning carried out through the super-het converter. First adjust the aerial tapping to give smooth reaction over the whole tuning scale and tune in any station on the band-spread condenser with the band-set condenser at minimum capacity.

Vary the screen-voltage to give best results after which tune the pre-set condenser across the coil L2 until greatest volume is obtained. Tune then with the band-set and band-spread condensers.

Components for SHORT-WAVE CONVERTER

CHASSIS AND PANEL.
1—Cadmium plated 18 gauge 6 by 6 by 1 in. (B.T.S).
1—Cadmium plated panel 16 gauge 7 by 6½ in. (B.T.S).
CONDENSERS, FIXED.
1—.0001-mfd. type 665 (Dubilier).
1—.0005-mfd. type 665 (Dubilier).
1—.01-mfd. type 4511 (Dubilier).
CONDENSERS, VARIABLE.
2—.0001-mfd. type VC100X (Raymart).
1—.000015-mfd. type VC15X (Raymart).
1—.0001-mfd. BB trimmers (J.B.)
COILS.
2—Home made to specification.
DIAL.
1—Type 1044 (Eddystone).
1—Type 1026 (Eddystone).
HOLDER, VALVE.
1—4-pin type chassis (Clix).
PLUGS, TERMINALS,
2—Spade terminals type 1025 marked LT+ and LT- (Belling-Lee).
2—Wander plugs type 1046 marked HT+1 and HT+2 (Belling-Lee).
1—Wander plug type 1046 green (Belling-Lee).
1—A and E socket strip type P51 (Bulgin).
1—Plug top connector type 1175 (Belling-Lee).
2—Crocodile clips type CR5 (Bulgin).
RESISTANCES, FIXED.
1—2 megohm type HW34 (Bulgin).
SWITCH.
1—Type S80 (Bulgin.)
SUNDRIES.
24—6BA nuts and bolts ½ in. round head. (Peto-Scott).
2 ozs.—22 gauge tinned coppper wire. (Peto-Scott).
3 lengths sleeving (Peto-Scott).
1 oz.—24 DSC wire (Peto-Scott).
1—3 in. length ribbed former 1¼ dia. (Peto-Scott.
1—Paxolin former ½ by 1 in.
VALVE.
1—SG215 (Hivac).



A Three-stage 50-watt Transmitter

By Kenneth Jowers, G5ZJ

This transmitter is now being used frequently on 80 metres (3,570 kc.) and 40 metres (7,140 kc.) and is securing quite satisfactory reports. Several details will be of interest to constructors, and the layout will interest transmitting amateurs.

On the left is the new three stage transmitter at present in use at G5ZJ. The rack is constructed from angle iron with metal panels. The transmitter on the right is the 20 metre rig described in the October 1935 issue but modified to use a class A-B modulator.

IN the October, 1935, issue I described the 40- and 20-metre transmitter in use at that time having a maximum input of 220 watts. During last winter this transmitter was used regularly on 20 metres owing to the fine conditions existing at that time, so that it was decided to build a smaller, compact low-power transmitter for 40-metre work.

The circuit chosen is shown in Fig. 1, consisting of a pentode crystal oscillator, triode doubler or sub-amplifier and triode P.A. The components have been arranged so that the C.O. buffer-doubler are on the same chassis with the buffer-doubler link coupled to the P.A.

The Pentode C.O.

As it is being used at the moment the C.O., an RFP15, is operating at 3,570 kc. in both grid and anode. It is capacity coupled to an 0-15/400 Tungsram valve used as a doubler at about 15 watts. This valve gives more than sufficient drive for the P.A.; another Tungsram valve, type OQ70/1,000, runs at an input of 50 watts.

Terrific drive is obtainable from the C.O. providing the correct voltages are applied to all electrodes. It is most important that a high value grid resistance be used, 100,000 ohms being a good average. The screening grid is taken to a 500-volt supply *via* a 10,000-ohm variable resistance and a 5,000-ohm fixed resistance. With 36 volts applied to the suppressor grid, 70 ma. flow in the anode circuit when the valve is out of oscillation, but this dips down to 15 ma. when oscillating freely. The maximum dip where the valve goes out of oscillation is approximately 10 ma.

Many amateurs are very much inclined to use a .002-mfd. coupling condenser and consider this to be the correct value. As has already been determined, on the higher frequencies a much smaller condenser is needed, but even on 40 and 80 metres I have found a .0002-mfd. condenser gives highly satisfactory results. It completely isolates the C.O. from the buffer and results in a much more stable transmission, the loss in drive being negligible.

This .0002-mfd. condenser is of the B.T.S. air-spaced type mounted on a ceramic base, but as this has a very narrow gap between electrodes, a .002-mfd. high-voltage condenser is connected in series with it.

It is most important that the screening-grid of the oscillator be carefully by-passed to earth, and until the by-pass condenser was connected directly to the correct terminal on the valve holder without any intermediate wiring poor results were obtained. Also with the RFP15 a high-frequency choke should be in series with the suppressor grid voltage.

Sifam have just introduced some very nice meters suitable for use in the grid circuit. One is being used in the grid of the doubler and has proved very useful when tuning up the transmitter.

The coil in the anode of the doubler should be of the highest quality material. When the transmitter was being tested experimentally, several coil forms collapsed owing to the amount of R.F. in the anode circuit, so if there is any possibility of a higher voltage being used or greater R.F. being obtained, I strongly advise the use of a ceramic coil form.

Although the 015/400 is mainly used as a doubler, when the entire transmitter is on 40 metres it will need neutralising. The neutralising condenser is a Raymart NC15, having .07 spacing and ceramic insulation. However, even this is sometimes inclined to arc, so that a .002 high-voltage condenser has to be connected in series with it.

Satisfactory radiation will not be obtained unless the buffer-doubler coil is correctly wound. This requires approximately 20 turns of 20-gauge enamelled wire wound to the usual spacing as given on the slotted coil form. Three turns from the top end of the coil, that is away from the anode, a gap of three turns is left and into this gap should be wound one turn for a link-coupling coil. This small amount of coupling gave

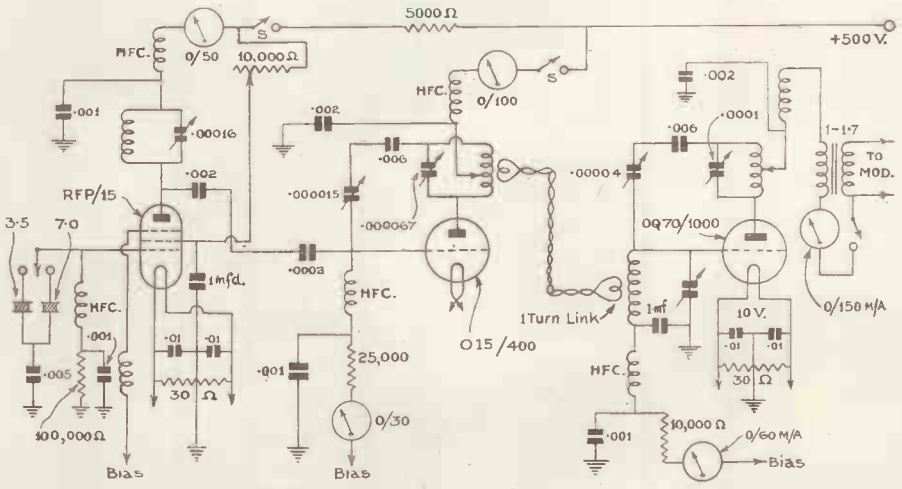
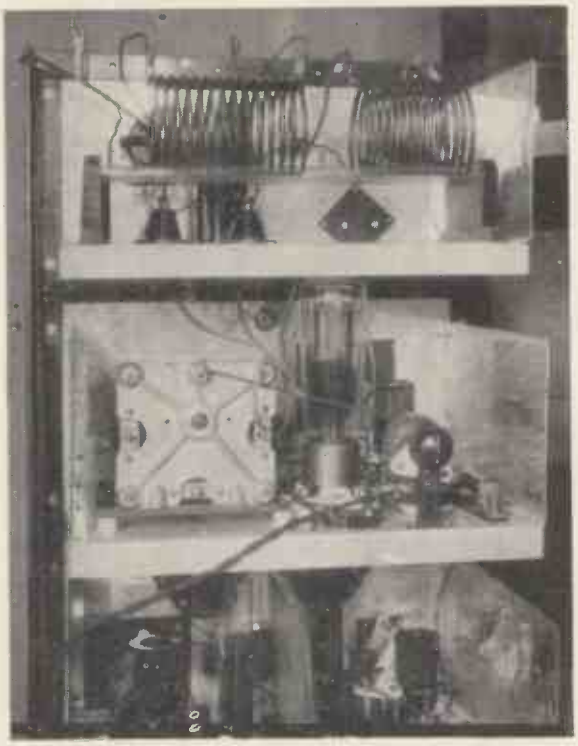


Fig. 1. The circuit used is quite conventional but several of the component values will cause comment.

Construction :: 3·5Mc. Crystal :: Class A Mod.



Some ideas as to how the racks are arranged can be obtained from this view. The top rack is for the tank and aerial coils while the OQ-70/1000 P.A. can be seen below.

ample amount of R.F. transfer while if any further increase is made in the number of turns for the coupling coil excitation drops.

In the third rack is mounted the grid circuit and base of the output triode, also the anode tuning condenser. The coil in the grid circuit of the OQ70/1.000 is a CT6 Raymart, for it is one of the only coil form that will stand up to the R.F. in this circuit. For a neutralising condenser a .00004-mfd. type TC40 Raymart is used. This has wide spacing and a capacity of 40-mmfd., but it has since been discovered that half that capacity would be sufficient. This was probably due to change in wiring made at the last minute when all of the P.A. circuit was wired with 12-gauge.

Reference to the illustration will give some idea as to how the transmitter is built up. In the top rack are the tank coil, coupling coil, R.F. choke and modulation transformer. Two leads come down through stand-off insulators into the second rack where they connect up with the anode tuning condenser in the anode of the P.A. Also on the second rack are the grid circuit components. Link-coupling from the second rack to the third rack housing the C.O. and buffer-doubler allows for easy method of coupling with high efficiency.

In the fourth rack is a power pack giving 500 volts at 120 ma. with very complete smoothing. I discovered that the most suitable chokes were Sound Sales type C1, which are wound so tightly that there is no possibility of chatter or feed-back to the microphone circuit. Also in this rack is a 10-volt transformer for heating the P.A. and a 400-volt low-current bias pack to be connected in circuit when all the final tests have been made.

During the construction and operation of this transmitter several little points came to light which will probably be of interest to other constructors. First of all, it is most important that the filaments of all three valves be bypassed at both ends of the feed wires, so to that end .01-mfd. condensers were put across the filaments both at the valve and transformer ends. Secondly, much better excitation was obtained by fixing the link-coupling coil slightly in from the end of the coil. When it was connected across the centre, excitation went down and could not be improved even by loosening the coupling.

I have noticed repeatedly that greater output and a more stable signal is obtained by using an 80-metre crystal followed by a doubler rather than a 40-metre crystal followed by a buffer. This has not been due to inefficient neutralising, for the same remarks apply if the crystal is followed by a multi-electrode valve. It is probably due to the greater drive given by the 80-metre crystal overcoming the loss in the doubler circuit.

It was decided originally that a neutralising condenser should be connected in circuit when amplifying and simply left connected with plates out of mesh when frequency doubling This system proved quite efficient and obviated the necessity of switching.

Those who are rather doubtful as to the use of so much metal in the transmitter will be interested to know that it has been proved quite conclusively that metal panels, chassis and screens do not have any detrimental effect; in fact, the additional screening makes for a reliable and stable transmitter. The C.O. and buffer-doubler stage are mounted on a metal chassis with a metal panel and three metal screens. Owing to the success of the system an ultra high-frequency transmitter is being constructed on the same rack principle, but having all the components mounted on a steel panel.

This transmitter is running with an input of 50 watts and class A modulation. The modulator used is fully described on pages 410 and 411 of the July issue. A 1-1.7 ratio output transformer couples the D.A.100 modulator into the anode of the OQ70/1,000. If the choke system had been used it would have meant lowering the voltage on the P.A. if correct matching of P.A. to modulator was to be obtained. By using the transformer system and the correct primary to secondary ratio the correct matching was obtained without loss of high-tension voltage.

(*Concluded on page* 479.)

Components for A THREE STAGE 50-WATT TRANSMITTER

CHASSIS AND PANELS.
4—Aluminium chassis 15 by 10 by 2 in. 18 gauge. (B.T.S).
4—Aluminium panels 15 by 9, 18 gauge finished grey (B.T.S).
7—Aluminium screens 5 by 10 by 1 in., 16 gauge. (B.T.S).

CONDENSERS, VARIABLE.
1—.00016-mfd. type ceramic (B.T.S).
1—.000067-mfd. type ceramic (B T.S).
1—.0001-mfd. type 979 (Eddystone).
1—.00001 5-mfd. type NC15 (Raymart)
1—.00004-mfd. type TC40 (Raymart).
1—.0001-mfd. type transmitting 1,000 volt. (Cyldon).

CONDENSERS, FIXED.
1—.005-mfd. type 22.205 (Bulgin).
4—.002-mfd. type 22.201 (Bulgin).
2—.002-mfd. type B770 (Dubilier).
1—.006-mfd. type 1,000 volt (Electradix).
1—.006-mfd. type 2,000 volt (Electradix).
1—1.0-mfd. type BB (Dubilier.)
1—1.0-mfd. type LSA (Dubilier.)
1—0002-mfd. air spaced trimmer (B.T.S.)

COIL FORMS.
1—4-pin type (B.T.S.)
2—Type CT6 (Raymart).

CHOKES, HIGH-FREQUENCY.
1—Type 983 (Eddystone).
1—Type CXT (Raymart).
1—Type BP26 (Varley).
3—Home wound to specification

DIALS, SLOW-MOTION.
4—Standard vernier (B.T.S.)

HOLDERS, FUSE.
2—Holders with 500 M/a fuses (Microfuses).

HOLDERS, VALVE.
3—4-pin type baseboard ceramic (Bulgin).
2—7-pin type baseboard ceramic (Bulgin).
1—Johnson 50-watt socket (Claude Lyons).

METERS.
1—0/50 M/a type 3 (Ferranti).
1—0/100 M/a type 29 (Ferrant).
1—0/150 M/a type 4 (Ferranti).
1—0/30 M/a type E66 (Sifam).
1—0/60 M/a type E66 (Sifam).

PLUGS, TERMINALS, etc.
2—Insulated terminals type H plain top (Belling-Lee.)

RESISTANCES, FIXED.
1—100,000-ohm type W (Ferranti).
2—30-ohm humdingers (Goltone).
1—5,000-ohm type P.R.9 (Bulgin).
1—10,000-ohm type P.R.11 (Bulgin).
1—10,000-ohm type PR36 (Bulgin).
1—25,000-ohm type PR14 (Bulgin).

SWITCHES
2—Type S80 (Bulgin).
1—Type S142 (Bulgin).

SUNDRIES.
3—¼ in. glass test tubes.
½ lb.—20 gauge enamelled copper wire. (Peto-Scott.)
2 ozs.—30 gauge DCC wire (Peto Scott

VALVES.
1—RFP-15 (362).
1—0-15/400 (Tungsram).
1—OQ-70/1,000 (Tungsram).

Anode-modulating Pentodes

By Malcolm Harvey and G2HK.

The English type radio-frequency pentodes can be used very successfully when anode modulated. The efficiency is much higher than when suppressor grid modulation is used.

AMATEURS are inclined to lose sight of the fact that pentodes give excellent results when anode modulated. Unfortunately far too many operators buy pentode valves for use in the final stage simply to suppressor grid modulate The introduction of the RK20 enabled the C.W station to change over to phone operation with the very minimum of expense, for it was quickly realised that 2 watts of audio was more than enough fully to modulate one of these valves.

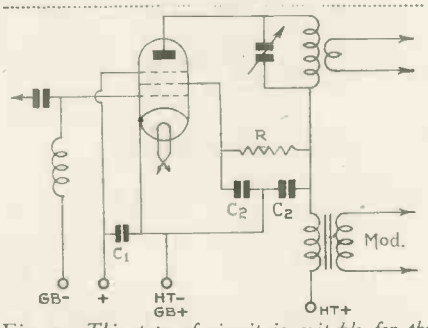


Fig. 1.—This type of circuit is suitable for the 802 or small receiving pentodes provided the correct anode voltage is used.

As a general rule quality was not up to standard although this may be blamed on to the operator for not using the correct bias and H.T. voltages. In addition to this the average efficiency, according to tests, has been little better than that obtained with grid modulation. By anode modulating a pentode valve can be compared with a similar wattage triode, when it will be found that the efficiency is almost as good. The average loss is in the region of 10 per cent., which is permissable when one considers the other advantages, such as small excitation and the omission of the neutralising condenser.

Anode and Screen Modulation

Screen-grid valves can only be anode modulated providing modulation is applied to both anode and the screen simultaneously, so it is safe to assume that the same conditions apply to pentodes. The first question to arise when using pentodes is, should modulation be applied to the suppressor grid? Generally speaking, the suppressor grid must be connected to the heater centre tap or to a low fixed positive voltage. This voltage has to be determined by experiment and of course varies from valve to valve.

Operation

The RK802 is a typical small transmitting pentode of the indirectly-heated cathode type and a suitable circuit for it is shown in Fig. 1. From a constructional point of view, the circuit is exactly the same for phone as for C.W. It will be noticed that the screen-voltage is obtained from the same source of supply as for the anode, but through a dropping resistance by-passed by a .001-mfd. condenser. In this way the modulation transformer secondary is in series with the supply to both anode and screen.

It is particularly important to by-pass the suppressor grid directly at the grid terminal of the valve holder with a fairly large capacity condenser, for these valves have a tendency to oscillate if shielding is not complete. For the 802 the dropping resistance should have a value of about 25,000 ohms when using an anode voltage of 600. The maker's figures for this valve are as follows. Anode voltage 500, screen voltage 250, suppressor voltage 40, control grid bias, negative 100 giving an anode current of 45 ma., screen current 12 ma., and a control grid current of 2 ma. Under such conditions the grid driving power is approximately .75 watt while about 16 watts are put into the aerial.

A 15-watt Pentode

The nearest British equivalent to this valve is the RFP15 with 500 volts on the anode, 400 on the screen, 12 to 15 volts negative bias and approximately 40 volts on the suppressor grid. The anode current is approximately 35 ma., screen current of 8 ma. and a driving power of approximately 1 watt. Under such operating conditions a carrier output of about 12 watts can be obtained.

The optimum suppressor voltage depends to some extent on the excitation available. If this is ample, which it should be if the pentode has been substituted for triode, the suppressor voltage can be almost doubled, giving slightly greater output and considerably better quality. An experimental hook-up using a 59 C.O. provided more than sufficient excitation for a pair of 802's in push-pull. This will give some guide as to the efficiency of this type of valve. If it is then anode modulated one obtains all the advantages of a triode with the additional advantages of the pentode.

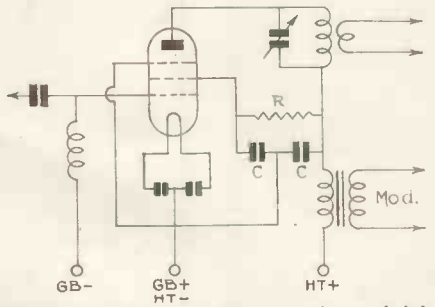


Fig. 2.—The RK20 or RFP60 need this slightly modified circuit, but the same method of modulation is employed.

The RK20 was perhaps the first universally used high-power R.F. pentode and was followed by its British counterpart, the RFP60. These valves are being used with varied success, although

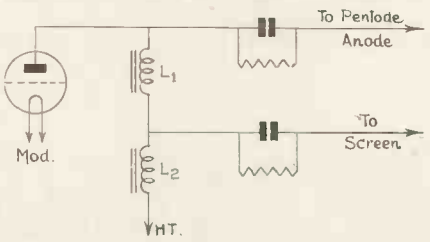


Fig. 3.—This ingenious arrangement allows for very close matching.

it must be admitted that both are capable of giving high output with very little trouble.

Variable Results

We have had a number of letters from British amateurs asking for help in obtaining the maximum efficiency from pentode valves. The RK20 is rated to have a maximum anode loss of 40 watts. The maker's figures are: anode voltage 1,250, screen voltage 300, suppressor grid voltage 45. Under such conditions a bias voltage of 100 negative is required giving an anode current of 92 ma., screen current of 32 ma., a grid current of 5 ma., with a driving power of 1 watt, while a carrier output of 80 watts is obtainable. When suppressor-grid modulated, the suppressor voltage should be 45 negative, giving an anode current of 43 ma., a screen current of 36 ma., similar grid figures and a carrier output of 18 watts. With the heater type of pentode, the circuit in Fig. 2 should be used. The screen and anode by-pass condensers should be approximately .001-mfd., while the resistance R should be of a value suitable to bring down the voltage according to the maker's figures.

It is essential if 100 per cent. modulation is to be obtained to calculate the

correct ratio of modulating transformer required. This is quite a simple matter for one merely has to calculate the load impedance of the P.A. at operating conditions and match this to the optimum load of the modulator, using the standard formula. If, however, a modulation choke is used as shown in Fig. 3, the voltage applied to the anode of the P.A. must be lower than the voltage applied to the anode of the modulator. Again, the correct value of resistance can be determined to give the proper operating conditions. When calculating the amount of audio amplification needed to modulate the P.A. circuit the wattage consumed by the suppressor grid must be added to that of the anode. This is a most important point for the RK20 requires a total input of about 110 watts, being 75 watts in the anode and 35 watts in the screen. The screen itself only consumes approximately 7 watts, the balance being absorbed by the voltage-dropping resistance.

Modulator Requirements

The modulator has to supply approximately 55 watts, that is half the total input, although 37.5 watts are taken by the anode and 3.5 watts by the screen; the balance is again dissipated in the voltage-dropping resistance. The load impedance of an RK20 and RFP60 is approximately the same, being about 9,000 ohms. A pair of PX25A's could be used to modulate and as these have an optimum load of 2,800 ohms when used in low-loading, a standard matching transformer would be entirely suitable.

The circuit shown in Fig. 3 is only suitable when a common power pack is unavoidable, for with it the voltage on the screen of the pentode has to be reduced, so giving a slight decrease in overall efficiency. By the use of a transformer, as shown in Figs. 1 and 2, the maximum voltage can be applied to both anodes, providing the correct ratio of transformer is calculated.

Referring to Fig. 3 again, the audio-frequency voltage divides across the two chokes L1 and L2 in proportion to their inductance. The resistance and condenser in series with the pentode anode are to adjust the operating anode voltage in accordance with the modulator requirements. With most pentodes where the ratio of D.C. anode and screen voltage is approximately 4 to 1, the ratio of choke inductances L1 to L2 should be higher. That is if L1 is 30 henries, L2 should be between 5 and 8 henries.

It is hoped that more amateurs will take advantage of the R.F. pentode so as to obtain a high output with minimum excitation. The fact that suppressor grid phone is so inexpensive should for the time being be given second place.

THE EIFFEL TOWER TRANSMISSIONS

Our Readers' Views

Correspondence is invited. The Editor does not necessarily agree with views expressed by readers which are published on this page.

M. *Barthélémy on the Eiffel Tower Transmissions.*

The following letter has been received from M. Barthélémy regarding the criticism of the Eiffel Tower transmitter which appeared in a French contemporary the "Haut Parler" and of which we gave a translation in the May issue—Ed.

SIR,

1. It is incorrect to write that 60 kilowatts are used at the P.T.T. studio for the illumination of a surface of 2 sq. metres; there are exactly 32 kilowatts to a surface which exceeds 9 sq. metres at the least.

To be precise: Three months ago the brightness of the illumination was about 20,000. It is actually reduced to 12,000 (it must not be forgotten that in the sun the brightness of the light is between 80,000 and 100,000).

As regards heat, a thermometer (contrary to the author of the article) registers 27 degrees Centigrade after one hour on the same scene. Should you compare these figures with those of film studios, or better still, with the light required by scanners of the cathode type, you would find that the system which we have evolved largely justifies itself.

Furthermore, we fit secondary transmission cells on to our cameras and therefore we can transmit street scenes, sporting events, etc., in comparatively dull weather (brightness of 3 to 4,000). Is not that the true formula of the future?, for we obtain an exceptionally stable service from these mechanical scanning cameras. It is in this way that the Eiffel Tower has ensured an uninterrupted service with the same camera every day for eight months. Is there any period of time elsewhere which can compare with this?

2. It is incorrect to state that the definition of transmitter FL is not 180 lines. Possibly M. de France's collaborator constructed a bad receiver, but all the technicians in Paris have been able to verify, for example, that the upstrokes of letters, 2 mm. in width, on a scene of 600 mm. on one side, were perfectly transmitted and received on suitable receivers. That represents, if I am not mistaken, 300 spots per line—which is much more than the 60 points accorded us by the pseudo "Major Watt" in his unfriendly article.

3. It is incorrect to say that our system was thrust upon the country: it was only after a lengthy investigation on the part of the Ministry into the propositions made by various French and foreign manufacturers that our camera was ordered, as being the only one which, at the present time, solves the problem before us: direct photography in diffused light.

4. I shall not discuss the given list of M. de France's works and their dates, but, omitting what I myself have been able to achieve on other dates, and which I do not wish to take into consideration here, there will be found in technical reviews, such as yours, numerous previous examples of those achievements for which priority has been claimed.

I do not wish to conclude this lengthy exposition without informing you that the strength of transmitter FL has just increased to 2.5 kilowatts (applied to feeder H.F.) which gives more than 10 kilowatts on the aerial. This procures an excellent television reception on an inside aerial with a simple 4-valve receiver.

The simplicity of our synchronising method enables us to construct complete television receivers having only 6 tubes, 2 thyratrons of which are for deflection. A second transmitter, which specialises in telecinematograph has already been installed through our efforts at the "Poste Parisien" on a wavelength of 7 metres 50, and we think that next season will see the industrial release of French television.

R. BARTHÉLÉMY
(Fontenay-aux-Roses, Seine).

Television on 40 metres

SIR,

I received the 40-metre television signal reported by S. Cattell in the July issue. I seem to pick up several vision signals and do not note the times or put them through my visor, but this signal was loud and at about 10 p.m. on, I believe, June 18.

I put the signal through an A.C. cathode-coupled 2-valve amplifier, which ends with a 7.6 watt pentode, and obtained a terriffic signal, it was already L.S. strength on my one-valve receiver (using class B battery valve). When I was going to couple up my visor I found that I had taken the mains resistor out for my transmitter, and decided not to trouble further because I could tell—from listening to the sounds of my own shadow and film transmissions—that the transmission was a silhouette, and I would have liked to receive a pictorial rather than a geometric image. No announcements were made and the same signal persisted for about an hour after I first picked it up, on 40 metres approximately.

To conclude, I may say that I have taken TELEVISION AND SHORT-WAVE WORLD regularly and have every copy from No. 1, but I think that this is the first time I have wished to make use of your correspondence columns. I will be pleased to give more details of set or settings of dial and coil used, etc., if any of your readers require same.

H. J. PEACHEY (Leyton, E.).

A French Transmitter

SIR,

I wonder whether you could assist me to trace a French amateur who went to the trouble of 'phoning me from London on June 19.

Unfortunately the telephone line was poor, and although my French friend spoke excellent English his name was rather difficult to decipher. The best I could do with it was C. O. Drimaon, c/o Monsieur Philips, 121 Walford Mansions, London, S.W.3. My correspondence to our French friend was returned as untraceable.

I am sure that you will agree with me that it would reflect upon the amateur status generally if I allowed apparent discourtesy to appear.

R. ADAMS (Wolverhampton).

A Pirate Station ?

SIR,

Should any reader work or hear a 40-metre telephony station signing G5LC please kindly send details to the owner of the call, who is QRT till Christmas. The call sign is being pirated.

LESLIE COOPER, G5LC
(East Molesey, Surrey).

A Commercial 10-metre 100-watt Transmitter

WE have received some technical information regarding the RME CT-100 transmitter. The general specification is very interesting, particularly when one considers the price—195.50 dollars. The transmitter is made up of several units, the first being a 101 exciter with a 6A6, double valve, crystal oscillator and second harmonic generator, two 42's in push-pull as buffers, two 801's or two RK70's in push-pull as final amplifiers.

For 10-metre operation another unit, comprising a 6A6 and associated circuit is plugged into a special connecting strip on the exciter chassis.

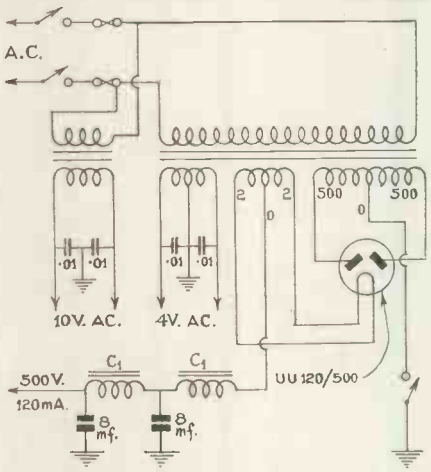
A 201 power supply makes use of two 866's with a single 83 for low-voltage supply, while a single 45 is used in the grid block keying circuit. All components are designed for continuous operation.

The frequency range is 1,700 to 30,000 kc. and by means of plug-in coils is changed from the front of the panel any of the five amateur bands can be selected. For keying, a grid block system is used in the final amplifier, while provision is made for a stand-by switch to facilitate reception on the crystal frequency. Keying may also be carried out in the crystal stage if battery bias is applied to the final amplifier.

A Three-stage 50-watt Transmitter

(Continued from page 472).

I often hear how stations use a complicated relay system to switch off the transmitter and have wondered if this is necessary. My remote control consists of a simple two-point tumbler switch breaking the return from the centre tap of the H.T. transformer from both modulator and transmitter power packs. In this way by simply breaking the circuit, H.T. to the whole



This power pack delivers 500 volts at 120 m/a in addition to heater voltage for all stages. The simple switching arrangement has proved satisfactory up to 2000 volt working.

transmitter is switched off by one control. This allows for a very quick change-over and an absolutely noiseless one.

So as to line up the first rack the hot wire meter used is taken out and in its place a Ferranti 0-1 ma. meter fitted. This meter will be coupled up to a monitor so as to check the quality and hum level of the transmission. This feature is a permanent one.

Top Band Frequency Register

MANY new stations have been added to this list during June. There are, however, still a number of stations whose frequencies are not listed, and we shall be glad to receive these in time for publication in the next issue.

Frequency.		Frequency.	
1726	G6GO	1790	5UM
1730	6oK	1790	2SN
1732	5ZJ	1791	5AK
1736	5OO	1792.6	2QM
1740	5HO	1794	5JU
1740	6WQ	1795	2UY
1742	5WL	1800	6TL
1746	6ST	1801.5	2HK
1748	5KV	1802.5	5LL
1750	2WK	1802.5	2IZ
1752	2KL	1805.9	2YW
1753	6KV	1806	5MM
1754	6ZR	1808	5CH
1754	6GO	1810	6BQ
1755	6PY	1810	2LD
1756	2AO	1810	5PP
1757	6YU	1815	2DQ
1759.5	5JW	1815	5OP
1759.5	2KT	1818.5	2OG
1760	5AR	1824.5	2WG
1760	5BM	1824.5	6UJ
1762	2UJ	1830	5KG
1762.5	2ZN	1830	6WQ
1764	5NW	1830	6QB
1765	5ZQ	1831	5XR
1766	6OO	1836.5	6RQ
1766	2WO	1840	2JU
1766	5JO	1844	6VD
1767.8	6LF	1849	5CJ
1768	6PL	1850	2CD
1769	5GC	1850	5OC
1769.5	5FI	1850	2HF
1770	5PR	1850	2SR
1773.1	5BC	1850	6UD
1774	6SO	1850	6VD
1774.5	6NU	1852	2KV
1775	6ZQ	1857	6TQ
1776.4	5YW	1857	2CF
1777	2JG	1860	5IV
1778	6SY	1860	6QM
1780	6BO	1861	2KL
1780	SZR	1862	6WY
1780	5RI	1869	2PS
1780	5BK	1869	5PB
1780	6BO	1870	2PL
1780	6HD	1870	2LC
1781.5	5VS	1870	5RI
1782	5RT	1870.5	2WT
1784	5IJ	1874.5	2XP
1785	6QI	1875	6WF
1785.5	5ZT	1881	6FV
1785.5	61F	1884	5KJ
1786	5NP	1888	2XC
1787.5	2XP	1890	2MI
1788.5	2GG	1893	5RD
1790	5MP	1899	5XF
1900	2YJ	1940	6PA
1900	2PK	1950	6KD
1910	2NO	1950	5GL
1910.5	2GG	1950	5SZ
1913.5	2UJ	1954	2GG
1916	5VT	1960	5UK
1916.5	2GZ	1961	5OQ
1920	6LZ	1961	2UJ
1921.7	2OV	1965.5	5LL
1925	6CT	1970	6UT
1925	6UU	1975	6OM
1930	5OD	1980	6KV
1935.5	2XQ	1988	5WW
1936.6	5IL	1990	6AU

The Tobe Super-het. Amateur Receiver

IN the issue dated August 29 we intend publishing full constructional details of our star amateur receiver the bare details of which we mentioned in previous issues.

The exact price of this amateur receiver will be fixed within the next few days, but already we have been able to arrange some simple hire-purchase terms for those who cannot afford to buy the receiver outright. Messrs. Eves Radio, who are supervised by G2NO, has full stocks of all Tobe products including the special air-trimmed tuner used in our receiver.

As far as we can tell at the moment the kit will cost between £13 and £14, including valves, the hire-purchase terms being £1 deposit with the balance spread over twelve months.

Constructional details of this receiver will include a wiring diagram and a straightforward system of I.F. stage alignment. This amateur bands receiver will solve most of the amateur's difficulties with regard to selectivity and sensitivity on all bands. For those who missed the previous specification here are some of the details.

H.F. stage, detector-oscillator, two I.F. stages, second detector, L.F. amplifier and rectifier. In addition there is the beat note oscillator and H.F., I.F. and L.F. gain controls. This model can also be adapted to include I.F. regeneration and a crystal filter. These extras will be dealt with in subsequent issues, but it must be realised that they will not cause any alteration to the original receiver.

The blue-print number is SW208 and we advise constructors to apply at once reserving a print for delivery on August 29. These prints show all connections and component values, in addition to the construction of the chassis, and cost 2s. 6d. post free. The first issue of these prints have already been booked which makes it all the more important for readers to order at once.

MISCELLANEOUS ADVERTISEMENTS

The charge for advertisements in these columns is 12 words or less 2/-, and 2d. for every additional word. All advertisements must be accompanied by remittance. Cheques and Postal Orders should be made payable to Bernard Jones Publications Ltd., and crossed, and should reach this office not later than the 15th of the month previous to date of issue.

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