TELEVISION

THE FIRST TELEVISION JOURNAL IN THE WORLD

NEW SERIES
PUBLISHED BY THE PROPRIETORS OF
"AMATEUR WIRELESS"
AND
"WIRELESS MAGAZINE"

MAY, 1934. No. 75

Simple Television In Any Part Of The Country

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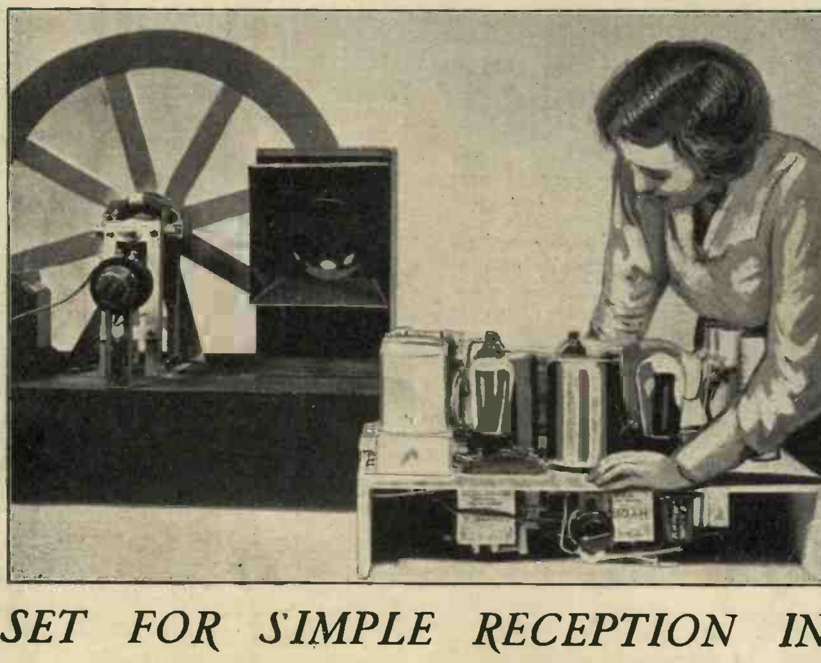

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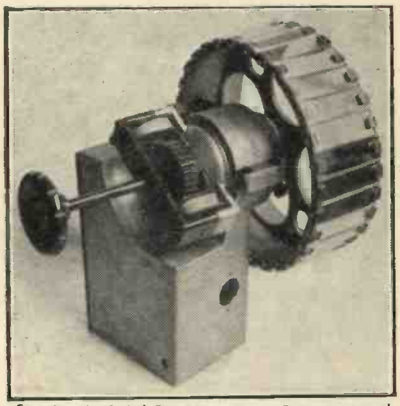

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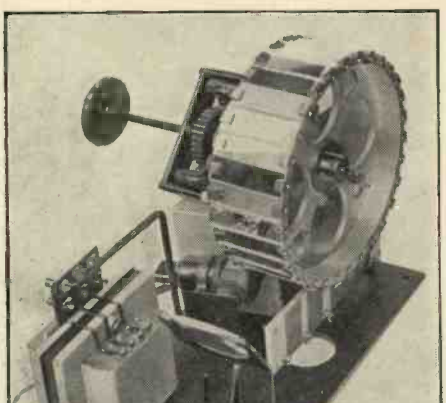

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TELEVISION

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TELEVISION

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COMMENT OF THE MONTH

Our Questionnaire.

AT the conclusion of the B.B.C.'s official statement notifying the curtailment of the television broadcasts there appeared the sentence " These transmissions will be continued until further notice, their duration being regulated partly by the use which is made of them by experimenters and partly by the rate of development of systems giving a higher degree of definition."

This, as everyone will agree, is quite a reasonable definition of future policy. The trouble is, though, that the B.B.C. has little opportunity of judging what amount of practical interest is being taken in television. In August of last year an attempt was made to take a census of those receiving the television programmes by asking for postcards to be sent. The result was that something less than two hundred replies were received, and naturally the opinion was formed that very little use was being made of the broadcasts; an opinion that, no doubt, has had considerable weight in the recent decisions. Shortly after that time, in fact, it was practically decided to stop the transmissions altogether. Admittedly, the census was taken at a very bad time—it was a holiday month and a time of year when indoor pursuits are at zero—but still the figures showed an amazing apathy and disinclination on the part of many to take a little trouble.

During the past few months we have been enjoined time after time to do something of a similar nature or to induce readers to write to the B.B.C. But we have refrained from doing the latter for two reasons: one is that the value of such an instigated campaign is doubtful and the other the probability that the result would never be known. We have decided to approach the matter from a new angle. We want facts and figures, and we shall be able to obtain them if our readers will fall in with our suggestion and fill in the questionnaire which is given on page 217 of this issue. The questions are applicable to every reader of this journal and to their friends if they are interested in the development of television. For you to answer the questionnaire it is not essential that you should at present be receiving the programmes or have received them in the past. It is optional whether you give your address, though it is desirable to state in what part of the country you reside. Neither is there any need to cut this issue of TELEVISION, the numbers of the questions with brief replies opposite on a postcard, or sheet of paper, with your signature will do.

We think that our readers will agree that the information obtained will be most valuable and may have a considerable influence on future policy; but it can only be of value if there is a whole-hearted response, which means *a reply from every reader*. Will *you* please send *yours*.

The Television Broadcasts

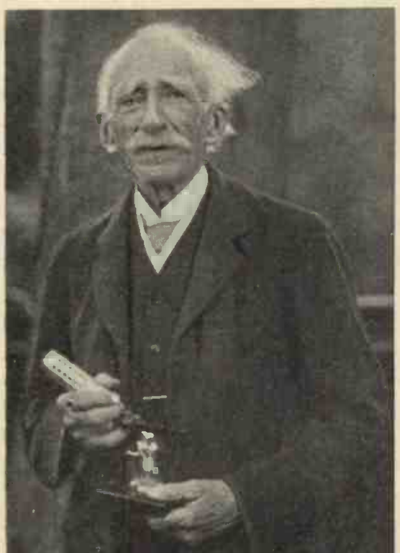
WHAT THE B.B.C

SOME WELL-KNOWN AUTHORITIES OFFER THEIR OPINIONS ON POLICY

From Sir Ambrose Fleming, M.A., D.Sc., F.R.S., President of the Television Society.

I will endeavour to state briefly why I think that it is not to the public advantage that a highly technical and rapidly progressing science like Television should be entirely controlled by a Government Department or by a State appointed Corporation over the operations of which the public have no direct control. I will illustrate this contention by recalling to mind a few of the facts of the history of telegraphy and telephony in Great Britain. When the electric telegraphy by wire communication was first brought to the condition of a useful service it was in the control of joint stock companies which gave, up to a certain point, an efficient service.

Then about 1866 or 1867 an opinion gained Parliamentary support that such service should not be a " monopoly," as it was called, but a State controlled service. Acts of Parliament were passed in 1868, giving the Government power to purchase compulsorily the plant and business of these telegraph companies. These Acts were, however, so skilfully drawn that when ten years later the speaking telephone was invented by Bell and the idea originated by him of telephone exchanges, the telephone was held to be a telegraph within the meaning of these Acts. The working of the telegraphs had been committed in 1870 to the General Post Office. When the Bell speaking telephone was first brought to England the G.P.O. technical officials laughed at it and called it a toy and useless invention. But when the Bell Telephone Company and Edison Telephone Company began to work rudimentary exchanges the G.P.O. made a great effort to get complete control. In 1880 the celebrated action, " The Attorney General v. The Edison Telephone Company," was heard by two judges, and in spite of the strong arguments of eminent scientific witnesses, that what the Government bought in 1870 was the telegraph business as it then stood, the Acts were interpreted to cover every possible form of intercommunication by electricity used for public service. The case, unfortunately, was never taken to the Court of Appeal or the House of Lords—the G.P.O. offered the telephone companies a licence for thirty years in return for ten per cent. of their net profits, and telephony came under complete Government control.


Sir Ambrose Fleming, M.A., D.Sc., F.R.S., President of the Television Society.

The result of this was disastrous. The G.P.O. officials with their very limited scientific knowledge resisted all attempts of scientific men like Mr. Oliver Heaviside to put them on the right path of progress.

It was not worth while for outside inventors to spend time on telephonic research when the whole thing was held in the grasp of a few state officials. Telephonic research, therefore, languished, and all the great inventions such as loading coils, uniform loading and the thermionic repeater have come from other countries where telephony is not a Government monopoly.

The same thing occurred in electric lighting. No sooner was the electric incandescent lamp perfected and central station supply begun than the Government passed their 1882 Electric Lighting Act—which throttled it all for six years until an amending Act was passed.

Then, oblivious to experience when wireless telegraphy became practical, they again passed the 1904 Wireless Telegraph Act and put the Postmaster-General in supreme control. And, finally, when the invention of the thermionic valve had made musical broadcasting possible and the British Broadcasting Company made it a success, the Government again cut in, and by establishing the present B.B.C. with its Charter in 1926 and income of about the half of every wireless licence fee, gave to it, and to a few officials of it, an absolute and irresistible control of speech and music broadcasting in Great Britain.

Television Possibilities

Then, lastly, we come to television. When the genius of Mr. Baird had opened up the pathway to practical television, which, though rudimentary at first, had great possibilities apparent in it, the B.B.C. officials declared it useless and would hardly even inspect it.

Then, when it had reached a stage at which it was compelled to make some small provision for it, the B.B.C. selects the ridiculous hour of 11.30 p.m. for its show, when all children and many adults are in bed. Meanwhile, unable to resist the evidence for its future utility, they are privately experimenting with it.

It seems clear that their intention is to first squeeze out all rivalry or competition, and by putting their present small television demonstration at inconvenient hours to prevent the public from obtaining television receivers other than those suitable for the reception of B.B.C. television. Then when they are ready with their own system they hope to obtain just the same absolute control over " looking-in " as they have over listening-in.

SHOULD DO

MANY VALUABLE SUGGESTIONS—PRESENT FACILITIES INADEQUATE

The public will not then be able to obtain any television except the B.B.C. television. It will not be worth the while of outside inventors to give time and thought to television research, because the only people to whom they can market their inventions have an absolute monopoly and can make their own terms for its appropriation.

Government control, therefore, of any highly scientific invention results in a restriction of progress as regards improvement.

What I think is urgently required is some powerful but quite independent association representing the public, the technicians and the interests of those most concerned or affected by such a Government control of the most powerful implement yet devised by the human mind for influencing public thought. It ought not to be within the power of a very few persons to prescribe what opinions in speech, what quality in music, what televised images we shall receive, or who shall be the speakers or performers. Nor is it desirable that the opinions of the majority of the uneducated or unelevated multitude should determine that choice.

From S. Sagall, Esq., Managing Director of Scophony, Ltd.

You have shown me the courtesy of asking me for an expression of my views on the "attitude of the B.B.C. towards television and on the poor facilities which are now given since the curtailment of the programmes."

I dealt with the problem of low definition pictures at some length in the January issue of Television. *I still adhere to the principle of "inevitability of gradualness."*

In spite of considerable advance in high-definition television, I would uphold my previous statement that there is very little hope of such a high-definition service being generally available in under a year or two. There is still a great deal to be done on the technical side—both regarding transmission and reception—before high-definition television could be established as a commercial entertainment proposition.

I would reiterate here my previous request to the B.B.C. and would emphasize it even more :—

> *Go on with high-definition experiments, but proceed simultaneously with the low-definition service. Increase the entertainment value by increasing the definition perhaps to 60 lines. Give flickerless pictures by increasing the number of pictures per second ; give better and greater transmission facilities, more convenient hours, more suitable subjects, and guarantee such a service for a period long enough to enable manufacturers to turn out receivers on a remunerative basis. Don't kill public interest in television by creating—perhaps for a few years—a complete vacuum, until high-definition pictures would definitely come in.*

And yet another request I have to make—to all whom it may concern :—

> *The ultimate in television has not been reached yet. The baby is still only crawling on all fours. Don't strangle it by too much caressing, nursing, planning ahead. Let high-definition television get first technically more stabilised, and then—only then and not before—consider the "how" and "by whom" of the broadcasting arrangements.*

From Sir Henry White-Smith, C.B.E., Chairman and Managing Director, International Television Corporation, Ltd.

The primary feature of the problem before us which springs to my mind is that I remember well not so very long ago sitting over a "cat's whisker" with a pair of earphones hoping to catch some Morse. It took a good many years to advance from that stage to even the stage of receiving a rather poor broadcast programme, frequently cut off by the inefficiency of the receiver.

To-day we are only content with the finest broadcast programme which can be given, and the finest type of receiver. For instance, we are no longer content to listen-in to a set which is not provided with a moving-coil loudspeaker, a comparatively recent luxury.

In television, as I see it, we are not so very far advanced over the "cat's whisker" stage—or perhaps I should say, the first loud-speaker stage—and yet we are clambering for the "moving coil loudspeaker" stage, before allowing the public to participate at all in the Art. I say "participate at all" because I do not consider that the very brief programmes of 30-line transmission which have hitherto been given by the B.B.C. at an hour when most people, certainly if they have work to do, wish to be in bed, can be considered as offering the public participation. I think I say with undoubted truth that had those programmes been broadcast at a more convenient hour there would have sprung up a strong demand for better receivers to receive even that programme.

To come down to practical politics, and looking at the matter commercially, it is my considered opinion that if the B.B.C. were to put out a 60-line sound and vision programme on a medium wavelength at a convenient hour to the public, there are in existence to-day receivers ready to be placed on the market fully adequate to make the best of such a programme. I have not the slightest doubt that anyone who put such receivers on the market commercially at a popular price would reap a fine harvest.

The next stage is the high-definition picture—90 lines and over. For that, as we know, we are compelled to call on the ultra-short waves, and we also know that the ultra-short-wave broadcast has a limited radius. Here again we know that there are receivers which could be immediately

"WHAT THE B.B.C. SHOULD DO" — *The opinions of*

placed at the disposal of the public for the price of a first class radio set, and if such a broadcast took place from the various B.B.C. stations, there is a very large public to whom it would appeal. In my opinion, however, such high-definition broadcast should be limited for the time being to 120 lines, and no attempt should be made to take the public further until a great deal more research work has been carried out on both the transmitting and receiving side.

I refrain from making any observations as to the merits of mechanical versus cathode-ray reception, as I do not profess to speak on the technical side of the question. I can only say that where it has been my privilege to view a picture of an equal number of lines received by a mechanical receiver, and at the same time by the cathode-ray method, the definition on the mechanical receiver has been strikingly superior.

From W. G. W. Mitchell, Esq., B.Sc., Hon. Sec. Television Society.

I gladly respond to your invitation to express my views on the present position of television, although I must be allowed to emphasise that these are my own personal views and not the considered opinions of the Television Society, of which body I have been an Honorary Secretary since October, 1928. I should first of all explain that, as an Honorary Officer of the first Television Society ever formed (September, 1927), I have had some opportunity—not so much, perhaps, as your readers may imagine—of seeing the "inside working" of television. I have never held any position which would involve the policy or management of any firm or organisation directly or indirectly interested in exploiting television as a commercial proposition or interested in the manufacture of television apparatus. Again, I live in a market town of some 15,000 population and at a distance of 50 miles from London. For these reasons, I claim to speak as an independent member of the great public interested in the progress of television.

The B.B.C.'s Obligations

Legally, the B.B.C. has every reason for curtailing the number of television transmissions. They might well say it was not their job, but they have nevertheless accepted a position which shows them to be an interested party. (Report in "The Times," September 12th, 1929: "The experimental broadcasting of Baird television outside programme hours will begin on September 30th. . . . The object of the demonstrations is to afford the Baird Company wider opportunity than they have hitherto possessed for developing the possibilities of their system of television and for extending the scope and improving the quality of reproduction. In granting facilities for these experimental demonstrations in which the public can, if they so desire take part, neither the Postmaster-General nor the B.B.C. accept responsibility for the quality of the transmission or for the results obtained"; and also letter from the Postmaster-General in "The Times" of March 28th, 1929, after repeating the above warning, continues: "While the (Baird) Company will not be precluded from selling apparatus to anyone who desires to purchase it, the purchasers must understand that he buys it as his own risk at a time when the system has not reached a sufficiently advanced stage to warrant its occupying a place in the broadcasting programmes.")

Although, technically, television has advanced beyond all bounds since 1929, I know of no alteration in the B.B.C. attitude that the broadcasts of television are other than "experimental." I conclude from this that the B.B.C. has a duty—that of fostering the development of television. That they have done so cannot be denied. Through their television programme director, Eustace Robb, and with the co-operation of several ex-Baird engineers, they have certainly improved 30-line television to a point where, in my opinion, it cannot go further.

But the present controversy is not so much one of continuing the 30-line transmissions as it is to decide between high- and low-definition images, and on this the B.B.C. are secretive and vague. The B.B.C. are no doubt thinking in terms of a 120- or 180- line picture se'vice and while the linking of stations by wire (as in ordinary broadcasting) is technically out of the question, it certainly requires another four or five years to fully explore the possibilities of utilising an ultra-short wave link between transmitters.

Harmful Exaggeration

There is another reason, and a perfectly good reason, why the B.B.C. is guarded on this question as it affects the future progress of television. No one will deny that television has had an unfortunate past. See how it has been over-advertised in the press (e.g., "Evening News," March 29th, 1929—"New Television Discoveries—How Revue could be seen from the Fireside—B.B.C. Service"—all in headlines; or the "Daily Mail," August 3rd, 1931—"Television in Colour—Test of New Invention—Pictures 10 ft. square—Special "Daily Mail" News—more headlines; or, again, in the "Daily Express" of January 2nd, 1931—"Cricket match watched 100 miles away?—Mass Scenes by Television Now—Vital New Step"). The public has been led to believe (implicitly, if not explicitly) that television of a standard at least approaching the home cinema film was available five years ago, and, of course, it wasn't. The whole thing has been hopelessly misrepresented to an easily persuaded public, and now it seems the genuine experimenter has to suffer by curtailment of transmissions.

I have seen it stated in a Sunday newspaper of recent date that the Baird engineers hope in the next few months to be able to:—

(1) *Transmit from their private experimental station at the Crystal Palace by the high-definition system everyday outdoor scenes observed in broad daylight as well as the present transmissions of studio programmes and films.*

(2) *Reproduce all these things on the full-size cinema screen. Here are two distinct problems:—(a) The home television receiver, and (b) some new form of cinema entertainment.*

Uses in the Cinema

If the latter is wanted, then no doubt the Baird Company, in association with Gaumont-British, will be able to look after its development. But it is not merely a question of linking up a number of cinemas on a circuit so that they all

W. G. W. Mitchell, J. J. Denton, L. H. Bedford & G. W. Walton

receive programmes by wire (even if that were possible !) or by ultra-short radio instead of by the easier and much less expensive system of distributing the programme by means of spools of film. The production costs of a " super " film would never allow of such distribution, and the use of television in the cinema seems to be limited to outstanding topical events. But possibly not to such an extent with the home television set ; here the problem of the moment is one of distribution. I do not believe that it is possible to go ahead right away with a scheme for servicing 75 per cent. of the population of this country with high-definition television programmes, and it should be remembered that those who live 30, 50 or 80 miles away from a large centre of population are the most interested class if topical events are to form the major portion of such programmes. It may be four or five years before this is practicable, as, besides the technical problems to be solved, there are other financial ones of erecting a large number of transmitters to serve different areas, each with its own programme ; but in the meanwhile, please, Mr. Chief Engineer of the B.B.C., let us know what is happening on these ultra-short wave lengths. The wireless amateurs in the past have certainly helped to make your broadcasting possible. Think more of the old " Writtle" days, and let the Postmaster-General's van look after " Pirate Transmitters."

Thirty-line Transmissions Daily

Summing up the present position, I would say : Let us have 30-line transmissions daily at 2,300 rather than 1,100, and let them gradually be replaced by high-definition pictures as these become technically possible. A start could be made almost at once using the same programme. And this, in my opinion, is exactly what the B.B.C. intends to do if only it can be brought home to them that they are justified in spending the money for such services.

From J. J. Denton, Esq., Hon. Sec. (Members) Television Society.

Wherever one mingles with the well-attended meetings of scientific and technical societies throughout the country, much surprise is expressed at the curtailment of facilities for television reception. This especially, as the B.B.C. has fostered and developed programmes which have proved so stimulating in spite of difficulties of reception, which include arousing the household after bedtime in order to experiment and help to justify the expense of the B.B.C. television transmissions. Surely, now, a better time can be chosen to suit experimentalists whose private time and expense is allied to the success of these transmissions.

Arresting Research

The fact of curtailment whilst so many desire to cooperate astounds all who are devotees of the subject, and interested enquirers wonder who is at fault in arresting progressive research so essential to the future of radio. The Friday morning service will be helpful to traders, yet it must seem hopeless to try and induce sales in the absence of sensibly timed transmissions.

From L. H. Bedford, Esq., Inventor of the Cossor Velocity-modulation System

I welcome your invitation to express an opinion on the attitude of the B.B.C. towards the 30-line television service.

Whilst the 30-line transmission has been an interesting and valuable experiment from many points of view, I think it is now beyond dispute that the future of television does not lie in the 30-line system, or any other system of low definition. Any exploitation of 30-line television as entertainment is not only itself certain to be unsuccessful, but is likely to create for television an unfavourable impression with the public.

Premature Exploitation

The responsibility of the B.B.C. towards the public and towards television has been emphasised freely in the press ; but is it not part of this responsibility to prevent the public being loaded up with apparatus which is both unsatisfactory from an entertainment point of view and likely to become obsolete, and to prevent the creation of the prejudice against television which would inevitably result from the exploitation of the 30-line system, or, indeed, from any other premature exploitation !

From this point of view it would appear that the B.B.C. policy of restricting the 30-line transmission merits the support of those who are most broadly concerned with the successful development of the television industry.

On the other hand, it is realised that the curtailment of transmission time is a rather serious blow to the 30-line experimenters. This is unfortunate, but it is difficult to see how the position could have been avoided, since the responsibility of the B.B.C. is not to any particular group of experimenters, but to the public in general.

From G. W. Walton, Esq., Inventor of the Scophony System.

The attitude of the B.B.C. towards television is a matter on which it is very difficult to express an opinion.

The B.B.C. is a public service and receives its share of broadcast licence fees for the purpose of providing broadcast telephonic entertainment, and no experimental work is justified except that directed towards improving that service. If a large proportion of the radio public wants television broadcasts, the B.B.C. may be justified in experimenting with television. If only a minority wants television, then only a proportionate part of the total broadcast programmes can be allocated to television, even if it is the duty of the B.B.C. to take up television. Telephonic broadcasting started in this country with about two hours programme per week ; why should television require more !

That, I believe, is the attitude of the B.B.C., and it is quite reasonable on the whole. Television, however, has to start under different circumstances, as it is compared with alternative entertainment, such as the cinema, telephonic broadcasts and the gramophone ; consequently it requires more push.

Public Support

Those engaged in the development of television contend that television will become the greatest form of entertain-

(*Continued on page* 228)

Recognising defects in television images

By ROBERT DESMOND

RELATIVELY few people taking up television reception know what standard of image they are likely to receive. It is unfortunate that there is such a dearth of photographic records of television images, which is no doubt due to the difficulty of taking such pictures and, when obtained, lack the psychological effect of movement which is such a great help in producing a satisfactory television image; in consequence one has no standard with which to make a comparison. It is probably true, however, to say that like sound broadcasting the reception of vision is, broadly speaking, not up to the standard of transmission. In Fig. 1A we have the reproduction of an ordinary photograph while Fig. 1B is that of the same photograph after it has been televised. These two reproductions will give readers a fair idea of what a 30-line television system can do, also some standard by which to judge their own results. It should be understood, however, that due to photographic difficulties there is considerable loss of definition.

Figs. 1A, 1B and 1C.—The first photograph shows the original picture which was televised. Fig. 1B is an actual photograph of the televised image. The third picture shows the image produced when the higher frequencies were purposely cut. As these are actual photographs of the received image they have suffered somewhat in reproduction.

Common Imperfections

Now let us see what imperfections may appear on the screen due to the receiving apparatus. First, however, we must realise that for a 30-line system as at present broadcast we require a frequency range of 12.5 to about 24,000 cycles per second, but owing to the fact that vision is radiated through a channel designed for sound we will only have to receive a band from 30 to 15,000 c.p.s., the 9,000 to 15,000 range only having recently been added according to a B.B.C. official statement.

It will at once be realised that speaking in the sound sense that a receiver must have plenty of " top " and " bottom " and that the commercial set which cuts off at 4,000 cycles so as to cut out interference of other stations will hardly do. If cutting of the " top " was its only fault it would give us a picture something like Fig. 1C; that is to say, very blurred.

Defects can be divided into two sections—electrical and mechanical. Taking electrical first, that of getting a negative image is most likely to be the first that a beginner will meet with. No illustration has been given of this fault as it is so easily recognised. We must all be familiar with the photographic negative in which the whites or high lights are black and vice versa. If the television image is of this nature for more than, say, 30 seconds, at the beginning of the transmission the phase of the signal must be reversed. If an audio-frequency transformer is being used anywhere in the receiving circuit it is only necessary to reverse the connections to one of the windings to produce a positive picture, which is very simple. But audio-frequency transformers are almost without exception very detrimental to good television results and their effects are discussed later.

Negative Images with R.C. Coupling

A negative image resulting from a resistance-capacity coupled amplifier is not so simple to correct, as a valve stage must be added or subtracted, or the form of detection altered. It should be noted that a positive image will be received if the detection is anode bend (bottom bend) followed by two amplifying stages and an output valve; anode bend followed by output valve and grid detection followed by one amplifying stage and output valve. In every case R.C. coupling must be used, the neon or similar lamp being in series with the H.T. supply and the anode of the valve.

When one comes to the Kerr cell a different treatment, however, can be applied. Fig. 2 is a very suitable output circuit for working such a cell and the image can be made either positive or negative by changing over the switch and at the same time re-adjusting Kerr cell potential for best results. The same principle may be applied to a neon or mercury glow lamp as shown in Fig. 3. The system, however, is not to be recommended as it is extravagant in H.T. current and the component values must be carefully worked out.

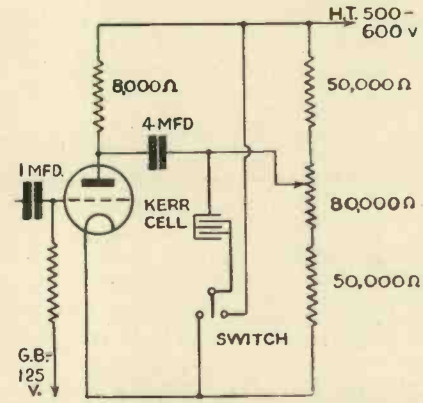


Fig. 1D (*left*).—*A type of distortion due to inductance in the circuit.*
Fig. 1E (*right*).—*A fault which is known as low-frequency flare.*
Fig. 2 (*above*).—*A circuit suitable for use in conjunction with a Kerr cell in which there is provision for reversal of the image.*

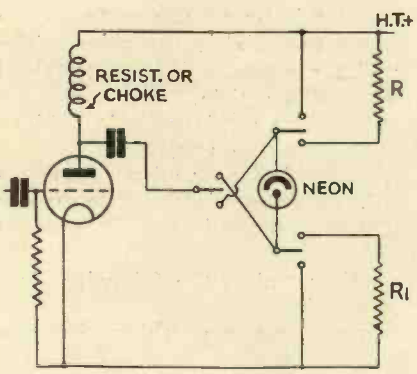


Fig. 3.—*A circuit suitable for use with a neon lamp. This also allows for reversal of the image from negative to positive or vice versa.*

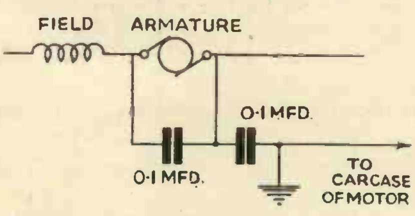


Fig. 4.—*This arrangement can be recommended for a motor of the universal type operated from A.C. mains.*

Phase Distortion

The commonest of all electrical faults is that of phase distortion which even the more advanced radio enthusiast has probably never heard of, let alone considered. Figs. 1D and 1E are of television images suffering from this defect. We will take each picture separately starting with 1D. Here the image is distorted by a white halo over the darker portions such as that of the mouth, nostrils, eyes and top of head. This halo appears to be due to a negative image which appears immediately after (the spot travels upwards) the main positive image, and while it is mostly noticeable on the extremes of contrast it is probably taking place with all the intermediate tones, producing a most curious result which in bad cases the writer has often been unable to distinguish from a positive or negative image even when rapidly changing the phases.

The cause of this type of distortion is usually due to inductance in the circuit such as in audio-frequency transformers, chokes and "tip up" or correcting networks of simple nature. Good quality intervalve transformers usually suffer from complete phase reversal within the frequency band required even for sound, so also do L.F. chokes though to a less degree. "Tip up" circuits which are so often included with excellent success in a sound receiver are quite hopeless for television reception owing to the introduction of phase reversal. Radio receivers in which transformers, etc., are used may often be improved by damping out resonances by the aid of resistances across the various inductances, though this, of course, will be accompanied with a reduction in signal strength. In resistance-capacity receivers this form of picture (Fig. 1d) is not often met with. In cases where it is present it is most likely due to feed back of post-detector frequencies, through insufficient de-coupling and more rarely to reaction and badly designed band-pass filters.

Flare

Turning to Fig. 1E, which is a televised photograph of a violinist on a white background, we have in this picture what is known as low-frequency flare. This is due to the phase distortion of the lower frequencies, say, from 25 to 150 cycles. Dark objects are topped with a white flare and vice versa. When watching, say, a dancer, they suddenly become more pronounced only to vanish again as the artist takes up a new position. What has happened technically is that the lower frequencies are generated more in one scene than another and in consequence are not always so pronounced.

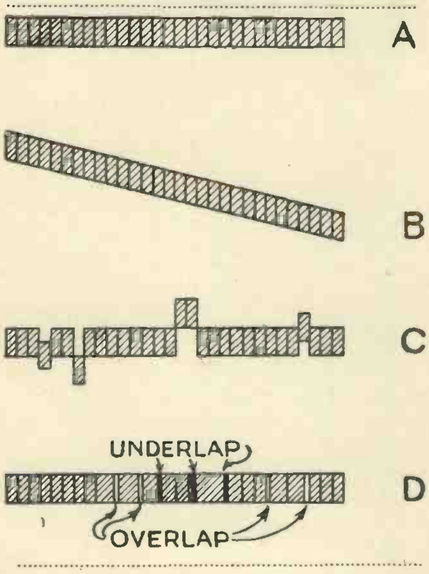


Fig. 5. — These diagrams show the defects due to bad angular, lateral and radial spacing of the scanning arrangements.

This form of distortion may appear in all receivers due to the values of the circuits attenuating the lower frequencies with accompanying phase distortion. In practice the principal cause of the trouble is too low an inductance in a transformer or choke, too small a capacity of the coupling condenser relative to the grid-leak and undesirable values of de-coupling circuits both in anode feed systems and automatic grid bias; the latter is not worth while for television reception.

The " soft " or out of focus effect of Fig. 1C as already pointed out is due to the lack of the higher frequencies of the post-detection frequencies which is a common fault in a large number of receivers. It may be due to too " sharp " or selective tuning of the pre-detector stages; excessive filtering of the radio frequence after detection; the Miller effect in the post-detection amplifying valves being excessive owing to too high an anode resistance; the anode load being shunted by capacity both in the case of resistances and transformer coupling; and finally to excessive stray capacities of the wiring.

The other common forms of electrical defects are those of interference. A heterodyne produces a fine moving mesh or grain over the picture, the lower the " het " note the coarser the grain. Insufficient smoothing from 50-cycle A.C. mains appears in the form of eight vertical shadows evenly spaced, slowly moving across the picture. If one is on the same mains as the transmitter at Portland Place the shadows will appear stationary. If only four shadows appear they are due to direct pick up from the mains.

Violent black or white spots are sometimes seen, often in such profusion as to blot out the picture. Such an effect is generally due to some electric motor. If due to the receiver's own motor the spots will generally appear stationary and the suggested cure is to clean the motor commutator and brushes; condensers may be put across the brushes with good result. Fig. 4 shows a recommended circuit for a universal motor running on A.C. Black and white spots moving across the screen are generally due to some neighbouring motor, which will readily suggest itself, such as a lift. Interference in the form of sudden short flashes may be due to atmospherics and the switching on and off of an electric circuit.

Double images are due to the reception of both direct and indirect waves and are rarely seen within a radius of 50 miles of the transmitter.

Mechanical Defects

Now we must turn to the mechanical side of the receiver. It is assumed that the motor can be run at the required speed of 750 r.p.m. The only mechanical defects which may distort a television picture are those of spot location. A straight line should televise as in A, Fig. 5, but by bad angular spacing it may appear as in, B and C or a combination of both. Inaccurate radial or lateral spacing produces white or black lines running vertically even when no signal is applied to the light source (see D, Fig. 5).

Inaccurate angular spacing can be clearly seen in Fig. 1D on the mouth at the junction of the 16th and 17th lines; the picture also is by no means free from black and white lines due to radial inaccuracies. The same holds good for all the reproductions of televised images used to illustrate this article.

With regard to cathode-ray receivers it is obvious that all the electrical defects will apply, while those due to the mechanical side of disc or mirror-drum receivers will not; it is, however, not intended to go into the various defects that may occur in spot location of such systems.

In conclusion, the writer makes the following suggestion for getting good pictures.

Don't use transformers for the post-detection frequencies.

Don't try to pass too much current through your neon lamp.

Don't run you Kerr cell at a higher voltage potential than necessary.

Use metallised resistances in preference to wire wound.

Use the largest de-coupling condensers you can afford.

The anode resistance should not be higher than the valve impedance.

As most distortion occurs in the post-detector amplifying stages the fewer the better; therefore an anode-bend detector followed by a pentode is good provided some 10 volts input are applied to the detector, not forgetting that H.F. resistance amplification is quite worth while.

An Experimenter's Notes

VIEWING THE IMAGE IN A MIRROR : MOTOR-CONTROL PANEL : A SYNCHRONISING TIP

No doubt many readers like myself, have to run their mirror-drum outfits in a fairly small room.

In my case, I found that I could not get far enough away from the screen, for the picture to appear even, unless I sat outside the door, in the passage!

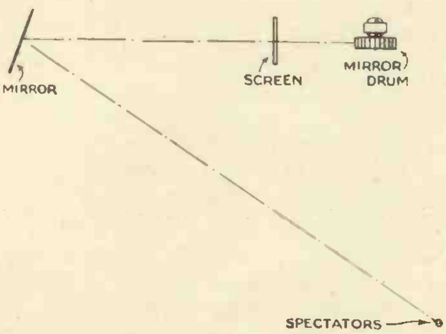


Fig. 1.—A mirror used as shown above will save space.

I got over the difficulty by placing a mirror about four feet in front of the screen and viewing the reflected image from the diagonally opposite corner of the room. If the drum is set for direct scanning the picture is, of course, reversed, but I have not found this a serious objection. The use of a mirror seems to add brilliancy and flicker is lessened (Fig. 1).

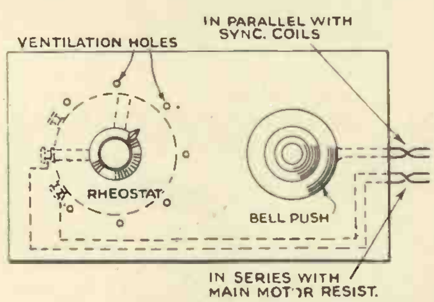


Fig. 2.—Details of a motor control panel.

Motor Control

To enable me to adjust the speed of the motor and correct framing I made the control panel shown (Fig. 2). This is connected to the apparatus by long leads so that it is unnecessary for me to move from my seat to make adjustments, except for framing and this should only be necessary at the start of the transmission.

The speed of the motor is regulated by the rheostat and by pressing the button of the bell-push the synchronising coils are shorted, allowing the picture to drift until framing is correct. On releasing the button the coils come into action again and the phonic wheel locks in step. The materials actually used in the control panel are an ordinary house-lighting double-switch wood block with a plywood back screwed on. The rheostat is an old Lissen potentiometer with the composition surrounding the resistance wire cut away, so as to expose the winding to the air for cooling. A few holes are drilled in the top and bottom of the wood block near the rheostat so that cool air can circulate. The main motor resistance is a 40 watt lamp covered thickly with black paint to stop any light being given off. To get the correct speed of the motor a neon lamp is placed close to the drum—which has eight spokes. This lamp is also painted black with the exception of a $\frac{1}{4}$ inch square facing the drum. This gives sufficient light on the drum without interfering with the illumination of the screen.

Synchronising

For a time I was troubled by the synchronising gear failing to hold the drum in step. This occurred at intervals—usually when the picture was a "close-up," and of course it became quite unintelligible.

It occurred to me that perhaps at times the impulses were too strong, causing the drum to be swung violently forward or back (although a filter is fitted)—the phonic wheel failing to get in step with the impulses, afterwards.

By putting a 10,000 ohm variable resistance across the primary of the transformer which couples the synchronising valve to the preceding valve and adjusting by trial I have quite got over this trouble. The pictures now keep in phase throughout the half-hour's transmission and remain almost dead steady.

When demonstrating to friends I place a card in front of the screen so that I can adjust framing and phasing unseen at the start. When all is correct I remove the card and a properly framed picture is seen on the screen. This, of course, impresses the audience more than if they saw a lot of meaningless lines drifting about or a chin resting on the top of a head!

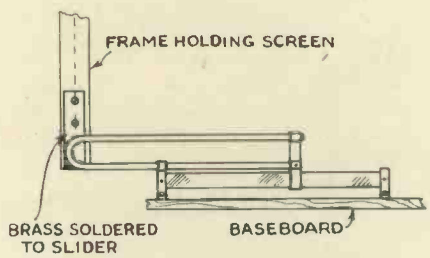


Fig. 3.—A cheap improvised focusing arrangement.

A cheap and efficient slide to enable the screen to be moved for focusing can be made from two 6d. store wardrobe hanger rails screwed upside down on the baseboard. A piece of brass is soldered to the end of each and drilled to take screws to hold the screen frame (Fig. 3).

By filling up the questionnaire on page 217 you will be helping the development of television.

A Television Society for South Wales

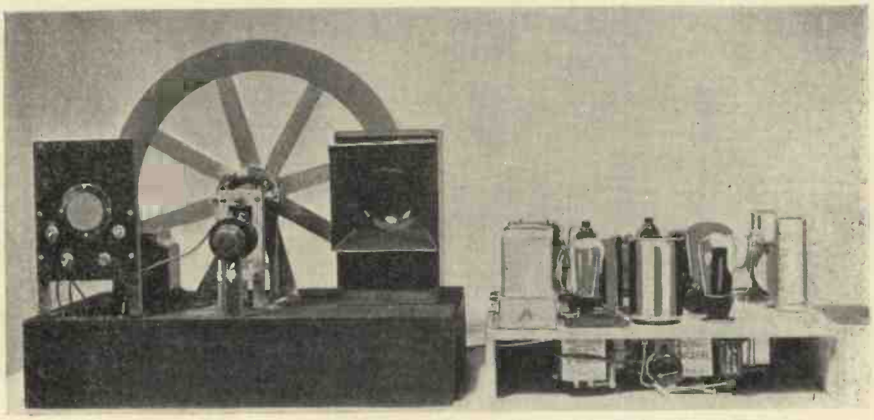
Readers residing in Cardiff and district will be interested to know that a society has been formed which is devoted to the development of television. Its title is the South Wales Television Society. Meetings are held every second Monday in each month. Applications for membership are invited and should be addressed to the Secretary, Mr. C. H. Tucker, 9 Splott Road, Cardiff (telephone 7746 Cardiff) from whom full particulars can be obtained.

A SET FOR SIMPLE TELEVISION

In the January issue of "Television" we described the Standard Television Receiver which was a high-class straight type of set capable of producing excellent modulating signals from the London National transmission. In order to make this set suitable for mirror-drum receivers, its output was large, the high-tension supply was in the neighbourhood of 500 volts and every precaution was taken to ensure an adequate frequency response.

The receiver that we present herewith is an attempt to provide a similar piece of

Many television receivers which have been published for the home constructor have had a limited range and have therefore been incapable of giving adequate modulation for visors which are situated a large number of miles from the National transmitter. For instance, people living in Devon or the North of England have often complained of unsatisfactory results.



This photograph shows the receiver connected to the Beginner's Visor described in the March issue of this journal.

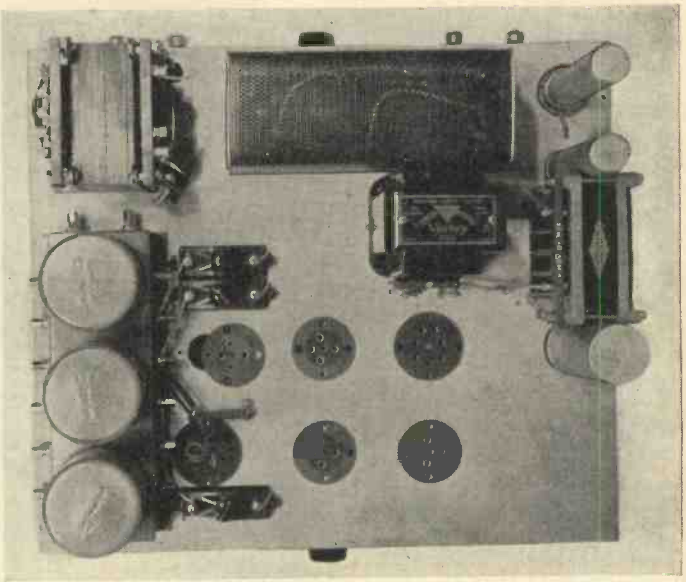
For this reason we decided to make the receiver a fairly sensitive job and have adopted a super-het circuit. There are quite a number of technical disadvantages attached to the use of such a circuit for television reception, the chief one being that the frequency response of the set is confined to the maximum band separation of the intermediate transformers. The use of band-pass filters in this position, however, ensures that the higher frequencies will be adequately reproduced up to the cut-off point, which in this case is 10 k.c. Allowing for the fact that the band-pass intermediates are not perfect and have not the much talked of square topped tuning curve, this should give a fairly high percentage response of frequencies in the order of 7,000 cycles.

This is by no means the maximum frequency transmitted by the B.B.C. in a television broadcast, but allowing for the fact that a disc receiver at its best cannot give perfect pictures, very good results can be obtained if the low-frequency response is of this order.

There is rather an erroneous impression amongst constructors that super-hets cannot possibly give good quality. With the use of band-pass intermediates, however, a distortionless second detector, and a carefully designed low-frequency amplifier, the super-het can be made to give just as good quality reproduction as any other type of receiver.

In order to provide a satisfactory compromise between cost, simplicity of construction and efficiency of results, a four-valve super-het circuit was decided upon for our disc television set. The first valve in the set is a heptode which combines the functions of first detector and oscillator. Actually this valve consists of a triode and a tetrode in the same envelope, the triode being used to produce the local oscillations which are necessary for the super-het system of reception. The tetrode part of the valve is used as the first detector.

The great advantage of the heptode over the use of separate detector and oscillator valves is that the mixing between the local oscillation and the incoming signal takes place inside the valve itself by means of what is known as electronic coupling. This arrangement gives a much more constant coupling from the local oscillator and tends to promote stability by obviating coupling leads from the oscillator coil to the first detector-anode circuit.



A view of the layout of the top of the chassis. This method of assembly ensures a very neat finish.

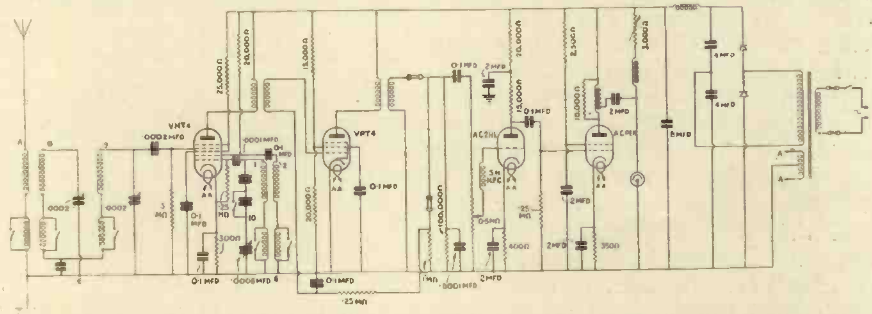
IN ANY PART OF THE COUNTRY

apparatus to this, but built on slightly more economical and less ambitious lines suitable for modulating the neon lamp of the recently published "Daily Express" television receiver, or any similar disc visor. In order to make the cost of the set compatible with the price of a disc visor various little refinements have been omitted, but care has been taken to see that no essentials, which would materially affect the functioning of the set, have been overlooked.

This first valve is preceded by a band-pass filter tuned to the radio-frequency that is being received. This circuit is arranged to be reasonably flatly tuned thus avoiding excessive peaking of the overall tuning curve with consequent low-frequency attenuation. At the same time the presence of the filter eliminates second channel interference to a large extent and generally "cleans up" the signal.

The Circuit

A four-valve superheterodyne circuit is employed. Good frequency response is ensured by the use of diode detection. Note the provision of a second diode for automatic volume control.



Preset Tuning

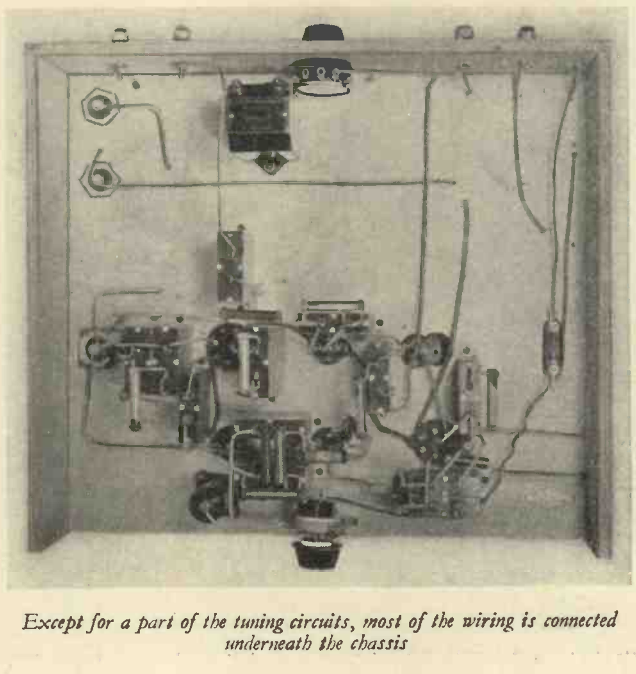
You will notice that the usual triple-gang condenser has not been employed to tune the band-pass and oscillator circuits. Instead small preset condensers have been utilised. This results in a saving both of cost and space. No disadvantage is attached to this move if reasonably stable preset condensers are utilised as the set is only required to tune to one station—the London National. Once the set is correctly tuned for the reception of this station the preset condensers need never be altered except for an occasional check to ensure that their capacity has not changed due to springing of the plates inside the condenser.

Only one stage of intermediate frequency amplification is employed, a variable-mu high-frequency pentode being used. This type of valve has an advantage over a straight screen-grid valve in that it is fitted with a suppressor grid connected to the cathode of the valve which promotes stability of operation. In the anode circuit of this valve is the second intermediate transformer, which is also of the band-pass type.

As will be seen from the circuit diagram diode rectification is employed. One of the new W6 Westinghouse metal rectifiers is used in this position. The main reason for the use of a diode as the second detector of a superhet is that it is linear in operation, and can handle a very large peak voltage input without giving rise to distortion due to overloading.

The second Westector is used for a process of automatic volume control, the control voltage being built up across the 1-megohm load resistance. This voltage is fed back via a de-coupling circuit of ¼-megohm and a .1-microfarad condenser to the low-potential end of the secondary of the first intermediate frequency transformer.

Thus when a fairly strong signal enters the second detector a voltage will be developed across the automatic volume control load resistance which will be applied as negative bias to the variable-mu intermediate frequency valve. The effect of this arrangement



Except for a part of the tuning circuits, most of the wiring is connected underneath the chassis

COMPONENTS REQUIRED FOR TELEVISION RECEIVER.

CHASSIS
1—Peto-Scott Metaplex 16 in. × 14 in. × $3\frac{3}{8}$ in.

CHOKE, HIGH-FREQUENCY
1—Wearite, type HFS.

CHOKES, LOW-FREQUENCY
1—Varlev Pentode output, type DP9.
1—Varley Nichoke II, type DP23.
1—Parmeko 30 henry 50 milliampere.

COILS
1—Set of wearite, type GN3.

CONDENSERS, FIXED
3—T.M.C. Hydra, type tubular values: 0001-(2),.0002-microfarad.
12—T.M.C. Hydra, type 25 values: .1-(7), 2-microfarad (5).
3—Dubilier, type electrolytic, values: 4-(2), 8-microfarad.

CONDENSERS, VARIABLE
3—Goltone .0003-microfarad maximum, type preset.

HOLDER, FUSE
1—Belling Lee single complete with 1-ampere fuse.

HOLDERS, VALVE
6—Clix, type chassis mounting, four-pin (2), five-pin (2), seven-pin (2).

RESISTANCES, FIXED
17—Erie, type 1-watt, values: 300-, 350-, 400-, 2,500-, 10,000-, 15,000-(2), 20,000-(3), 25,000-, 100-000-ohm, $\frac{1}{4}$-(3), 1-, 3-megohm.

RESISTANCES, VARIABLE
1—Erie, $\frac{1}{2}$-megohm with switch.
1—Claude Lyons 3,000-ohm, type M3.

RECTIFIERS
2—Westinghouse, type W6.
1—Westinghouse, type HT8.

SUNDRIES
1—British Radiogram 2 in. metal mounting bracket.
Connecting wire and sleeving.
4 yd. thin flex.

TERMINALS
4—Belling Lee, type M, marked: Aerial, Earth, red, black.

TRANSFORMERS, INTERMEDIATE-FREQUENCY
2—Wearite, type OT1, OT2.

TRANSFORMER, MAINS
1—Savage, type Massicore for HT8 with 2-0-2 volt, 4-ampere filament winding.

VALVES
1—Ferranti VHT4.
1—Ferranti VPT4.
1—Mazda AC2HL.
1—Mazda ACPen.

is obvious. A strong signal will cause a larger bias to be applied to the intermediate valve than a weak signal. Thus, the intermediate stage will amplify the weaker signal to a much greater degree than the stronger, and the effect will be to produce a steady output regardless the level of the aerial input. This arrangement is specially useful to listeners in remote parts of the country, as the National transmitter is rather subject to fading, which would cause a varying intensity of the picture that is being received.

You will notice that the Westinghouse rectifiers used are not the very latest low-capacity ones, type WX6, but are the older W6's. This is because the WX6 cannot safely pass a current of more than 100-microamperes, and this would necessitate a load resistance of at least $\frac{1}{4}$-megohm on the rectifier that is used for detection. In the interests of frequency response, however, it is inadvisable to use a load resistance of more than 100,000-ohms and for this reason we have used the W6. If we were dealing with broadcast frequencies it would be necessary to use the lower capacity WX6 rectifier, in order to obviate the effect of the load thrown back on the tuning coil, but at intermediate frequencies this loading is negligible.

The output from the rectifying stage is taken via a

The completed receiver is compact and is sure to be most effective.

$\frac{1}{2}$-megohm volume control potentiometer to the low-frequency amplifier. The latter is of quite simple design and consists of one medium-gain stage, resistance-coupled to the output pentode. In the grid circuit of the first low-frequency stage you will notice a high-frequency choke. This is of the super-het type and is used to prevent stray intermediate frequency signals getting through into the output stage and causing low-frequency oscillation and distortion.

The resistance in the anode circuit of the first low-frequency amplifier is reasonably low, being little greater than the impedance of the valve. Although this arrangement does not allow the valve to give its full amplification, it prevents undue high-frequency attenuation, the retention of the higher frequencies being more important than overall amplification in a set of this description. For a similar reason the coupling condenser and grid leak have been given reasonably low values, but care has been taken to see that these values are not such as to decrease, to any perceptible extent, the lower frequencies.

The pentode output valve is choke-condenser coupled to the neon lamp, which provides the picture lighting. It would have been better in this case to have used a resistance of about 5,000 ohms as an anode load for the pentode, in order to prevent high-frequency loss due to the self-capacity of the windings of the output choke. Had a resistance been used in this position, however, the voltage drop caused by the anode current of the output valve would have necessitated a total high-tension voltage in the neighbourhood of 400 volts.

Accordingly we have compromised by using an output choke of reasonably low self-capacity and putting in parallel with this a limiting resistance of 10,000-ohms. This has the effect of keeping the impedance of the output load reasonably constant and preventing distortion in the pentode stage, by over-accentuation of the higher frequencies.

Besides the modulating voltage, the neon lamp has to be fed with a steady D.C. potential in the neighbourhood of 180 volts to cause it to light up. This is obtained from the high-tension supply of the set, via a variable resistance of 3,000 ohms.

In series with this resistance is a low-frequency choke, the function of this component being to prevent a partial short to high-tension positive of the modulation frequencies supplied by the output stage of this set.

A useful function of the metal rectifier as second detector, which we have not already mentioned is that the phase of the modulating signal can be changed merely by reversing the connections to the Westector, thus, should a negative picture appear on the screen of your televisor it is only necessary to reverse the connections to the Westector to obtain the required positive image.

The Stixograph and Scophony

By the Inventor, G. W. Walton.

In this, the third article on the Stixograph, the quality of reproduced normal pictures is analysed. It is explained that the quality equals pictures produced by normal optical means. The relation of pictures to time and motion is explained graphically using the Stixograph, and the pictures of the ordinary cinema are analysed and compared with the new Stixograph cinema film.

HAVING now shown that a Stixograph can be produced and reconverted, it is necessary to show that it is in every way equivalent to a normal picture. There are many, particularly those familiar with ordinary optics, who are of the opinion that dividing a picture into strips must greatly reduce definition. As this is an optical criticism, we will deal with it in an optical way.

We have all heard of the wonderful acuity of human vision, put by some as one minute of an arc. This estimate was for a stationary object and an eye held as stationary as possible. Rather an absurd way of estimating, for we have more interest for moving objects than for stationary, and to hold the eye stationary at a fixed focus requires such an effort of will power, that few can maintain it for more than a second. It is against all our habits and instincts of searching a scene. Should the object move or the eye swing, change focus or pupil size, then during these movements the definition is something like one-tenth of the extreme acuity.

All this is mentioned because many think a picture subtending usual angles of view should consist of over 1,000 strips. Whilst this is true for a picture which is to be scrutinised, it is not true in normal viewing of natural scenes containing moving objects which compel the eye to swing and change focus and pupil size. Two to three hundred strips are ample in such circumstances.

Definition

Definition in ordinary optical images is generally measured in terms of the "minimum circle of confusion." This depends chiefly on lens aberrations, the chief of which are longitudinal, chromatic, astigmatism, inaccuracies of the optical surfaces and the nature of light itself.

Visible light consists of small but measurable wavelengths and Lord Raleigh has shown that the focus of a converging pencil of rays is that region where the rays are within one-quarter of a wavelength of each other, i.e., phase differences do not exceed 90 degrees. In some cases the focal region of a pencil of rays is quite large; for instance when the pencil is only a small cone. The focus also has appreciable size transverse to the direction of light travel for exactly the same reason. It is quite safe to say that a perfect lens cannot focus an image of an object point as a point, but only as a more or less circular area of light consisting of a central condensation of highest intensity surrounded by an area the intensity of which decreases with increasing distance from the centre. This area, which is the image of a point, is known as the Airy spurious disc and its size can be calculated for any wavelength of light at a given maximum angle of convergence of the light rays.

There is another measure of the capabilities of a lens which follows from the fact that an object point is focused as a luminous area, and that is the angular separation between two object points necessary for their images to be seen as separate. The least angular separation resolvable is inversely proportional to the aperture of the lens, and for a perfect lens is about 11 seconds of an arc for 1 cm. diameter of lens. The Airy spurious disc is also inversely proportional to the aperture of the lens and for a cone of light at $f/_1$ (which is about 53 degrees) the diameter of the disc is about one and a quarter microns for a perfect lens.

A good lens therefore is subject to certain defects in definition, which can be taken as an average over the desired field of view and expressed as the diameter of the luminous area, which is the image of an object point, and includes all the defects mentioned. This is not, however, a measure of definition from a picture point of view, as it corresponds only to a point of the object.

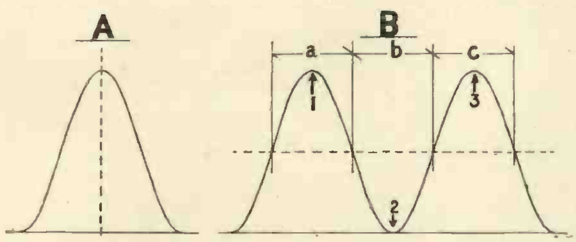


Fig. 17. The distribution of light intensity across details.

Distortion

From the above we see that even a perfect lens distorts a picture, for a point is focused as an area, and therefore there is a distortion of size and light intensity. Obviously, we are not interested in object points which cannot appear as points in the image; what is required from a picture point of view is that the minimum size of detail in the object which can appear in the image without appreciable distortion of size or light intensity. The ordinary optical measures of definition do not give any indication of this.

The average 35 mm. positive film has a minimum detail size of .05 mm. which is $\frac{1}{380}$ of the vertical height of the picture. As projected on to a screen, variations of location in the gate of successive frames reduces this definition to about half that value, i.e., $\frac{1}{190}$ of the vertical height. Motion in the recorded scene still further reduces definition on the film, but we can ignore this and give normal optical images the benefit.

A picture consisting of close-fitting strips (without overlap or separation of the strips, such as would be obtained by converting a Stixograph) will be equal to a cinema picture of the same ratio, when the minimum size of detail throughout the picture is the same in both cases, and the details can occupy any position in the picture. In an optical image, the minimum detail is roughly circular in shape, and the light intensity is approximately as shown in Fig. 17A. In a strip picture, the minimum detail would be more of a square shape, the light intensity in the direction of the length of a strip would be as shown in Fig. 17A.

The square detail would at a correct viewing distance appear more circular to the eye, and would correspond to a circular detail having a diameter of 1.13 times that of the square. The measure of the size of the detail would not be taken over the whole of Fig. 17A for it may include light from adjacent details.

Fig. 17B shows two bright minimum details 1 and 3 as close together as they can be without merging. The detail 1 can be taken as the size *a*, and 3 as *c*. Between 1 and 3 is really another detail 2 which is dark and has the size *b*. *a*, *b* and *c* are equal, if they are all minimum details, and they are at the minimum separation possible without distortion by merging.

It will be noted that there is no sharp line of demarkation between the adjacent details 1 and 2, so the end of 1 and the beginning of 2 is taken as being at that point where the light intensity is a mean between the maximum intensity of 1 and the minimum intensity of 2. Fig. 17B is a real measure of definition, in that it does not deal with images of object points, but with images of object *areas*, which are not distorted but represent accurately, for all practical purposes, the original object.

It will be admitted that in the length of a strip, definition will be precisely the same as in any optical image, so that what has to be ascertained is that width of a strip which will give equal definition without any limitation of positions of details in a direction across the strips. Before a picture is divided into strips, it will usually be focused optically as an image, and therefore the minimum detail of the latter will be the same size across the strips as in the direction of the length of the strips.

In Fig. 18 one minimum detail is shown as an intensity graph, falling in different relations to the strips. The minimum detail is taken as being 1.5 times the width of the strips, in *A* the detail falls centrally on one strip, in *B* equally in two strips and in *C* one-third in one strip and two-thirds in the next strip. A_1, B_1 and C_1 show the respective integrated intensities in the strips such as would be the illumination of the laminations of an echelon at the exit surfaces.

These strip intensities viewed by a lens, having all the limitations of a lens, would project details having the resultant respective distributions of light intensity shown by the solid curves A_2, B_2 and C_2. A_2, B_2 and C_2 are satisfactory representations of *A*, *B* and *C* respectively, and, what is more important, they have the same relative positions in the picture. Dividing the picture into strips has not reduced the definition appreciably, nor has it displaced details, from which it will be obvious that a strip picture, and therefore a Stixograph, is in every way representative of an original picture and has practically the same perfection as a normal optical image having the same minimum size of detail.

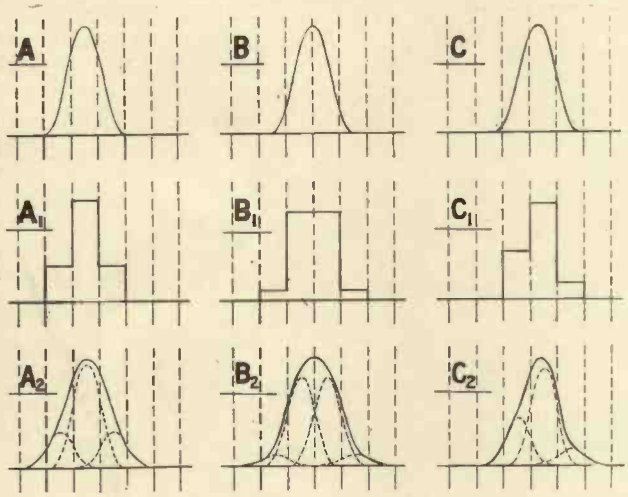


Fig. 18

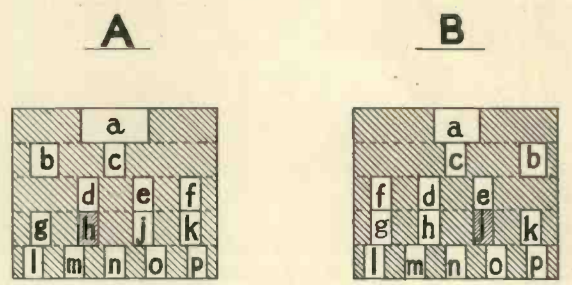


Fig. 19

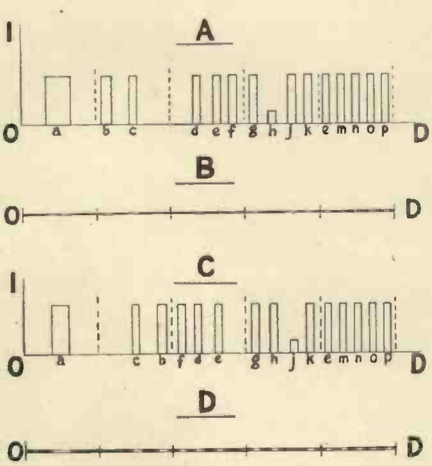


Fig. 20

Fig. 18 *Diagram showing that the dividing of a picture into strips does not limit the position of details in a direction across the strips.*

Fig. 19 *Synthetic picture to show the feature of any normal picture.*

Fig. 20. *Graphs of the diagram shown by Fig.* 19.

Fig. 21. *Time-position size graph of Fig.* 19.

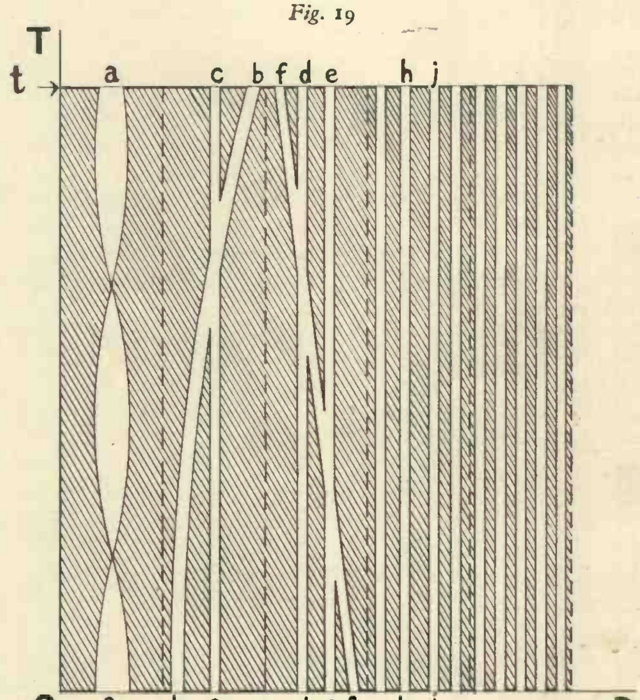


Fig. 21

It follows, therefore, that a strip width should be about two-thirds of the diameter of the minimum detail of the picture required. Taking the cinema picture on the screen as having a minimum detail of $\frac{1}{180}$th of the height of the picture, the strip width becomes $\frac{1}{270}$th of that height, or 270 horizontal strips. This is rather a high figure and would give generally a better picture, particularly of moving objects, than the average cinema.

It was previously stated that the modern arts dealing with pictures involved "time." To visualise what this means requires graphical illustration, which is impossible using normal pictures, but having shown that a Stixograph is equal in every way to a normal picture, we will put it to work the picture after an interval of time *t*. At time *t* we will presume that the detail *a* of strip one has done one and one-eighth revolutions, the left centre detail *h* of strip four has increased its intensity to four times what it was at *T*=*O*, and right centre detail *j* has decreased to a quarter of the intensity at *T*=*O*. Using the top left-hand corner of Fig. 19A as a point of reference, a Stixograph may be formed of the picture and a graph can be made showing the light intensity at any distance from the point of reference as shown in Fig. 20A.

It will be noted that Fig. 20A shows intensity, size, and distance from the reference point *O* of every detail in the *D* is given for every point of *T*, e.g., the detail *a* in the first strip of the picture which is rotating and is therefore a sinusoidal variation between the maximum size shown Fig. 19A and zero, and in the time *t* it has zero size twice.

Fig. 21 is important, so the information it gives about the picture Fig. 19A and how that picture changes into Fig. 19B in a period of time *t* should be precisely determined. The items of information are :—

a. The position of any detail in the picture, shown as the distance in *D* from the reference point *O* at any and every instant of time. Mark well, there is no intermittency, so that Fig. 21 is a true

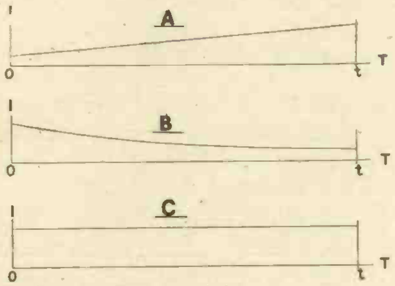
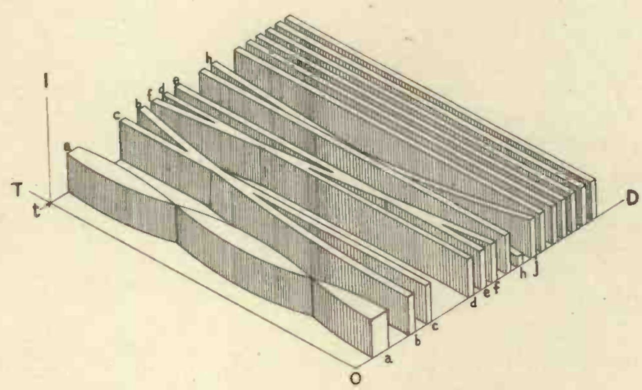


Fig. 22 (left) Time intensity graphs of details.

Fig. 23 (right) Three-dimensional graph showing times, position, size and intensity of Fig. 19.



at once so that pictures in relation to time and motion can be accurately studied.

For the sake of simplicity, we will take a picture of only five strips, and so that the strips may be recognised they can have 1, 2, 3, 4 and 5 large details in order from the top strip, as shown in Fig. 19A. A normal scene would have its details changing size, position and light intensity with time, so these variations can be portrayed as follows :

The detail *a* in strip one is a rectangle rotating on a vertical axis, so that it changes its size. The left-hand detail *b* of strip two moves to the right of the picture with an increasing speed. The right-hand detail *f* of strip three moves to the left at a uniform speed. The two centre details *h* and *j* of strip four are changing intensity, the left one *h* increasing and the right *j* decreasing. The details of strip five are constant. This is really not complete, for only horizontal motion is shown, vertical and diagonal motion at constant and varying speeds will be introduced later.

Fig. 19A shows the appearance of the picture at *T*=*O* where *T* is time, and Fig. 19B shows the appearance of picture. If size and distance from *O* only are given, Fig. 20B will represent Fig. 19A. Similarly, Fig. 20C shows intensity, size and distance from *O*, and Fig. 20D size and distance from *O* only, of Fig. 19B, the picture after an interval of time *t*.

To introduce time, it is necessary to show graphically all variations of size and distance from *O* of the details during a time interval of *t*. This can be done by taking as co-ordinates *D* and *T* in Fig. 21. At *T*=*O*, Fig. 20B will represent the size and position of details in *D*, and at *T*=*t*, Fig. 20D shows the changes of size and position that have occurred. By filling in between *T*=*O* and *T*=*t* the instantaneous pictures similar to Figs. 20B and 20D, the complete story of the types of changes will be given as is shown in Fig. 21, where the light bands are the tracks of the details in time.

If a detail does not change its position then its track will be parallel to the *T* co-ordinate, e.g., all the details except *b* and *f*; if it moves, then its track will be compounded of *T* and *D* values, and will not be parallel to *T*, e.g., the details of *b* and *f*. Should a detail change size in time, then the width of the track will change, so that the size of the detail in and complete time-position graph for any detail.

b. The size of any detail in the picture shown as a distance in *D* at any and every instant of time. Again no intermittency, so Fig. 21 is a true and complete time-size graph for any detail.

c. The items (*a*) and (*b*) of any detail are shown simultaneously and continuously without any interference.

d. The items (*a*) and (*b*) of *every* detail in the picture are shown simultaneously and continuously without the slightest interference.

e. As previously shown, for a predetermined definition of picture, the Stixograph is equivalent to a normal picture image, therefore Fig. 21 is a true simultaneous time-size-position graph of the original picture. A similar graph can be obtained for any scene, picture or image.

One more item of information about each detail is required in addition to what is given by Fig. 21, and that is for a monochrome picture, the light intensity and variations thereof with time. The light intensity of the detail *h* increases from what it is in Fig. 19A to four times that value in Fig. 19B in a period of time *t*. If a graph having as co-ordinates *I* and *T* is made, it will appear as in Fig. 22A, presuming the change is uniform and continuous over the period of time *t*.

Similarly the detail *j* has its light intensity reduced over the same period of time, and presuming the change is continuous but at a reducing rate of change the *I*—*T* graph will be as shown in Fig. 22B. A similar graph of a detail which does not change its ligh intensity would be as in Fig. 22C and would consist of a line parallel to the *T* axis. Any variation of light intensity for any detail can be shown in the same way.

So far the relations of *I* to *D* at instants of time are shown in Figs. 20A and 20C, the relations of *T* to *D* at a common intensity are shown in Fig. 21, and the relations of *I* to *T* at one particular value of position (i.e., one detail) are shown in Fig. 22. Only two co-ordinates have been used in any one graph of the three co-ordinates *I*, *T* and *D*; to use the three a three-dimensional kind of graph is required, which, of course, would be solid.

Such a graph can, however, be portrayed as a perspective drawing, such as Fig. 23, which is a combination of Figs. 20A, 20C, 21, 22A, 22B and 22C. In Fig. 23 at $T=O$ a plane containing the *I* and *D* axes would show Fig. 20A and a parallel plane at $T=t$ would show Fig. 20C. A plane containing *T* and *D* with *I* at a small value, would show Fig. 21 and any parallel plane a similar graph at some other value of intensity. A plane containing *I* and *T* at $D=O$ would be an intensity-time graph for a detail at *D*—*O*, which would be similar to those shown in Fig. 22, or any parallel plane would show such a graph for some other detail at a different position along *D*.

Fig. 23 shows the following items of information in addition to those enumerated in connection with Fig. 21:

1. The light intensity of any detail, no matter how it changes its position in the picture at any and every instant of time. This is without intermittency or integration over any period of time, and is therefore a true time-intensity graph of a detail.

2. The light intensity at any point in the picture at any and every instant of time, and this is shown also without intermittency.

3. The light intensities of every point or detail in the picture is shown at any and every instant of time, no matter how those intensities may change with time or change position in the picture, and there is no intermittency and no interference of intensities, positions, sizes, or times whatever.

From this it will be seen that Fig. 23 is a true and complete portrayal of an animated monochrome picture over a period of time, and is, in fact, an arrangement of non-interfering graphs covering simultaneously the whole of a picture and the changes taking place as an animated picture.

In Fig. 19 to 23 motion across the strips was omitted, but it can be shown in the same way and quite as accurately. It will be evident to all that a detail moving in a diagonal direction in Fig. 19A has one component of movement along the strips, which will be shown in the same way as the details *b* or *f* in Figs. 21 and 23. The other component of diagonal movement will be across the strips in a direction at right angles to them.

A detail moving across the strips can only appear as changes of light intensity, for in the Stixograph there is no definition in that direction, and the detail size corresponds only to the size of the

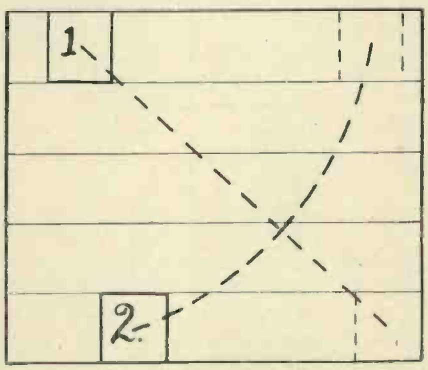


Fig. 24. Diagram showing diagonal movements of details.

original picture detail along the strip. This being so, if only part of the detail is in a strip, then it appears as the same size of detail at a lower light intensity. This feature will be more readily understood by reference to Fig. 18, where the light intensity of the detail in one strip epends on the amount of the detaild falling in that strip, and obviously if the detail moves across the strip, say taking successive positions *A*, *B* and *C*, the light intensity of corresponding Stixograph details will be A_1, B_1 and C_1 respectively. The changes of intensity due to movement of a detail at right angles to the strip corresponds to the details *h* and *j* in Figs. 19 to 23.

Fig. 24 shows various movements across the strips of the picture, and having a component of movement along the strips, the centres of the details moving along the dotted lines. The detail 1 moves in a straight path, and if the speed is uniform, movement along the strips will correspond to the detail *f* in Figs. 19 to 23; if the speed changes then the movement along the strips will correspond to the detail *b* in Figs. 19 to 23. The detail 2 in Fig. 24 follows a curved path, and with a uniform speed, movement along the strips will correspond to the detail *b* in Figs. 19 to 23. If the speed of detail 2 in Fig. 24 is not uniform, with a particular characteristic of speed change, movement along the strips would correspond to detail *f* in Figs. 19 to 23, and for all other characteristics of speed change, movement along the strips would correspond to detail *b* in Figs. 19 to 23.

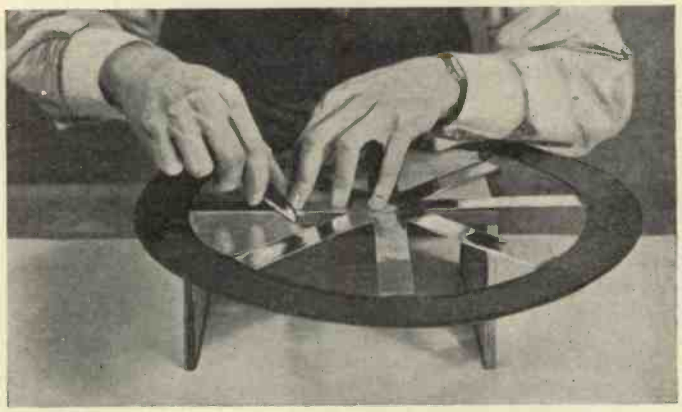
It will take less than five minutes to fill up the Questionnaire given on page 217 of this issue.

When comparing one television system with another be careful to make full allowance for the nature of the subject; it is most difficult to make a true comparison unless the same subject is shown on each system.

The fluorescent screen at the end of the cathode-ray tube is usually coated with "willemite" which is a natural form of zinc silicate. This gives a brilliant green fluorescence under electron bombardment. If a blue-white fluorescence is required cadmium or calcium tungstate is used. For television work the green screen is not such a disadvantage as might be supposed, since the colour is soothing to the eye and there is a slight trace of "afterglow" which tends to prevent harshness of contrast in the picture. With high-definition scanning, of, say, 120 lines, it is of importance to have instant response from the screen and no trace of persistence of fluorescence, which would blur rapidly-moving objects.

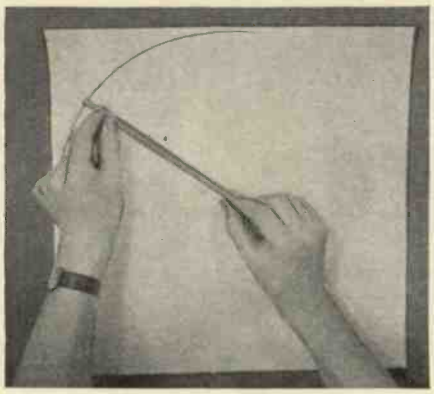
Intensity modulation is used almost exclusively in continental television; when experimenting with this system don't forget that some tubes will modulate quite well using the gun instead of the shield.

A SIMPLE METHOD OF MAKING A SCANNING DISC



The spokes can be cut out with a sharp knife if the portion to be cut is rested along the edge of a piece of wood.

INSTRUCTIONS for setting out and punching a scanning disc have been given on several occasions, but the methods described have either relied upon accurate use of drawing instruments or some sort of rather elaborate jig which had to be specially constructed and usually required more work putting into it than the actual making of the disc. In the method about to be described a jig is certainly used but this is of a particularly simple character and can be rigged up in a few minutes from materials that are readily available.



This photograph shows how the trammel is used to scribe the disc and the radial positions of the scanning holes.

A scanning disc to be effective requires to be made with great accuracy, for the scanning holes are only .02 in. square and if an even screen is to be produced succeeding holes must exactly cover adjacent areas as the disc is revolved. Obviously, errors, if there are to be any, must not exceed a matter of a couple of thousandths of an inch and it is no easy matter to ensure this when working over such a comparatively large area as a scanning disc.

The size of the punched holes in a scanning disc varies according to the diameter of the disc, and the size given above is for an outside diameter of sixteen inches which has now come to be accepted as the most convenient. Compared with, say, a 20 in. disc the picture is very little smaller and the size of the complete machine is much more convenient.

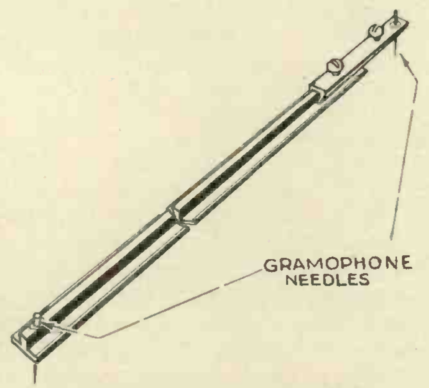
Metal for the Disc

The first requirement is a sheet of aluminium 17 inches square and of No. 32 gauge. This gauge may seem rather thin, but it is the most suitable thickness as its flexibility allows the disc to straighten out perfectly flat when revolving. The approximate centre of the metal is found by lightly scribing lines across from opposite corners. It is now necessary to place this on a flat wooden surface so that the scribing can be carried out and it is important that this surface should be reasonably true.

Setting Out

The scribing is done with the home-made tool shown by the sketch and in the photograph; it will be seen that this consists of a length of dovetail brass curtain rod and one of the joint pieces which can be purchased from any Woolworths Stores. Through one end of the rod a hole is drilled and in this a gramophone needle is inserted and fixed by soldering. Another needle is inserted in a hole drilled at one end of the joint piece, and it will be apparent that here we have a trammel which can be adjusted with a great degree of accuracy by moving the sliding piece along and securing by means of the set screw. If desired a scale can be scratched on the long bar to indicate the amount of movement necessary for the scribing of each hole. As the largest radius required is 8 inches the length of the rod can conveniently be 9 inches, and after the periphery of the disc is scribed the pivot needle can be inserted further along the rod. The innermost scanning hole is 6⅞ ins. from the centre and this should be the distance between the two needles when the sliding part is closed right in.

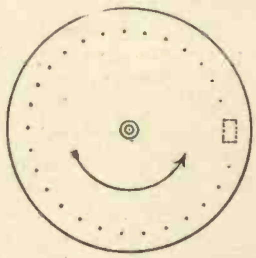
Before the scribing is commenced the pivot needle should be driven through the aluminium sheet and well into the board underneath and after this it should not be removed until all the scribing is completed. It is, in fact, an advantage to lightly tack the metal down to the board at the corners which, of course, will eventually be cut off.



A sketch of the simple adjustable trammel used for marking out the disc.

There is no purpose in scribing the lines for the scanning holes completely round so it is as well before marking these to divide the disc up into thirty parts with radial lines drawn through the centre. The thirty divisions can be set out by stepping the radius round the circumference, and in order to do this and avoid removing the trammel a pair of compasses can be used or an improvised trammel be made from a strip of wood with needles driven in at each

A suitable punch can be made from a short length of steel filed to the shape shown above.



This diagram shows the spiral arrangement of the holes in the disc.

end the correct distance apart. When the six divisions are obtained it is an easy matter to divide each of these into five by trial and error. Alternatively a protractor can be used, though if accuracy is to be obtained this must be fairly large.

With the disc divided into thirty sections the scanning hole positions can be scribed, and it is important to decide in the first place what position the holes should occupy with respect to these so that there will be no possibility of punching some of the holes on one side of the line and some on the other.

Punching the Holes

There now remains the punching and the cutting out of the disc. For the former purpose a square-ended punch will be needed which can be filed up from a 2-in. length of silver steel. The shank of a broken drill will make an excellent punch, the main consideration being to get the end quite square and with sharp corners.

The actual punching should be done upon a piece of lead, or the end grain of a block of close-grained hard wood. A few trial holes should be made in a piece of scrap metal before operations are commenced on the disc. It will be found that for the best results a very light smart tap with a light hammer is necessary, the punch being held quite firmly as the blow is struck. As each hole is punched the metal must be moved to a fresh position on the block: failure to do this will result in a jagged hole being produced. If there is any burr left on the under side this can be removed with a sharp knife.

Fitting the Boss

The cutting of the central hole to take the boss requires considerable care. First of all the size of hole required should be scribed and the hole made in the first instance should be smaller than this, after which the surplus metal can be cut away by the careful use of a round file, the disc being supported on a block of wood with a hole in it to provide a backing. The holes for the securing screws can be punched or drilled with the boss in position as a guide and the holes enlarged slightly afterwards.

The disc can be used plain but it will be found better to provide it with spokes as this will give it greater flexibility, and if eight spokes are made these will provide the stroboscopic effect so useful in determining the correct speed when viewed by the light of a lamp operated from 50-cycle A.C. mains. This means that eight triangular pieces will have to be cut out, which is quite a simple matter if the disc is supported on the edge of a piece of wood and a sharp knife used for cutting in the manner shown by the photograph, holes having been previously punched at each corner of the segments which are to be removed. The

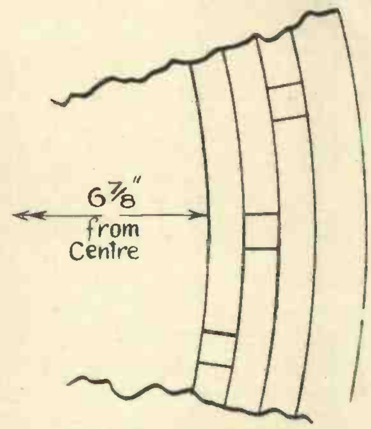


Diagram showing the radial positions of the holes.

width of the spokes can be approximately 1 inch, and the lines for cutting should be scribed in the first place, for it is important that each spoke should be the same width in order that the balance of the disc may be preserved.

Finally, that part of the disc through which the scanning holes are punched should be blackened, and it will be found that the spirit stain sold for staining leather will be very suitable for this. Made in the manner described the disc will be highly satisfactory, but the need for absolute accuracy is strongly stressed.

Okolicsanyi on Synchronising

THE sweep circuits for synchronising lines and pictures represent an unnecessary complication of present-day receivers. The remedy is to use one sender having a frequency of 40 Mc. for the transmission of the picture proper (which requires a band 0.5 Mc. wide when there are 180 lines and 25 pictures), and a second sender having a frequency of 42 Mc. for carrying the sound and the two sawtooth waves for bringing pictures and lines into place. A saw-tooth wave consists of the fundamental and an infinite number of overtones, but it will be sufficient to transmit only the frequencies below the thirtieth overtone. This represents a band between 25 and 800 cycles for the picture changes and a band between 4.5 and 140 k.c. for changing the lines. The second transmitter is directly modulated with the broad frequency spectrum corresponding to the lines, whereas the second frequency is first composed with a 200 k.c. wave, the picture frequency with a 250 k.c. wave and then impressed upon the second sender.

FERNS, TONFILM.

It will take less than five minutes to fill up the Questionnaire given on page 217 of this issue.

PUZZLING PARADOXES IN TELEVISION

By J. C. Wilson.

A SYSTEM of reconstitution which was at one time much in vogue for " large screen " reproduction in theatres and the like consisted in the use of a mosaic of separate little light elements brought into circuit one at a time, but in very rapid succession, by means of a suitable switching device.

This is the second article of a short series on some of the peculiar problems of television. The elucidation of these is of particular interest to the experimenter who will probably be able to avoid pitfalls which are not readily apparent.

A system of this type using small incandescent-filament electric lamps

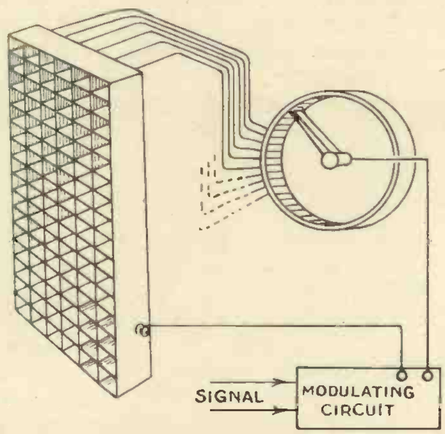


Fig. 1.—Schematic diagram showing the system of using a number of light units to build up the picture.

in a kind of cellular bank or "honeycomb," the lamps being brought into circuit successively by means of a commutator, was described by Baird in 1923 in his British Specification No. 222,604, and he subsequently demonstrated a large television screen of this kind at the London Coliseum, and in Paris, Berlin and Copenhagen.

A variant in which glow-discharge elements were employed instead of filament lamps was proposed by Schmierer and others, and has many years later been reduced to practice in the Bell Telephone Laboratories; these systems, however, and others of a similar nature suffer from an inherent disadvantage in that when a picture of high definition is to be reproduced the speed at which the mechanical switching device, or commutator, has to operate becomes prohibitive. Either the segments of the commutator must be made exceedingly narrow, or else the arm bearing the rotary contact (see Fig. 1) becomes long and cumbersome and the peripheral velocity of the contact over the segments is too high.

Reducing Contact Speed

It must long have puzzled some of those interested in television, as it did the author, that the scheme proposed by Schmierer himself, and also by Jenkins, von Bronk and others in various forms, involving the use of two commutators, one for the " rows " and the other for the " columns," was not adopted in practice in order to overcome these inherent disadvantages by greatly cutting down the contact-speed. A double-commutator system of this type is illustrated in Fig. 2 for those readers who are not already familiar with it: it has recently been described, however, as a workable system by Schroeter in his book " Bildtelegraphie und Fernsehen " with which most readers will be conversant.

On the face of it, this arrangement seems extremely promising; the commutators would, of course, be geared together and in the case of a square screen each need only have one-nth of the number of segments required in the single-commutator case, n being the total number of lamps in the screen.

Waste Current

In practice, however, a sinister phenomenon would very quickly manifest itself: when the screen was in operation, not only the lamp supposed to be in circuit at any instant, but also the other lamps for some distance around it would light up; rather dimly, it is true, but nevertheless they would be absorbing power intended to be expended in raising the temperature of the proper lamp to its appropriate value. In this connection, it must not be forgotten that although the normal rating of the lamps, supposing them to be ordinary filament lamps, may be a small fraction of an ampere for full brilliancy, when they are used under television conditions and receive current for only a tiny part of the period of each scan they may require several amperes to operate them efficiently; since all this current must pass through a modulating device such as a bank of large valves in parallel, it is obviously of vital importance not to waste any of it.

An analysis of the problem of this " waste current " has been performed by Mr. H. L. Wright, B.Sc., who has shown that for screens of the size required for television the total loss amounts to practically the whole of the current input to the screen, as we shall now proceed to show.

Let us suppose that we have a

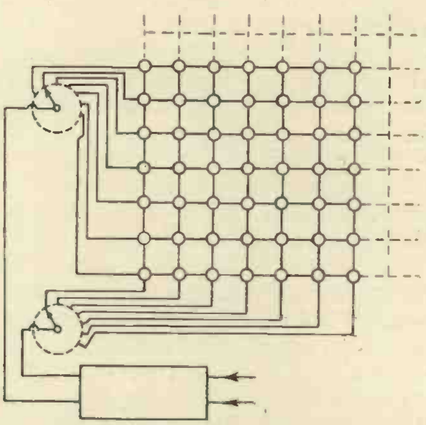


Fig. 2.—A double commutator system designed with the object of reducing the number of commutator segments.

screen of lamps, as shown in Fig. 3a, comprising only four lamps, A B C and D. The two commutators are represented by contacts and arrowheads, and in the position represented in the figure, the lamp B is supposed to be in circuit alone. Now a moment of consideration will suffice to show that in addition to the straightforward path from contact *a* through lamp B to contact *b*, there exists an alternative path from *a* through lamps A C and D to *b*; the resistance of this alternative path is clearly equal to $3r$, where r is the resistance of a single lamp, and therefore one-quarter of the total current output from the modulating device will flow through it and be wasted.

Again, considering Fig. 3b, we see that with six lamps arranged in three vertical columns of two lamps each, there is a branched alternative path either through lamps A and D, or through lamps C and F to the point marked *p* and thence through lamp E to *b*; this clearly yields an alternative-path or "back-circuit" resistence equal to that of two lamps, i.e., equal to $2r$, and therefore one-third of the current output from the modulating device will be wasted.

In the case of the more complicated screen of Fig. 3c, in which there are three rows and three columns of lamps, the "back-circuit" resistance is equal to $5r/4$, giving a waste current equal to $4/9$ of the total output. One might continue to perform this process of adding lamps and calculating the waste of

Fig. 3a

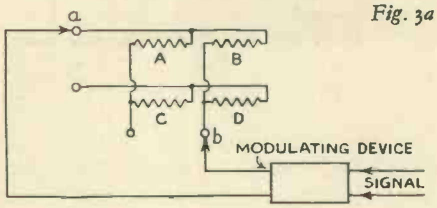


Fig. 3b

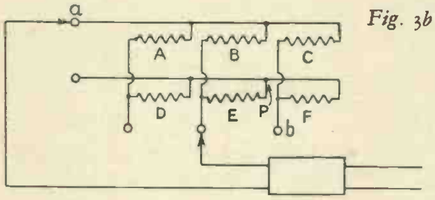
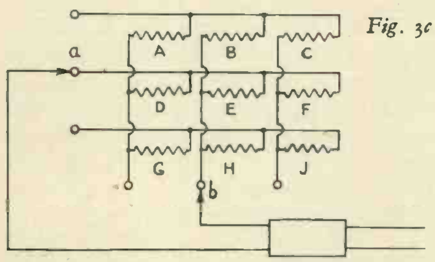


Fig. 3c



Figs. 3a, 3b and 3c.—Diagrams showing how there can be almost a total loss of input current.

current, but the circuits involved become exceedingly complicated and, compared with the use of generalised analysis, very tedious; the analysis previously referred to gives the ratio of waste-current to total current as:

$$\frac{I^1}{I} = \frac{(m-1)(n-1)}{mn}$$

where I^1 is the waste-current
I is the total current
m and n are the number of rows and columns severally.

Thus for screens of, say, thirty rows and thirty columns the waste is 0.934 of the total available current, and the system is quite unpractical. It is true that this analysis applies only to bilateral conductors which obey Ohm's law, and that Dr. Schroeter was more particularly concerned with the case in which small gas-discharge elements are used instead of filament lamps, but since in practice when gas-discharge lamps are used it is usual to excite them continuously with a high-frequency electric-current to prevent their total extinction, the possibility of the "back-circuit" lamps not striking does not arise, and the defect is not overcome by the use of this type of lamp.

THE PHOTO-ELECTRIC EFFECT

THE phenomenon of photo-electricity provides an outstanding example of the manner in which a discovery without apparent possibilities of practical application can eventually become of great industrial importance. Although the first experiments on photo-electricity were made nearly half a century ago it is only during comparatively recent years that the effects have been applied in practice. The theory of photo-electricity, developed by the physicist to explain the observed phenomena, has incidentally provided confirmation of the electron theory and a link with Planck's theory of radiation. This arose from the observation that for a given photo-electric substance the emission of photo-electrons could be obtained only when the incident light had more than a certain critical frequency, called the "threshold frequency." Light of lower frequency is quite unable to produce any photo-electric effect, but as soon as the threshold frequency is exceeded the effect is immediately observed.

The theoretical interpretation of this peculiar effect is that each photon, or light corpuscle, of the incident illumination has a certain amount of energy, which it is able to impart to one of the free electrons in the photo-electric substance. If the energy of the incident photon exceeds that necessary to eject the electron from the substance, then the photo-electric effect due to the ejection of electrons in this manner will be observed. The energy of each ejected electron will be equal to the difference between the energy of the incident photon and the energy required to dislodge the electron from its normal surroundings. The speed of electrons ejected photo-electrically from various materials by the action of light of different wavelengths has been measured experimentally and is found to be in good agreement with this theory, which indicates that light cannot be regarded as having a uniform or homogeneous structure. This proposition is entirely in agreement with the corpuscular theory of light, but is difficult to reconcile with the wave theory, which is the only theory capable of explaining the observed laws of optical reflection and refraction.

The cathode-ray tube familiar to experimenters is almost the smallest of the family; in laboratories, tubes with thousands of volts on the gun are used, and they are pumped all the time that they are working to maintain the vacuum. Tubes with nine-inch screens have been made experimentally in this country, similar in all other respects to the standard tube.

Getting Results with The Daily Express Receiver

Last month we described the assembly of the "Daily Express" receiver and gave some hints on its use. This article deals fully with the methods of connecting it to the wireless set and gives complete instructions for its operation.

Connections to Receiver

Upon completion of the assembly of the *Daily Express* Television Kit the first problem that will present itself is the connecting of the neon lamp to the wireless receiver; the manner in which this is connected will depend upon individual circumstances, which will be appreciated if the following facts are borne in mind.

The first point is that a certain minimum voltage must be applied to the lamp before it will "strike" or light up. This figure is approximately 180 volts which may be in excess of that which is available at the loudspeaker terminals. Whether this is the case may be known, but in any case it is a simple matter to make a test by merely connecting the lamp in place of the loudspeaker (Fig. 1). If the lamp lights up with the familiar red glow, irrespective of whether any signals are being received, then all is in order and the television broadcasts can be received right away.

If, however, the lamp does not light, then resort must be had to some means of increasing the high-

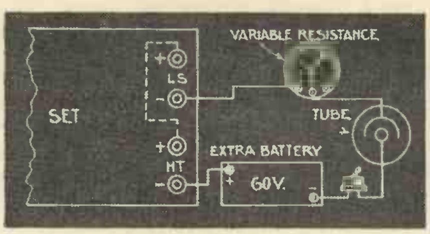


Fig. 2. A simple method of increasing the high-tension

tension voltage, and this can be accomplished in several ways. Fig. 2 shows what is probably the simplest scheme. In this an additional external high-tension battery is used and the method of connecting this will be quite clear from the diagram. It should be noted, however, that this system means increasing the total high-tension on the valves and therefore adjustments of grid bias will have to be made to conform with the new conditions and should this battery be removed then the original grid bias values must be reverted to.

A scheme which avoids increasing the high-tension supply to the valves is shown by Fig. 3. In this an entirely separate source of H.T. is provided for the neon lamp and

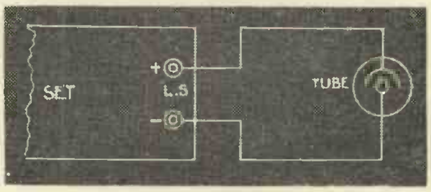
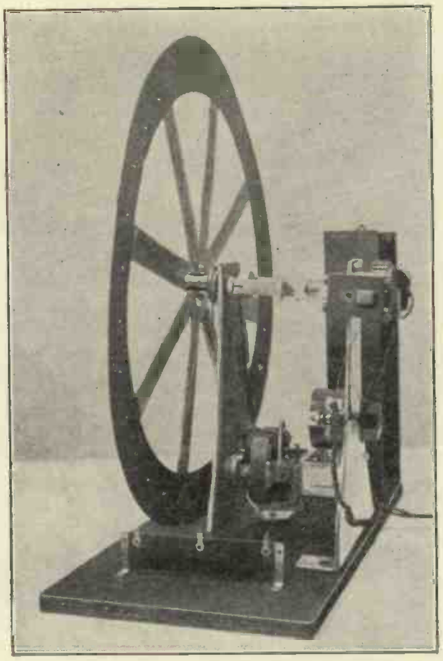


Fig. 1. The receiver connected direct to the set, a method which can be employed if the H.T. voltage is sufficient

the modulating signals are applied via a 1-1 transformer. This system entails the use of additional apparatus, but it has the merit of not interfering with the existing values of high-tension applied to the set.

If the receiver is provided with choke output and it is found necessary to increase the high tension the method shown by Fig. 4 must be used. This entails the use of an additional choke of the same type as the one already fitted, and an extra source of H.T. This scheme also will not increase the H.T. on the valves.

Should it not be desired to use batteries in any of the above arrangements then their place can be taken by a mains-operated exciter unit, which was shown photographically last month. The circuit arrangements are given by Fig. 5.



The foregoing arrangements will cover most of the ordinary receiver systems and the information given should be sufficient to enable readers to adapt others in special circumstances. Bear in mind that the lamp must be caused to strike irrespective of signals and that the latter only serve to modulate the *amount* of light.

First Tests

It will not be necessary to wait for a television broadcast to test whether the apparatus is functioning correctly. Tune the set in to an ordinary broadcast, set the motor running

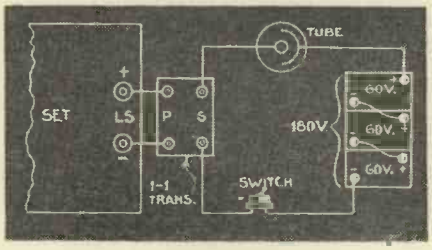


Fig. 3. A method of using a separate high-tension supply

and look into the lens. If all is in order a curious varying pattern will be seen due to the modulation of the light by the incoming signals. The object should be to get as bright and clearly defined pattern as possible and with this obtained we are ready to receive the actual television transmission.

Receiving the Television Broadcasts

About twenty minutes before the transmission is due to start the motor should be switched on and the disc allowed to revolve. After about ten minutes' running an attempt should be made to get the speed of the disc approximately correct, and provided that A.C. mains are available this can be accomplished fairly simply by watching the spokes of the disc when viewed by the light from a lamp supplied from 50-cycle mains. When the correct speed of 750 revolutions per minute has been attained, the eight spokes of the disc will appear to be stationary. An ordinary incandescent lamp will serve as a source of light, but a small neon lamp of the "beehive" or indicator types will be better.

London National, from which the vision signals are transmitted, should be tuned-in on the loudspeaker. But do not use too much reaction as this will spoil the picture. When this station is obtained at its loudest the set can be switched on to the neon lamp, and the commencement of the television programme awaited, the motor still being allowed to run.

Picture Faults

When the vision transmission starts it is improbable that there will be a recognisable image, but this is merely because the speed of the disc is incorrect, and with a little adjustment of this some semblance of a picture will be observable which with a little further adjustment will be resolved quite clearly, although it may have certain defects of which the causes and remedies are detailed below.

The greatest probability is that the picture will appear to float diagonally either to the left or right and have a distorted appearance. If it tends to travel towards the right-hand bottom corner, then the disc is running too slowly, and if in the other direction, then the speed is too great. A little practice and experience will soon enable the operator to correct this fault.

Another very common fault is that a split picture is obtained; it may be that half the image is on one side of the frame and half on the other, or the proportions may be totally different. Whatever is the appearance of the picture in this respect this fault is due to the disc being out of synchronism with the transmitter and it can be corrected by allowing a number of pictures to slip by momentarily altering the speed of the disc, when it will be observed that the image gradually moves over to one side. To check this movement when the framing is correct requires a little judgment on the part of the operator, but this soon comes with practice.

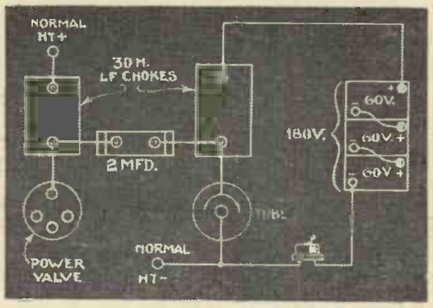


Fig. 4. Method of providing extra H.T. when the set has choke output.

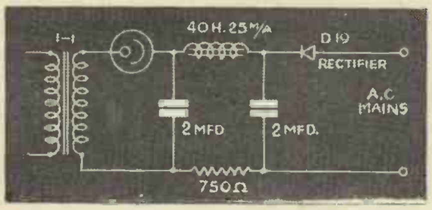


Fig. 5. Circuit of exciter unit for provision of extra H.T. from the mains.

It may be that when the first picture is received it will be negative; that is the parts which should be black are white and vice versa, a state of affairs which can be corrected in a variety of ways. One simple method is to change the type of detection used. For instance, if this is leaky grid then a change to anode bend will effect the desired reversal, or vice versa as the case may be.

If transformer-coupling is used in the receiver then a change of the connections of either the primary or secondary (not both) will also reverse the picture. This method is not effective with auto-transformers or resistance-capacity couplings. Still another method is to add an additional stage of amplification.

After a little practice the operation of the receiver will be found to be quite a simple matter, for the reason of each little difficulty will be easily recognised and correction applied immediately.

Receivers for the New Berlin Television Service

Although the new television service is still an experimental one, the radio industry is concentrating on the manufacture of television receivers, which are for the time being tested in various parts of Berlin. From reports received, it seems that a reliable service is at last possible, covering the whole area of Berlin by means of one ultra-short wave transmitter. The Broadcasting Authorities still stress the point that the question of programmes for a television service is by no means solved, and may become a stumbling block in the very near future.

Radio Photo Service in America

As already reported in the April issue of TELEVISION, a radio facsimile inter-city service is planned by the Radio Corporation of America. Further details are now available, a frequency range of 86,000-400,000 mgc. (0.76-3.5 metres) will be used and as the range of this band is somewhat limited to approximately 30 km., "repeaters" will be used at such distances. Such "repeater" service system will be eventually of great importance for the television service. The results of these experimental transmissions should be very interesting.

The velocity-modulation system of television has the advantage over all others that every scrap of the available light is used, light not wanted in the dark places is used up in the lighter portions.

* * *

One of the problems of television on short waves is the interference that the receiver picks up from the ignition systems of motor cars. This form of static radiates over a surprising distance and does the most damage between 6 and 12 metres; the suppressors available are very cheap and quite effective, but how many motorists will fit them?

RECENT DEVELOPMENTS

A RECORD OF PATENTS AND PROGRESS
Specially Compiled for this Journal

Film Television

(Patent No. 404,020.)

The clearness or definition of any transmitted picture depends upon the ratio of the size of the picture to the size of the scanning aperture. So long as sufficient light can be projected through the scanning aperture, the smaller the latter can be kept the better

Where the picture is taken from a kinema film it is desirable to be able to adjust the size of the aperture to the overall brightness of each film, because some films are of higher average transparency than others, and unless steps are taken to offset this difference the quality of the received picture will suffer accordingly.

According to the invention the transmitter is associated with a "local" receiver, which first measures the average light-and-shade or "tonal" value of each film, and then automatically adjusts a variable scanning aperture to the proper size.—(*Electrical & Musical Industries, Ltd.*, and *C. O. Browne.*)

Mirror Drums

(Patent No. 405,783.)

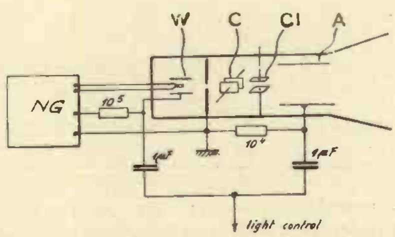
Drums can be cast in special metal alloys with the aid of accurate moulds, the mirror surfaces being subsequently polished, but it is found that all the usual methods of polishing impart a small but undesirable curvature to the edges, owing to the action of the liquid film of grinding material employed.

To overcome this difficulty, and to enable a number of drums to be handled simultaneously in manufacture, they are finished on dividing machines with the aid of diamond tools. The dividing machine makes it possible to adjust the drum so that the mirrors are formed with great accuracy, whilst the fine shavings taken by the diamond leave a perfectly polished surface behind which requires no further finish.—*H. Pabst.*)

Cathode-ray Systems

(Patent No. 405,892.)

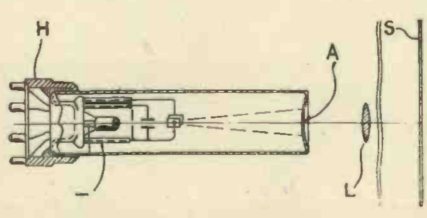
As the intensity of the cathode stream increases, in response to varying light-and-shade effects, it is found in practice that the response of the stream to the control-voltages applied to the tube electrodes tends to fall off. The consequence is that the



The Ardenne system of connections for cathode-ray tubes.

position of the spot of light on the fluorescent stream varies in an undesirable manner, and gives rise to a certain amount of distortion. According to the invention this difficulty is overcome by applying a compensating voltage to an auxiliary electrode A placed between the ordinary control electrodes C, C1 and the fluorescent screen.

As shown in the figure the annular electrode A is connected through a resistance R with the anode or Wehnelt cylinder W surrounding the cathode, so that it carries the same fluctuating voltage. The resistance R is such as to prevent the "return"



A novel construction of cathode-ray tube with an inwardly curved end.

current, due to electrons being "sprayed" on to the electrode A, from creating any appreciable voltage drop.

As the intensity of the cathode-ray increases, the potential on the electrode A becomes more negative. This diminishes the velocity of the electrodes and increases the effective control of the deflecting electrodes C, C1.—(*M. von Ardenne.*)

Luminescent Screens

(Patent No. 405,964.)

Certain technical difficulties arise in forming a uniform and strongly-adhering layer of luminescent material over the viewing end of a cathode-ray tube. The presence of the screen must not, for instance, interfere with the production of the necessary degree of vacuum inside the tube; it must also be sufficiently transparent to transmit the full luminous effect produced by the impact of the electron stream to an outside observer; finally it must be able to survive, without damage, the vibrations and shocks incidental to ordinary use and transport.

According to the invention the luminescent (fluorescent or phosphorescent) material is first suspended in a dilute solution of borax and then applied to a glass base, the solvent being evaporated off after application. Alternatively, boron trioxide can be used as the adhesive, or any inorganic substance which takes up a glass-like condition when its ordinary water of crystallisation has been abstracted.—(*Telefunken Co.*)

Cathode-ray Tubes

(Patent No. 405,977.)

Instead of the ordinary concave shape, the end A of a cathode-ray tube is made convex, as shown in the figure, so as to strengthen the glass tube against the effects of the internal vacuum. The image formed on the end A of the tube is enlarged by projecting it through a lens L on to a distant screen S. The tube itself is only 20 centimetres long, with a diameter of from 4.5 to 6 centimetres, and the radius of curvature of the convex end is made slightly longer than the focal radius of the lens L so as to minimise marginal distortion of the enlarged image.

In order to prevent flash-over, due to the compact arrangement of the electrodes, the supporting wires are screened off from each other by glass tubes T. It is also desirable to apply a mirror deposit on the inner walls of the tube, and to make the fluorescent screen conductive by adding a metallic powder and connecting it to a suitable discharge point.

The cathode-ray tube may be mounted inside a loudspeaker so as to project the received image on to a transparent screen arranged in front of the speaker diaphragm.—(*M. von Ardenne.*)

Electrode Arrangements

(Patent No. 406,009.)

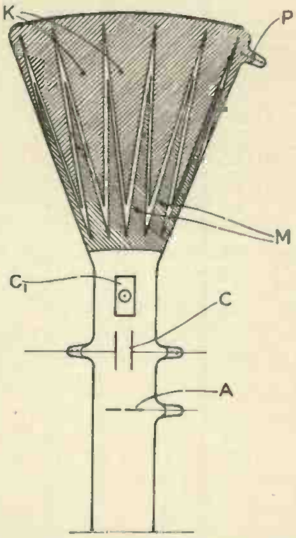
The parts of a cathode-ray tube near the fluorescent screen frequently collect charges which are liable, particularly in the case where the tube is highly evacuated, to react upon the electron stream and to set up spurious movements which obscure or distort the received picture.

This difficulty is overcome by arranging two metal coatings K and M in such a way that they closely interengage but are electrically separate. The coating K is connected to the voltage supply at P and is also in contact with the fluorescent screen, whilst the second coating M is preferably kept at the same voltage as the anode A. As the electron stream approaches the electrodes K, M, after passing through the anode A and control electrodes C, C1, it enters a region of uniform potential distribution and reaches the fluorescent screen without being influenced by undesired deflecting forces.—(*Fernseh Akt.*)

Transmitter Tubes

(Patent No. 406,353.)

Relates to cathode-ray transmitters of the kind in which the photo-sensitive electrode is made up of a mosaic of minute cells upon which the picture to be transmitted is projected. The cells then develop electric charges to an extent depending upon the different light and shade values of the picture. According to the invention the sensitive surface is prepared inside the tube, after the plain electrode has been mounted in position, by evaporating a pellet of silver and allowing



[*Cathode-ray tube with serrated metallic coatings.*

the condensed particles to deposit themselves upon the surface of the electrode through a grating of wire mesh, so as to form a mosaic of separate cells. The wire mesh, after it has served this purpose, is removed by a pair of pincers, the glass bulb is sealed up and evacuated, and a thin coating of caesium is finally applied, by distillation, to the deposited silver.—(*Electric & Musical Industries, Ltd., W. J. Tedham* and *J. D. McGee.*)

The Mihaly stationary mirror-drum receiver—the photograph shows Mr. E. Traub of the International Television Corporation Ltd.

Summary of Other Television Patents

(Patent No. 405,018.)

System using a cathode-ray tube for transmitting visual information to assist navigators.—(*Marconi's Wireless Telegraph Co., Ltd.,* and *A. A. Linsell.*)

(Patent No. 405,227.)

Facsimile system particularly adapted for the transmission of printed matter, line drawings, or other objects presenting contrasts of light and shade.—(*Westinghouse Electric Manufacturing Co.*)

(Patent No. 405,821.)

Improvements in the optical arrangement of lenses used for television scanning.—(*W. H. Peck.*)

(Patent No. 406,507.)

Improvements in photo-electric cells.—(*N. V. Philips Gloeilampenfabrieken.*)

(Patent No. 406,665.)

Improvements relating to the manufacture of photo-electric cells.—(*R. H. Cubitt, A. L. Williams* and *The Westinghouse Brake and Saxby Signal Co., Ltd.*)

(Patent No. 406,672.)

Television systems in which the direct current component is suppressed and compensating means are applied to restore the average tone-value of the transmitted picture.—(*Electrical Research Products Inc.*)

REVIEWS OF THE PROGRAMMES AND RECEPTION REPORTS

IF the architect of No. 16 Portland Place could have foreseen a hundred odd years ago that his house was to provide a home for television, he might have strengthened the joists which support the large room on the first floor. Not that there is any fear of collapse under the strain which is so unexpectedly placed on it—for they built to last in those days in what was the best part of London—but the workers beneath would now be less critical of the programmes if their ceiling were less responsive to the taps of dancing feet.

Perhaps it was a repetition of ballet programmes, or maybe just a specially boisterous rehearsal, which caused the ceiling to vibrate. Anyway, flakes fell like snow in the room below. The alarm was raised and an investigation followed. The producer was asked to repeat the rehearsal, but by this time the dancer was changing in her dressing-room. Could Eustace Robb give an impression of her act? He did, and I have never seen him dance more blithely. The structure was reported to be sound and when the ballet taps disturb the workers below, business will be sacrificed for art—or is it science?

* * *

The second visor used for checking in the projection room reproduces a picture under home conditions, because it is *not* locked to the mains which feed the transmitting gear, as was the instrument in use at Broadcasting House. Variations in the load on the mains affects synchronisation and it was interesting to compare results on a screen at Portland Place and on a visor at Radio Centre in the Haymarket, where an engineer had gone to look. As sometimes happens, it was difficult once or twice during the programme to keep the picture steady, but a comparison of notes afterwards showed that when the picture was lost momentarily in the Haymarket, it was perfect at Portland Place, and vice versa.

The roller screen, described last month, was used for a quick change of scene when Elsa Brunellescho was dancing. For the early part of the programme the backcloth had been white and while lookers were watching drawings in the caption machine, the roller was dropped, revealing palms in a tropical scene, a suitable setting for the Spanish dance which followed. The producer has a keen news sense, and rejoices whenever he can forestall his theatrical rivals by presenting an act before it opens on the West-End stage. Walter Crisham was such a case and on the same evening we saw him dancing, "Modern Rhythm," in a crazy jazz costume several weeks before the premiére of the show, "Why Not To-Night?"

* * *

The producer has received more post in the past few weeks than ever before. He keeps a note of lookers-in who write about programmes and he has about six hundred names on his list. Some towns are keener than others and if correspondents are correct, about seventy-five lookers live around Tunbridge Wells and Rochdale has about fifty. In the programmes every change brings praise and criticism. After the Jackson Girls and the Step Sisters, letters arrive from lookers-in who like this kind of production. They enjoy themselves as they do when watching a revue in a theatre, they say.

On the other hand, an experimenter complains that these programmes are too elaborate. He dislikes the dizzy effect as the projector sweeps quickly down the line of girls in a brief cinematic shot before the scanner is steadied to introduce the chorus. I thought the trick rather effective, though it would become painful if overdone, as trick photography does on the films.

Other lookers-in may agree with this correspondent. So I give his views. He likes simple single acts —rope-spinning, paper-tearing, for instance, and a singer in close-up or a solo dancer in a semi-distant picture, with a voice singing off-stage. He would cut out the long shots and never have more than one figure in the picture at a time. Others, on the contrary, write in favour of the long shot. I am best pleased with a programme in which close-ups, semi-extended and distant pictures are about equally represented, with fairly frequent changes from one range to another, which I find relieves any tendency to eye-strain.

Miss Dawn Davis, the popular television artist.

Again, lookers write about the scenery, some suggest that it blurs their picture, a white background improves definition, they assert, while others welcome the novelty of a fresh setting. All of which proves that a producer has his trials.

* * *

At a distance of six feet, I readily recognised a photo of an image of Betty Bolton taken from a visor in Bradford. Unless the lens in the camera was altogether exceptional, the film must have been exposed for two seconds at least, and since twenty-five pictures would be projected in this time and Betty Bolton was not posing for a photograph, the likeness was remarkable. The success of this photograph seems to prove the wisdom of making the eyes up fairly heavily, as is still the producer's practice.

Eustace Robb has mixed illustrated lectures with entertainment in the morning programmes. The exhibition of ju-jitsu and Japanese fencing was quite the most thrilling thing of its kind which has been transmitted, though the demonstration was given as an adjunct to a talk by Shaw Desmond. The Japs were all members of the Budokwai, the club where the sport is practised, and with naked swords they looked as if they meant business. For me the spectacle of two men engaged in beating each other on the head with bamboos is always funny.

There is to be another good programme in the morning on Friday, May 4, when Alexieva, Turganoff and Laurie Devine are coming to the studio.

As usual, dancing has been a strong feature of recent productions. Reita Nugent made her name dancing on her hands, and the inverted pose was effective in the studio. I was impressed also by the precision of The Gym Ballet from "Yours Sincerely" which she danced with Freddie Carpenter.

At the Folies Bergères Georgia Graves is famous for three dances: balloon, scarf and fan. Her act was original. I rubbed my eyes as the Step Sisters appeared on the same evening in those futurist bathing costumes. Some wore black and white and others black and red, and the effect was more startling in the studio than on the screen.

Look out for Nini Theilade, who is returning from the United States and has promised to televise on her arrival. This young dancer was a success in the Regent's Park production of *A Midsummer Night's Dream* last year and she is due back from America about May 11. The Cleopatra Ballet is down for an early revival.

* * *

In the course of the month I have also noted that the caption machine is being used more frequently for introducing artists by name, that the Jackson Girls, soon off to Tokio, are a snappy troupe, all blonde and of more sophisticated appearance than the Step Sisters, and that a trumpet, supplying welcome change in tone colour, has made its debut in the television studio.

THE "DAILY EXPRESS" KIT—5,000 SETS ORDERED!

On March 27th last the "Daily Express" co-operated with certain manufacturers in putting out a Television Kit to the listening public, in order that they might see for themselves the possibilities of the application of television to ordinary broadcast programmes, and also to make an opening for manufactur-r] to pursue this potential market.

A certain response was expected, but the ultimate response has more than exceeded expectation. The trade entered wholeheartedly into the scheme, and in less than a week after the page appeared over 5,000 orders were received, and further applications are being received by every post. Listeners who have purchased the kit have only one complaint in general—that is, "We want more television broadcasts."

Real Interest

I am gratified at this reception, for I firmly believe that the time is at hand when television must play a great part in the make-up of the everyday broadcast, and I do thank TELEVISION *for placing before the public so much information which has undoubtedly helped to create real interest. We all know the difficulties of the pioneer, but I would suggest that as far as television is concerned, the public themselves can help now by carrying this point forward—"Let us have more television."*

More Transmissions Wanted

I have received many letters from traders throughout the country who are arranging demonstrations during the morning broadcasts; whilst they appreciate this move, they deplore the fact that only one half-hour remains during the week for the family to "look in." This is a serious difficulty which must be overcome, and I trust that television enthusiasts will not just voice their opinions between themselves, but will put their thoughts on paper, in order to get recognition of that fact. We have a wonderful stimulant to trade and entertainment within our grasp; it would be a pity to see it slip away through apathy. I am sure that manufacturers will appreciate public opinion, as it will guide them as to their responsibility in producing the instruments required; it will also hasten the day when television will play a great part in giving us entertainment. We have started the ball rolling; will you give us your criticisms and suggestions in order that more rapid progress can be made

R. NEWTON BROWN,
"Daily Express" Radio Correspondent.

Dispatching "Daily Express" Kits to the North by aeroplane.

FITTING SYNCHRONISING GEAR

By L. A. CHAPMAN

This article explains the fitting of synchronising gear to simple disc receivers such as the Beginners Receiver described in the March issue or the "Daily Express" machine. The reduction gearing shown by the drawings can be dispensed with if desired, thus simplifying the fitting very considerably. It was fitted in the present instance so that the control could be brought outside the cabinet in a convenient manner.

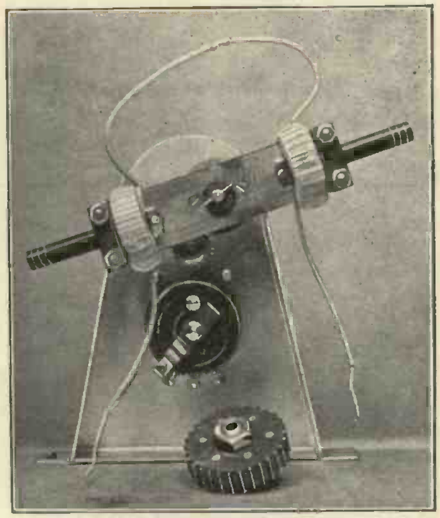


Fig. 1. Photograph showing the synchronising gear fitted on a separate standard.

WHILST picture reception is possible with the most elementary of television apparatus, more elaborate apparatus certainly permits of it being accomplished with less effort on the part of the operator.

Perhaps the most troublesome difficulty associated with amateur television reception is that of maintaining the speed of the motor constant. In many instances, amateurs rely upon adjusting the motor rheostat to control the speed of the motor. Those who have had experience of this will be ready to admit that they would appreciate some means whereby a correct speed can be maintained without manual control.

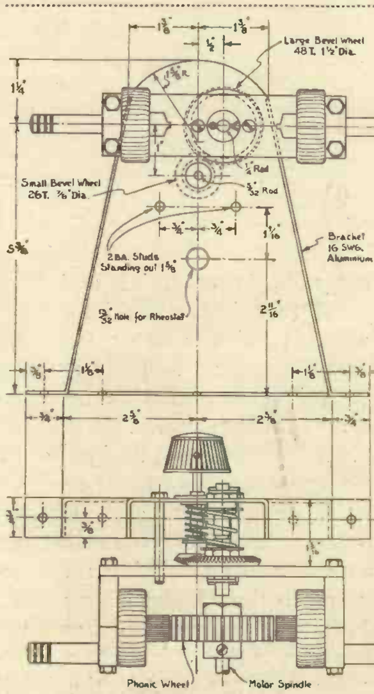


Fig. 2. Detailed drawings showing the gear fitted with reduction wheels.

Now synchronising consists of super-imposing upon the normal television transmission an electrical impulse of particular frequency which, when picked up by the receiver and passed through suitable apparatus, effects an electrical "governing" action on the speed of the motor. Should the motor tend to get out of synchronism with the transmitter electrical impulses give rise to an "advancing" action which causes the motor to speed up. If the motor begins to gain speed, the synchronising impulses check it.

In practice the result is accomplished as follows. A 30-toother laminated-iron wheel—known as a "phonic wheel"—is fitted to the shaft of the television motor. Arranged edge-on to this wheel and exactly opposite each other are two soft-iron magnet pole-pieces. Around these pole-pieces are two magnet windings which are designed to respond to and peak at 375 cycles per second.

When the 375-cycle impulse is picked up by the receiver, amplified and passed through these magnet-

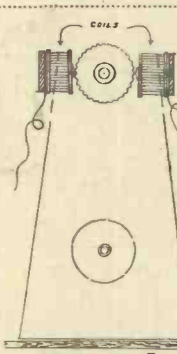


Fig. 3. This drawing shows an alternative and simpler method of fitting the gear directly.

coil windings, and the speed of the television motor is adjusted to be as near 750 revolutions per minute as possible, each electrical impulse so received and amplified tends to act upon the teeth on the phonic wheel and control the speed of the motor.

Should the speed of the motor be such that the appropriate teeth are slightly in advance of the controlling electrical impulse, the latter will tend to retard the wheel by applying a "brake" action. Exactly the reverse takes place if the speed of the motor tends to drop below the normal.

We may now turn our attention to the practical side of the question. Fig. 1 is a photographic illustration of what is necessary in the way of apparatus. The phonic (toothed) wheel is clearly to be seen at the base

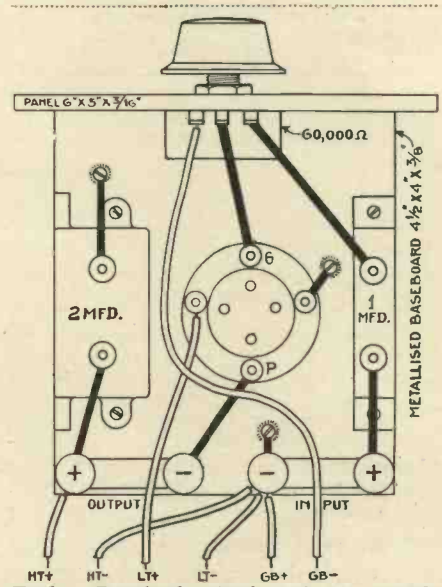


Fig. 4. Details of a simple single stage amplifier for supplying current to the synchronising coils.

News *from* Abroad

By OUR SPECIAL CORRESPONDENTS

Germany

Details of New Experimental Television Service from Berlin

As the greater part of Berlin is supplied with alternating current, synchronisation will be chiefly carried out by utilising the mains for the new ultra-short wave transmissions. As already reported 180 lines and 25 frames per second will be used. The two aerials, one for television transmissions and the other for the sound part of the programme will be used side by side on the radio tower.

The high-frequency cables from the transmitters to the aerials are of special design which is necessitated by the very wide frequency band to be transmitted without appreciable attenuation. In addition to the mains synchronisation impulses will also be transmitted.

Of interest is the comparatively new method of preventing the interaction of synchronising impulses and the picture currents. When the carrier-wave is not modulated, the aerial current for such conditions is reduced to about ¼ of the maximum value. The picture modulation takes place from this value upwards (increased current values). The transmitter is "locked" for a short period (time of one scan) after each scanning line (4.500 times per second) and also after each complete picture. The synchronising impulses will also be transmitted on the sound counterpart of the transmission, the frequency being sufficiently high not to interfere seriously with the quality of the sound transmission.

Transmission will consist chiefly of films, as experiments have shown that films give the best picture for a given effort. Provision for direct scanning will also be made. The first transmissions are to take place this month, for the time being without the sound counterpart, as the sound transmitter is not yet ready.

The Short-wave Experiments

At the last annual meeting of the Heinrich Hertz Institute of Berlin, a résumé of television reception for the last year has been given. The transmission received originated from the famous Radio Tower in Berlin, transmissions being carried out on 7 m. and using 90 lines.

A fairly good picture could be obtained. Although this transmitter had considerable power, considering the frequency band used, it has been found to be insufficient for reliable service.

On many occasions the reception was greatly influenced by weather conditions; also to get sufficient power to modulate the different television receivers in use, considerable amplification at the receiving end was required. Reception was not very successful, unless four or five valves were used. The best results have been obtained with the mirror screw receiver, although cathode-ray tube receivers have also been used. Experiments are being continued in this direction.

France

The Defrance and Barthelemy Systems

M. Pollenc of the French Broadcasting Service is planning to erect a short and ultra-short wave transmitter for transmission of the television systems of Barthelemy and Defrance.

M. Defrance, who is only 23 years of age, has obtained remarkably good results by using cathode tubes, utilising 180 lines, and 25 frames per second. Images of remarkable intensity have been obtained, the subject of transmission being chiefly films. Barthelemy is still using 60 lines and 16 frames per second.

"Fitting Synchronising Gear"
(*Continued from preceding page.*)

of the synchronising-gear support. The black object in the centre of the support is the normal rheostat for adjusting the initial speed of the motor. At the top of the support can be seen the arm which carries the two pole-pieces and magnet windings.

For the benefit of constructors it might be mentioned that the assembly shown in this photograph is an experimental one, fitted up for work in conjunction with the Beginner's Disc Receiver described in the March issue of TELEVISION.

A detailed description of the assembly is covered by the drawing, Fig. 2. It will be observed that a geared arrangement is used to control the "rocking" of the magnets

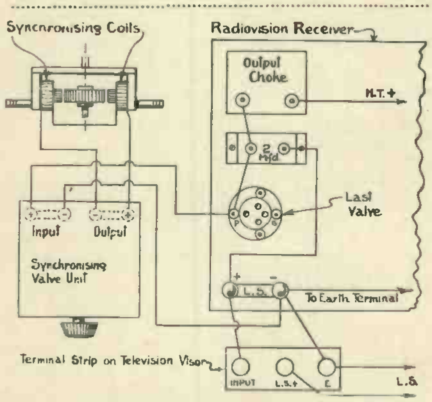


Fig. 5. The method of connecting the amplifier to the radio receiver.

around the phonic wheel. Absolute rigidity in the support which holds the magnets is essential and constructors, therefore, should fully appreciate this point before attempting to fit up such gear to their motors.

Fig. 3 is an alternative arrangement, and much simpler.

Fig. 4 covers the design of a single-stage amplifier to suit the synchronising apparatus, and Fig. 5 shows the method of connecting up this amplifier to an existing radio receiver and to the synchronising gear.

This latter drawing also shows the way to arrange the output of an existing radio receiver to suit the input to the disc receiver previously mentioned.

Correspondence

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

High - or - Low - Definition ? :: *Improved Results*
Reception in Spanish Morocco :: *The New "Television"*

High-or-Low-Definition ?

SIR,

With reference to Mr. Wikkenhauser's letter in reply to mine in February issue of TELEVISION, may I be permitted to reply very briefly to his five arguments?

Mr. Wikkenhauser points out that a picture 8 in. x 8 in. size will limit the number of observers to three or four people viewing conditions which are admittedly almost the optimum for television viewing. When I proposed a picture 8 in. square I was, of course, concerned only with home television reception where one has actually to cater for three or four persons. The occasional accommodation of six or eight people is a matter for compromise. The development of receivers for use in large halls may safely be left to those who consider that there is a field for television in such places.

I am at a loss to understand Mr. Wikkenhauser's remark about cinema picture frequency, for whilst the number of frames per second is certainly 24, it is universal modern practice to project each frame two or three times, thus making an actual picture frequency of 48 or 72 per second for the purpose of overcoming "flicker." In any case flicker in the cinema sense differs considerably from flicker in the television sense, the latter being intransically more visible to the eye.

With reference to synchronisation at the Berlin Exhibition I took great trouble to ascertain how the synchronisation was being effected in each case and I found that whenever the results were satisfactory it was being effected by artificial means, namely, by the use of separate synchronising lines. I submit that this is not synchronisation in the practical sense.

On the occasions when I saw the TeKaDe mirror-screw news-reel reception it was, in my opinion, extremely poor by comparison with cathode-ray reception of the same type of subject. In addition, the colour (rose) was very objectionable and the angle of view was limited to about 15°; that is why I did not mention it. The only successful mirror-screw reception which I saw was confined to much less ambitious subject matter.

In my letter I pointed out that the 3-dimensional effect on the Fernseh mirror-screw was a spurious one. This adjective would appear to describe quite a number of effects in television and may even more aptly be applied to some arguments.

O. S. PUCKLE (Highbury, N.).

* * *

Improved Results

SIR,

I have not looked-in for the last six months and my televisor had been partly dismantled. Recently I fitted it up once again and immediately was rewarded with results *two to three times as good as ever before*! The "close-ups" were well defined, while the "longs" were extremely plain, whereas before they were not recognisable. "Charlie," the Boy Xylophonist, was remarkable, and so was the lady artist who followed, both close-up and long-shot.

The words "Entertainment value" were never thought of till now, but I am looking forward to Friday to receive both sound and vision.

Allow me to congratulate TELEVISION on its success. Also to congratulate the B.B.C. on its enterprise in constructing another studio, which I am sure is responsible for these marvellous results!

I, among thousands, urge the B.B.C. to arrange more television broadcasts. Don't let other countries get ahead of us with "our" invention!

And, in conclusion, may I emphasise the fact to all amateurs that television *is* worth while. Commence with a disc receiver and help to make a demand for television broadcasts and components.

HERBERT R RAWLINGS (Guildford).

* * *

Reception in Spanish Morocco

SIR,

I receive actualy the emissions of television from London regularly, with a set Krosley-3 A.F. detectrice and two pass of B.F. a Push Pull, but making use for conecting with my reciever disc only one of the valves of out put, wit a power of 0,125 Watts. Upon this conditions reception is admissible enought, though syncronisation does not work, and frequently it wonts contrast and is wiped by fading.

At the end I pray you, to publish in your magazine the following idea if you find it worthy of been takin in consideration: Should be practicable that between all the good amateurs (those inscribed in the television circle are many, and surely are there many more no yet inscribed) we should procured a subside to the BBC. with the purpose it dedicate to us daily an hour od emision on 30 lines, thought it would be after the closing of its ordinary sound emission, for instance at midnight?

This should procured us not only entertainement, but the occasion of increase the observations capables to give progres to this new science.

Is still recent what has happen with the study by the amateurs of the short waves.

On this request it can be called efficaciously all the constructors as well English as foreing, which does not should hesitate in include ammong its working expenses a considerable amount to this end, I supposse.

For my part I offer my co-operation in the share it could correspond me.

!Amateurs of the world! Thing for a moment on what it would suppose for us to dispose dayli a whole hour of television as much as entertaining inasmuch as study to those well prepared tecnically in this new knowledge.

Dont you believe it is worth while this monetary effort, which being collective should be very little? You and the manufacturers have the word.

(Dr.) ANGEL MORA GARCIA MELILLA (Spanish Marocco).

(*The above letter is printed exactly as received.*—ED.)

The New "Television"

SIR,

I would like to take this opportunity of congratulating you on the publication of TELEVISION in its revised form. It is a great improvement on the old magazine, whose scope was obviously limited to the everyday articles which were no more than those appearing in most of the weekly wireless periodicals. In fact, I was a rather infrequent reader of this journal until January last, because practically all the more important inventions and practical circuits of this particular science, were to be found in *Amateur Wireless*.

(JOHN CHALLIS (Harlesden).

* * *

Thirty-line and High-definition Transmissions

With regard to the communication from Mr. Hugh Miller in your April issue, may I make a few comments?

I did *not* say in my earlier letter that 30-line experiments should be dropped immediately in favour of high definition work—Mr. Miller would appear to have misunderstood me. However, an interesting point emerges from his letter, namely, that Mr. Miller, in common with those who say that 30-line television reception provides real " entertainment value " does not appreciate the significance of the term. Television cannot be said to provide " entertainment value " so long as any substantial part of the interest is due to the method by which pictures are seen.

Mr. Miller will, I am sure, admit that he would not think much of the entertainment value of a cinema show which was even 10 times as good as the television results he obtains at home. Also Mr. Miller will realise that I am intensely interested in television and I hope he will believe me when I say I have tried looking at good 30-line reception and (in spite of my interest) I have been bored " stiff " from an entertainment point of view. A friend of mine to whom I showed it for the first time said after ten minutes, " Well, I suppose it's wonderful, but I can't stand it any more." No—there is no entertainment value in it. Mr. Miller is fascinated by television reception—he is not interested in the pictures as such, but the general public will not be satisfied with anything much less good than a home cinema, which is about the level provided, by, say, 180-line television at present. The pictures to be received in the home of the future must provide amusement exactly as in a cinema and must not rely for their interest on the fact that they are electrically transmitted from a distance.

I think the present 30-line system is just about as good as it could be made and I am in entire agreement with Mr. Miller's remark that mechanical devices in television are troublesome and that cathode-ray tubes are not yet perfect. However, the latter are being rapidly improved and offer very great advantages over mechanical systems, both for transmission and reception. In my opinion, mechanical systems will find no place in television in five years' time.

In conclusion, I would say that the B.B.C. are quite right in their attitude of refusing to increase the programme time on the 30-line system for no appreciable advances are at all likely to be made in that direction, as is admitted by those engineers who are competent to speak on the subject. Even the Baird Company (who developed the 30-line system) have dropped it for a high definition system! As is generally known, the B.B.C. are making exhaustive tests of various systems and when they are satisfied as to the best arrangement a plan of action will be embarked upon. I feel we can safely leave the matter in the hands of a body which has already proved itself able to develop broadcasting in a thoroughly satisfactory manner, and I hold to my original opinion that Mr. Sagall is not justified in saying that the B.B.C.'s attitude on the subject of television needs defence.

O. S. PUCKLE
(London, N.).

Please fill up the Questionnaire which is given on the opposite page.

Puzzling Paradoxes

SIR,

May I draw your attention to part of the article entitled "Puzzling Paradoxes in Television " which appeared in the April issue.

At the top of page 164 Mr. Wilson states that:—

$$\frac{d_2b}{dt^2} + m\frac{db}{dt} + c = O.$$

Surely this should be:—

$$\frac{d_2b}{dt^2} + m\frac{db}{dt} + cb = O,$$

then assuming $b = e^{pt}$ satisfies the equation we have

$$Ap^2e^{pt} + mApe^{pt} + CA\,e^{pt} = O$$

$$\therefore p^2 + pm + c = O$$

$$\therefore p = \frac{-m \pm \sqrt{m^2 - 4c}}{2}.$$

$$= \alpha \pm i\beta \text{ (where } \beta = \sqrt{m^2 - 4c})$$

then $b = Ae^{(\alpha + i\beta)t} + Be^{(\alpha - i\beta)t}$

$$= e^{\alpha t}\,[Ae^{i\beta t} + Be^{-i\beta t}]$$

$$= e^{\alpha t}\,[A(\cos\beta t + i\sin\beta t) + B(\cos\beta t = i\sin Bt)]$$

$$= e^{\alpha t}\,[E\cos\beta t + F\sin\beta t]$$

which is the required result. I do not see how this can be deduced from the differential equation given.

G. J. McDONALD (Shrewsbury).

* * *

Write to the B.B.C.

SIR,

At last the B.B.C. have carried out the threat that has been overhanging you, and all others, who are interested in this newest of sciences, by curtailing almost to the point of complete extinction the programmes we have enjoyed for a considerable period.

This is invariably the case when a Government department gets a hold by its monopoly of a system, and apparently no amount of persuasion will move those in charge. It is as usual not a case of what the public want, but what the autocratic officials decide to give them.

As no redress seems possible, may I suggest that you, as representing a large body of lookers-in, endeavour to arrange with some outside transmitter, such as Athlone, for a regular transmission, and by so doing, show the B.B.C. that their "stick in the mud" attitude is wrong.

Secondly, I suggest that you in your paper encourage all readers to *pester*, and I mean the word *literally*, the B.B.C. to alter their decision. Surely something can be done, as the present half an hour once a week is quite a useless period to do any serious work.

The morning transmissions which are ostensibly for demonstration to buyers are an insult. Who will buy any apparatus which can be used for only 26 hours a YEAR?

Do your best, and I think that public feeling will be more than ever with you now that the hours HAVE been curtailed, even if you were not backed up before.

W. STANLEY ATKIN (Wallasey).

Scanning Lines

SIR,

In the article describing the Cossor cathode-ray system in your March issue, it states on page 108 that 120 lines horizontal are equivalent to 160 lines vertical. I assume this allows for the picture ratio

$$\frac{4}{3}, \left(120 \times \frac{4}{3} = 160\right)$$

Does the same apply for vertical scanning? I mean, is 30-line vertical, ratio $\frac{7}{3}$ equivalent to

$$30 \times \frac{7}{3} = 70 \text{ lines horizontal?}$$

If so, what is the difference in the received picture? Perhaps some reader can explain?

S.G. (London, N.).

A *Pioneer*

SIR,

I was responsible, for the first few months, for the alleged entertainment broadcast from Newcastle. I had a small orchestra of seven, each performer playing into his own particular "mike"—the old P.O. pattern. The result—indescribable. Entertainment?—perhaps! The point I wish to make clear, however, is this—no matter how poor the programmes, no matter how poor the reception, the experimenters jumped in in their thousands to make their own sets, crystal and valve, and did they care a tinker's curse about the entertainment value of their sets? I say most emphatically—No! The experimenter got his entertainment not from the programmes, but from the joy of building, scrapping and rebuilding again and again. The joy of achievement was his, and the trader's joy was the serving of him.

I certainly do not agree with the B.B.C. idea that they wish to see a sign of public desire for television before doing anything further. This is exactly opposite to the policy of the old British Broadcasting Co., who erected stations in London, Birmingham, Manchester, Newcastle and Glasgow and *created* a demand for wireless. As one who was in the wireless trade before these stations were erected, I can safely say there was no business in wireless until these stations got going and then! Oh, for a return of those days! Apparently the present B.B.C. wants its customers before it opens its shops.

T. PAYNE (Newcastle-on-Tyne).

OUR QUESTIONNAIRE

(1) *Do you consider the recent curtailment of transmissions will correspondingly curtail television progress?* ________

(2) *Are you able to use either or both of the present bi-weekly transmissions?* ________

(3) *In your opinion is 30 minutes long enough either for entertainment or experimental work?* ________

(4) *What is the minimum weekly programme time you consider desirable?* ________

(5) *At what hour do you consider it necessary to retire at night in order to keep fit for following day's work?* ________

(6) *Bearing in mind the B.B.C.'s difficulties, what do you think is the latest reasonable hour for the transmissions?* ________

(7) *Do you consider it essential to extend and encourage low-definition transmissions until such time as high-definition apparatus becomes available in reasonably inexpensive form, for use in any part of the country?* ________

(8) *Approximately, how many people do you know who have been receiving the television broadcasts within the past twelve months?* ________

(9) *Roughly, what amount of money have you spent on television apparatus?* ________

(10) *Are you experimenting with any particular improvement or system of your own?* ________

(11) *If so, state whether scanning, light-modulation, synchronism or projection.* ________

(12) *If up to the present you have not received the television broadcasts, is it your intention to purchase or build apparatus to do so, provided that better facilities are given?* ________

I hereby declare that this is the only questionnaire completed and personally signed by myself.

*Signature*________________

*Town*________________

Mark your envelope "Questionnaire" and Address:
THE EDITOR OF TELEVISION,
58-61, Fetter Lane,
LONDON, E.C.4.

(*In order to avoid cutting this issue of* TELEVISION *it will suffice if the numbers are written on a postcard or sheet of note paper and the replies placed opposite.*)

AN EXPERIMENTAL SYNCHRONISING SIGNAL

One of the major problems in television reception is the accurate adjustment of the synchronising gear. Unless this adjustment is correctly made before the transmission starts, much valuable time is wasted while the picture is being received. This article, by S. Rutherford Wilkins, describes a simple 375-cycle oscillator which will enable you to check the synchronising independently of the transmission.

THE synchronising section of a normal television amplifier consists of a fairly large power amplifying valve with an input transformer tuned to peak at 375 cycles. The input is usually taken from the output of the modulation valve (Fig. 1). The object of the tuned transformer is to give selective amplification of the 375-cycle component of this low-frequency voltage, the former being the frequency of the synchronising signal transmitted by the B.B.C. Thus the only frequency appearing in the output of the synchronising stage should be 375 cycles.

Owing to the fact that the television transmissions only occur for a short period and at a late hour, there is usually very little time to spend tinkering with the synchronisation side of the apparatus, it being necessary to concentrate on the actual reception of pictures.

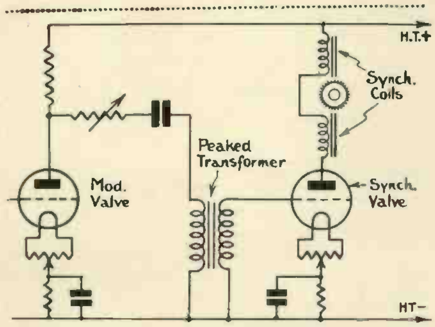


Fig. 1.—Circuit showing the usual synchronising arrangements employed with a mechanical receiver.

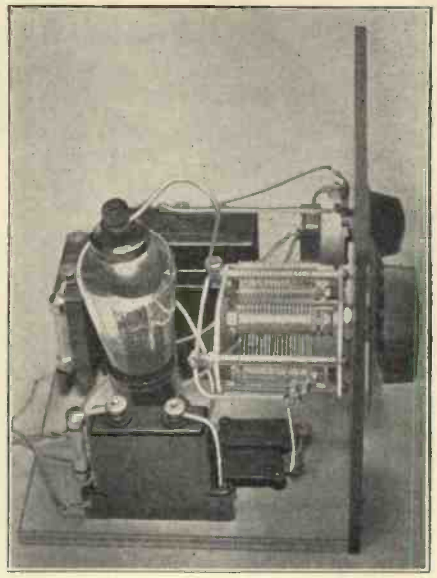
An Aid to Synchronising

In order to give myself a chance to do a little experimenting with my synchronising gear, I found it helpful to have some independent 375-cycle source which could be fed into the amplifier and used instead of the transmitted signal when no B.B.C. television programmes were available.

In order to minimise complication, the oscillator used was a simple battery-operated dynatron. This type of oscillator depends on the fact that a screen-grid valve when fed with about twice the voltage on the screen that is applied to the anode develops a negative internal resistance. If, now, a tuned circuit is put in the anode circuit of such a valve, the whole system will oscillate when the dynamic impedance of the tuned circuit is greater than the negative resistance of the valve.

The frequency of these oscillations depends on the L.C. product of the tuned circuit, and in order to induce the valve to oscillate readily the $\frac{L}{C}$ value should be high. As the frequency stability of the oscillator improves with a large value of tuning capacity, however, it is not advisable to have a coil with too large an inductance. This limitation is not serious, however, as the dynatron is an inherently stable type of oscillator, and in any case a small percentage change in frequency only means one or two cycles when we are dealing with frequencies of the order of 400 cycles.

In the present oscillator I found it convenient to use the primary of a Ferranti output transformer as the inductance in the anode circuit of the screen-grid valve. The inductance of this winding was found to be a little over 30 henries. This required a condenser a little under .006 microfarad to tune to a frequency of 375 cycles. This capacity, in practice, was achieved



This photograph shows the simple oscillator for producing an artificial synchronising signal.

by means of two fixed condensers of .005 and .0005 microfarad in parallel with a .0005 microfarad variable. By means of the latter it was possible slightly to alter the frequency of the note when checking, and so ensure an output of exactly 375 cycles. As it is unlikely that the reader will have at his command a beat note oscillator with which to check the frequency of his output, the best way of doing this is to check it up against the B.B.C. synchronising signal.

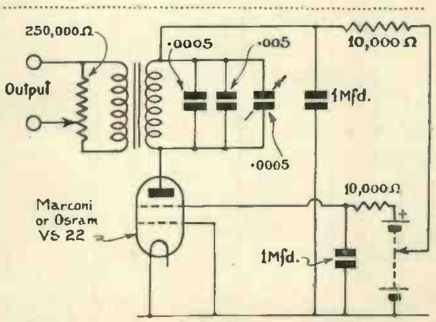
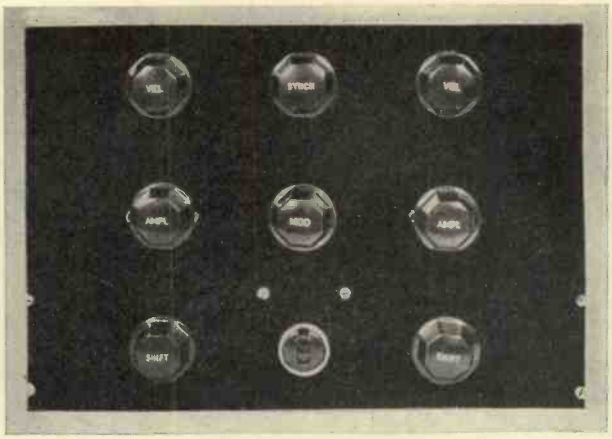


Fig. 2.—The circuit diagram of the dynatron low-frequency oscillator described in the text.

The way to do this is to replace the synchronising coils temporarily by a loudspeaker. When a television programme is now tuned in the well-known synchronising note will be heard in the loudspeaker. The output from the oscillator is also connected to the input of the television amplifier, and the small variable condenser on the oscillator is gradually varied until a beat of 4 or 5 cycles a second is heard in the speaker, superimposed on the synchronising note. This will then

(*Continued on page 222*)

A Double Time Base for Cathode Ray Television



The panel of the time base.

THE design and layout of this double time-base, the circuit of which is shown below, is based on the assumption that it will be used with an existing cathode-ray tube exciter unit. If, however, the television equipment is to be assembled as a complete unit, the panel layout of this time-base can be modified to include the controls for the tube, leaving the H.T. supply to be connected to the appropriate terminals.

It is advisable to sound a note of warning about the connection of this time-base in its present form to the tube-supply circuit. As we have seen, the modulating signal is applied to the auto-bias circuit of the tube itself through a potentiometer. To connect the potentiometer in the shield circuit, it will have to be broken and the terminals of the modulating potentiometer connected between the shield and the auto-bias resistance. It is most important that this connection should never be broken when the tube is operating or the shield bias will be removed and the tube ruined. When connecting up, particular attention should be paid to this part of the circuit, and it is advisable to check that there is continuity through the potentiometer to be on the safe side.

Components

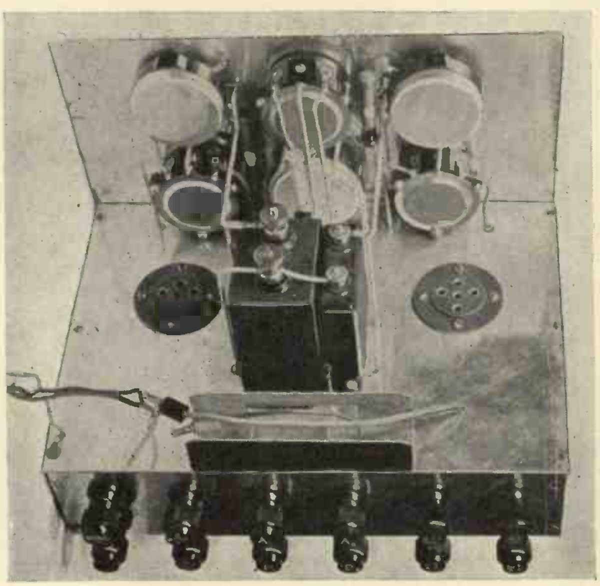
The components required for the time-base are given in an inset on the next page. It is not recommended that alternatives should be used as the panel has been made as compact as possible and larger sizes of components might not fit. In addition, the following sundries will be required: 14 No. 4 csk. brass woodscrews ½ in., 12 6B.A. round head ½ in. screws and nuts, ¼ lb. No. 18 s.w.g. tinned copper wire, 4 lengths Systoflex tubing to fit. Odd lengths of flex.

Panel and Chassis

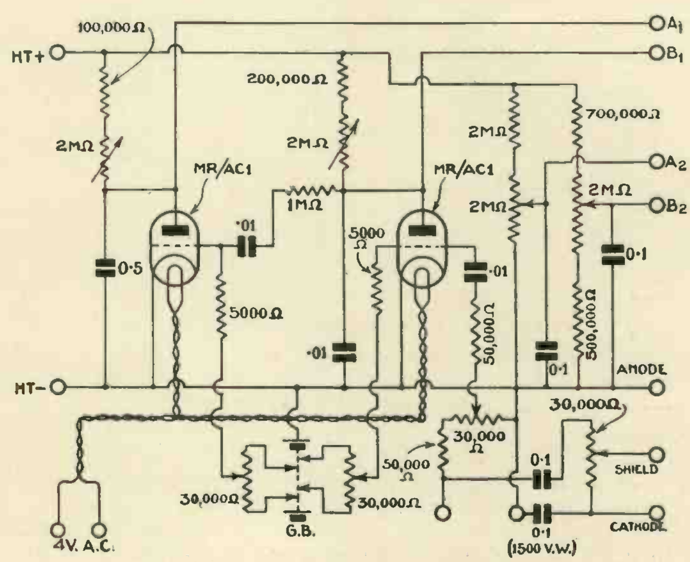
In the time-base illustrated in the photographs the front panel shown was cut from 1/16 in. aluminium sheet, although ¼ in. ebonite would have done equally well for the panel.

The chassis is cut also from aluminium sheet, bent over at the back to form the terminal rack. The sides are reinforced with ⅜ in. plywood to give stiffness to the platform. In cutting the aluminium chassis a tongue of metal was left at one end to fasten the front panel and give further rigidity.

For those not accustomed to work in aluminium, the whole can be built of plywood or "Plymax," but the use of metal makes a neat job, and it is by no means difficult to work.



The double time base is particularly compact.



The theoretical circuit diagram.

It cuts easily with a pair of small snips, and the usual carpenter's bit is sufficiently keen to cut circular holes where required for the terminals and valve-holders. Although care must be taken in insulating the terminals from the metal, bushes are provided with them, and the fixing is straightforward.

Aluminium has the advantage that it does not warp and provides an efficient screen and earthing connection at all points. The cutting diagram should be followed for the front panel, whether of metal or ebonite. The holes shown allow for insulating bushes round the potentiometers. If the Bulgin type of on-off switch is used, the lowest centre hole can be reduced.

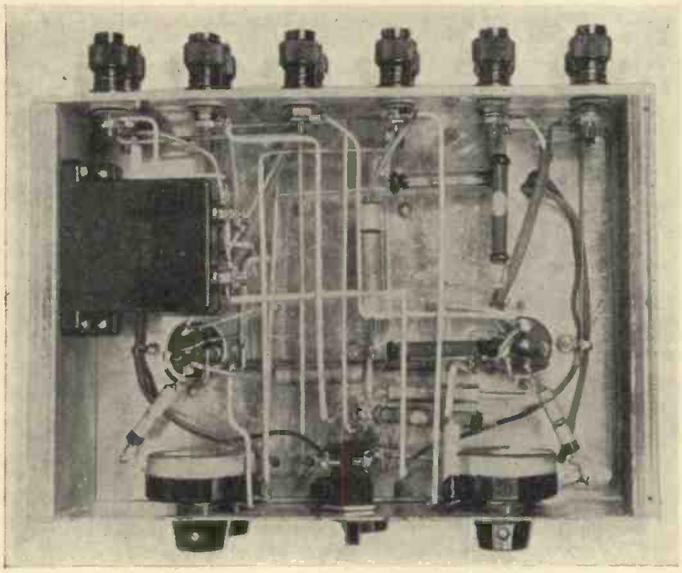
The chassis is cut to the dimensions given by the drawing. The dotted line shows where the sheet is bent at right angles to form the terminal mount, and at the other end of the sheet the projecting tongue shown is to bend in the same direction to fasten to the front panel. The screw holes for fixing this tongue to the panel should be pricked through from the front of the panel when the whole is assembled in order to make sure that they register correctly.

After all the holes have been drilled, the chassis can be bent up. The best means for doing this is to use a pair of angle iron strips about 18 in. long, clamped in the jaws of a vice. This ensures that the panel is bent along the marked line cleanly and at one operation. If the bend is tapped with a hammer to sharpen it, a piece of hard wood should be interposed between the hammer and the metal, or unsightly marks will be left on the edge.

The plywood sides are cut from $\frac{3}{8}$ in. plywood and measure $6\frac{1}{2}$ in. by $2\frac{1}{4}$ in. deep. The whole chassis and front panel can then be bolted together and the mounting of the valve-holders and fixed condensers undertaken, with the exception of the condensers under the chassis.

The potentiometers for the vertical travel of the beam are mounted at the left of the panel looking from the

(*Continued on page 222*)



This photograph shows the underside of the chassis.

List of Components for Double Time Base.

CHASSIS
1—Peto-Scott aluminium to specificatiou.

CONDENSERS, FIXED.
2—T.C.C. .01-microfarad, type tubular.
1—T.C.C. .01-microfarad, 1,000-volt working.
2—T.C.C. .1-microfarad, type tubular.
2—T.C.C. .1-microfarad, 1,000-volt working.
1—T.C.C. .5-microfarad, 1,000-volt working.

HOLDERS, VALVE.
2—Clix five-pin, type chassis mounting.

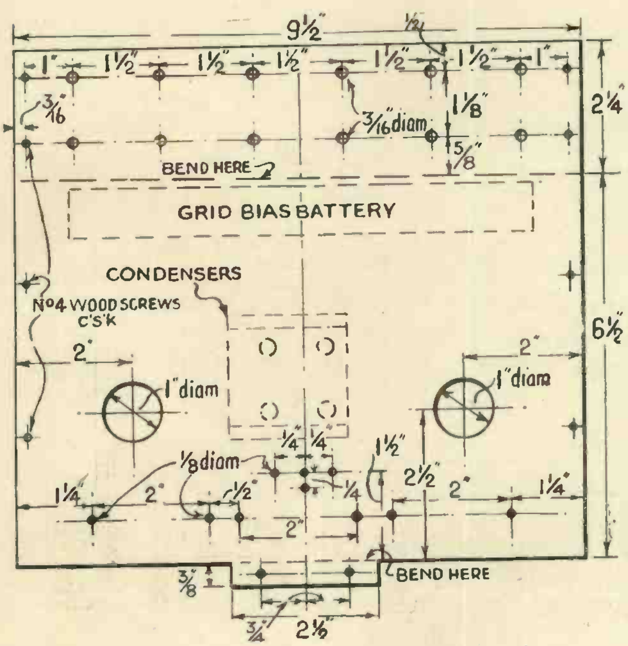
RESISTANCES, FIXED.
10—Dubilier, type 1-watt, values: 5,000-ohm (2), 50,000-ohm (2), .1-, .2-, .5-, .7-, 2-, 1-megohm.

RESISTANCES, VARIABLE.
4—Reliance Manufacturing, 30,000-ohm.
4—Reliance Manufacturing, 2-megohm.

SWITCH.
1—double-pole on-off.

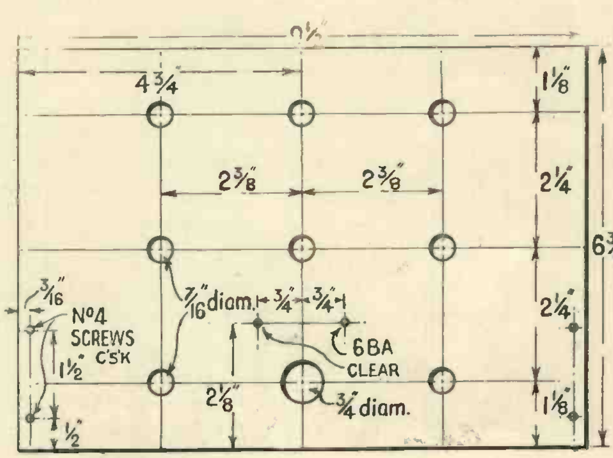
TERMINALS.
12—Belling Lee, type B with insulating bushes, marked: Input (2), L.T.A.C. (2), H.T.+, H.T.—, Mod. (2), A1, A2, B1, B2.

VALVES.
2—Ediswan M.R./AC1 mercury vapour relays.



Left: Details of Chassis.

Below: Diagram showing panel layout.



"An Experimental Synchronising Signal"
(*Continued from page* 218)

indicate that the difference between the frequency of the oscillator and that of the B.B.C. synchronising signal differ by only 5 cycles.

At this point a note should be made of the condenser dial reading. If now the capacity of the condenser be altered slightly to produce a 5-cycle beat on the other side of the zero-beat position, the intermediate point between these two readings will give the setting for 375 cycles.

The output of the oscillator was taken from the secondary winding of the output transformer, which is of the low-impedance step-down type, having a ratio of 15 to 1, the output being varied by means of a high-resistance potentiometer connected across this winding.

A full circuit diagram is shown in Fig. 2, and the accompanying photograph will give all the necessary constructional details. The high-tension voltages used were 60 on the screen of the valve and 27 on the anode, and with these values the output was quite sufficient to carry out the necessary tests on the three-stage television amplifier that I was using.

If it is necessary slightly to increase the output from the oscillator, it might be advisable to increase the screen voltage to 120 and the anode voltage to 50. Another method is to employ a transformer with a larger secondary winding, but be careful not to make the winding too large, otherwise variation of volume will alter the note.

With an oscillator of this description it is quite a simple matter to ascertain the number of volts in the synchronising coils required to hold the mirror drum or disc at the right speed.

Nearly all mirror drums are provided with a stroboscope, which is a series of black and white patterns so arranged that one particular pattern will appear to be stationary if viewed by the light of a lamp fed from 50-cycle A.C. mains, when the drum is rotating at its correct speed. If now the input from the oscillator is fed into the television amplifier, and its magnitude altered either by means of the amplifier volume control, or by the output control on the oscillator, until the drum is held steady at its correct speed for a long period of time, it may be taken that the correct synchronising voltage is being developed across the synchronising coils. It is a good plan slightly to slow the speed of the drum by touching the spindle with the finger. Provided the change in speed is not great, the synchronising signal should restore the speed of the motor.

This voltage can now be measured by means of a good class alternating current voltmeter. When the television signals start, it will only be necessary to vary the synchronisation control on the amplifier until the correct voltage is shown across the synchronising coils in order to ensure good synchronisation and a steady picture.

Another useful function of this little oscillator is to test the efficiency of the 375-cycle peaked transformer. The procedure for this is to apply the output from the oscillator to the input of the television amplifier with a voltmeter or other indicating device connected across the synchronisation coils. The frequency of the oscillator note is then varied on either side of 375-cycles, by means of the small .0005 microfarad variable condenser, and a rough curve can be plotted showing the relation between frequency and output volts. This curve should peak quite steeply at 375 cycles.

"A Double Time Base for Cathode Ray Television"
(*Continued from page* 220)

front, and it is advisable to scratch a "V" on them to prevent confusion when wiring them in an upside-down position!

If the wiring is undertaken in a definite order it will save trouble in one or two awkward places at a later stage. For this same reason the fixed condensers on the underside of the chassis should not be fixed at this stage, but left out for the time being.

The order of wiring which will be found simplest to follow is:

Filament sockets of the valve-holders to be connected parallel and to the terminals marked AC.L.T. Use twisted flex for this, or twist the Systoflex covered leads together.

Connect the cathode sockets to the chassis by soldering leads from them to one of the holding screws of the valve-holders.

The following two points can also be earthed to the chassis: H.T. -ve. Lower end of right-hand shift potentiometer viewed from the front.

By the way, notice that the shift potentiometers and the speed control resistances are mounted asymmetrically, and care must be taken in wiring them so that they turn in the same "sense," i.e., increase their effect in the clockwise direction.

The next steps are: Interconnect "horizontal" valve-holder anode with "vertical" valve-holder grid by a 1 meg. resistance and .01 condenser and lay these as near the metal chassis as possible without touching.

Wire up the double-pole on-off switch to the grid-bias tapping plugs. One end of the switch goes up through a hole in the chassis to the "Amplitude" potentiometer while the other end of the switch is connected to a length of flex brought up near the bias battery (see photograph). The other flex is connected to the other end of the bias potentiometer. To finish this part it will be convenient to connect the centre taps of the potentiometers to the grids of the respective valve-holders through 5,000-ohm resistances.

The 2-meg. resistances at the top half of the panel may then be wired to the H.T. supply terminals, the fixed series resistances being suspended in the wiring as seen in the photograph.

The condensers on the chassis are then connected, one terminal of each to the chassis via a fixing screw and the other terminal to the tapping on the "vertical" and "horizontal" speed controls. Take care that the .01 mfd. condenser is connected to the right-hand resistance looking from the panel front. The same terminals of the condensers go through the panel to the anodes of the respective valve-holders.

The modulating and synchronising potentiometers are now connected up, but before completing this wiring it will be necessary to fasten down the fixed condensers under the chassis. The side panel is best removed for the purpose and refixed.

Finally, the deflector plate terminals are joined to the shift potentiometers, and the two .1 mfd. tubular condensers are joined to the A_2 and B_2 terminals and to the chassis.

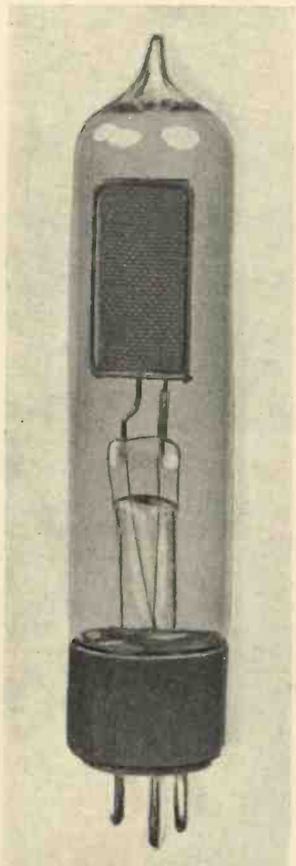
The A_1 and B_1 terminals are joined to the anodes of the valve-holders, *B_1 going to the vertical traversing circuit.*

It is not intended that the foregoing should be a comprehensive guide to the wiring up of the chassis, but rather to indicate the best method to adopt. The photographs of the underside and top of the chassis itself will show the run of the wiring.

« APPARATUS FOR THE EXPERIMENTER

The Mervyn Nu-Glow Lamp

A feature of the *Daily Express* kit set is a new type of neon lamp. The plate of this is made of gauze and the other electrode is a flat polished



The Mervyn Nu-Glow lamp.

metal plate which acts as a reflector. The striking voltage is 180 and the recommended anode current 25 milliamps. Tested direct in the anode circuit of a Pen 20 valve with a D.C. mains supply of 200 volts, the lamp struck immediately and modulated excellently. Another test was made on the Simple Television Receiver described in March issue and it was found that good bright pictures were obtained and that the modulation left nothing to be desired. We understand that for the present these lamps are only available with the kit set mentioned above, but that it is proposed to place them on the market separately at a later date.

Special Television Transformer

A TRANSFORMER specially produced for television and public address amplifiers has just been introduced by Messrs. Ohmic Acessories. This transformer has undoubtedly been designeu to stand rough usage and considerable overloads. The output is 500-0-500 volts at 150-milliamperes, 2-0-2 at 2 amperes, 2-0-2 at 4 amperes and 2-0-2 at 2.5 amperes. It is suitable for amplifiers using valves such as two DO26's, in push-pull, and two low-frequency stages with a DW4 full-wave rectifying valve.

It is one of the largest and most soundly constructed transformers of its kind on the market. No. 2 irons are used having a cross section of $3\frac{1}{2}$ in., while the various secondaries are wound with the gauge of wire sufficient to stand exceptional overloading. The primary is tapped for all voltages between 300 and 250 in steps of ten. Careful matching of the primary to the mains voltage is essential owing to the unusually good regulation, small variations in primary voltage cause rather wide differences in secondary voltage. As may be expected with a core of $3\frac{1}{2}$ in. cross-section, the regulation is remarkable. For example, the 4-volt 4-ampere winding off load gives 4.1 volts and the application of 4 amperes load decreases the voltage by less than 1/10th. The same regulation applies to the other windings.

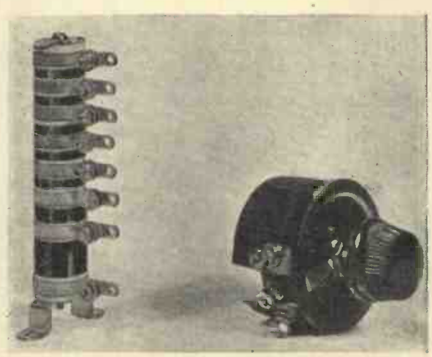
Ohmic Accessories transformer.

The primary is screened from the secondary, and the screen connection is brought out to a soldering tag under a fixing bolt.

It is quite obvious that this transformer has been designed to give a predetermined performance, irrespective of price, but even so the manufacturers are able to retail this at the low figure of 39s. 6d. Besides being one of the cheapest transformers of its kind, it is one of the most robust in the 500-volt class. For those who intend to make up television amplifiers or high output equipments for public-address work it will be found to be ideal.

Peto Scott Resistances

We have received from Messrs. Peto Scott, Ltd., two samples of their resistances intended for use for



Two Peto-Scott motor resistances.

the speed control of television motors. One of these is the preset type with tappings, the range being such that it will cover all requirements of all D.C. or A.C. mains. The other resistance is of the variable type for actual control of motor speed. This has a total resistance of 150 ohms and tests showed that a very smooth and fine control was possible and that the motor speed could be held steady at 750 revolutions per minute for long periods without difficulty. These resistances are eminently suitable for use with disc-type visors and can be recommended.

THE TELEVISION ENGINEER

GAS-FILLED RELAYS—III

By C. R. Dunham, B.A.

This is the third and concluding article describing in a simple manner the theory and operation of the gas-filled relay. The two preceding instalments appeared in the February and March issues.

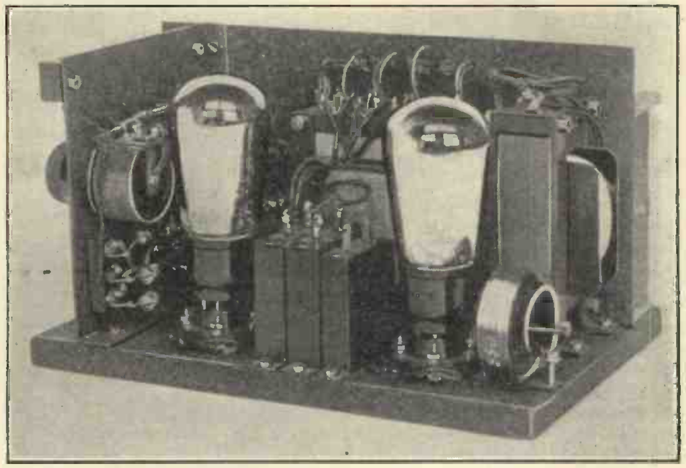


Fig. 14.—An inverter of the self-excited type employing a pair of gas-filled relays.

AN inverter of the "self exited" type employing a pair of Osram GT.1 gas-filled relays is shown by Fig. 14. This inverter is capable of delivering an A.C. output of 50 watts at 50 cycles per second, when fed from a D.C. supply of 200-250 volts. A few notes on the practical design of this circuit, and its operation, will be given for the benefit of the amateur experimenter.

Two transformers are required, a main transformer to couple the D.C. and A.C. circuits, and a grid transformer. The main transformer has a centre-tapped primary winding of 2,850 turns in all of No. 30 d.s.c., and a secondary winding of 1,800 turns of the same wire, wound on a laminated iron core of 1 in. square section. The grid transformer has a core of ⅝ in. square section, with a primary winding of 7,700 turns of No. 42 enam. and

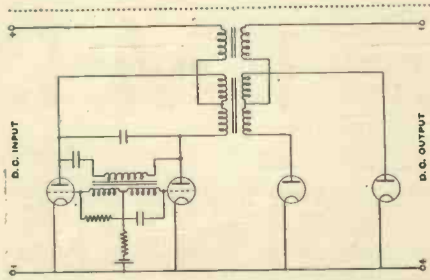


Fig. 16.—A circuit of a high-efficiency D.C. transformer.

s.s.c., and a centre-tapped secondary of 4,000 turns in all of No. 40 enam. and s.s.c. It is necessary to insert a choke in the d.c. circuit in order to assist the commutation of the current between the two valves. The choke consists of 1,500 turns of No. 28 d.s.c. wound on a core of 1 in. square section, a small airgap being arranged in the iron circuit in order to prevent loss of inductance due to the saturation of the iron by the D.C. The remainder of the components of the inverter are at

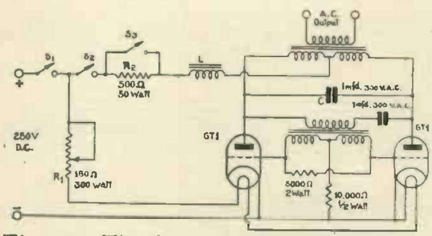


Fig. 15.—The theoretical circuit of the inverter shown by the photograph.

once apparent from the circuit diagram which is given by Fig. 15.

When the inverter has been assembled, the resistance R_1 must be adjusted so that the current which flows through the filaments of the two gas-filled relays is 1.3 amps., when the switch S_1 is closed. After allowing one minute for the cathodes to attain the correct operating temperature, the switch S_2 may be closed to connect the supply to the inverter circuit proper. The circuit should then "invert," which will be apparent from the flickering blue glow in the two valves, and an alternating voltage will appear between the terminals of the secondary of the main transformer.

On the first occasion it may fail to do so, this will be because the grid transformer has been connected in the wrong phase. This may be corrected most easily by reversing the leads to the primary of the grid transformer. When the inverter has been made to operate in the proper manner, the switch S_3 may be closed, thus shorting out the series safety resistance R_2. This switch must not, however, be closed if the inverter is not operating properly, or an unduly heavy current will pass through the transformer windings.

Under the above conditions, when the D.C. voltage is 230, the output voltage will be 250 for a 50-watt load. Should a different output voltage be desired, it would be necessary to design the main transformer to have a correspondingly different number of turns in the secondary winding.

The figure quoted of 50 watts is not the limit of what a pair of GT.1's are capable in an inverter. In a well designed circuit, using a main transformer of larger size, 100 watts may

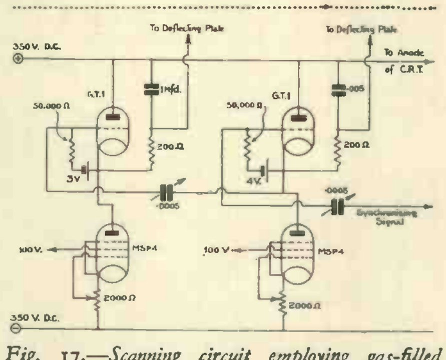


Fig. 17.—Scanning circuit employing gas-filled relays for 180 lines and 25 pictures per second.

quite easily be obtained when the D.C. supply voltage is 200, and the efficiency will be about 80 per cent. For higher supply voltages the wattage is proportionately increased, and the efficiency of conversion is also higher.

The frequency of the alternating output may be controlled by adjusting the constants of the grid excitation

(Continued on page 230)

"WHAT THE B.B.C. SHOULD DO"

continued from page 191

More Opinions: W. J. Nobbs and E. L. Gardiner

ment, but the difficulty and therefore the cost of establishing a reliable and sufficient service is much greater than was the case with telephonic broadcasting. They believe that it is not unreasonable to ask the public to encourage the development of television by paying for experimental transmissions and buying such television apparatus as is at present available. The public will eventually derive the greatest benefit.

The public is interested in television, it appeals to the imagination. Unfortunately cheap apparatus, of reliable performance, has not been obtainable by those interested, and uncertainty regarding television programmes is not calculated to induce them to take it up. Consequently, the public has been unable to form any opinion up to the present. That opinion is the only one that matters ultimately, for no one can presume to decide for the public. The public supported the gramophone, cinema, motor-car and radio in the earliest stages of development, and that support was by no means niggardly. Modestly submitted, it is probable that the public will encourage television at once, though they will not tolerate anything in the nature of a television ramp.

There is another aspect which concerns television itself, and that is the danger of establishing a service working on present-day standards of television. This might give something of a service, but would obstruct the introduction of improved methods. Television to-day is in a state of flux, and until it has become stable enough to plan a few years ahead, nothing should be done which is likely to dwarf its growth. We know that something which will become a giant is being born, but it is no use at this stage trying to decide just what it is going to be by imposing restrictions or establishing anything which will have to be displaced against the opposition of vested interests, probably in the near future. Television must be allowed to develop naturally, and when it has reached a satisfactory stage it will itself show what should be done with it. In any case, then the public will know what they want, what they can get, and how they would like to have it. Meantime everyone genuinely interested should help as much as possible.

In conclusion, it seems that experimental transmissions by existing wireless stations will do much to popularise television and encourage those engaged in its development, but the establishment of a full television service on present-day standards may do harm by delaying the introduction of real television. When television is within measurable distance of giving pictures as big, bright and good as the cinema which can be transmitted and received as readily as telephony over channels as universal as those used for telephony—then it is time to think of how it is to be handled.

From E. L. Gardiner, Esq., The Radio Reconstruction Co., Ltd.

I am unable to conceive any logical reason why the B.B.C. should reduce a service already far inferior in quality to those available in Germany and America. I admit in fairness to the B.B.C. that they came into the field early, and that the quality of their television transmissions has reached an extraordinarily high standard; but surely this very high quality which has been so laboriously evolved is in itself a powerful reason for a large increase in the broadcasting hours.

I am no believer in our present 30-line vertical scanned standard, but since we have this standard now widely established, and there are many thousands of receivers for it in the hands of the public, it would seem best to retain it in preference to the comparatively small gain which would result if a change was made to, say, 60-line horizontal scanning of " cinema ratio."

Time Ripe for Inclusion in Programmes

I take the point of view that low- and high-definition television services are in no way mutually exclusive, and must in fact be provided and developed together to give an adequate national service. High-definition means at present the use of ultra-short waves, of localised range only, and is also still in an early stage of evolution; and there seems no justification, even if this line is most energetically pursued by both the B.B.C. and other workers, for expecting a satisfactory service over the whole country for about another two years at least.

I have been very impressed in recent months when viewing images on the latest types of receivers with the excellence and very considerable " programme value of " close-up subjects as now transmitted by the B.B.C., and I feel that the time is ripe for the inclusion of this type of television within the normal B.B.C. programmes, which would benefit greatly thereby.

Presumably television will eventually be used to show us the faces of all the most important broadcast speakers. I submit that the present 30-line service has reached the stage when it is quite adequate for this work, which should always be the prerogative of a low-definition television service using a comparatively long wave-length which can be received over the greater part of the British Isles.

The B.B.C. has the technique, the studio and transmitter; and there are many hours a day still when both transmitters are not being made use of to give an alternative programme. Let them introduce television at once into the suitable portions of their everyday programmes, and I feel sure that they will not be long left in doubt as to the great interest which awaits a chance of development.

From W. J. Nobbs, Esq., Managing Director, Mervyn Sound & Vision Co., Ltd.

The present arrangements for television broadcasts by the B.B.C. must bring forward just criticism against them.

In the year 1934, with the potential advantages of television becoming common talk among the public, we find the B.B.C. reducing the broadcasts to two per week, without any justification. For some time now the number of new " lookers-in " has been steadily increasing, and in recent weeks the figures have been, and still are, jumping up at an enormous rate. If the B.B.C. gave an adequate service to take the place of the present transmissions, much of their attitude could be understood. I am, of course, referring to transmissions of high-definition television on the ultra-short waves.

As far as I know, no commercial high-definition apparatus is readily available, both as regards the radio side and the actual television reception equipment, and even if it were, to provide satisfactory service would mean the erection of a

(Continued on page 230)

"Gas-Filled Relays—III"

(*Continued from page* 226)

circuit, but there is a lower frequency limit determined by considerations of transformer design. There is also an upper frequency limit beyond which the efficiency of the circuit becomes very low, owing to the fact that period required in each half-cycle for the ions in the non-conducting valve to disappear is no longer short compared to the time of the half-cycle. 10 to 1,000 cycles per second might be taken as a practical frequency range for inverters (but not for a single inverter).

The wave-form of the alternating current obtainable from a simple inverter, such as that described above, is for all purposes rectangular in form. However if the choke *L* (Fig. 15) is made to tune with the condenser *C*, a sinusoidal output wave-form results; in practice this is a difficult condition to achieve (except by accident). In very many applications the rectangular nature of the wave-form offers no objections, and in some cases it has decided advantages. For instance when it is desired to rectify the output in order to obtain a direct current of different voltage from the original, not only does the squareness of the wave-form mean that greater efficiency can be obtained from the rectifier, but also that the resulting D.C. will be almost completely free from ripple.

Fig. 16 shows a high efficiency "D.C. transformer" in which an inverter and a rectifier are combined with a common transformer, and a common choke built as a transformer. The turns ratio of the transformer should be equal to the turns ratio of the choke, and this ratio will determine the ratio of the input and output voltages. The iron circuit of the choke requires no airgap in this case since the two D.C. fluxes will exactly neutralise each other.

Another application of the gas-filled relay, which is possibly the one which will be of the greatest interest to the television amateur, is its use as a scanning means in conjunction with cathode-ray tubes for television reception. A number of articles have already appeared in recent issues of TELEVISION, and in view of these the remarks given here will be restricted to the briefest form.

The principle of reception by means of a cathode-ray tube is well known. The employment of gas-filled relays forms the most attractive method of obtaining the necessary "saw-toothed" deflecting potentials for bending the beam of cathode rays so that the screen of the tube is scanned by the fluorescent spot in synchronism with the scanning at the transmitter. Two circuits are required, one operating at the "picture scanning" frequency say 25 per second and one operating 30, 120, or 180 times faster according to the number of lines. Fig. 17 gives in outline the circuit of a scanner for a 180-line system. The deflecting potentials are obtained from two condensers respectively, each of which is charged uniformly from a D.C. supply through a high frequency pentode, and discharged periodically instantaneously, through a gas-filled relay. Care has to be taken that the high frequency pentode is operated over that part of its characteristic where its anode current is constant.

The voltage across the condenser therefore increases linearly with respect to time, until it reaches the value at which the gas-filled relay strikes. The condenser is then practically instantaneously discharged through the gas-filled relay, and commences charging again. It is most important that some resistance be included in the discharge circuit in order to dissipate the energy liberated by the condenser at each discharge, otherwise this energy would be dissipated inside the gas-filled relay and would rapidly destroy the cathode by sputtering.

Adjustment of the grid voltage of the gas-filled relay will alter the magnitude of the voltage swing obtained across the condenser, and hence the dimension of the scanned area. The frequency of operation is adjusted by altering the charging current, i.e., by varying the grid voltage of the pentode. Synchronism is very easy to maintain by the application of minute impulses to the grids of the two gas-filled relays obtained, in the case of the high-frequency circuit, from the synchronising signals transmitted and received, and in the case of the low-frequency circuit, from the high-frequency circuit.

"What the B.B.C. Should Do"

(*Continued from page* 228)

series of transmitters around the country, which I doubt could be in operation inside twelve months.

Extension Desirable

Meanwhile, those who are taking up the subject must be forced to have what practically amounts to one half-hour per week. The other transmission on Friday morning gives the dealers—who I know are definitely interested in television—an opportunity of demonstrating. But, apart from the fact that the customer has to be told he can see the broadcast on Tuesday nights at 11 p.m., to whom is the dealer going to demonstrate!

If the B.B.C. do not feel justified in extending the service, why do they not cease altogether and allow commercial firms to provide their own service, as they did in the early radio days. Such an arrangement could be quickly arrived at, and the B.B.C. would be able, if desired, to lease the use of transmitters not in use to such an organisation. The monopoly claim of the B.B.C. could be handed back in, say, two years, after it had reached a considerable state of development.

There are available technical experts who could decide the matters arising and progressively prepare the public for the high-definition broadcasts which will eventually come.

There appears no justification yet for dropping the present transmissions. In my opinion, they are capable of providing entertainment without trying to be ambitious in the production. The present 30-line transmissions should be continued for some considerable time and alternative service with a higher number of lines—either 60 or 90—immediately be instituted.

The high-definition ultra-short transmissions should be allowed to develop naturally, and the progression from low to high take place in an orderly and gradual manner.

The B.B.C. is definitely forcing the issue, which will undoubtedly give the "looker-in" transmissions from Continental transmitters, mixed up with a plentiful supply of doubtful publicity broadcast.

I, of course, realise that a definite decision first on the question of horizontal or vertical scanning and shape of the picture area must be reached, but surely this is capable of immediate settlement, to everyone's benefit. Such a decision has to be reached sooner or later, and it might as well be now. The question of the number of lines is largely governed by wavelength and reception problems.

Just one other point worthy of mention. If the B.B.C. consider that they must not spend revenue on television, they should issue debentures, which they are empowered to do, to cover the financial needs of both high and low-definition television. The issue of such debentures would be welcomed.

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The enormous interest aroused by the "Daily Express" Television Kit clearly shows a definite desire on the part of the constructor public to experience the thrill of their first pictures "over the air."

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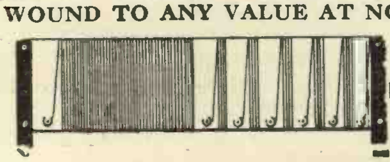

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* (1) I already subscribe to your journal at the address below.

(2) I have placed a regular order for TELEVISION with my booksellers, Messrs..........

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Please send membership badge *free of charge* to

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*Strike out lines not applicable.

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Readers residing in the New Malden and surrounding districts will be interested to know that the above society has facilities for experimental work, which include machine tools, that are at the disposal of members. The club nights are Tuesdays and Fridays. Particulars of membership can be obtained from the Secretary, Mr. R. W. Blake, 31 Idmiston Road, Worcester Park, Surrey.

Television Lectures

A special course of four lectures on television has been arranged by the Polytechnic, Regent Street, London, W. These will be given by H. J. Barton Chapple, Wh., Sch., B.Sc., on Wednesdays, commencing May 30, at 6.30 p.m. The course is intended for those who have a reasonable knowledge of electrical technology and desire to become acquainted with the principles of television. The fee for the course is 6s.

We are informed that W. Andrew Bryce & Co., of Woodfield Works, Bury, Lancs., have taken over the business of Wilburn & Co., manufacturers of Peak condensers. In future all communications respecting these should be addressed as above.

The Television Society

Owing to the demands upon our space in this issue we have been obliged to hold over the report of the April meeting of the above society.

ANSWERS TO QUERIES

An expert service is available to assist readers who experience difficulties in the construction, operation and maintenance of television apparatus or associated wireless receivers and amplifiers.

The following rules should be observed:

Please write clearly giving all essential particulars.

A stamped, addressed envelope and also the coupon on the last page must accompany all queries. Not more than two questions should be sent at any time.

Reply will be made by post.

Queries should be addressed to the Query Department, TELEVISION, 58-61, Fetter Lane, London, E.C.4.

Miscellaneous Advertisements

Readers who wish to sell, exchange or purchase apparatus will find this column a very successful means of disposing of their surplus gear, or obtaining new apparatus at bargain prices.

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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DISC RECEIVER COMPLETE, cost £7, accept 70/-.—"Roma," Moor Park Road, Northwood, Middlesex.

BENNETT TELEVISION CO. ANNOUNCE NEW RECEIVER OUTFIT. The amateur, instead of hearing about Television, can See for Himself with this receiver without extra expense. The Receiver includes Bennett metal enclosed lens assembly (specified in "A.W.," April) and half-dozen other complete units ready to mount on base-board supplied. Different Television type lamps can be used, the cheapest being the Beehive Neon. Models for A.C. or D.C. mains, 200/250 volts, or 6 volt battery supplied at same price, £3/17/6, carriage paid; with Beehive Neon, 3/- extra. Separate Television Components supplied, including "Baird" and Mervyn apparatus. Lists free.

DALLOW CABINET FOR MERVYN TELEVISION KIT. The Dallow Manufacturing Co., Ltd., Forge Mill, Milford, Derby, are manufacturing a Cabinet for the Mervyn Television Kit for home constructors, which is being sponsored by the "Daily Express." This is veneered in figured walnut, strongly constructed, distinctively designed, and well finished. The retail price is 23/6, and deliveries will be available in seven days.

THE "SALTER" MAJOR AND MINOR complete Kits, supplied direct to constructors, now available. Prices from £3/10/-.—John Salter, Estd. 1896, Member of Television Society, Featherstone Buildings, High Holborn, W.C.

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MOTOR & 750 OHM RESISTANCE BAIRD, 16" disc Mervyn £2. 5. 0. 82, Glebelands Road, Prestwich, Manchester.

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Cathode Ray Potentiometers and Resistances are available from stock for the instrument described in this issue. Price 4/9. Post 3d.

Synchronising Gear complete for double-ended spindle motors, unassembled, 22/6; by post extra 9d.

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Super Quality Lens 4" Biconvex, allowing pictures to be further enlarged without distortion, 5/- post free.

"E.L.G." Motor with Polished Base, 35/-, post 9d.

We have for disposal a few slightly used components for Mirror Drum Receivers. Let us know your requirements, and we will quote you lowest price.

Handbook
"Easy Lessons in Television" 2/- Post Free

Call and let us explain technical details.
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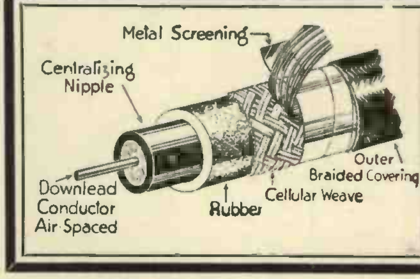

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