G. E. ENGINEER

By I. J. KAAR
Design Engineer, Radio Div.
General Electric Company

Mr. Kaar discusses a few of the outstanding problems which face the television stations both from the financial and technical ends.

A British version giving a 2-ft. picture without the use of expensive C-R tubes.

THE quality of television pictures achieved in the past few years has certainly been good enough to interest an increasingly large proportion of the population, but there are still two major questions to be answered, I. J. Kaar, design engineer of the General Electric Company's radio division, pointed out in a paper delivered November 1 in Detroit, before the fall convention of the Society of Motion Picture Engineers. The first of these—fixing satisfactory television standards—has practically been settled now, he added. The second is a method of paying for the programs.

"Television differs from sound broadcasting very markedly in the importance of standards," said Mr. Kaar. "In the latter the technical quality of transmitted programs can be improved year by year, and while this happens a receiver once purchased is always usable, even though it may become outmoded. The situation in television is quite different. Because of the use of scanning and the necessity of synchronization between receiver and transmitter, if transmission standards are changed, receivers designed for the old standards become useless. Because of this fact no responsible manufacturer would sell receivers to the public until standards were fixed by the industry and sponsored by the Federal Communications Commission.

"It required considerable technical perfection to justify our high standards, but this has now been attained and the essential standards agreed upon. It may be said with some assurance that the last technical obstacle in the path of commercial television, at least so far as the excellence of the picture under proper conditions is concerned, has been removed."

The question of who shall pay for television programs has not been answered, Mr. Kaar said, pointing out that the present broadcasting system, with its commercial sponsors who pay the bill, requires the existence of tens of millions of receivers, with listeners who may be induced to buy the advertised products.

"Such an audience does not exist in television," he said, "and cannot be expected for several years. Of course, no such audience existed in the early days of sound broadcasting, either, and the receiver manufacturers, along with a few others, operated the stations. In those days, however, the thought of something coming through the air, receivable at no cost, was an entirely new one. People were quite satisfied with the new toy as such and program excellence was a secondary consideration. This meant that the cost of broadcasting, as compared to the present, was low. Now the public has been educated to expect a high degree of excellence in program material. In other words, when television is born, it must be born full-fledged as far as program material is concerned. This means great expense, which undoubtedly will have to be borne by the pioneers."

In television, it was pointed out in a discussion of the standards which have been adopted in this country, the picture is scanned at both camera tube and picture tube by an electronic spot in a series of adjacent horizontal lines. The number of lines into which the picture is divided in the scanning process determines the fineness of vertical detail which is reproducible. After scanning the whole picture, the electronic spot then repeats the process at a sufficiently rapid rate so that no apparent flicker exists. The frequency of repetition of scanning the whole picture is known as frame frequency. In order to conserve ether space, it is desirable to keep the frame frequency as low as possible, and an artifice, "interlacing," is employed to increase the apparent frequency of repetition. It consists of scanning every other line, then scanning those in between which were missed the first time. This gives the physiological effect of scanning the picture twice, as far as flicker is concerned, even though all details of the picture have been scanned only once. The apparent flicker frequency under these conditions, which is twice the frame frequency, is known as field frequency. In America the number of lines per frame has been standardized at 441, the number of frames per second at 30, and the number of fields per second, interlaced, at 60.

Among other matters requiring standardization are the synchronizing operations at both transmitter and re-

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iscusses Television

ceiver. To keep the error small, synchronizing signals are always transmitted with the picture signals, Mr. Kaar said.

Answering the questions as to how good television will be and how much it will cost means discussing how large and bright the picture will be and how much it will show, said Mr. Kaar.

"The standard high quality television system which will possibly be commercialized shortly will have a 12-inch tube with a picture 7½ by 10 inches. Three, five, seven, and nine-inch tubes will probably also be standard commercial sizes. Compared with the size of a motion picture or even a home movie, these dimensions seem small. However, considering the fact that an audience viewing a television picture will ordinarily not be more than four feet from the screen—and in the case of the small tubes, even one foot from the screen—these sizes do have considerable entertainment value. Nevertheless it is reasonable to expect larger pictures in the best systems of the future.

"The matter of increasing the size of a cathode ray picture presents serious obstacles," Mr. Kaar declared. "As tubes become larger they also become longer, and their overall size becomes such that it is difficult to find suitable cabinets for them which at the same time lend themselves to attractive styling. When the 12-inch tube is used it is invariably mounted vertically in a cabinet, and the picture is seen as a mirror image by the observer. Since a mirror causes loss of light, and possible double images and distortion, it is an undesirable adjunct at best. As a further difficulty, as cathode ray tubes are increased in size, they require more driving power, which is expensive, and higher anode voltages, which cost more and offer shock hazards."

Mr. Kaar suggested as an alternate method of increasing the picture size the projection picture tube. In this case a very brilliant picture on the screen of a four-inch cathode ray tube is enlarged by an external optical system and projected on a screen three or four feet wide. This system requires an exceedingly bright tube with a very fine spot. The ultimate size of projection tube pictures is limited on one hand by the brightness obtainable from a fluorescent screen without causing its rapid deterioration, and on the other hand by the detail which can be obtained. Projection tube apparatus is probably too large and costly for home use, he said, but undoubtedly has a future for public performances.

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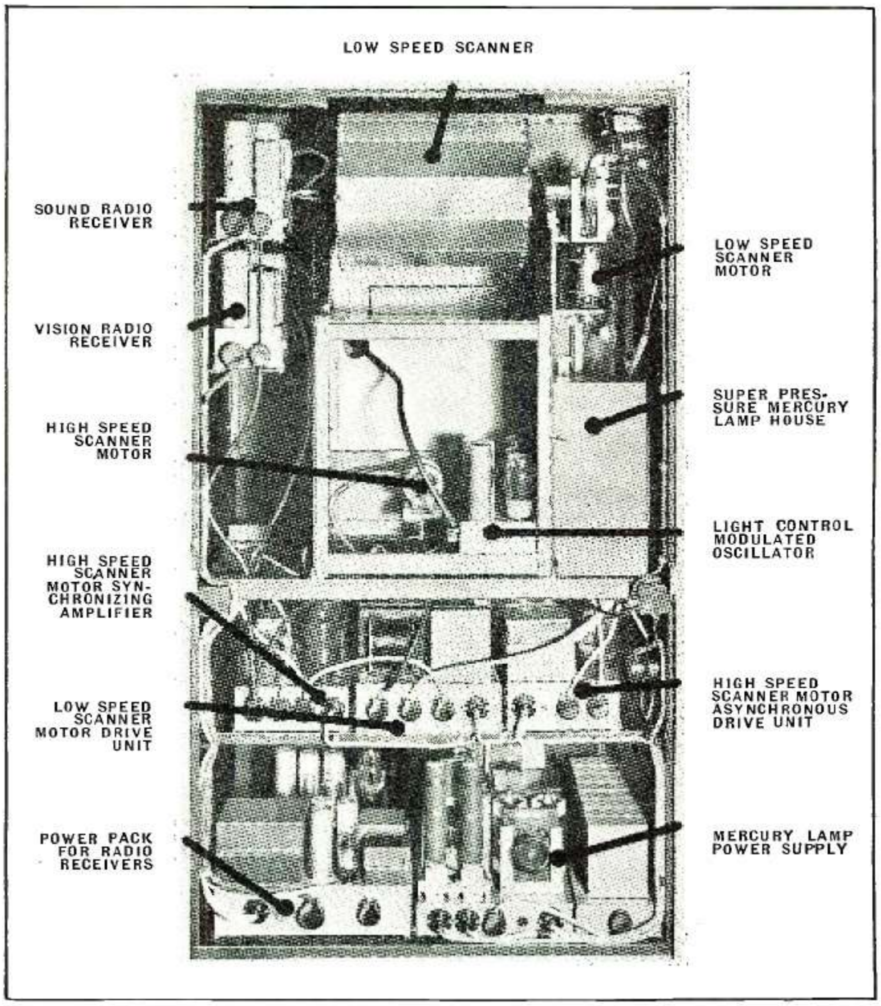

The entire "works" of the British "Scophony," all-type-transmission, television receiver.

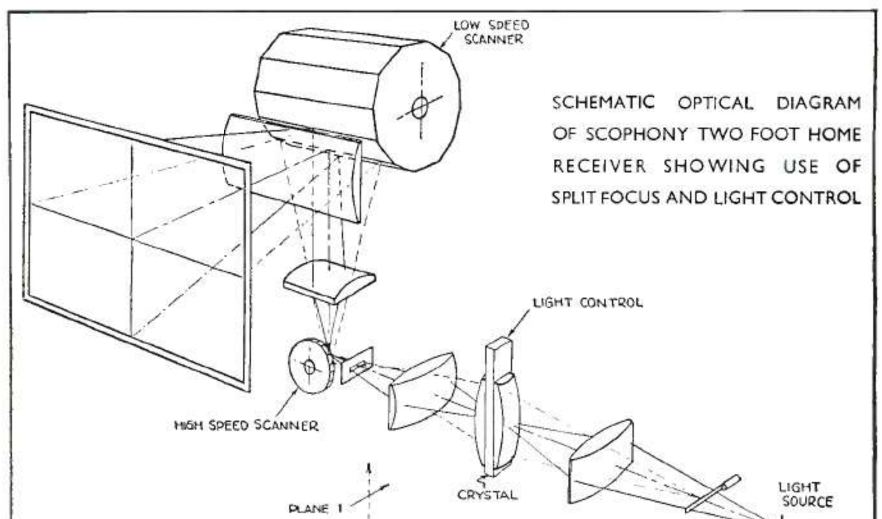

Diagram showing the mirror principle of the "Scophony" receiver.

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G.E. on Television

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He told his listeners that vertical detail depends on the number of scanning lines and horizontal detail upon the ability of the electrical system to pass extremely high frequencies. A large television picture of high quality would require, at conservative estimate, a band width of 80 megacycles per program for its transmission, or 80 times as wide as the whole spectrum allocated to broadcasting in the United States.

"The problem of signal propagation in television is far more serious than that in sound broadcasting," Mr. Kaar said. "The exceedingly wide frequency channels required in television make it necessary that signals be transmitted in the ultra-short wave bands. At these frequencies there exists reliably only line-of-sight transmission, since there is no longer reflection from the Heaviside layer. Nevertheless, because of the very short waves employed, such objects as steel buildings and overhead wires provide efficient reflectors and give rise to 'ghost' images. The severity of this problem will be realized more fully when the public begins erection of receiving antenna on a large scale.

"It is not surprising that the great problem in the relaying of television signals is cost," Mr. Kaar said in conclusion. "The cost per mile of a coaxial cable is many times the cost of corresponding networks used in sound broadcasting, both as regards initial cost and maintenance. If radio relaying is used, the cost of the relay transmitters is very great. However the coming years are likely to bring great reductions in the cost of both methods, particularly the coaxial cable.

—30—

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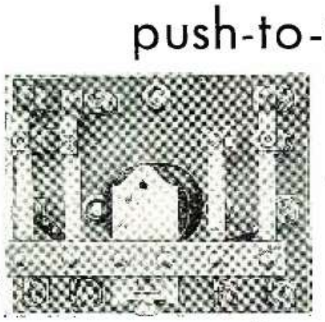

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NAT. QSO Page

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ized, diminished, or terminated, except upon a definite showing that the best interests of the membership would be served thereby.

In conclusion, I wish to commend you, the editor of RADIO NEWS, on your fair-mindedness in publishing this and other controversial communications.

(Sgd) Robert Akeridge Kirkman, W2DSY

■ **Thank you, W2DSY, for your clear, unequivocal statement of your stand and platform. We know the membership of your District will appreciate that you have taken them into your confidence (which is as it should be), and placed yourself squarely on record. If all the other Directors did as you have done, there would never be any doubt as to just what a man stood for in seeking election to the Board. We commend your action to the members of your District for careful consideration, and also to the membership at large.—The Editors.**

[*Since we received this letter, W2DSY has advised that he has been disqualified by the Committee. He also advises that he will file a protest. RADIO NEWS will faithfully report the results of the protest, next month. The Editors.*]

C. G. Plane Radio

(*Continued from page* 35)

pilot by radio his exact position.

In the construction of the first radio direction finder, Coast Guard engineers took many tips from the successful marine radio direction finders—certain basic mechanical elements like an electrostatically shielded loop to cut off effects of rain, snow, and dust static, but they were still a far cry from perfection.

The process of determining location with the present day perfected loop radio direction finder and the established radio beam differs widely. In the first place, when riding the radio beam, the more accurate the airplane is on course, the louder are the signals over the ship's loud-speaker or pilot's earphones. The radio direction finder, on the other hand, employs but one broadcasting station, and when the rotatable loop is at exact right angles to that station, then the signals are weakest. In other words, this device acts as a warning, for the more off course the pilot is, the louder are the signals from his radio direction finder.

It is but a simple matter today for the pilot of a Coast Guard plane, presumably lost at sea, to slowly revolve the loop until the signals of the station he is contacting come in with the least intensity. A map before him shows the exact location of the broadcasting station, and by simple triangulation he can determine almost instantly his position and correct his line of flight.

After the effectiveness of the loop antenna was proved, Coast Guard engineers set upon the problem of discovering a method of insulating it. The various metal parts of the planes collected static electrically which interfered seriously with the reception. Finally a system of electrically connecting all the integral parts of the ship, known as "bonding," was developed. This method prevents the setting up of any static in the ship whatsoever, and greatly increases the efficiency of the radio direction finder. In addition to bonding, a