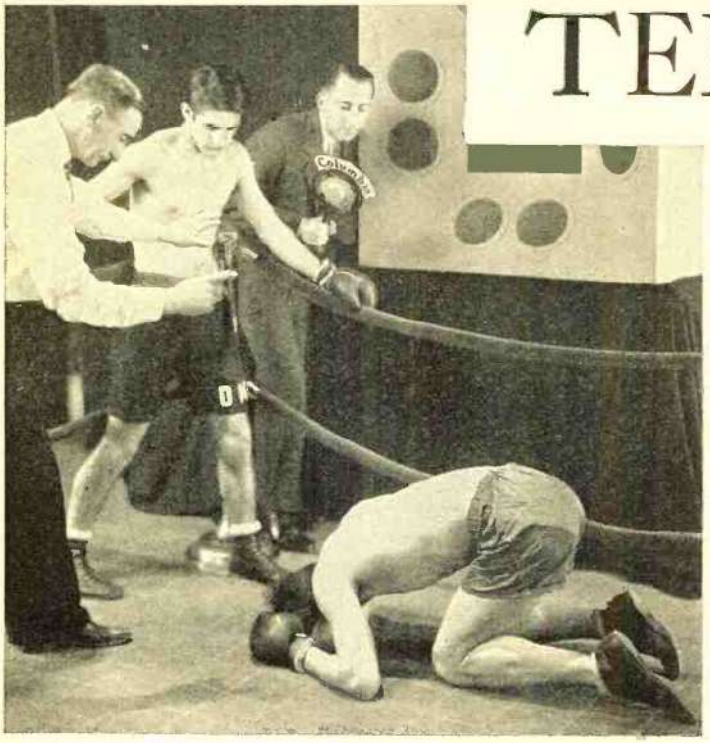
TELEVISION ON ONE

Revolutionary method for casting on a single transmitter and bined wave on a single receiver living pictures side by side



ONE OF THE FIRST "COMPLETE" BROADCASTS

A boxing bout presented before the electric eyes of the new combination transmitter developed by Columbia engineers

By Samuel Kaufman

THE inauguration, recently, of a new method of transmitting moving images and synchronized sound over a single station and on a single channel, by the Columbia Broadcasting System, is appropriately timed for the first anniversary of the network's entrance into the television field.

In addition to representing an important advancement in sight-and-sound transmission methods, the CBS system called for a new system of reception. Network engineers offered the public a plan whereby a single television receiver, with certain economical modifications, could be made to successfully receive both the picture and the synchronized sound. This plan was limited only to certain television receivers yielding a high enough frequency response to adequately reproduce the sound portion of the programs.

In the Summer of 1931, the Columbia System stirred up considerable interest in the field of television by launching a "sight" transmitter, W2XAB, in New York City, and presenting regularly scheduled daily programs. A large number of the television broadcasts during the first year of the transmitter's operation were presented with synchronized sound programs from the network's short-wave station W2XE. As in the instance of all other television stations in the United States during this period, this television station was licensed by the Federal Radio Commission as an "experimental" transmitter. Regardless of what method of reception is used, the new system, in the opinion of William A. Schudt, Jr., television director of the network, will be of great value to the radio audience.

"When we broadcast pictures and sound on separate transmitters," Schudt remarked to the writer, "it was discovered, through mail from all parts of the country, that some persons received the television portion of the synchronized programs very clearly but had difficulty in locating the sound station. Likewise, there were some persons who obtained the sound but not the picture. By having sight-and-sound on *one* transmitter, every person who succeeds in tuning in the picture will be assured of getting the sound along with it.

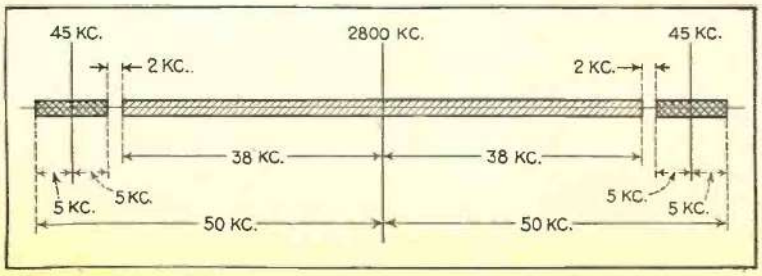
"Under the old method, the transmissions of W2XAB were successfully received, according to fan mail, over a 2,000-mile distance from New York. Two-thirds of the United States has been covered by our picture programs. There is every indication that our new method of sight-and-sound broadcasts on a single wavelength reach over this same area.

"I believe that the sound portion of the programs will penetrate farther than the television part of the presentations. This is due to the fact that the sound takes the air directly, while the images must first be converted into sound impulses at the transmitter end and later be reconstructed into images."

The CBS has applied to the Federal Radio Commission for an additional channel in the ultra-short-wave band for future expansion of the network's television system. When officially granted, it is the plan of the CBS to use the added wavelength for the simultaneous broadcasting of the same sight-and-sound programs as on W2XAB.

"The Columbia television development is a great step in the advancement of television," the networks television director declared. "Television is not around the corner. It is already here and has been here for over a year!"

Network engineers working under E. K. Cohan, technical director of the CBS, were so satisfied with the advanced ex-



COMPLEX WAVE

FIGURE 1

Television signals modulate the main carrier with side bands of 38 kc. A 45 kc. carrier carrying 5 kc. sound side bands also modulates the main carrier for television

AND SOUND WAVE!

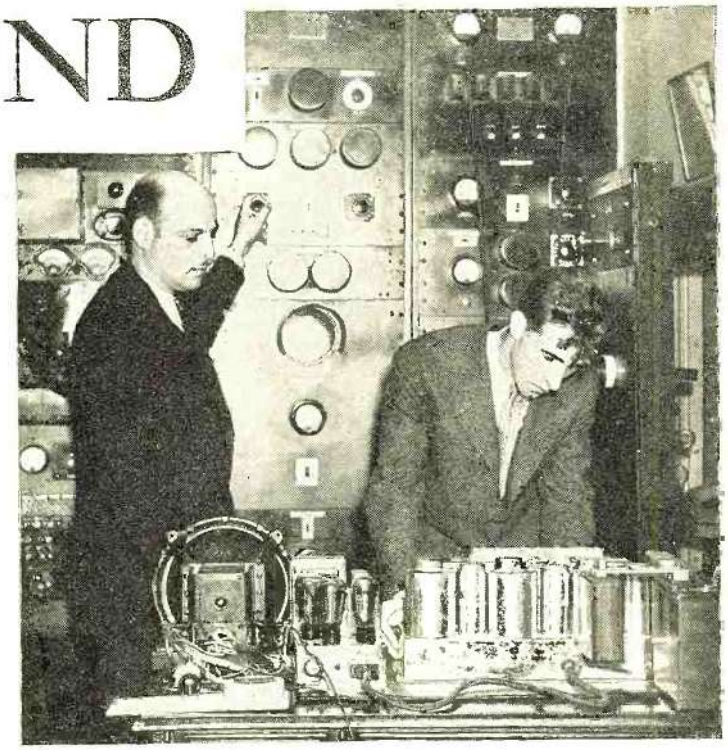
transmitting sight and sound broad- for picking up the resultant com- that demodulates and produces the with the broadcast sounds

periments that a two-hour sight-and-sound broadcasting schedule each day, excepting Saturday and Sunday, was put into effect at the time of the system's inception in July.

CBS engineers acknowledge the fact that sight-and-sound broadcasting on one wavelength has long been a field of study for research engineers and that the goal has previously been achieved in laboratories. Nevertheless, it is believed that the CBS, through its New York transmitter, is the first broadcasting firm to utilize this method regularly.

It was necessary to close down W2XAB for a two-week period to make the necessary modifications in the transmitter to accommodate sound in addition to images.

William B. Lodge, development engineer of the network who was assigned to the project, asserted that "double modulation" is the term which best describes the principle of the system. He explained that when the user of a radio set tunes his receiver to a broadcasting station, he is tuning to the particular carrier frequency of that station. The signal which reaches the set from the antenna consists of this carrier frequency combined with the frequencies of speech or music. Thus, he explained, the receiver has the ability to separate the speech or music from this complex wave and to reproduce it in the loudspeaker. The carrier is said to be *modulated* by the audio signal.



A VIEW OF THE COMBINATION TRANSMITTER

Edwin K. Cohan and William B. Lodge operating the new transmitter and a converted Scott receiver used in some of the first tests

The Fundamental Principle

Lodge asserted that the first step in the new system is to modulate a carrier of 45 kilocycles with the sound signal picked up by a microphone in the television studio. Thus, a complex wave is produced, from which the sound could be obtained by receiver circuits tuned to 45 kilocycles. Actually, however, the sound signals are not radiated at 45 kilocycles. The television signals consist of frequencies up to 40 kilocycles. In the sound and sight broadcast, the 40 kilocycle television signal and the modulated 45-kilocycle carrier are combined and both transmitted over a single band *on a fundamental carrier of 2800 kilocycles!*

The receiving set, Lodge pointed out, detects and reproduces the signal. Frequencies up to 40 kilocycles are applied to the terminals of a neon tube to reproduce the picture. The 45-kilocycle modulated carrier-wave contains the sound, and an additional receiver circuit tuned to that frequency can be utilized to obtain this audible portion of the program. This system is shown diagramatically in Figures 1 and 2.

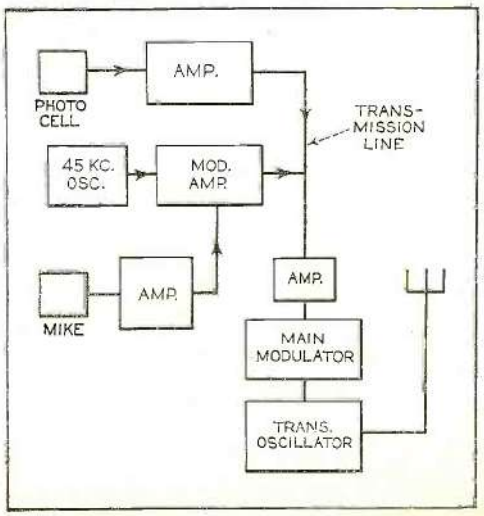
Prior to the launching of the new system, Lodge suggested the use of a single television receiver, with special modifications, to receive both sight and sound. In the television receiver, he said, it is only necessary to insert a simple filter at the terminals of the neon lamp to prevent the 45-kilocycle voice carrier from interfering with the picture. It is also necessary, he said, to add a second (*Continued on page* 314)

AN ORCHESTRA WITH A "GHOST" CONDUCTOR

Harold Stern's orchestra in the St. Moritz Hotel playing under the leadership of his image and spoken word in a television receiver. Mr. Stern conducted the orchestra from the television studio one mile away

SCHEMATIC OF THE SYSTEM

Figure 2. Sketch shows the layout of the various circuits for modulating both sound and sight on a common carrier wave



ception of this short-wave English station. For the five consecutive evenings when the set was hooked up in New York City, FYA, France (with the Marsellaise), and G5SW, England (with the chimes of Big Ben), were heard signing off. During this period the European reception was consistently satisfactory.

Daytime reception in New York City brought in WIP, Philadelphia; WGY, Schenectady; WICC, Bridgeport, in addition to a multitude of closer stations, all with good loudspeaker volume and a favorable noise-signal ratio.

The evening operating tests for the broadcast band measured up to the tests in Fairfield. The location for the city test is close to a number of high-powered local stations, but no difficulty was encountered in tuning in distant stations on channels immediately above and below these locals.

The apartment-house antenna is a single wire of 40 feet with a lead-in of 20 feet, and a ground connection measuring 10 feet to the cold-water pipes.

From the foregoing reports it is evident that the CB-1 receiver functioned consistently throughout the three sets of tests. The only possible exception was found in the daytime short-wave reception tests at Fairfield, but it is believed that the inability to obtain really good results was due to the poor short-wave transmission conditions existing at that time rather than in any inconsistency in the receiver itself. This belief is borne out by the fact that EAQ of Madrid was very satisfactorily received the preceding evening.

Evidently the receiver not only provides a high degree of sensitivity on both the broadcast and the shorter waves, but also a degree of selectivity adequate to meet any normal city or suburban requirements. A receiver which will provide real 10 kc. selectivity when operating within the New York City limits should provide entirely satisfactory reception so far as selectivity is concerned under almost any condition that can be imagined.

As mentioned in the Chicago report, the tone quality was found to be entirely satisfactory and the output volume was surprisingly high for a pair of –45's. This high volume is accounted for by the true Class A audio amplifier design which enables the –45 tubes to provide an undistorted output of approximately 8 watts. This relatively high output is then fed into the new speaker having an unusually high conversion efficiency.

P. A. System

(*Continued from page* 283)

the plate and cathode of any stage. This meter should have a range of 0-300 volts. The voltage of each stage can thus be adjusted accurately with the rheostats.

Plate current can be measured with a milliammeter mounted on panel 1. Three push-button switches enable the operator to connect the meter in any one of the three cathode leads (see Figure 1).

List of Parts (Panel No. 1)

C1, C4—Aerovox 1 mfd. condensers, 200 volts
C2, C5—Aerovox 1 mfd. condensers, 400 volts
C3, C6—Aerovox ¼ mfd. bakelite case condensers, 400 volts
L1, L2—Kenyon parallel-feed chokes, type KC-300-3
M1—Milliammeter, 0-25 ma. range
R1, R3, R5—Aerovox 50,000-ohm, 1-watt metallized resistors
R2, R4—Aerovox 2700-ohm, 2-watt metallized resistors
R6—Aerovox 1350-ohm, 10-watt vitreous-enameled resistor
S1—Federal double-pole-double-throw switch
S2, S3, S4—Yaxley push-button switches, type 2007
T1—Kenyon audio transformer, type KALG
T2—Kenyon transformer, type KADL
T3—Kenyon audio transformer, type KALG
T4—Kenyon audio transformer, type KA-12
T5—Kenyon audio transformer, type KA2DL
VC—Centralab 500-ohm T-pad
4 subpanel sockets, 5-prong
1 subpanel
6 Eby binding posts
1 cable receptacle, 7-prong

List of Parts (Panel No. 2)

C7, C8, C9—Aerovox electrolytic condenser block E5-2816
C10, C11, C12—Aerovox 2 mfd. condenser, 400 volts
L3—Kenyon filter choke, type KC-15-120
L4—Kenyon filter choke, type KC-40-60
L5, L6, L7—Kenyon filter choke, type KC-700-5
M2—Voltmeter, 300-volt range
R7, R8—Ward-Leonard adjustats, 50,000 ohms
R9—Ward-Leonard adjustats, 25,000 ohms
R10—Aerovox bleeder resistor, 5000 ohms, 25 watts
S5, S6, S7—Yaxley push-button switches, type 2003
T6—Kenyon power transformer, type K-245-PT
1 subpanel type 4-prong socket
1 battery cable receptacle, 7-prong
1 a.c. receptacle

For Interconnection Between Panels 1 and 2

1 battery cable, 7-wire
2 cable plugs, 7-hole type

Television and Sound

(*Continued from page* 271)

detector with a tuning circuit set to 45 kilocycles to obtain the audio signal.

When the writer discussed the plan with Lodge at the inception of the new system, the engineer declared that listeners could also utilize two separate receivers for the sight-and-sound portions of the transmissions. He declared that some television receivers on the market did not provide for a sufficiently high-frequency audio response for good reception. However, if the television receiver is satisfactory in this respect, he said, the necessary alterations for the sight-and-sound reception would cost but a few dollars.

The launching of the new system coincided with the first anniversary of the network's entrance into the television field and a special program for the event was arranged. Schudt and Cohan spoke on the engineering aspects of the initial year's television operation and the prospects for the year to come. They also gave a description of the methods which enable the station to broadcast sight-and-sound programs on a single wavelength. The sound portion of this special program was broadcast over the entire CBS network as well as W2XAB. All subsequent television programs, however, are confined to W2XAB alone.

A special feature of the sight-and-sound station is the regularly scheduled appearance of a dramatic troupe in especially written playlets for television. Schudt, likening these broadcasts to the talking films, has titled them "tele-talkies."

The Columbia television transmitter was manufactured by the Radio Corporation of America. The technical changes for the sight-and-sound broadcasts, however, were executed by network engineers. The transmitter uses 500 watts power and is assigned to the 2755 to 2845-kilocycle television band. A 60-line scanning disc is used at 20 frames

per second for rebuilding the pictures.

The transmitter is located on the twenty-third floor of the system's building at Madison Avenue and 52nd Street, New York City. A special room in the building is set aside for the reception of the sight-and-sound programs for the convenience of visitors.

Before this new plan went into effect, W2XAB used the short-wave transmitter, W2XE, for experimental work on the sound synchronization. At times WABC, the key station, and other network outlets picked up the sound portions of important programs originating in the television studio.

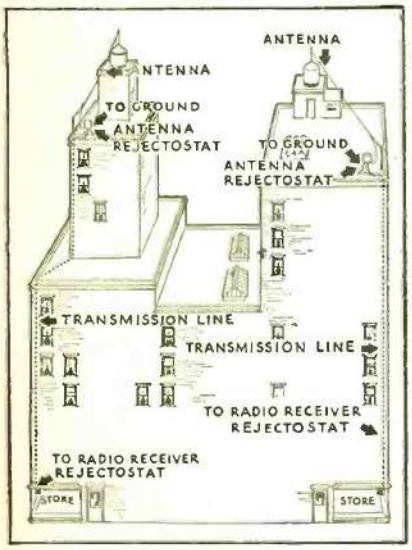
Sight-and-sound programs are now being featured over W2XAB each evening, except Saturday and Sunday, from 8 to 10 o'clock, Eastern Time. Here is a fine chance for experimenters to revise their sets and get in on something new.

Rejectostatic

(*Continued from page 275*)

items. The coils are mounted on bakelite tubes which are, in turn, mounted in aluminum shields. The condensers in the antenna rejectostat are mounted on a sub-base on which the antenna impedance-matching transformers are also mounted.

Figure 7 shows the complete rejectostatic kit.



INSTALLATION FOR STORES

Figure 4. Shows the arrangement for installing the Rejectostatic system in stores located on the first floor of tall buildings

The complete system, as shown in Figures 2 and 5, was set up, using a Kolster completely shielded receiver. A standard dummy antenna was substituted for the antenna and voltages were applied to the antenna from a signal generator. The output voltage of the receiver rejectostat for various frequencies in the broadcast band was then measured. The input voltage to the antenna rejectostat was also measured. The ratio of these two voltages is the so-called "transmission ratio."

Curves A and B, Figure 8, show the transmission ratio for a 50 ft. and 400 ft. transmission line as compared to the receiver connected to the antenna alone (unity ratio). Figure 9 shows the sensitivity of the receiver alone and the sensitivity when using 50 ft. and 400 ft. of transmission line.

Tests show that a number of receivers can be operated on a single antenna and transmission line, provided each receiver is equipped with a receiver rejectostat.

"Yes"

(*Continued from page 280*)

jazz, silly talk, foolish jokes, anything to make a laugh and nothing to educate. And look at the ballyhoo type of radio advertising. The broadcasting stations have had to give in to a considerable extent to these demands, and with the gradual lowering of the prices of radio sets, the better class of human individua will be more and more bombarded with this type of program and may finally succumb to them.

Another instance: Radio has increased the noise in our cities and homes. It is already known that many defects in our work and in our behavior are due to the growing influence of noise. Noise detracts our attention and ruins our nervous systems, although we say we get used to it. The fact is, it damages our nervous system even when we have gotten used to it! The introduction of radio reception stops us from concentrating on our work, our thinking is impaired and our attention toward many other things is affected. The man at the machine in the workshop has his attention distracted and is more liable to hurt himself in a noisy location. Even in motor cars we now listen to music while driving and how anybody can listen to music and drive his car, paying attention to the signals of the other cars, for the whistle of the policeman or the signal lights, is beyond me to state. And there is more to this question of sound and noise than just radio sounds pouring out in hotels, restaurants, shops, business offices and our homes. Experiments have already been made which have shown that the peristaltic movement of the stomach slows down considerably under the influence of noise. In the subway, for instance, it decreases to only a small fraction of its usual time of movement. This means an impairment of our digestion and possibly our "nervous." How many of our gastric and nervous conditions are directly due to the habit of listening to radio after supper?

And I do not need to speak of the interrupted sleep caused thousands because our next-door neighbor does not shut off his loudspeaker during ordinary sleeping hours. I do not need to speak of the harm that comes to people sitting up all hours of the night listening to the radio itself.

Definite statistics show that the number of divorces and murders in cities are in direct ratio to the amount of noise. The noisier the location, like in the lower part of Manhattan, the greater are the number of divorces and human troubles per capita.

Noise and radio, these go hand in hand. They undermine our nerves and those of our children. They undermine our culture. They destroy human tissues. What more can I say. I therefore place these in the category of eminent dangers to the human race and sound the warning that if we do not discontinue our present dangerous, headlong pace in increasing radio operations and of filling the ether with dangerous amounts of radiant energy, we may be degenerated to a race of morons or worse.

"No"

(*Continued from page 280*)

for the danger to the physician, he *knows* about it and *protects* himself. In the Viennese and Jena experiments, the operators wore metallic coverings in their laboratory coats and operating caps to prevent these short rays entering their bodies. Under the proper control of *experts*—and in the hands of nobody else—these transmitters are a