A-T-E JOURNAL

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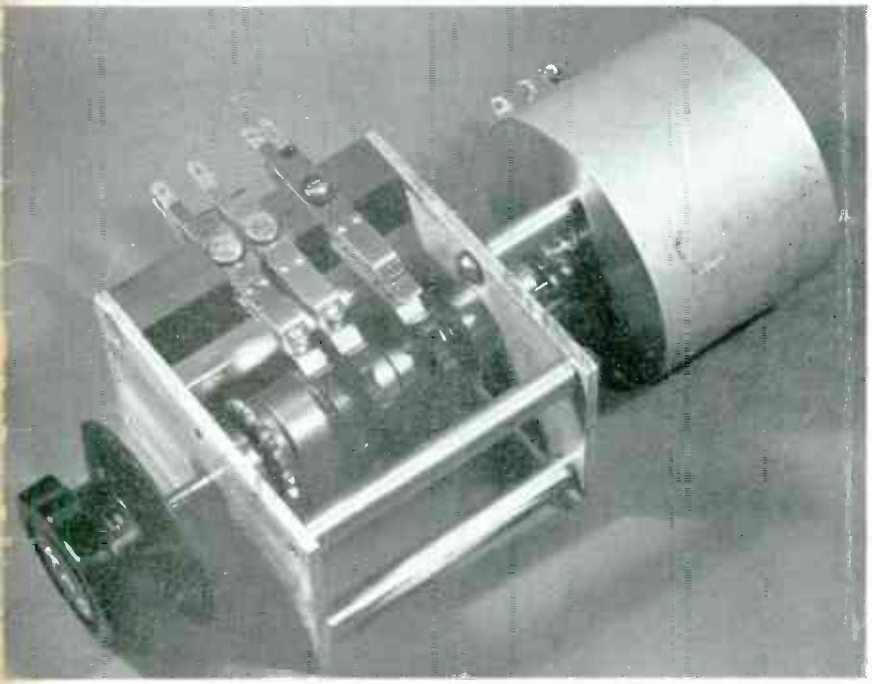

A Practical Motor Controlled Fader

## Theory and Operation of Automatic Audio Gain Control Amplifiers

## Artificial Reverberation

## Motor Controlled Faders

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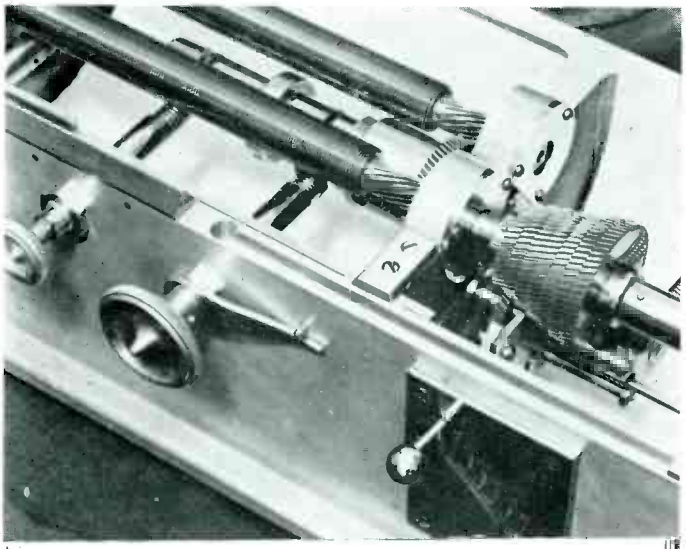

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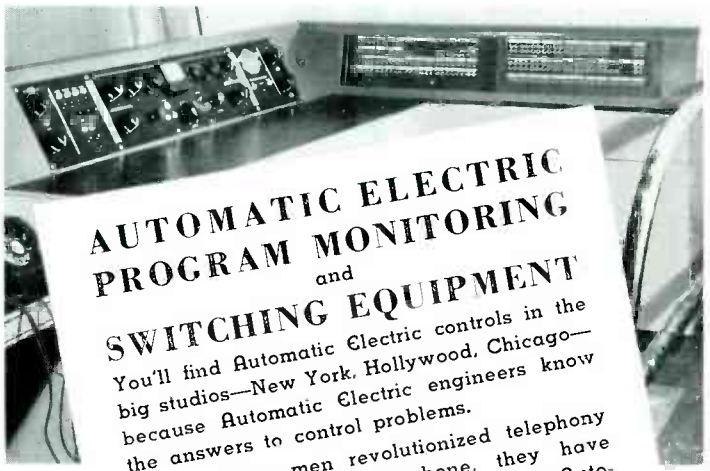

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### OUR COVER

A close-up view of a motor controlled fader (from the article of the same name!). For details see page four.


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# Automatic Audio Gain Control Design Considerations

By J. L. Hathaway

Engineering Department, National Broadcasting Company

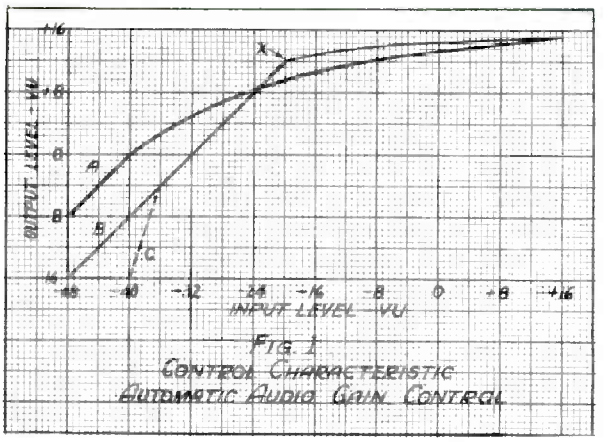
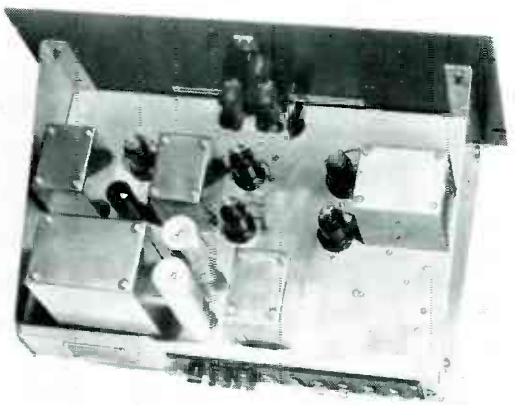
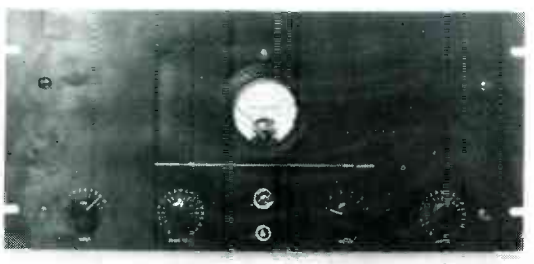



FIG. 1
CONTROL CHARACTERISTIC
AUTOMATIC AUDIO GAIN CONTROL

SINCE 1930 the NBC Development Group has designed and experimented with many different automatic audio gain controls, among which have been the variable resistance filament type, the variable resistance thyrite type, the variable shunting tube impedance type, the variable degenerating feedback type and the variable tube amplification type. Of these the latter seems to have the advantage in producing the most desirable characteristics in the simplest manner. In all, 18 different types of transmitters and amplifiers employing automatic gain control have been developed by this Group and over 100 units have been constructed and used in broadcast or recording equipment. A description of each type would be lengthy and this article is, therefore, confined primarily to a circuit analysis of only one of the higher quality amplifiers, namely, the type ND-36F. (See photo.)

Certain performance standards have been set up for automatic gain controls including all of those necessary in ordinary amplifiers, such as sufficiently flat response, low wave form distortion and low noise level. In addition to these usual standards, with automatic gain control the rate of gain reduction on high level peaks and the subsequent gain recovery must be correct, also the gain must be reduced without creation of an audible "plop." One further requirement of a good unit is that the control characteristic, output level as a function of input level, should be linear up to a certain predetermined point and then bend off sharply and in such a manner that output will never appreciably exceed this level. If a control characteristic, as shown on Curve A of Fig. 1, is employed, it is found that when program level is adjusted to achieve good regulation of normal or high level passages the low level passages are raised excessively and as a matter of even greater consequence room and circuit noises are raised to an objectionable level during program silent periods. A control characteristic typical of the better automatic gain control units is shown on Curve B of Fig. 1. It is evident from these curves that with units adjusted for good control on normal or high passages the low level passages and noises are raised to a smaller degree than with the characteristic of Curve A. A still further improvement on the control characteristic is possible as shown in Curve C, which actually tends to decrease circuit and room noises during periods of program silence. This improvement has been incorporated in certain experimental models, however, is not employed in the present units because of the added complications.





The type ND-36F is of the variable tube amplification type and is primarily a two stage push-pull amplifier, as shown in Fig. 2. A portion of the program voltage is diverted from the output circuit to an auxiliary amplifier whose output in turn feeds a full wave diode rectifier. The rectified voltage is applied, through suitable resistance capacity filters to the two sets of push-pull grids to cause reduced transconductance and consequent gain reduction.

In order to achieve the sharp knee marked X on Curve B of Fig. 1 a bias voltage from the voltage divider is inserted in the diode rectifier circuit to prevent rectification until program peaks exceed the d.c. bias. Thus rectification and resultant gain reduction do not start until a definite level is reached, but above which point an increase in level is very effective in reducing gain. Considering a specific example, if the diode bias were 10 volts and the output level were raised 6 db causing program voltage on the diode to increase from 10 volts to 20 volts, we would have a 10 volt increase of d.c. bias on the controlled tube grids. If, however, the diode bias were 30 volts and the program voltage at the diode was again doubled from the point where rectification just started, that is 30 volts, the resultant increase of bias on the controlled tubes would be 30 volts. In this case it is evident that after the control has just started gain reduction, an increase of output could be achieved only by a very great increase of input. The higher the diode bias the sharper the knee on the control characteristic.

Many of the units employed by the National Broadcast Co., such as the ND-39 and the RCA-96A, have only one gain controlled stage. Primarily such amplifiers are designed for handling relatively small level changes, although their action on peaks producing up to 10 db gain reduction is entirely satisfactory. The second stage of the Type ND-36F, Fig. 2, corresponds to the controlled stage of these simpler units. Where exceptionally high level input is occasionally encountered it has been found desirable to perform at least some measure of adjustment ahead of the controlled stage to prevent it from being overloaded and producing excessive distortion or control action. This reduces the rapid shifting of gain over wide limits which would tend to eliminate dynamic range and cause changes of emphasis. The first

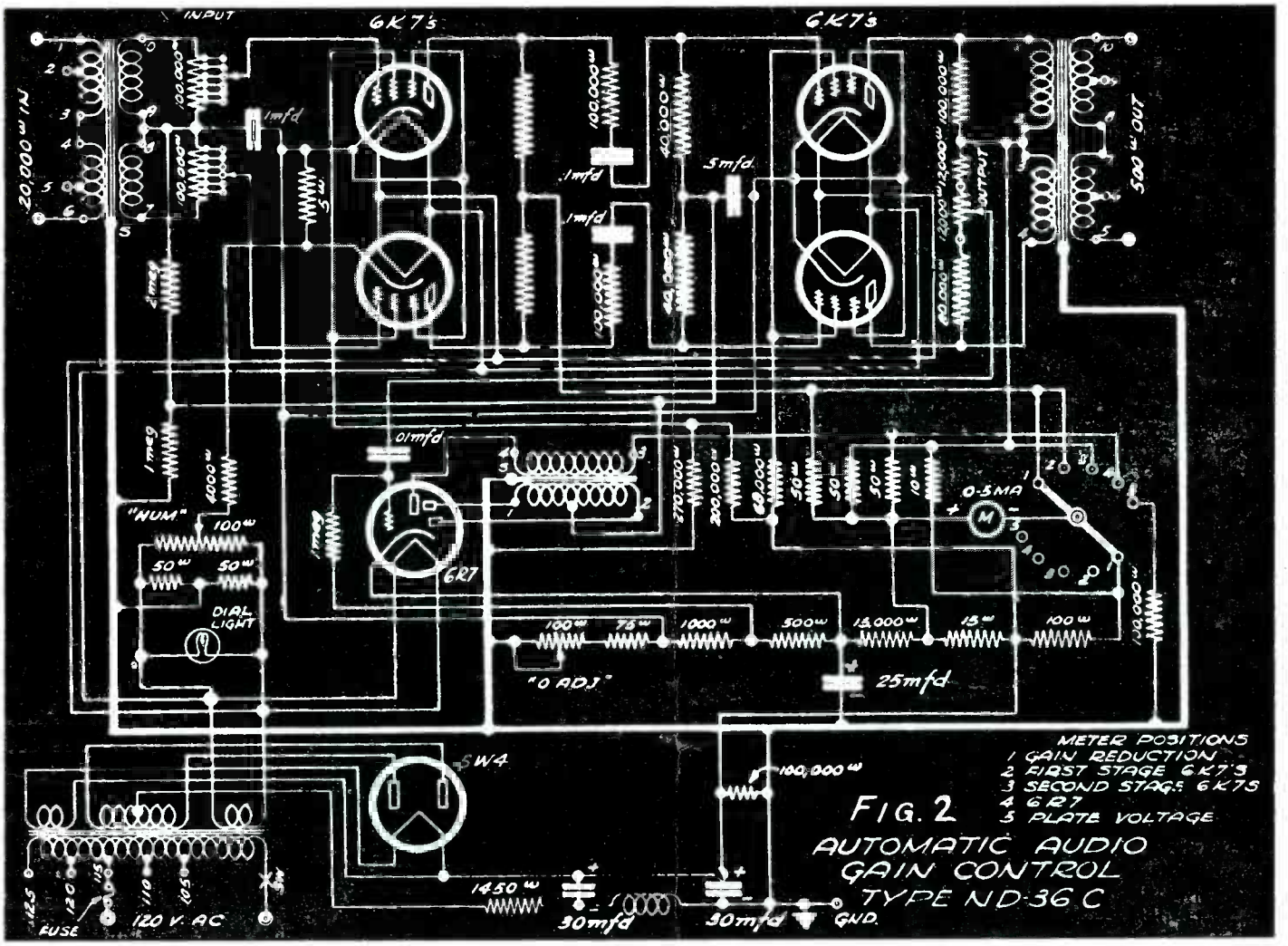



FIG. 2
AUTOMATIC AUDIO GAIN CONTROL TYPE ND-36 C

controlled stage acts to give this adjustment as a function of average level, reducing or increasing in gain relatively slowly so that the entire burden falls on the second stage only momentarily at the time of an extreme level shift. The action of the combined circuits is analogous to neck and eye action, whereby a person glances momentarily at an object without turning the head, although if objects in that direction continue to attract attention the head automatically turns. After this, the eyes are free to glance rapidly to care for small sight changes about the new center. Thus the large shifts are eliminated for all but the initial change. Time delay circuits for the two stages are radically different, the second being capable of gain reduction in about 2 milliseconds and gain restoration in about 1 second as compared to 2 seconds for gain reduction in the first stage and 15 to 20 seconds for recovery. Thus control action occurs first in the second stage which acts relatively fast to raise or lower the gain approximately the amount required. This action is then followed, after a time lag, by the level adjustment of the first stage, which in turn relieves the second of a large portion of its control action. Thus the second stage always stands ready for sudden changes, but after the first has become adjusted to the new level there is less of the sudden gain shifting than would be the case with the simpler single stage controls.

Push-pull amplification is desirable in a high quality unit of the variable tube amplification type to prevent wave form distortion as well as audible "plops" accompanying sudden gain shifts. A positive surge results in the plate circuit when grid bias is suddenly shifted more negatively, the surge voltage being, in cases of extreme gain reduction, many times greater in magnitude than the program voltage at this point. Unless this surge voltage is cancelled out, it is transmitted through succeeding amplifiers causing possible damage as well as a disagreeable audible plop. The action of push-pull controlled tubes in eliminating this effect is evident since if the push-pull tubes are properly balanced the surges generated in the transformer primary are equal and out of phase. The transformer primary should, of course, be balanced.

Associated with the "plop" problem, which is solved by perfect balancing, is the question of how much program level to feed the tube grids at the point where gain reduction starts. Too high a program level results in wave form distortion, whereas too low a level results in excessive plop to program ratio if there is any misbalance. The design of two stage control units should be such that with program level adjusted to produce 30 db of gain reduction, there is about 1 or 2% rms distortion. With this adjustment and with tube transconductances closely balanced the plop voltages are negligible. The balance has been found satisfactory if tube static plate currents are within 3%.

Circuit noises arising ahead of or within the automatic control amplifier are more objectionable than with an or-

(Continued on Page Four)

# Motor Driven Faders

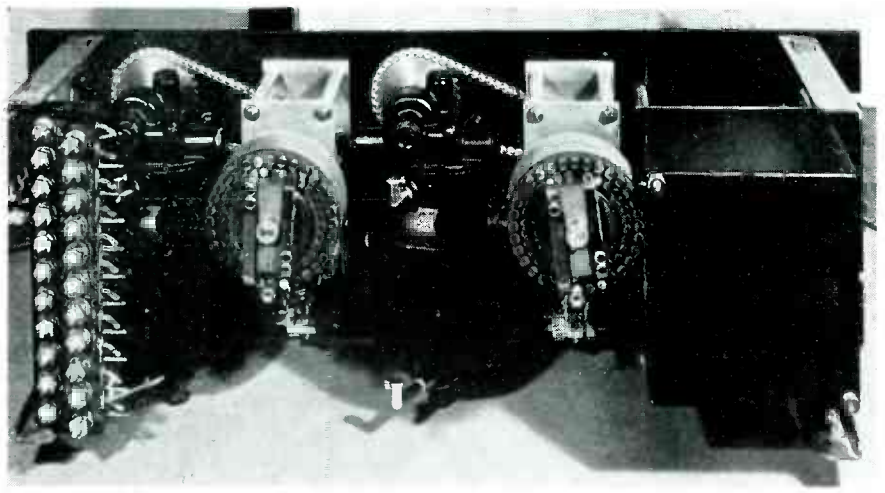
By Dan Williams
Engineering Department, National Broadcasting Company

THE use of motor driven faders is not new. They have been used in New York and Chicago for some time. Their application here in San Francisco has been the solution to the problem of inserting local "spot" announcements, joining programs late, etc., as is the current practice with local network stations. Previously it was necessary for the announcer to arrange with the board man to fade the network on cue, drop the channel to be picked up in another studio for the local commercial. With more and more spot announcement business, this unwieldy method was a problem for the boys in the control room.

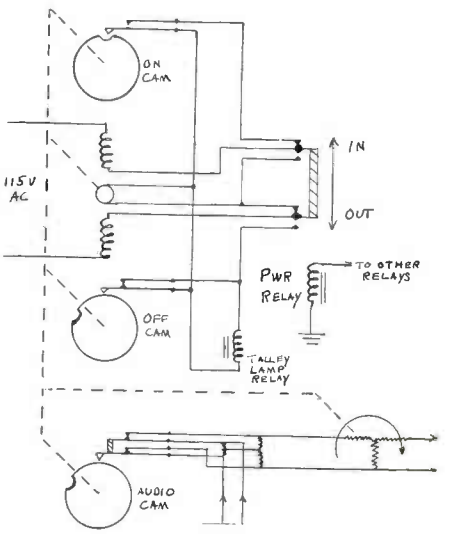
Until recently, San Francisco was the network distribution point and our work was primarily with the network. Before the great increase in local spot announcements, our two local stations offered no unusual operating problems. However, the picture changed, and we are now primarily concerned with the two locals, KPO-KGO, and the short wave KGEI, as well as a certain amount of network operations.

With a change in the methods of operation, it was decided that a motor fader would co-ordinate operations and eliminate a lot of unnecessary work in conjunction with local spot announcements. In designing this unit, there were two relays for each fader, as shown in the drawing. After some discussion, 1½ to 2 seconds was considered an ideal fade for general use, and the choice of chain drive offered a quick method of altering the duration of fades. The chain drive was also a simple means of using a stock high grade motor that had a compound worm gear as an integral part. Like most problems, there appeared to be many solutions; gear drives, radio dial drives, minature belt, and rubber roller drives were considered, and each was discarded for lack of dependability, flexibility, or added work necessary for proper application.

The cam and clutch mechanism design consists of 3/16" dural end plates separated by ⅜" posts and a bakelite block that holds the cam contact springs. The line-up is: bronze bearing, ball thrust, sprocket, clutch, cam for "in"position, cam for "out" position, audio cam, clutch spring, ball thrust, and bronze bearing. The clutch is of the cork to steel type. On one side of the sprocket is the plate, and the cork is attached to the side of the bakelite cam. An occasional drop of oil is all it needs. It is understood that the clutch is necessary for protection of the motor and compound worm gear during deceleration. Ball thrusts were used to reduce friction due to the clutch spring and to reduce the required pressure. The audio cam was included as a precaution against cross-talk that might exist with the bridge "T" fader in the "out" position. The power cam contacts are made of pure silver and are self-wiping. The fader contact arm is protected at the end of travel by a stop, and is driven through a flexible coupling.



Electrically, the unit is simple. The de-energized position of the relay represents "fader in," and the energized position is "fader out." The push buttons operate a conventional relay control system that operates the reversing relay. Push buttons appear on the Master Control Desk, as well as in the Announce Booths associated with the particular fader. The toggle switch on the AC is for use when manual fades are made; without this, the motor would attempt to operate the fader.




The above-described unit has been in satisfactory operation for over eleven months, and is used constantly throughout the day.

## Automatic Audio Gain Control Design Considerations

(Continued from Page Three)

dinary amplifier of similar gain. Noise level of the ND-36F is extremely low, the major component being thermal agitation voltage from the input circuits which cannot be reduced. Heater hum is counteracted by a hum bucking potentiometer which provides a means of applying any degree of bucking potential in either phase to the cathode of one tube.

In the Type ND-36F, as well as in several other types of automatic control

units, a rather complicated metering system is incorporated. This includes not only means for metering plate voltage and various plate currents, but a method of directly reading gain reduction in db. This indicates gain reduction regardless of whether it occurs in the second stage or in a combination of both stages. A bucking potential is utilized to reduce the second stage plate current relative to the first so that the cumulative current reduction or the second stage only is read, depending on the momentary distribution of control action.

Certain other types of automatic gain controls have been developed and have proved fairly successful wherein push-pull amplification was impractical because of physical size and weight limitations, such as in the ND-31 pack transmitters. A partial remedy for the audible plops which result from single ended controlled stages was found by controlling two succeeding stages to different degrees. Thus, the positive surge at the second grid, caused by the first grid bias increase, is largely cancelled out by the negative surge of bias in the second stage.

In the case of automatic control of portable radio transmitters, full wave diode rectification is not required or in many cases desired, since microphone polarity is generally fixed and can be easily maintained. This means that maximum voice peaks always modulate through the transmitter in the same direction, preferably producing upward modulation and the half wave rectifier always operates on the same side of the voice wave. However, for general program work where no control of polarity is exercised, the full wave rectifier is essential, since with a half wave system the output level would differ as much as 5 or 6 db on certain voices, depending upon polarity.

Experience with the many different types of automatic gain control units has indicated that wherever possible the variable tube amplification type employing two controlled stages, with balanced input and output is most desirable. Units of this type have exceedingly good control action with low distortion and require little maintenance and are applicable to many different services. Automatic audio gain controls cannot substitute for brains or technical artistry in controlling broadcast programs. However, they have been used extensively and satisfactorily to perform certain functions impossible of human accomplishment and have proven of considerable value in limiting excessively high level peaks, as well as raising average level.

# Artificial Reverberation

By T. E. Lynch

(*Engineering Dept., Brush Development Co., Cleveland, Ohio*)

TIME was when the only requirement of a sound system was that the reproduced sound should be a facsimile of the sound at the microphone. It is too much to say that even now this ideal has been completely realized, but it is true that what we shall call controlled distortion has added much to the apparent excellence of present-day sound systems. Such controlled distortions should be capable of operating upon a sound signal to give any desired audible impression. Such operations include frequency distortion, dynamic range distortion, and change in reverberance. All three of these operations are even now used to some extent in sound systems. For example, frequency predistortion is oftentimes used in broadcasting systems where the requirement is to boost the high frequencies at the transmitter to make up for the bad high frequency response of the average receiver. Dynamic range distortion is also a normal procedure for both broadcasting stations and recording systems where the characteristics of the transmitting or recording medium make it impossible to carry the full dynamic range of the sound source. Such dynamic range distortion is brought about by monitoring, and when carefully done, either manually or automatically, adds much to the apparent realism of the sound system. As an example of this dynamic range distortion carried to a very practical objective, the "Compandor" used on transoceanic wireless telephone systems comes to mind; also the expansion systems used on many phonograph reproducers.

Even reverberance has begun to be controlled, but before dealing with this matter in detail it is in order to define what we mean by the term reverberance: If we take a symphony orchestra to several different halls of different sizes and architectural constructions, and in each hall listen to the orchestra play the same selection, the audio impression upon us will be different. This difference is what we shall call reverberance and physically is caused by the reverberation time and frequency absorption characteristics of the various halls.

A number of studies have been made to determine what these reverberation and frequency absorption characteristics should be for best results, and normally it is found that a reverberation time needs be some kind of function of both size of hall and type of sound. It is also found that the ideal frequency absorption characteristics should be a function of these same two factors of size of hall and type of sound. This means, for example, that a hall perfectly correct for a great organ would be completely wrong for, shall we say, a string quartet. From these considerations, it is at once apparent that the desirability of changing the reverberance of a sound system is very considerable, since with such a system it would be possible to give the effect of Boston's mellow old Symphony Hall when recording or transmitting a symphony orchestra, and then, merely by manipulation of controls, changing this reverberance to that of a great cathedral for an organ recital.

The problem has been attacked in several ways, but the customary method is to use rooms known as reverberation chambers in which are located speakers and microphones. These rooms are normally architecturally treated to give very long reverberation times. A sound signal to be reverberated is supplied to one or more of the speakers in the reverberation chamber, and, after being reverberated, is picked up by one or more of the microphones and is then recombined with the original signal and distributed to whatever channels are required. The amount of reverberation is controlled by the relative placement of speakers and microphones and by the relative intensity of reverberated signal and direct signal. This system of reverberation chambers, although extensively used since there is no better system available at present, has several drawbacks, chief among which are the high construction and maintenance costs of such rooms. Then, too, it is easily seen that merely changing the ratio of reverberated to direct signal is not the same as changing the reverberation time of the signal. It is only an approach to the requirement. Actually, the only proper method of changing the reverberation time is by changing the relative placement of microphones and speakers as well as the absorption characteristics of the walls, and leaving the ratio of reverberated sound to direct sound constant. Obviously, such a procedure is costly and relatively inflexible, not easily allowing for quick changes from one reverberation time or one reverberation characteristic to another.

It has long been desirable that an inexpensive reasonably sized and extremely flexible device should be developed to take the place of such complicated and expensive sound chambers. Several such devices have been developed, but none, up to the present time, have been entirely satisfactory.

Before going into detail on a specific method which seems, fairly well, to provide this desirable reverberance, we shall analyze briefly what is required of such a mechanism: in Fig. 1 is shown the build-up and decay time curve for a normal auditorium. It is seen that the sound intensity builds up exponentially from the intensity of the direct sound wave and approaches a limit after a period of time when the absorption by the room reaches equilibrium with the generation of sound energy in the room. If, now, the sound source is stopped it is seen that the sound energy in the room decreases exponentially to zero, as it is absorbed by the walls of the room. A little thought will show that the shapes of these exponential curves are not smooth, but are an average of discrete increments of sound change. This follows from the fact that it requires a finite and fixed length of time from the instant the sound source starts radiating before the sound pressure wave has reached a reflecting surface and has been bounced back to the microphone. This same incremental change is also apparent in the decay part of the curve. When we analyze the curves from this point of view, we see that the complete sound effect consists, fundamentally, of a direct sound pressure wave to which is added periodically, with an intensity which is an exponential function of time, the reflected components of the wave. In the literature the reverberation time of a room is defined as the number of seconds required for a signal level to decay 60 db after the sound source has been cut off. Further consideration must show that any acoustical, electrical, or mechanical system which will introduce a time delay in a signal channel and allow the signal to be reproduced at strategic time intervals with different intensities, can be used for producing artificial reverberation. Many possible methods spring to mind, but possibly the simplest is shown in Fig. 2, where a recording head records the signal in any convenient material. Spaced along this material are a number of pick-ups, and connected to each

of these pick-ups is a suitable attenuation network adjusted so that the output from each pickup has the proper exponential relationship to the preceding pickup for any required reverberation time. Obviously, it makes no difference what the process of recording is or what the recording material is, providing only that such process and material lend themselves to immediate play-back, wide frequency and dynamic ranges, and do not introduce any noticeable distortion. The problem, then, becomes one of cost, and the method which does not use up material suggests itself as the ideal one. The idea of recording by means of a cathode ray a transient fluorescent sound wave on a screen which subsequently moves past a number of scanning systems has been suggested, and a number of such units have been built. One other very flexible system of recording which does not use up any recording material and which has certain advantages is magnetic tape recording, and it is with this device which we shall now treat.

This magnetic tape recording method has the characteristic that the signal carrying medium is in no way damaged by the recording and reproducing process. Once a recording is made it can be reproduced as many times as desired without any damage to either the recording material or to the signal. On the other hand, it is very simple to wipe off a previous recording, leaving the recording medium unharmed and ready for a new recording.

An artificial reverberating machine using the magnetic tape recorder is shown in principle in Fig. 3. There it will be seen a single endless loop of steel tape is rotated through a cycle including the following units: a recording head, a series of reproducing heads, and a wiping out head called an obliterating head. Each head in the series of reproducing heads reproduces in time sequence the same part of the signal as the sound carrier travels through the series of heads. In this wise, we obtain the discrete time intervals which, as we have already pointed out, is a characteristic of natural reverberation. Each reproducing head has included an attenuating network adjusted to reduce its output level exponentially with relationship to the preceding head.

In the introductory section of this article, it was pointed out that what we called reverberance is made up not only of reverberation but also of frequency absorption characteristics. In other words, the architectural treatment of a particular hall may be such as to absorb very quickly a high frequency sound

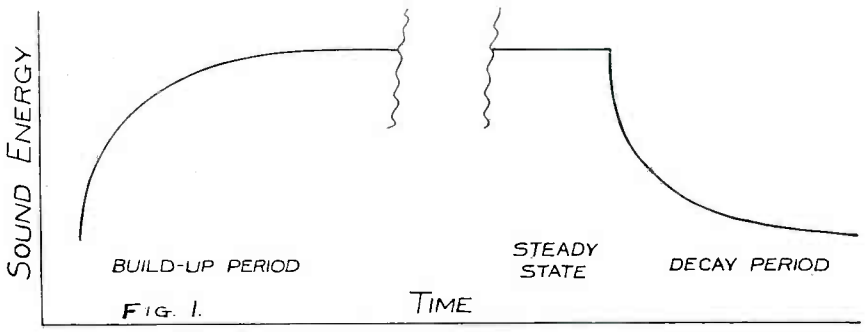


FIG. 1.

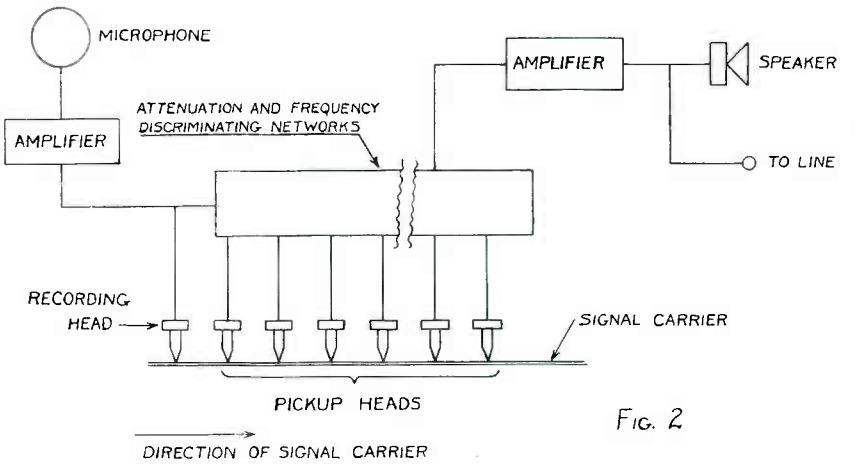


FIG. 2

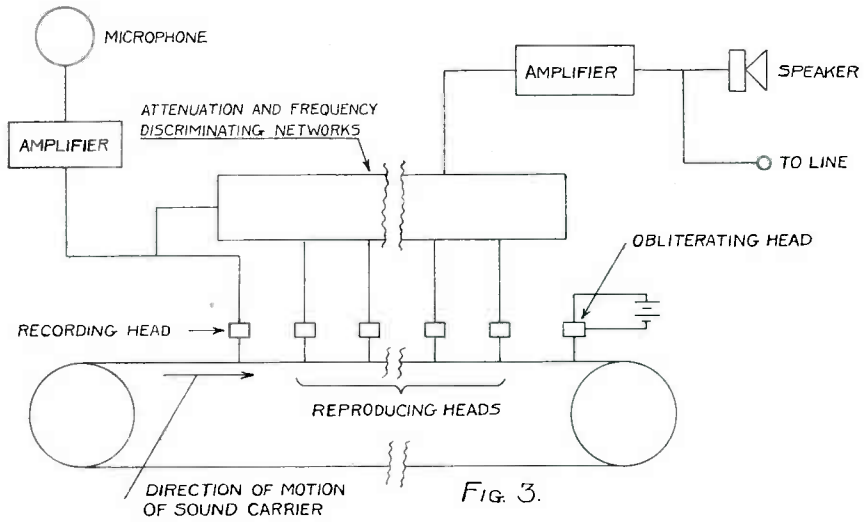


FIG. 3.

but at the same time absorb very little low frequency sound. Returning to our magnetic reverberation machine, we see that this characteristic may be obtained if we introduce into our series of reproducing heads a frequency discriminating network such that the high frequency at any particular head will be reproduced with less relative intensity than the low frequencies. In other words, our reverberation machine is so adjusted as to have different decay rates, and consequently different reverberating time, for different frequencies.

Thus it is seen that by means of a simple, compact, and inexpensive electromechanical device, it is possible to obtain the two characteristics of reverberation and selective frequency absorption which are required to simulate reverberance. There are, of course, many practical details involved in the construction of such a machine, such as, for example, how

(Continued on Page Ten)

# The Operation of Automatic Audio Gain Control Amplifiers

## (Limiting Amplifiers)

By George M. Nixon

Engineering Department, National Broadcasting Company

SATISFACTORY transmission of program material over telephone or program circuits and through associated amplifiers for recording or radio broadcasting usually requires that the apparatus be used as nearly as possible up to its full load capabilities but without the introduction of aural distortion. Aural distortion due to overmodulation becomes increasingly objectionable as the frequency range of program circuits and associated equipment, including loudspeakers is widened. Careful regulation of program level to avoid overmodulation is, therefore, necessary and to this end, there has been an increase in the use of limiting amplifiers or automatic audio gain control amplifiers. These latter amplifiers are a refinement of the ordinary limiting amplifier and as used in the National Broadcasting Company [and elsewhere] were developed by J. L. Hathaway under the direction of R. M. Morris, NBC Development Engineer. The need for such devices and the functions which they perform is perhaps better understood by a consideration of some of the characteristics of program material and of the human ear.

The simplest form of program material and the one usually employed for convenience in communication circuit design is the sine wave. (See Fig. 1). (This form of wave is approximated in practice by some organ stops, certain notes of the flute and the horn when played "stopped" and the celeste.) The maximum or peak value of this wave is designated as unity or one and the r.m.s. value is 0.707 times this value or a ratio of 3 db of peak to r.m.s. value.

If this wave were used to modulate a transmitter in which detectable distortion occurred when the signal was in excess of 1.0 peak volt, it would be immaterial whether an r.m.s. or a peak meter were used to indicate the incoming signal to prevent over-modulation. When using an r.m.s. instrument the signal would be kept below 0.707 volts and with a peak instrument the signal would be kept below 1.0 volt. In other words it would be possible to measure the peak voltage (which causes the over-modulation with consequent distortion) by means of an r.m.s. instrument so long as the ratio between peak and r.m.s. values were known.

In practice, however, the ratio of peak to r.m.s. value of the program material may and frequently does change with each syllable of speech or passage of music ranging from perhaps 2 or 3 db to as high as 20 db. (See Fig. 2). This would seem to indicate that a peak instrument would be preferable as this instrument indicates that value which causes distortion. Extensive tests have shown this not to be true.

Operation of a radio transmitter, a conventional audio amplifier and a feed back type audio amplifier as devices to be protected against distortion and critical observations over a 30 - 8,000 cycles monitoring system indicated that substantially the same results were obtained with either a peak volume indicator (actually quasi-peak) or an r.m.s. indicator. Continuation of this investigation led to the development of the VU meter and the finding that if the VU meter were operated at a sensitivity of 8 db above the sine wave overload point of the transmitter (or other de-

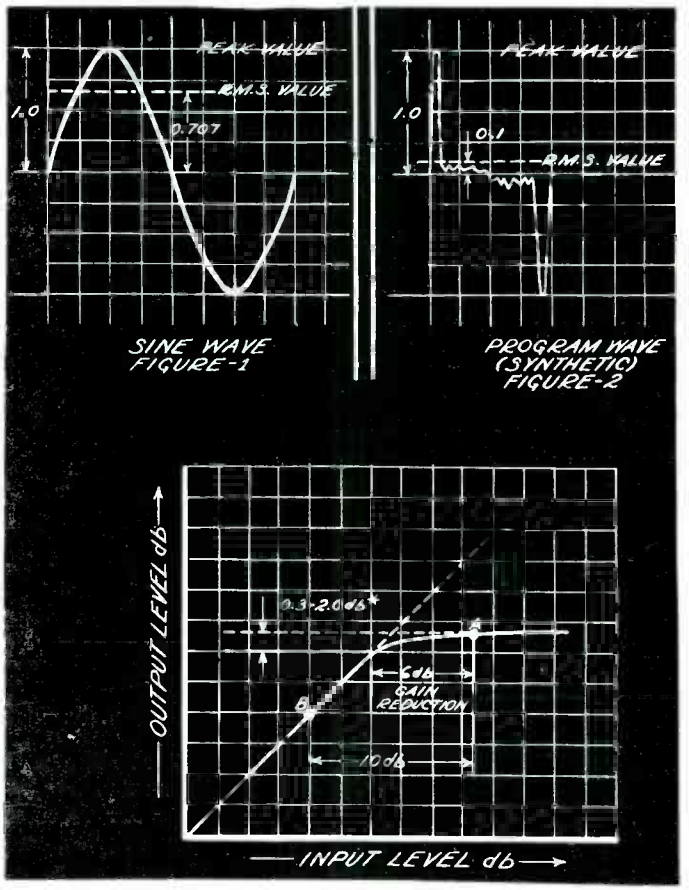



Figure 3 — Input Level vs. Output Level
Automatic Audio Gain Control Amplifier
Point "A" Operating Point for Maximum Permissible Modulation (Sine Wave)
Point "B" Operating Point for Program Transmission
* Range of increase in gain (from level gain reduction starts [O gain reduction] to 6B gain reduction point) of various gain control amplifiers

vice to be protected against overloading) aural distortion was usually avoided. (A transmitter would be arranged to produce maximum modulation without distortion with a reading on the VU meter of 100 on single frequency tone. The gain of the system at a point in circuit after the volume indicator was then reduced by 8 db).

Any volume indicator regardless of type indicates the value of the wave which has already been transmitted so that no corrective measures may be taken. This lack of anticipation is partially but not entirely corrected by rehearsal of programs during which time the engineer is able to judge the degree of level control which is required. He then merely remembers these hundred or more peaks for several hours to several days and hopes that the performing group when on the air performs the same as during the rehearsal. These conditions seldom obtain so that the exact degree of changes in level cannot always be anticipated, consequently, some objectionable distortion occurs.

The same conditions apply, perhaps more stringently, with respect to recording, as any distortion impressed on the disc is more or less permanently preserved to be heard whenever reproduced and to be transferred to any copies which are made of the original for further repetition. If the level were definitely limited at a pre-selected point by a suitable device, over-modulation, which produces distortion could be practically eliminated. This may be accomplished by the use of an audio automatic gain control amplifier.

The performance of the automatic audio gain control amplifier is based largely on certain characteristics of the human ear, which after all, is the ultimate judge of quality. It has been found that distortion or over-modulation which exists for only a very short time is not manifest to or recognized by the ear as distortion. Also if the over-modulation is relatively high, it may not be allowed to persist as long as relatively slight over-modulation to be unrecognizable as distortion. Further, a higher degree of over-modulation is tolerable at low frequencies than at medium or high frequencies before detection. These facts are some of the basic elements included in the design of the circuits in automatic audio control amplifiers.

These amplifiers are designed to reduce the gain to a pre-determined value with such rapidity that the ear will not be cognizant of the reduction as an abrupt change of level nor as distortion (within limits) when the restoration of the gain to its normal value is accomplished slowly. The circuits of these amplifiers are also arranged so that after small reductions in gain are effected, normal gain is restored quite rapidly, whereas, for large reductions normal gain may not be restored for more than 2 or 5 seconds. These amplifiers also permit peaks of short duration less than 2-3 milli-seconds which would not be evident as distortion to be transmitted without appreciable reduction. If these peaks were allowed to govern the action of the gain reduction circuits, there would be a tendency for the average modulation level to be lowered.

Satisfactory performance of limiting amplifiers is obtained only when they are properly adjusted for the required operating conditions. These conditions are briefly that (1) no over-modulation which will result in aural distortion will be permitted; (2) no noticeable compression or reduction in dynamic range will be apparent; and (3) the average modulation level will be maintained and perhaps increased 2 - 3 db.

It will be noted in Fig. 3 (a typical curve between output level vs. input level of a limiting amplifier) that beyond a certain value of input level a further increase does not result in an appreciable increase in output level. Consequently, if the limiting amplifier is located in the circuit ahead of the device to be protected against over-modulation, whether it be an amplifier, radio transmitter or recording head, and the input level adjusted to be along this flat portion of the curve, no over-modulation (for practical purposes) will ever occur. However, while operation in this manner would prevent over-modulation if the input level were always at too high a value, two undesirable effects would occur; (1) reduction in dynamic range and (2) noticeable compression. It is, therefore, important in the operation of the limiting amplifier that neither of these two effects take place and also that the danger of over-modulation is prevented.

It will be noted that at a "gain reduction of 6 db"

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# Operation of AAGC Amplifiers

(Continued from Page Nine)

(point A on Fig. 3) an increase in input level will not result in an appreciable increase in output level with most limiting amplifiers. Consequently, "peaks" in excess of this level will produce only a very slight amount of over-modulation. If this point (A) is selected for lining the equipment for maximum modulation on single frequency sine wave tone (of say 300 cycles) and then the input level reduced 10 db (to point B, Fig. 3) for program transmission, compression will occur only on the higher portions of the program wave. It was stated previously that operation of equipment with relatively infrequent aural distortion was possible by the use of VU meter as a guide to volume control, provided that for program transmission the input level were reduced 8 db below the sine wave overload point, (or the sensitivity of the volume indicator were increased 8 db). The difference between the operating point of the limiting amplifier (point B, Fig. 3) and the sine wave overload point of the equipment to be protected (point A, Fig. 3) is about 10 db; consequently, there is an additional margin of 2 db plus the limiting characteristic of the amplifier to prevent over-modulation.

In practice, the overload point of the equipment to be protected is usually known on the basis of distortion measurements and aural observations. The limiting amplifier is installed ahead of this equipment and single frequency tone at 300 cycles applied to the input of the limiting amplifier at program level. The input control of the limiting amplifier is then adjusted until a gain reduction of 6 db is obtained. The output control is then adjusted until the input level to the equipment to be protected is at the sine wave overload point. The input control of the limiting amplifier is then reduced 10 db (or the gain of the system prior to the limiting amplifier reduced 10 db) and the system is ready for program transmission.

If the limiting amplifier is provided with an instrument showing the degree of gain reduction, a different degree of reduction will be observed on network programs received over 5,000 cycle circuits and those originating locally, in which the frequency response extends to 8,000 or more cycles. In the former cases, these indications observed intermittently will be 2 - 4 db (approximately) and in the latter, 4 - 6 db (approximately).

Operating experience has shown that well designed automatic audio gain control amplifiers when operated properly eliminate for all practical purposes, all noticeable distortion without perceptible impairment of program quality, dynamic range or the introduction of noticeable compression. Their use as a supplement to the functions performed by the studio engineer adds an additional safeguard to the maintenance of high standards of program transmission, radio broadcasting and recording.

# Artificial Reverberation

(Continued from Page Seven)

many reproducing heads shall be used and what shall be the relative spacing between the heads. This was the subject of some study and it was found that too few reproductions of the signal led to a feeling that the resultant sound consisted of definite pulses, more like multiple echo than reverberation. On the other hand, too many heads led to a peculiar frequency discrimination, due to the fact that for every head reproducing one part of a voltage wave in a wave train, another head later on in the series was reproducing a corresponding point on a voltage wave 180° out of phase. If there were no attenuation between these two heads under consideration, it is easily seen that the resulting voltage would be zero. In other words, such a system would be incapable of reproducing any signal whatsoever. If there were attenuation in the head such as normally would be used for a reverberation machine, complete cancellation of any voltage would not exist, but a little consideration will show that partial cancellation would occur and the degree of this partial cancellation would be a function of the wave length of the recorded signal. The practical result of this consideration is that too many heads will have a resulting high frequency loss due to this cancellation process.

A practical number of reproducing heads was found to be about fifteen, spaced equal distances along the sound carrier so that the signal will take approximately one half second in passing from the first head to the last head. It was found that for a reverberation time of one second, it was satisfactory if the intensity of signal reproduced by the last head was approximately 30 db below the intensity at which it was reproduced by the first head. It was found unnecessary to decay the signal more than about 30 db, since lower intensities are completely masked by the higher intensities from the other heads.

It was found practical to bring all of the attenuating networks from the various heads to one set of switches, which could be operated as a group by one operation, thus making it possible to change the reverberation time by the simple manipulation of one control. The frequency absorption characteristic should also be controllable with one device, and this it was found possible to do with a simple resistance-capacitance equalizer with a variable resistance for control.

As may be expected from such a system as has been described, many unusual and abnormal characteristics may be added to a sound signal. For example, by using only discrete pickups widely enough spaced from another, distinct echoes may be obtained; if only a single reproducer is used, a single echo will be obtained; if several heads, multiple echoes. A queer effect is obtained when the intensity of the first reproduction is considerably less than the intensity of subsequent reproductions. It sounds like an echo getting louder, a difficult condition to imagine. Other peculiar effects are obtained when the frequency characteristics of an echo or echoes with respect to the original direct signal are greatly altered. At first glance, some of these tricks may not seem to have any practical application, but already sound-effects men have discovered new uses for a machine with this great flexibility. It is obvious, of course, that some of the "thrillers" now being broadcast are very dependent upon such peculiar sound effects.

# The Case of the Missing Overcoat

By Tom Gootee

IT ALL happened on a very cold February day in Chicago.

Early that morning Mr. Glen Webster, one of the most serious and conscientious of studio engineers, came to work snugly and properly bundled up in his almost-new-three-years-ago heavy overcoat.

In his usual efficient manner that day he traveled from one studio to the next, performing his regular allotted work. And promptly at 4:15 p.m. he was ready to make the long cold journey back to his warm little suburban home. Whereupon Mr. Webster returned to the Engineer's Room, filed his day's reports, and then looked around for his hat and overcoat.

But a careful investigation of every nook and cranny of the Engineers' Room failed to reveal his valuable possessions!

This shock stunned him at first, but he sat down and carefully thought of other places where he might have left his hat and almost-new-three-years-ago overcoat. He inquired at the checkroom in the NBC lobby, and even tried on several dozen actors' coats in an effort to find his own—or one like it. But to no avail! Then it was that Mr. Webster became properly incensed and his blood began to boil slightly. Being a mild natured individual it was somewhat of a surprise to find Mr. Webster pacing the corridors, muttering to himself with rage, and wildly flinging his fists through empty air. Some of the pages thought he had lost his mind, but Mr. Webster explained with great anguish that someone had done him wrong!

Calls to the service department, all the supervisors, most of the executives, the janitor, and his local Draft Board failed to bring any results! It was then well after 5 o'clock, and Mr. Webster was at the exploding point. He had missed four trains to his warm little home; his wife would be irate, and his supper might be cold. But he could not find his almost-new-three-years-ago overcoat!

Some dastardly person is playing a foul trick on me, thought Mr. Webster quite aloud. A joke is a joke, but this is carrying things a little too far. He finally gave up in despair. It had ceased to be a practical joke, and he intended to see that the whole matter be brought to the attention of the authorities the next morning.

Whereupon Mr. Webster plunged out into the intense cold, without benefit of his warm almost-new-three-years-ago overcoat. However, due to the fact that he was running such a high temperature upon leaving NBC, he fortunately did not contract a cold or chills.

Eventually he reached home, and spent a restless evening wondering what could have happened to his valuable apparel. Then he realized that his coat and hat might have been stolen, and the vision of having to pay $10.98 for another overcoat brought his spirits to a new and all-time low.

Bright and early the next morning Mr. Webster returned to work at his usual time, but wearing his old prewar overcoat—the one he had been using to keep his car radiator from freezing. He was still very irate, and in a very bad humor due to a long sleepless night. He was all ready to make quite an issue of the whole thing—until one of the building cleaners reported finding Mr. Webster's almost-new-three-years-ago missing overcoat! Yes, strange to say, during the night they had found it in the control room of Mr. Webster's first studio—exactly where he had carefully placed it the previous morning!

Mr. Glen Webster was conspicuous by his absence all during the rest of the day. But an actress, who happened to be asleep in the lobby at about 4:15 p.m. that day, said she saw Mr. Webster leaving NBC wearing two enormous overcoats and using some very atrocious language of the type that cannot be repeated!

## Annual Rose Bowl Classic

THERE are four Hollywood engineers whose faces cloud up with dark scowls whenever any mention of Rose Bowl is made. It seems that the boys ran into a bit of distasteful business on the eve of the Rose Bowl festivities.

This year as always the National Broadcasting Co. handled the broadcast of the Rose Parade and Rose Bowl game. It was decided that to avoid the mad traffic and terrific congestion of New Year's morning, the engineers, along with the production dept. personnel, would obtain accommodations

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# Who's Who In Chicago!!

(The Third of a Series)

By Tom Gootee

AMATEUR radio has been responsible for many things in its own right, but it never played a more important part than in the life of Ralph Brooks of Chicago. For Ham radio not only reshaped his entire career but also resulted in an amazing series of adventures north of the Arctic Circle. He can truly boast of some experiences that most of us can but vaguely imagine—and he owes it all to his interest in Ham radio.

Ralph was born near Fort Wayne, Indiana, in 1900, and attended school there and in Chicago and Hammond. He first became interested in Ham radio early in 1914—during the end of his grade school education. By the time he entered high school, in 1915, he had his first license for a station under the call: 9-L-D. The rig was much of an oversized breadboard affair, using the conventional rotary spark gap and a Crystaloy Detector.

His interest in radio and electricity led Ralph to his first job after leaving school, in a small shop in Hammond. Pre-War prosperity had settled over the country at about that time, and work was far from scarce. Ralph soon began moving from one job to another in an effort to better himself. He did a great deal of electrical and mechanical construction work in Hammond and Chicago, until the urge to travel tempted him to quit his work and join the Navy in the spring of 1918.

His plans for traveling and fighting in the World War were rudely shattered, however, when the Great Lakes Naval authorities learned of Ralph's skill as an electrician and machinist. So Ralph spent the duration of the "War" within the State of Illinois.

Early in the spring of 1919 he was discharged from the service, and immediately went to work for building and electrical contractors. He managed to do a little traveling in his work, and went from Chicago to Indianapolis, out to the West Coast, and finally back to Chicago.

Directly after the war he applied for a new amateur license and call, and continued his interest in Ham radio during most of his spare time. In 1919 he had the call: 9-A-F, which he kept until 1925, when the Commission assigned him a new call: W9AFA.

During 1926 and 1927 most of his work was in northern Indiana, and Ralph found plenty of time to develop and experiment with his rig. By the early part of 1927 he had a fairly efficient 25-watt transmitter in operation. The rig was built around a type-852 tube in a self-excited (Hartley) circuit using about 1,500 volts, somewhere on the 20-meter Ham band. For reception Ralph built his own regenerative receiver, with two stages of amplification Thus situated, the unpredictable happened!

One night while tuning aimlessly on his receiver, Ralph picked up the faint

Ralph Brooks

but readable signal of the MacMillan Expedition somewhere off the coast of Labrador. He immediately made contact with the operator, Clifford Himoe, aboard the ship, and so began a long wireless friendship.

The MacMillan Expedition, sponsored by the Chicago Field Museum, was a scientific organization engaged in the exploration of Baffin Land—a huge, ice-covered island which lies far to the north of Labrador. The Expedition was interested in establishing a permanent contact in the Chicago area, and Ralph agreed to handle messages for them on a daily pre-arranged schedule.

This message arrangement continued successfully for fifteen months, until the Expedition's schooner returned to Maine in the fall of 1928. Upon the invitation of Capt. Donald B. MacMillan, Ralph went to the East Coast and met the leader and members of the Expedition.

Several months later, in the spring of 1929, Ralph was offered a job as radio operator for the Expedition for a five months' trip to Baffin Land. Needless to say, he jumped at the opportunity, and was aboard the Schooner Bowdoin when it headed northward.

The ship had been specially built for the MacMillan Expedition: a heavy 88-foot schooner, and with a sixty h. p. Diesel engine for pushing through ice. The radio equipment did not compare with the rest of the ship's gear, however, and Ralph completely rebuilt both the transmitter and homemade receiver before the schooner left Maine.

The rig itself consisted of a single 204-A tube, in a Hartley oscillator. A motor-generator operated from the ship's battery supplied 2,000 volts, and the power output of the transmitter was about 100 watts. The only purpose of the equipment was for direct communication with the United States. It used the call: WDDE, and operated just above the 20-meter Ham band. The Expedition's previous operator, Clifford Himoe, had secured a job with WEAF on Long Island, and with his own Ham station acted as the principal contact for messages. At one time or another, however, Ralph also worked John Kulik of New York, and Jon Larson, then of Chicago.

After leaving Wiscasset, Maine, the schooner sailed up the East coast to Sydney, Nova Scotia, through the Straits of Belle Isle, around the Labrador Coast, and thence approaching Baffin Land some three weeks later.

The MacMillan Expedition made yearly visits, until 1931, to explore the eastern coastline of Baffin Island, or Baffin Land. Much of that region is practically unknown, geographically, and the Expedition did a great deal of exploring and mapping. Wind and weather data was also taken, and an attempt made to measure glacier shifts.

Most of northern Baffin Land lies enshrouded in ice and snow for ten months of the year—the "winter" period. "Summer," as such, lasts about one month and is the one time during the entire year when the Expedition

can travel through the coastal waters with some comparative ease—despite the ever-present icefields and icebergs. During low tide, however, at any time of year, water travel is impossible close to shore—due to the ice fields and ice-cake formations. But high tide, usually at least fifty or sixty feet, would break up these obstacles and enable the ship—with the aid of the Diesel—to travel with some degree of ease. However, navigation at all times was extremely hazardous, and through uncharted and unknown waters—with the ship's keel often scraping over some hidden ledge or rock beneath the surface.

The Expedition was particularly interested in the exploration of Frobisher Bay, and much time was spent in the vicinity of this huge, ice-filled gulf. The entire region is a frigid mass of ice and snow. Stretching in every direction, and broken only by occassional lofty icebergs, it is hard for most of us who have never witnessed such desolate expanses to realize the cold vastness of such Arctic lands. At that point the Expedition was at least 600 miles from the nearest outpost of civilization!

The famous Grinnell Glacier, which occupies most of the southern part of Frobisher Bay, was an important exploration of the Expedition. This huge mass of ice, which Ralph helped to explore, is the last vestige of the Great American Ice Age—the last of the huge sheet of ice that at one time covered the entire American Continent back in the Dark Ages. The Grinnell Glacier is over 600 miles long, several hundred miles wide, and in most places from 3,000 to 4,000 feet high. Ralph often climbed around on this icy glaciation, and he claims it's more fun than mountain climbing.

There were fifteen members in the Expedition, and they were kept busy almost all the time collecting and preparing scientific data concerning the region. Besides his regular radio duties, Ralph assisted in the collection of wild flora, and did some geographical mapping. He also contrived to keep himself from freezing—which was probably the hardest feat of all!

It was particularly cold and windy at night, and even salt water froze easily and quickly despite the heavy current that ran along the Baffin coast. This current, due mainly to prevailing winds at the head of the Gulf Stream, was partly the cause of the most breath-taking adventure of the entire trip.

The schooner was locked firmly in a heavy ice field, during low tide and with extremely cold weather. Helplessly frozen in the bad ice jam, the men were suddenly aware of a mountainous iceberg bearing slowly down upon the ship. It was the largest piece of moving ice that Ralph had ever seen. It was over two hundred feet in height, and probably extended over six hundred feet below the surface! It approached the schooner at about five miles an hour, and soon gave the crew cause for alarm. The order was given to abandon ship, and half the crew jumped out on the ice — fully expecting the ship to be crumpled up by the iceberg, as though it were a frail matchbox. When the mountain of ice was about sixty feet from the ship in its path, huge cracks and fissures began to develop and break in the thick ice. The ship itself was gradually being lifted "out" of the ice by the great pressure, and was actually about half out of the water when a wide break in the ice field behind them offered a sudden last chance of escape. Capt. MacMillan eased the ship through the narrow strip of water with the Disel straining every inch of the way to safety—out of the path of the iceberg. It passed them about fifty feet away.

What *might* have happened, had no break come in the ice, can only be conjectured. The ship was over five hundred miles from Labrador. Only a few of the stores and food could have been saved. And the crew would have been helpless in the two frail lifeboats in such treacherous water.

When it was all over, and their immediate safety seemed secure, Ralph sent a full report back to the United States—a dispatch that later made the front pages of most of the newspapers.

Before returning to the United States, the Expedition was fortunate in relocating the original site of the first explorer in that region, the camp made by Frobisher, over 350 years earlier! At that time Frobisher was attempting to find a northwest passage to India, and, incidentally, gold. He found neither, and returned to England with little to show for his efforts.

But the investigation of the old camp site at Countess-of-Warwick Sound, in Frobisher Bay, was certainly a thrill for Ralph—although little remained, in spite of the preservation afforded by the ice and snow.

Their trip finally at an end, the Expedition returned to the United States in the fall of 1929, and Ralph came back to Chicago. He found the country plunged into a depression, and contracting work almost non-existent. Then, early in 1930, he first came to N.B.C., and worked as a maintenance man at 180 North Michigan, in Chicago.

But the call of the far north was still in his mind, and Ralph found it hard to keep himself from mentally wandering back to the frozen regions of the Arctic. In the spring of 1931 he obtained a leave-of-absence from N.B.C. and again accompanied the MacMillan Expedition on a return trip to Baffin Land.

The second trip north was much like the first, except that his work was more routine and not quite as exciting. Ralph used the same radio gear which he had built two years before, and spent most of his spare time assisting other members of the party.

Two new features were incorporated in the Second Expedition. A Lockheed Amphibian was taken aboard the ship, for use in mapping the jagged Baffin Land coastline and for long-range geographical exploration. Another innovation was the taking of colored motion pictures—which was quite a feat back in 1931. A special camera was used, that exposed double rolls of film for all shots—in order to record all colors. A special cameraman ran the intricate machinery.

Ralph again visited the Grinnell Glacier, and did much exploration work with other members of the Expedition. But the second five-months trip came to an end all too quickly, and he was soon returning from the frozen northland. He came back to Chicago, and resumed his work with N.B.C. There he remains today, going about his work in his usual silent way—but not without occassionally thinking of the familiar icy vastness of the Arctic north.

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## Annual Rose Bowl Classic

(Continued from Page Eleven)

at the rather elite Huntington Hotel in Pasadena for New Year's Eve. Reservations were made by the production dept. for all parties concerned, several weeks in advance.

Upon arriving at the hotel, the engineers parked the mobile unit loaded with gear and presented themselves at the desk for their reseverations. The production dept. who had been taxied in a Packard limousine had arrived ahead of time and were well taken care of. A bellhop with much braid then conducted the engineers out the back door, around the kitchen and thence to a

pair of rooms in the servants' quarters, sans plumbing but with a crude pair of cots and a hunk of wire and bulb for a light fixture. The gang after Staring at one another in amazement informed the bellhop, and later the desk clerk and the manager that there must be some mistake. Particularly so since the production dept., with *wives*, had de luxe rooms with all modern conveniences in the hotel. All reservations had been made at the same time.

To make a long story short, the engineers were told that there had been no mistake, that those were the rooms as reserved for them and since there were no other rooms in the city of Pasedena available they would have to take them or else.

We are proud to report that the boys "or elsed" and after packing their gear returned to Hollywood and the repose of their own beds. It was tough getting up early the next morning to beat the traffic and rush but the self respect was worth it . . . Amen.



# So You're Thinking About FM Home Equipment

PART of the business of the broadcast station engineer is to be "quality conscious" when it comes to the matter of the tonal qualities of radio equipment. For this reason he will have fuller appreciation of the advantages which FM offers and in many cases will be giving thought to equipment for his own home, to enable his family and himself to enjoy these advantages.

There is always the problem, however, as to just what form this equipment is to take. Very often the solution will be influenced by the standard broadcast equipment already on hand. If the present equipment is quite suited to his requirements for reception in the 550-1600 kc range, and perhaps the short-wave ranges as well, then to scrap it in favor of a combination FM/AM receiver would be impractical. In such a case an FM tuner, arranged to use the audio system of the existing equipment, might prove the best compromise.

On the other hand, if the present equipment leaves something to be desired in the matter of output quality there may still be some hesitation at the thought of scrapping it in favor of a necessarily rather high priced FM/AM job (if it is to be kind of equipment which will provide fullest advantage of FM quality and noise reduction).

Such are problems that every man must solve for himself in the light of his own desires and economic affluence. But an outfit which seems to provide an easy solution for many is the new one illustrated here.

This is a 9-tube FM/AM tuner which terminates in a triode output stage delivering 130 milliwatts undistorted output to an external amplifier. This amplifier may be the audio end of a standard receiver, the special amplifier which is available as an accessory to the tuner, or any other suitable equipment.

Because many listeners who really appreciate tone quality have already equipped themselves with special high-fidelity amplifier-speaker combinations, this tuner provides everything needed to make a first class FM installation. In addition it provides high-fidelity broadcast-band reception over the range of 540 to 1650 kc., and phono input connections in the grid circuit of the 6SR7 utilizing the gain provided by the triode section of this tube. The choice of FM, AM, or phono is made by means of front-panel switches.

The relatively high output of this tuner makes possible the use of a reasonably simple, low-gain amplifier which is both easy and inexpensive to build.

The circuit of the tuner, which is the Hallicrafters Model S-31 includes a 6SK7 r. f. stage and 6SA7 converter which are common to both the FM and AM channels. The 4.3 mc FM i.f. channel utilizes an 1852 (6AC7) and an 1853 (6AB7) as the first and second amplifiers, a 6SJ7 limiter and 6H6 discriminator. The AM channel of 455 kc. employs a single 6SK7 i.f. amplifier followed by the 6SR7 which serves as diode detector, a.v.c. and as the common output amplifier for both i.f. channels and phono. An unusual feature of this AM channel is the band-pass network in the input of the 6SK7 which utilizes two separately shielded transformers with a total of 4 tuned circuits. This combines the advantages of superhet selectivity with the freedom from sideband cutting usually found only in t.r.f. circuits, and insures maintenance of the wide band necessary for good reproduction of the better quality broadcast stations, right up to 1650 kc.

In FM operation full limiter action is obtained on all signals above 60 microvolts input and selectivity is rated at 150 kc. The tuning range of this band is 40 to 51 mc.

The tuning dial is of the "slide-rule" type and beside it on the panel is an "S" meter, calibrated in the usual 1-9 and db. scales to serve as a tuning meter and signal-strength indicator for AM signals. For FM signals it is switched automatically to the diode circuit where it serves to permit precise centering of the carrier for maximum noise reduction and fidelity of reproduction. The simple panel controls include: FM/AM switch; 3-position power, radio, phono switch; tuning wheel; a.f. gain; tone control.

Combined with a really good amplifier and speaker system, this tuner provides just about everything that the most discriminating listener could desire, and it represents one economical solution to the problem of FM equipment—plus the advantage of higher fidelity in the reproduction of the better quality standard broadcast programs.

# New York News

By Ted Kruse

NOW that the membership copies of the Journal are mailed to our homes, we are sure that the Editor and staff would appreciate it if you gentlemen will inform the Subscription Department of any change of address. This will not only make their work easier, but will insure prompt delivery of the Journal.

Dan Russell, the popular announcer and linguist, has resigned from NBC to take the position of Director of Public Relations with the Pan-American Grace Airways. We are sure that on his travels through South America, Dan will have the best wishes of everyone he came in contact with at Radio City.

Bill Trevarthen is the latest member of the Home Owners' What's Wrong With Your Place Association. The other day the conversation turned to methods of heating a house. When some one asked Bill if he burned oil he answered "And how!"

A. T. Williams has finally been called up for service with the Air Corps. A. T. answered a few false alarms, but this time it's the McCoy.

We missed seeing Charlie Gray for a week or so last month. Snooping around in search of Journal material we came across a newspaper clipping which read, "Charles Gray, of Greenbush Avenue, sprained his ankle fighting a brush fire opposite the Salvation Army Home with the Tappan Volunteer Firemen." We advise Charlie to wear ankle supports the next time he decides to go around stamping out fires.

W. R. Brown believes in mixing business with a hobby. Brownie, who is the engineer on Information Please, is collecting autographs of all the important people appearing on the program.

Phil Falcone has blossomed out with a nifty new green ensemble that has all the local belles in a thither. It looks like he will not even get a chance to break it in though. Phil drew a 1A classification in his local board, and is at present packed and ready to go when called.

We have been studying Sigmund Freud lately to learn the connection between acetate recordings and a visit from the stork. It seems that Fred Frutchey, George Anderson, Syl Caranchini, Jack Holmes and Nick Close, all of Recording, are expecting draft and income tax exemptions. The stork will really have to travel to make a delivery at Nick Close's, as he has been transferred to Washington, D. C.

On the sick list we find Rudy Bauer who was out with the grippe and Bill Glasscock who had an infected ear. We are happy to report complete recovery in both cases.

When Harry Hiller returned to work after too many weeks in a hospital, we found out that besides the seven broken ribs, reported in the column last month, the "assorted bruises," turned out to be a broken collar bone, broken chest bone and punctured lung. Talk about understatement!



Lester Miles left on an extended leave of absence. Les, or Dr. Miles, as he should be called, holds a Ph.D. in psychology and is at present writing for the American Magazine and doing radio work. Best of luck, Doc.

Jon Larson and Don Whittemore are getting a taste of Army life without putting on a uniform. Jon and Don handling the tour of the Army camps which will take about three months and cover practically every post in the United States.

Frank Williams has been promoted to the post of Control Relief Engineer to replace John Kulick who resigned.

Andy Waddell is taking Spanish lessons and is addressing everyone as Senor or Don and saying si instead of yes. (Any connection with the maintenance File System?) Bob Scheutz, back East on business, dropped in to say hello, looking like a very bad advertisement for the famous California sun. Bob did not even have a trace of a tan. Claims he is too busy to even get under a sun lamp.

H. H. Wood has been transferred from WEAF to Radio City.

Recording has two new members in Neale McCarroll and N. C. Youngster. Harry Jones, T. Crennan and Pete Narkon are the new additions to the Studio Group. We owe an apology to Narkon for not announcing his arrival before.

## Activity A-plenty on Twenty

By W2MSC - W2NAZ

The following poem is the first in a long series received by members of the "black and blue" network on twenty meters. The anonymous author is a short-wave listener who has been following the conversations on the band for the past five years and shows his appreciation by mailing these poems to the stations. He never seems to miss a contact and always sends a poem to comment on the subjects discussed the next day. He signs himself "Major Joel" but as yet remains unknown by sight to any of the recipients of the poems.

You can have your Crosby
  And you Eddy Cantor, too,
As for me I'll take the QSO's
  On the good old "Black and Blue."
I'd rather hear sweet Inez call
  Her Matty an "old meanie"
Than listen to the dulcet strains
  Of Arturo Toscanini.
I'd rather hear old Freddy
  Pull a very ancient wheeze
Than listen to the experts
  On "Information Please".
I'd much prefer to hear old Bill
  And Mary, his sweet spouse,
Than listen to the pathos
  Of that drama "Hilltop House".
I'd rather hear cute Marion
  And Frank, "2BUS"
Then all the stars that have appeared
  On the "Pursuit of Happiness".
So you can have the broadcast band
  And I'll choose "14 megs".
My dish is "ham," but not the kind
  That always goes with eggs!



### Corrections — January Issue

In the first sentence of "A Lightweight Crystal Pickup Design," the word *not* was erroneously omitted, and should of course read, ". . . that will *not* damage . . ."

In the article, "High Frequency and Noise Level Characteristics of an Instantaneous Recording Disc," line nine at top of page seven should read, ". . . enough to allow a 50% decrease . . ."

Our January, 1941, Recording issue is already being acclaimed by the industry as an outstanding work on Recording. To all of the authors who made this issue possible, our sincere thanks.—Ed. S.

# Hollywood News

By Ray Ferguson

GREETINGS, everyone, from Hollywood!

What with soaking rains one day; blue, sunny skies the next, late January finds us already eagerly looking forward to Spring. Not necessarily plugging the local Chamber of Commerce, we do find it comforting to manage golf, tennis, and live quite an out-of-door life even for this time of year. Of course, if you prefer snow, there's plenty of it now in the mountains that stretch away to the northeast. Yes, it is boring to talk about the weather. Perhaps even a mental burden to be so much aware of it so much of the time. What else can a guy do when driving down Sunset Boulevard to the studio when on each side trees, flowers and lovely lawns and homes are so inviting everywhere. There's such a feeling of freedom, of not being shut-in. We mean you've got room to turn around in and be grateful for it all.

Conversing with Harry Saz, head of our Sound Effects, the other day left us with this bit of interesting information regarding NBC's Athletic Association's new gun club. It seems some of the guys got tired of shooting at beer cans and felt the need of something bigger and more worthy of their powder. So now it's the NBCAA Gun Club! Henry Saz is President. Jimmy Brown, of Master Control fame, Vice-President; Stanley Radom, Executive Officer; Beardley Graham, Secretary, and last but still in there pitching, William (Big Bill) Andrews is Treasurer. Bill, for his All-American physical construction, is ideal for guarding the club's financial property. We understand that when in a hurry, Bill never stops to open a door. He simply walks through it!

Harry told us the new club aims to affiliate with the National Rifle Association of America. This is a swell idea because the interest shown is gratifying in as much so many here in the studio are going in for it. We called Stan Radom the other evening to go to a show. His reply was that he was sorry but could not find the time as he was moulding rifle balls in the kitchen stove.

The club's first shoot is coming up. Harry went on to say that, at present, Brearley and Graham are possibly the best shots. Among the members, Dorothy Brown in Continuity, seems to be right there in ability and spirit. Dorothy packs a .38 Smith and Wesson. It is a known fact she hit a tom-cat in the eye at two hundred yards one day last week. Maybe it happened at night . . . at any rate, the gal's a good shot. Sam Hayes, famous for his news, sports and Sperry Flour commentation each day, totes a Colt automatic .45 and at option time we hear that Sam always lays his gun out on the table in front of the Sponsor. At any rate, either way you look at it, Karel Pearson of Program Traffic and just recently conscripted, is getting his rifle experience first hand from the army. We hope that the Top Sergeant is understanding and not too severe.

For the time being, the club has purchased two Winchester bolt-action .22 guns with every intention of soon graduating to the heavier calibre stuff. No doubt this means sixteen-inch coast defense guns; because, of the spirit shown, the members aren't kidding.

And while on the subject of Harry's conversation, we might add anyone listening to the baying of the Baskerville hound on the Sherlock Holmes show must be grateful to Ed Ludes who, with no small amount of charm, hoists his Adam's apple to one side, puts a crystal mike on the other side of his throat, and bays, good people, simply bays! It's an electrical system and from the source of Ed's throat to the final part where it all comes out of a sound truck's speakers, we experience goose-pimples the size of walnuts because the sound is that thrilling and wierd.

Well, if some of us in Engineering had come across with as much material as Harry Saz, we would be putting it down here. We mean, don't feel neglected, simply because Harry fairly out-did himself in giving us something to tell the world. And, why not? We've got an excellent Sound Effects department. Why keep it a secret?

For example: The Sound Effects men are quite proud of their new rain machine. It's the only one of its type using a centrifugal pump. The water drops five feet from seventy holes. The whole thing looks like a big, black box that a couple of pianos could be shipped in. Well, by turning this knob and that wheel you can produce a fountain effect; running water, and, of course, rain. That isn't all. By turning something else, the machine sounds like a bath tub being filled, water splashing along down the gutter and practically any kind of water sound required. However, we still wonder if the thing can make the sound of water gurgling down the bath tub drain, just as the last bit of Saturday night's bath disappears from view.

Harry explained that because of growth developing in the water it has become necessary to use the same kind of chemical as used in the studio's huge air-conditioning tank under studio H. It seems that he and Harry Albers, Chief air-condition man, got together one day and figured this all out. In other words, there aren't any fish or other strange deep sea life to be found in either water system.

Any time you think our Recording Room isn't busy just stop by some time. The boys had quite a job to do recently, and from all reports did themselves a great piece of work. Martin Lewis, of Chicago, came here to supervise the task, which is one of the year's biggest promotional stunts organized by the NBC Press Department and Movie and Radio Guide in connection with the magazine's Tenth Anniversary celebration, which all required the cooperation of the program and Engineering Departments. NBC made special five-minute transcriptions of nearly every major network program originating in Hollywood's Radio City. These transcriptions will be played over four hundred and fifty-two radio stations throughout the United States; thus reaching many listeners who normally would not hear NBC

stars and programs on their stations, inasmuch as not one of these shows is heard regularly over even one hundred stations!

Each of the stars wrote original routines for their transcriptions. Each of the five-minute spots is packed with real entertainment; and plugs for Movie and Radio Guide

on its Tenth Anniversary were carefully kept down to just small opening and closing announcements in order to increase the record's entertainment value.

We learned from Bob Callan, ace recording engineer, that for the past month the department has been working on this big job; not to mention the usual routine of work which constantly keeps Recording chasing the chips. Bob said musical numbers, fanfares, play-ons and play-offs were recorded separately using Gordon Jenkins and David Rose's orchestras. The technical problem for Recording was to build four, fifteen-minute programs well balanced, properly produced and using spots previously recorded. For example: in order to get four shows of fourteen and a half minutes duration, it was necessary to combine spots recorded, delete portions, dub in applause from one act as applause for the performance of another artist. Tony Martin's number had no applause, so the applause from the Fibber McGee and Mollie show was used for Tony. Or, while recording one show, the audience of another had to be held while they were still "hot" or before they "cooled off." Yes, there is a difference between the two types of audiences as we all know only too well.

The boys are now pretty well relaxed and most of the headaches gone. We understand Martin Lewis has returned to Chicago very pleased and quite happy about the fine results obtained. A job well done!

The picture of us all was taken at our last A.T.E meeting, just after Denny returned from the National Convention. Jim Brown has since been elected to fill the spot of Hollywood Chapter Chairman. We want to say right now how grateful we all are to Denny for his fine work, patience and consideration during the term of his office.

The meeting was held in the Aviation Room of the Plaza Hotel, as you can obviously tell by the back-ground airline ensignias. In the immediate front are what remains of coffee and sandwiches. In the front row, all looking very pleased with themselves, left to right: John Morris, Maintenance; Steve Hobart, Master Control Number One Supervisor; Ed Miller, studio; Earl Sorenson, Maintenance; Miv Adams, ace Field Supervisor. In the second row, left to right, Wes Turner, Television; Lester Culley, Recording Supervisor, and a grand fellow for those of you who don't know Les; then, alas, myself, which we should quickly skip over; Floyd Wettland, Master Control; "Jake" O'Kelly, studio. In the last row: Carl Lorenz, studio; Ralph Denechaud, studio; Jim Brown, Master Control; Al Korb, Maintenance; Frank (Smiley) Figgins, Maintenance Supervisor. Then, along the right wall all appearing very delighted with things at three o'clock in the morning, are, left to right: Bob Brooke, studio; Joe Kay, studio; R. Beardsley Graham, Television; Ralph Clemens, Recording.

Because of schedules, the rest of the boys couldn't make the meeting. We mean those not appearing in the picture. Those that had to get up at dawn.

For notes of interest we talked with Carl Lorenz and Ed Miller in the Lounge last night about their forth-coming fishing expedition up thar in the high mountains. Joe Kay's hair was being blown about by a Hollywood breeze the other day while he was on the roof of the studio fixing up for tests with Miv Adams in an army bomber. The plane, really a Douglas A20A attack, was circling the studio time after time. The boys were testing, the ship circling, people standing around watching, and Buddy Twiss, Special Events, looking very important with his script in one hand and a stop-watch in the other. It's a funny thing, but Joe always gets the strangest look when he's around an ND-10 and a 50-a mic. He's simply out of this world!

We are glad to report everyone in good health. That is, everyone except poor old Carl Lorenz. He was doing some heavy lifting around his house the other day and it was just too much for him. Now his back is out of kilter, and Carl feels pretty much off the beam. It takes a lot to get a good man down, so we know Carl will soon be back in his inimitable form; a thing of rare beauty.

From Master Control to the parking lot, as you walk around through the studio past the bustle of Recording; the lines of racks in Equipment with each amplifier so quietly doing its own important duty; down the Artists' Lobby, where the hurry and tempo of many people in and out of the stages and studios is exciting in itself, one feels the swiftness of the pace of Radio and the wonderful organization of things throughout the studio. Each department functioning with thoroughness and understanding so that every effort is a good one, and the results are of the finest quality. It makes us proud and grateful to be part of it all!

## KFI-KECA Views

By H. M. McDonald

RAY WALLING, Transmitter Engineer at KFI, has been called to duty in the Navy. He has long been an active member of the U. S. Naval Reserve, communication division, and is ranked a lieutenant. For the present he will assist with Reserve administration at the District Communication Office in San Diego. Ray was with RCA for ten years, as operator at KPH and KSE, and in the Maintenance Department at Wilmington, before coming to KFI-KECA in 1931. His hobby, cryptanalysis, should stand him in good stead now.

James Wright, ex-KEHE, who made vacation reliefs here last summer, will fill the vacancy at KFI Transmitter created by Walling's departure.

One fellow who left NBC San Fran for life in the Navy (Fullaway, we presume) finds plenty of hard work aboard a destroyer, according to Morrison of SF, whom we heard in a rag chew on 7mc tonight.

The President's inaugural speech reached Los Angeles on the Blue about one-half second sooner than it did on the Red. We tried to time the difference but clockings varied, from two-fifths to four-fifths of a second. Sometimes two and even three single syllable words would be completed on one net before they began on the other.

Heard Joe Emerson (Hymns All Churches, Chicago) give Engineer Washburn a nice plug on their Christmas day program. (And he had a nice ad in the Christmas Yearbook, too.) His program is one of the few in the day-time that are not hard to take.

Ray Moore plunked down a lot of money for a new test oscillator, with electronic sweeps, range 100 kc. to 110 mc., crystal for frequency check, 'n everything. He finds more bugs with it than Pasteur ever thought of.

A thief jimmied open a wind wing on Rex Bettis' car and stole his golf clubs and sun glasses, valued at $170, when he re-entered the club house for a few minutes after a game. We'd have quit the game, but not Rex. He bought another set of equipment and a membership at another club, Fox Hills. He reports that the course is good and the crowd congenial. (And from another source we hear he's won a trophy already.)

Eight KFI-KECA Engineers possess RCA television receivers and are anxiously awaiting resumption of broadcasts by W6XAO, Los Angeles' only television station, to date. The station has been off the air the past couple of months while moving to their new location atop Hollywood hills.

The "bangtails" at Santa Anita held little interest around our studios this year until this week when a longshot named "Red Flannels" won in a photo-finish and paid $178 on the $2 ticket which a couple of the boys held. Now everybody's studying a racing form.

## San Francisco News

By Lee Kolm

CHRISTMAS was celebrated at NBC San Francisco on the twenty-fourth of December with a merry get-together in the executive offices. Manager Al Nelson hosted the party which included the exchange of twenty-five cent presents between members of the staff, drawing of many fine gifts as door prizes, and an excellent luncheon provided by Chef George Mardikian. Of some 200 prizes, Engineering received about twenty. As many of us were working during the time of the party, the proceedings were piped to the twenty-second floor so that all could hear the entertainment.

It is interesting to note that: "Cannonball" Manning, KPO, is driving a new Studebaker Champion sedan, and Henry Dunton, KGO, is dashing about in a 145 h.p. Chrysler recently purchased . . . Dick Parks, KGO, the bridge expert, has joined the Elks . . . Warren Andresen, SE, has became a technical adviser to Archie Presby, m.c. of the KGO Musical Clock. When advice on camera technique is given the listeners during the early hours of the morning, Archie mentions that all information given has been checked by Andy. Even now the fan mail is addressed to "Andy and Archie." . . . The new home of Joe Baker, KPO, was officially opened with a house warming on December 29th . . . Mark Dunningan suffered the only severe case of flu during the epidemic and spent a week at home to regain strength . . . Alan O'Neil, Recording, reports that his Christmas movies were very satisfactory. Using his new Cine-Kodak "60," he tried some stop action sequences with results that provide many laughs for his audiences . . . Frank Barron, SE, has a very amusing story to tell in regard to the acrobatic act at the Bal Tabarin Cafe . . . KLS is the only Bay Area station using ASCAP music . . . KGEI, General Electric short-wave station, will rest on 95-foot piles on land adjacent to the KPO plant at Belmont on the Peninsula . . . Robert Barnes, KPO, is utilizing the mild weather to set out his fruit trees and in a few years expects to be picking apricots, peaches, and persimmons from his own orchard . . . Mort Brewer, KPO, is still attempting to get some fish. His latest effort was balked by a bad storm in the vicinity of Half Moon Bay . . . If the boys of KPO didn't bring home the bacon during the high tides of early January it was because they didn't try. One thousand pigs from a farm adjoining the Belmont plant were flooded out of their pens and they finally found refuge from the water near the front door of KPO transmitter . . . Red Sanders, FE, has again taken up his miniature train hobby. After completing one large layout, he started drawing plans for a much larger and more complete railroad system . . . FLASH! Rumors of an expected arrival in the Don Hall household were confirmed the third of February with the arrival of a seven-pound boy! Congratulations

## Washington News

By A. R. McGonegal

THREE new men have been taken on in the past few days. One of them, John Stetson, is an old friend, having served as vacation relief man for the past two summers. One of the others, Nick Close, was transferred here from New York Recording; and the other, McClellan, first name as yet unknown, was last with Paramount News. Welcome to Washington, gentlemen.

WMAL's new transmitter is rapidly approaching completion. The transmitter is installed and completely tuned, and work on the tower tuning is rapidly progressing. Difficulties with the directional array (a four tower layout) have slowed up the work, but Station Engineer Wadsworth expects to be on the air by February 1.

Directional array troubles at WRC's new layout, caused primarily by the proximity of WOL's transmitter just across the road, have caused Duttera, Fitch and McMillan to return to New York, where they can do their head-scratching in comparative privacy. They promised to return as soon as they can cook up something new to try. Meanwhile, WRC is still operating on its old non-directional antenna.

While on the subject of WRC, S. E. Newman tells us that a local builder's supply house delivered a load of sand that had been ordered several days before. On being questioned about the delay, the truck-driver said he had spent all his spare time for three days driving up and down the road, looking for a mail-box bearing the name of W. R. See!

Bob Chapman, who has been detailed to WRC for the past few months, has returned to his former job as maintenance engineer at the studios. Just in time to pull in new cables for the inaugural equipment. Tough luck, Bob.

Charlie Fisher of WMAL has a new definition for "Death in the Afternoon." Anyone who has had to stand a day watch at a transmitter, listening to all the soap operas, will understand, says Charlie.

John Rogers, of WRC and WMAL, has had a last-minute reprieve. John, being a naval reservist, had expected to be sent to the Canal Zone with the Washington Reserves, but at the last minute was put on the inactive list. He'd be singing "Happy Days Are Here Again" if it wasn't ASCAP music.

Eddie Burg, WMAL engineer, tossed a goodly party on New Year's Eve, attended by some six or eight Washington engineers, as well as numerous non-radio friends of the Burgs. The affair ended with breakfast about 7 a.m., as some of the guests complained of hunger, not having eaten since supper was served at 2 a.m. They had nothing to complain of about the liquid refreshments, service in that department being practically continuous.

The Mile of Dimes Campaign, originally put on in Washington by NBC to raise funds for the Infantile Paralysis Fund, has been extended to cover twenty-four other cities this year. Charles Barry, Washington Night Manager, who has been in charge of the project each year, is this year National Director, traveling about the country to give pointers in the towns where it is being tried out for the first time. The customary rush of field jobs in connection with the campaign has started, keeping our field men busy with six to eight pickups a day from the Mile of Dimes booth, in addition to all the regular field work.

Bill Young, NBC Recording Department representative in Washington, had the unusual honor of having his office selected to be used as a special events control room during the Inaugural ceremonies. Ousted from his sanctum, he presented a pitiable figure wandering about the corridors with his hands full of papers and no place to lay them down.

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