1952

Radio stations for Montana high schools

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RADIO STATIONS FOR MONTANA HIGH SCHOOLS

by

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B.A., Montana State University, 1949

Presented in partial fulfillment
of the requirements for the degree of
Master of Education

MONTANA STATE UNIVERSITY

1952

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

This professional paper has been approved by the Board of Examiners in partial fulfillment of the requirements for the degree of Master of Education.

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Date Aug 18 1952

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CHAPTER I

INTRODUCTION

Radio projects for public schools have a rather interesting and lengthy history. Educators in general were quick to realize the educational potential of radio, and soon after its widespread adoption radio entered the classroom. However, in most cases there was no organized program to insure maximum educational returns from these efforts. In very few instances was educational broadcasting actually attempted by schools, and many of these met with failure. The demand for space on the airwaves for commercial stations grew tremendously as the advertising potential of radio was recognized. Idle frequencies reserved for educational purposes were desired for commercial use, and eventually these frequencies were released for this purpose. The Nation's educators had lost an opportunity to utilize educational broadcasting.

With the advent of frequency modulated radio and its corresponding high frequencies, a second chance was given to the educators of America to make the most of educational broadcasting. The Federal Communications Commission set aside certain frequencies to be used only for educational broadcasting.[1] New regulations were established controlling

[1] Eighty-eight and one-tenth megacycles to ninety-one and nine-tenths megacycles.

low powered, frequency modulated, non-commercial, educational stations which made it very easy for schools to operate their own stations. Many of these educational stations have been put in operation since World War II, but none of these have been in Montana.

The cost of the necessary equipment presents no small problem and might be considered by many as the chief reason why Montana educators have ignored this valuable educational aid. However, when the facts are examined it becomes quite evident that the cost of equipment need not eliminate educational broadcasting from the Montana scene.

The equipment necessary for the typical high school station may be used as it is assembled, and thus the assembling of equipment may be extended over a convenient period of time. With the formation of a project such as the one described in the following chapters, maximum utilization of the equipment will be assured as the equipment is assembled and the project will be free to grow from very meager beginnings. In most cases meager beginnings will actually prove a benefit to the project, because such a beginning will allow the project to sell itself as it progresses and thus become established on a firm foundation of cooperation and understanding.

Most of the high schools of Montana have much to gain from the adoption of a radio project of some type. Certain-

ly the benefits and the most suitable type of project will vary considerably with the local situation. The purpose of this paper is to present a practical plan for establishing such projects in Montana high schools. A plan which will meet all situations is impossible to create, and the reader should understand that only a portion of the plan here outlined may be of interest to a specific educator working in one local situation.

The scope of such a project need be limited only by the imagination of the educator acting as its sponsor. The term "radio project" is so broad in its meaning that the acquisition and utilization of a single, simple radio receiver might rightly be considered as a start. However, some sort of a goal should be in mind at the beginning of such a project because unfortunately, unlike Topsy, such educational projects do not seem to grow unless they are carefully planned and nurtured by those sponsoring them. At Missoula County High School such goals were established very early; the establishment of a ten-watt, frequency modulated, noncommercial, educational radio station. Because of many problems related to such an undertaking,[2] those persons taking part in the Missoula project realized that this could not be

[2]From the beginning the radio project at Missoula County High School was faced with financial problems and a shortage of persons trained to operate a transmitter.

achieved immediately, but nevertheless the project was started. At the writing of this paper the original goal has not been achieved, but much progress has been made.

Many of the facts contained in this paper were learned at Missoula by simple experimentation because there was no written work to guide the project. Therefore, this paper will attempt to present these facts to other Montana educators in order that they may profit from the errors and the progress made at Missoula. Limited finances, isolated communities, small enrollments, and physical plants unsuited for installing studios are problems facing Montana educators which create the need for a guide such as the one presented here.

The purpose of this paper is not to discuss in detail the benefits of a high school radio project. Many such benefits will be immediately obvious to anyone connected with public secondary education. However, the benefits that were considered at Missoula County High School during the creation of its radio project will be mentioned briefly herewith. Coordination of the various parts of the curriculum, actual service to the school, development of specialized individual skills, service to the community, improving instruction in the class rooms, and increasing the sources of instructional information were among the benefits which were anticipated. Needless to say, as the project developed many

more benefits were forthcoming.

The building or purchasing of equipment, production problems, technique of recording, planning and equipping a studio, starting a project, the supporting student organization, making use of community resources, increasing the services of the project, securing financial support, and a summary of the paper are among the topics which are discussed in detail in later chapters. In each case an effort has been made to use a very practical approach, and no special knowledge of radio is needed to follow the discussions. Perhaps the one exception to this is the chapter dealing with the building of related equipment.[3] If this chapter does create an obstacle to any reader, the aid of a local radio repairman or radio amateur should be secured. The reader will find that most of these individuals are very cooperative, and any technical material contained in the above-mentioned chapter will present no problem to such persons.

Many projects of the type discussed here are now in operation throughout the country. They range from very elaborate programs with operating budgets of over a thousand dollars each year to very simple, single classroom projects. Regardless of the scope of the project, there are definite

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[3]Chapter three.

benefits to be gained from each, and the fact that certain school systems can afford to sponsor elaborate projects should not discourage other less fortunate schools from taking advantage of educational radio.

The introduction of a single radio receiver into a classroom will undeniably broaden the subject coverage of the related teacher and class. Certainly, a very intense program that will train that teacher in making best use of her receiver or even one that will funnel certain material into that receiver will increase the caliber of instruction even more if carried out under favorable conditions. But of the possibilities here presented, obviously, the most important is the introduction of the classroom receiver which creates fertile ground for the creation of any type of a radio project.

Since the end of World War II many low-powered, local commercial radio stations have been established in Montana. These stations cater to one community which is more often than not also a school community. These stations are compelled to devote fifteen per cent of their programs to public service and this fact is being taken advantage of by many educators.

Tape recorded programs produced in public schools are being used by Montana commercial radio stations, and here lies the key to the establishment of radio projects in many

schools. At Missoula two weekly programs of this type are being produced. While these programs are not the most important part of the project in Missoula, they nevertheless have been very important. Here is something specific that can be pointed to when the project is being scrutinized by the cynics that seem to criticize all such projects. This portion of one type of project is presented here in an effort to provide the reader with some degree of understanding concerning the activities which may be included in such a project.

CHAPTER II

STARTING A RADIO PROJECT

Prior to the actual starting of a radio project several factors should be given some consideration and, by all means, the chances for success should be studied in detail. A project of this type which fails might conceivably do real damage to the professional reputation of the sponsoring educator. While such risk could not be conceived to be very great, it certainly should be given consideration.

A method of starting a radio project that will fit all situations is impossible to describe, but the problem of finance will be encountered in most situations. The possibilities of gaining financial support should be investigated intensively very early. At Missoula County High School this problem has not been entirely solved, but at the time of the writing of this paper progress has been made along this line. At first those persons participating believed that little support could be expected, but this was later shown to be untrue. The sources that were utilized exist in most communities and are available to almost every Montana school. The sources of support should be considered on two bases: those from outside the school, and those from within the school organization.

The local power company, a local radio station, an oil

company, and certain individuals who were willing to make very worthwhile contributions were among the sources of support utilized by the Missoula project. Most of these sources provided support not in the form of cash, but rather by providing equipment and other items or services which were equivalent to many dollars. The power company contributed five hundred dollars in cash and several hundred dollars worth of obsolete equipment. These contributions were not solicited, but rather seemed to be a part of the community support which developed with the growth of the project. The possibilities of such support seemed remote when the project was first undertaken. Local radio men (amateurs and professionals) were approached and their contribution of time and energy proved invaluable as later chapters will reveal. A radio station contributed an old recorder, but a service even more valuable was the provision of free broadcast time which kept the project alive from the start and gave all concerned something for which to work.

Financial support from within the school should constitute a major portion of the finance for the project. If the project is worthy of adoption by the school, it is the duty of the administration to provide a reasonable portion of its financial support. The student governing body may provide funds in certain schools as may student clubs of various types.

Indirect financial aid may be gained within the school by organizing record drives, old radio drives, and other such activities on the part of students. A record drive at Missoula netted the radio project over five hundred serviceable records which are valued at around three hundred dollars. This drive was sponsored by one of the student service clubs. A small prize was given to the home room which contributed the greatest number of records. Only about one-sixth of the records could not be used. The science department also made contributions equivalent to financial support by donating surplus equipment and supplies to the project.

Very early in the history of the project the sponsor should establish a schedule of activities which will provide all student members with specific tasks. This is an essential task if a sound organization is to be maintained during the first phase of development. The non-participating student soon loses interest and may have dropped out of the organization by the time he is really needed. Because of the very nature of the project, the initial period of a few weeks will be one of planning rather than one of activity, and there is some danger of the organization deteriorating before it actually starts to function. Training activities can do much to hold student interest through this difficult period and will pay dividends when the operational activities become more intense.

The training program must be geared to meet the local situation. Many schools have initiated their program by introducing related classes into their curricula, but this procedure produces many problems. A training program which is successful as an extra-curricular activity can always be made a part of the curriculum at a later date. If a transmitter is to be installed, the training program will have to be an intensive one in order to meet licensing requirements[1] for the engineers. At Missoula the training program was begun on a very simple scale, and it was allowed to increase in scope as the project grew. This approach has been used by many schools and certainly seems most advisable when the training and experience of the sponsor is very limited.

Community resources (radio announcers, engineers, etc.) should not be overlooked when setting up the training program, but even if these are fully utilized this phase of the project will undoubtedly prove most burdensome to the untrained and inexperienced sponsor. However, many of the most successful radio projects over the nation were started by classroom teachers with neither experience nor suitable training in radio, so it may safely be assumed that this need not be an insurmountable obstacle.

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[1]A copy of the licensing requirements for engineers may be secured upon request from the Federal Communications Commission, Washington 25, D. C.

Outlets for programs should be sought very early unless a transmitter is included in the initial operation. Local radio stations, children's wards in hospitals, and fellow faculty members are a few of the outlets that should not be overlooked. This is an important step in selling the project to the school and community, and provides excellent learning experiences for the students.

From the start at Missoula, an effort has been made to stress student participation, and this has proved an asset in securing program outlets. Students contacted the local radio stations and secured free broadcast time which served as outlets for tape recorded programs. Students also contacted department heads in the high school and secured more outlets for special recorded programs. News programs for history classes, science programs for the general science classes, and special event programs for many other classes were some of the programs produced for the high school. The students working on the project found that everyone concerned was very cooperative and although at first the mistakes of the students were numerous, much support was gained through these activities.

In other schools stations have undertaken very worthwhile projects which furnish children's programs for the crippled children confined in local hospitals. Obviously, this project is not suitable for all communities but may

serve to suggest other possibilities to the reader. Every community has its share of shut-ins, blind and crippled citizens who might enjoy various types of programs. In most communities these programs are delivered to the person's home and played for them whenever they desire. Uninterrupted music, book readings, and current events are but a few of the programs being produced.

Cleveland, Ohio[2] and Rochester, New York[3] have been the sites of much of the pioneer work in educational broadcasting. However, due to the dissimilarity between these school systems and the school systems of Montana, a description of these projects has not been included.

In the event that a transmitter is to be utilized from the beginning, there will be no need for securing the additional outlets mentioned above. Outlets have been suggested here to point out that most schools can find many profitable activities for a project of this type. The broadcast schedule considered appropriate for the operation of a transmitter will no doubt prove quite a challenge to most newly organized radio projects, but additional outlets should not be ignored once smooth operation is established by

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[2]Edward F. Helman, "Educational Stations of the Nation: WBOE," The Journal of the Association for Education by Radio, 8:53-56, January, 1949.

[3]Edward S. Foster, "Pioneering in Educational Radio," New York State Education, 35:544-46, April, 1948.

the project fortunate enough to begin with a transmitter.

As stated previously, equipment needed to start a project may vary considerably. This subject will be dealt with in considerable detail in chapter three, but it seems appropriate to mention it briefly at this point. The project at Missoula was begun with about one hundred dollars worth of equipment. This consisted of one used wire recorder, two very much used turn tables with homemade pickups, a very old amplifier, and an inexpensive second hand microphone. This equipment was all donated to the project, but its equivalent is available in most communities at a cost of about one hundred dollars or less. Many projects have been started with less, but obviously this limits the activities of the project.

When buying equipment the sponsor should always consider his plans for the future and make certain that the new equipment will fit into those plans. Much of the available equipment can be used in any radio project, and thus the danger of buying equipment which cannot be used at a future date is not too great. However, experts should be consulted before buying major pieces of equipment such as recorders.

While planning the establishment of a radio project, the sponsor should consider the location of the studio. All available space in the building should be carefully inspected before the project is started. Almost any room can be con-

verted to a studio, but some rooms are more suitable than others. If there are several unused rooms to choose from, the sponsor should choose the room with the fewest windows, irregular walls, silent floors, and a location farthest away from the general activity of the building.

The size of the planned project should, of course, be considered when selecting a location for the studio. As a last resort a classroom may be used, but this should be avoided if possible. The technical aspects of the studio will be considered in chapter five. A school building without at least one room suitable for housing the project is indeed difficult to imagine. Many successful projects are housed in classrooms which are also being used for other purposes.

Among the agencies from which the beginning sponsor may secure advice is the National Scholastic Radio Guild.[4] This organization was founded by the Scholastic Magazine and today is doing fine work in providing various types of support for school radio projects. The yearly membership can be secured for four dollars which is far less than the value of their services. The organization has members in many parts of the country, and there is a free exchange of ideas among members. Their services include script writing and scripts

[4]National Scholastic Radio Guild; 351 Fourth Avenue; New York 10, New York.

are given to members at regular intervals. They also keep members posted on current events of interest to radio groups. This guild has done much to stimulate interest in radio as an educational tool and deserves the support of all high school radio groups. The scripts provided will prove a great asset to the new sponsor.

There are relatively few publications on the subject of high school radio projects, and many of these do not consider the problems facing Montana educators. However, two of these are worthy of mention at this point. The U. S. Office of Education publishes a booklet entitled FM for Education[5] which should prove very valuable to any educator connected with a school radio project. This booklet discusses such topics as pertinent curriculum adjustment, studio construction, and outlines of progress in other schools. Another publication entitled Fundamentals of Magnetic Recording[6] is published by the Audio Devices Inc., and should be considered necessary reading for every sponsor of an educational radio project. This booklet tends to be somewhat technical in nature but has much to offer the untrained sponsor. A

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[5]A copy of FM for Education may be secured upon request from the Federal Security Agency, Office of Education; Washington 25, D. C.

[6]A copy of Fundamentals of Magnetic Recording by C. J. LeBel may be secured upon request from Audio Devices Incorporated; 444 Madison Avenue; New York 22, New York.

description of good recording technique is included. A progressive radio project should involve at least a small amount of recording, and because of this fact any information concerning recording technique should be sought after by the sponsor of a radio project. Proper recording technique leads to high signal fidelity.

Most high school faculties have much to offer that will be helpful to the sponsor of a radio project. At Missoula, several English teachers have given invaluable aid to the project. This help has varied from correcting the grammar of scripts to training announcers for special programs. The music instructors have done much to assure the success of the project. Programs containing high school music rate a high degree of public interest. Certain science teachers also made a worthwhile contribution by aiding with the installation of equipment and by giving technical advice concerning equipment construction.

There is little doubt that the faculty at Missoula County High School has done much to aid the radio project, but there is no reason why this same cooperation cannot be secured from many faculties. The effect of the uncooperative actions of certain teachers was so pronounced that the importance of securing the support of all faculty members became very obvious to all members of the project.

Publicity of various types is a powerful tool not to

be overlooked when establishing the project. If a school paper is available, every effort should be made to keep the name of the project in it. There is need for caution in making use of the school paper or the community paper to gain support for the project, but if care is used, this may prove one of the most worthwhile attempts to gain support. The Konah[7] at Missoula has been most cooperative with the project and is doubtlessly one of the factors responsible for gaining the financial support mentioned previously. Fortunately, there have been no bad results from the publicity given this project, but great care has been used to control its content. Unfavorable publicity could do much to weaken the new project.

Every attempt was made to draw attention to the project by carrying out several worthwhile service projects. One of these was to build and install a public address system in the auditorium.[8] This system is still maintained and operated by student members of the radio project. Another service provided was to furnish announcers for the public address systems at athletic contests. Still another service which is also being carried on at the present time is the playing of music and news through an address system in the

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[7]The Konah is a newspaper published weekly by the students of Missoula County High School.

[8]See Appendix.

lunch room and the waiting place for the bus transported students. There was a constant attempt to keep the project in the minds of its friends as well as its enemies. In this case there was a real and forceful opposition to the project which had to be won over and not overcome. A defeated opposition can never be counted on for cooperation, and a project of this type needs the cooperation of all faculty and administrative personnel.

In general the problems related to starting a radio project are much the same as those connected with many of the other extra-curricular activities of a high school. A real interest in the project and a relatively complete understanding of the local situation on the part of the sponsor are about all that are needed to assure success. Obviously, there are many pitfalls and the sponsor should attempt to avoid staking his professional reputation on the success of the project, but the benefits so outshine the bad points that most enthusiastic educators are more than willing to take the risk.

There are few times in the average teaching career when one can hold his head high and say, "This is my best contribution; this is my greatest work." A radio project could be such a contribution for most Montana educators. The thrill that accompanies seeing one child gain self confidence and poise as he gains a reputation as a staff announcer or

department head, and the satisfaction that is felt when one "bone head" English class springs to life as it "hits the airwaves" are payment enough for most teachers.

Essentially, any school project is only as strong as the students participating in its activities; therefore, the criteria for the selection of student members are critical factors affecting the success of the project. The establishment of any school project cannot be defended unless it is beneficial primarily to the students and, as a result, a radio project should by all means be student controlled, but the sponsor must use his influence to maintain a strong organization at all times. In establishing a project of this type, where much valuable equipment may eventually be used and certain federal laws obeyed, there is little to be gained by opening the membership to all students. A high school station is a perfect target for vandalism, but much of this can be prevented by carefully controlling the selection of members. In a small school this may not be an important problem, but in schools with enrollments exceeding five hundred it becomes a very important factor.

In certain schools the formation of the student club or organization operating the radio project will be closely controlled by the student government organization, but in most cases this will not prove to be a serious handicap.

The following offices are suggested: station manager,

office or business manager,[9] chief engineer, chief announcer, and chief of production. These students act as department heads. This group of officers may be further organized into a board of directors if the organization expands to the point where it becomes unweildy. A board of directors will lighten the burden of the project sponsor if the project expands to include twenty or more members. The student directors can have meetings independent of the entire group and thus can bring many problems to the attention of the sponsor that might not be brought out in a meeting of twenty or more members.

Whether or not to base the formation of the student organization on a democratic basis is one problem which should be left to the project sponsor. In all of the cases investigated in the preparation of this paper, no illustrations have been found of democratic organizations. This was not the case with the Missoula project. In this case, one objective of the project founders was to provide training for students in the democratic process.

There are several ways of influencing the selection of members, but the way most suited to the large school seems to be by utilizing an organizational constitution. This constitution should state clearly the requirements for membership. A copy of the constitution of the radio project at

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[9]See Figure one.

FIGURE 1.
THE BUSINESS OFFICE OF THE RADIO PROJECT
AT MISSOULA COUNTY HIGH SCHOOL

Missoula County High School is included in the appendix of this paper.[10] In this organization all officers are elected by the students in the organization. Such an organization could become very inefficient, but by keeping the qualifications for office holders always before the entire organization this situation has been averted.

The key student office is that of station manager. The project sponsor should constantly point out the importance of this office to the students in the organization so that they will realize the importance of the post. This practice will also enable the project sponsor to keep the organizational elections from becoming popularity contests.

Nominations to the offices of department heads such as chief of production, chief engineer, and chief announcer should be limited to the organization's constitution to members of the department affected.

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[10]See Appendix.

CHAPTER III

THE PURCHASING AND CONSTRUCTION OF EQUIPMENT

Equipment for the educational radio project can be considered in two categories; that which is purchased, and that which is constructed. Great difficulty is encountered if one attempts to present a list of equipment that should be constructed by the members of the project, because many factors should influence the decision of whether to buy or build. Also, difficulty is encountered if one attempts to present a list of equipment to be purchased in every instance. However, there is some possibility that criteria can be created which will inevitably place several items of equipment in the latter category. Every sponsor should establish such criteria at a very early date, and in doing so he should consider such factors as finance, available technical aid, the local supply of parts, purpose of obtaining the equipment, and related Government regulations.

The building of needed equipment can prove a very educational and interesting experience for the project members involved, and there is much equipment which can be built by the average high school group. Very few tools are needed for this type of work, but the purchasing of a few tools will prove very worthwhile. A soldering iron, screw drivers, pliers, small and large hammers, long-nosed pliers,

and a drill will meet the needs of most of the possible construction. Many school shops can be used for constructing equipment and thus eliminate the need for any expenditure for tools.

Much of the furniture used in connection with a radio project is very specialized and should be constructed to fit a studio. The table upon which the console,[1] turn-tables, and microphones are to be used will undoubtedly have to be constructed. Stations which have attempted to modify desks or factory made tables have invariably found themselves faced with a remodeling job shortly after initiating operations.

At Missoula the first console table was built on a two-by-four frame with a plywood top. The top was later covered with hard-board to provide a better appearance. A half circle was cut out of the front center of the table to allow the announcer to be seated closer to all pieces of equipment on the table. The turn-tables were mounted on each side of this half circle, and the console was placed directly in front of it. A boom-type microphone is most satisfactory, because it enables the microphone to occupy a central position without any danger of its being knocked over. This boom could be installed as a permanent piece of equipment and thus could be made by project members. For con-

[1]See Figure two.

FIGURE 2
THE STUD[illegible] RADIO PROJECT AT
MISS[illegible] COUNTY HIGH SCHOOL

venience all wires were run under the table and these were tied into cables or suspended on group hangers. Also, all wires were labelled to facilitate repairing or extending circuits. The front side of the table was enclosed, and all switches were mounted here within the indented half circle. This provides, for the announcer, complete and convenient control of the equipment.

Other furniture used at Missoula consisted of a record rack, a swivel chair for announcers, a utility table with a shelf below for storing equipment, and several pieces of office furniture. The record rack and utility table were built by project members at a cost of less than twenty dollars. The record rack consisted of nothing more than a series of shelves against a wall with wire supports for the records. Provisions were made for enlarging the record rack as the increased capacity is needed. The utility table was built long enough to hold three recorders, which enabled members to make two copies of a recording tape at one time. Even though a project may not have three recorders, the extra space should prove a great asset.

The heart of the radio equipment in a project of this type is the control console. The purpose of a console is to prepare the raw signal for reproduction or broadcasting. The tone or volume of a signal may be changed by the console in such a way as to make it correct for a given application.

The console at Missoula was constructed by a local amateur radio operator and contains four circuits.[2] Two of these are phonograph amplifiers. One is a high impedance microphone amplifier, and the other is a low impedance microphone amplifier. A console of this type has several characteristics which make it very suitable for the average high school station. The four separate amplifier circuits provide sufficient outlets for use with the school inter-communication system or public address system. The high and low impedance microphone circuits are capable of providing any type of microphone service that could conceivably be required. The fidelity is acceptable, and the cost is relatively low.

When building a console it should be remembered that the transmitter modulator is very often considered as a part of the console. In most cases this is an ideal situation. Consequently, space should be provided for this circuit when planning the console. The accompanying plans do not provide for such a circuit, because a transmitter has not been used at Missoula.

If the members of the project wish to provide public address service for the school, this equipment may also be built. The public address amplifier should be constructed in such a way as to utilize a separate pre-amplifier.[3] A

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[2]See Appendix.

[3]See Appendix.

separate pre-amplifier can be used for several other purposes in the project. Remote broadcasting can be done through long lines with this device. Thus, recordings can be made in the studio of broadcasts originating in the gym, auditorium, or classrooms. Because this circuit must be included in the public address amplifier, very little additional expense will be encountered by mounting it as a separate unit. The accompanying diagram for the pre-amplifier provides for three microphone input circuits which will increase the usefulness of the public address system.[4] This diagram is an exact copy of the original diagram submitted to the author by Woodrow Davey, the designer of the pre-amplifier used at Missoula County High School.

The final stages of amplification for the public address system may be permanently installed. A permanent installation reduces bad connections and damaged equipment to a minimum. The final stage amplifier should be housed near the speaker or speakers and far from the reach of the student body. The amplifier at Missoula County High School is mounted about twenty feet from the floor on a shelf and has never been damaged by students. Provisions must be made for cooling the amplifier, which means that it cannot be enclosed in a close fitting box. If at all possible, the top of the surrounding box should be covered with screen wire to allow

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[4]See Appendix.

maximum ventilation. When mounting this amplifier, a means of connecting the pre-amplifier to the input must be provided. A small, two connector, terminal block with a shielded lead will serve this purpose very well. The amplifier shown in the appendix was designed especially for the project at Missoula and should prove very satisfactory for any radio project. This unit has excellent quality and ample volume. At Missoula two speakers are used which serve in an auditorium seating over twelve hundred students.

Speaker mountings can be made by students. The mountings should protect the speaker from any disturbance, but they should not cause any change in the signal. This can be done by building a box around the speaker without a front or back and then covering the front and back with heavy cloth. The speakers should be placed so as to provide maximum quality, and therefore the arrangement will depend on the local situation. In most cases a suitable location for speakers is found by simple trial and error. Such experimentation may be used to teach participating students many of the characteristics of sound.

Pickups for use with transcriptions may be made at low cost, but these should not be considered as permanent installations. The correct balance necessary to assure minimum surface noise is difficult to attain with student-built pickups. The pickups shown in Figure three are student-made and

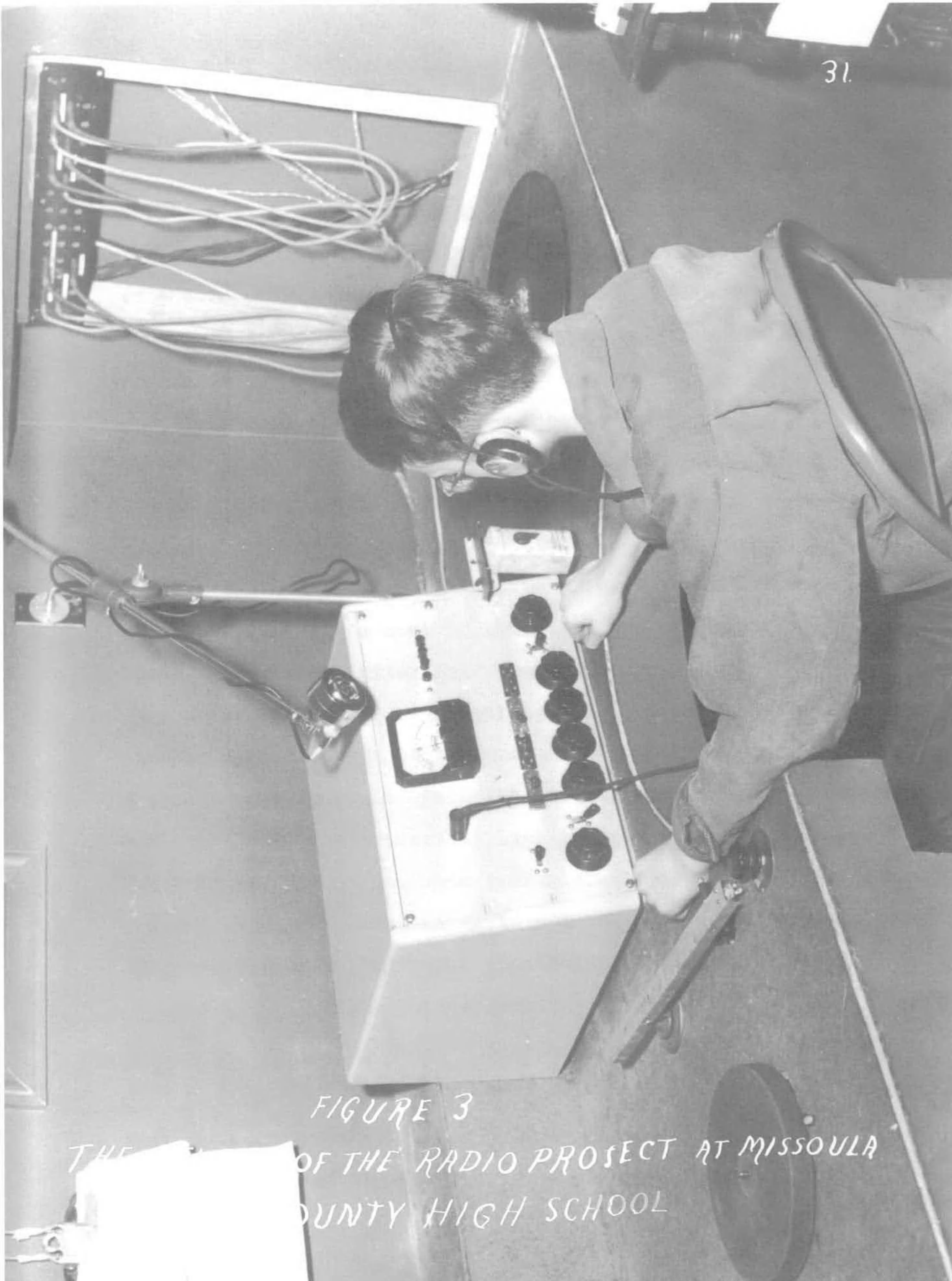

FIGURE 3
THE [illegible] OF THE RADIO PROSECT AT MISSOULA
[illegible] OUNTY HIGH SCHOOL

were used for about one year; however, they were eventually replaced with commercially made pickups.[5] The pickup cartridge should be wired with shielded wire to the phono input of the console. The arm of student-made pickups should be grounded[6] to prevent squealing. The pickups must be long enough to clear a sixteen inch transcription.

In some cases standard phonograph pickups may be used by extending their arm. This can be done by cutting the arm of the pickup in two near the center and inserting a piece of light wood of the desired length. The wire running through the arm must be spliced to cover this extension. A little sanding and a coat of paint can produce an attractive looking instrument after this operation.

Turn-tables of high quality should be acquired as soon as possible. While the project is getting under way second hand turn-tables from old electric phonographs may be used, but these offer serious limitations. Even in very elementary radio work accurate timing should be attempted, and this is impossible when using turn-tables designed for other purposes. When building the studio at the Missoula project very inexpensive turn-tables were installed by the participating students, but these were replaced after about one

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[5]Astatic model 400-CAC-D arm distributed by Allied Radio Company; 833 W. Jackson Blvd.; Chicago 7, Illinois.

[6]Connected to the chassis of the console.

year. The replacement turn-tables[7] cost approximately fifty dollars apiece and have proved very satisfactory. Turn-tables should be able to accommodate sixteen inch transcriptions and operate at a very constant speed. The motors should be large to insure cool operation over long periods of time, and friction drives have been found very satisfactory by commercial broadcasters. The rotating plate should be covered with a felt or rubber disk, or both, and these should be allowed to rest loosely on the plate without being cemented or otherwise attached to the plate.

If a transmitter is desired, evidence indicates that it should be purchased intact. In the summer of 1951, Woodrow Davey[8] did considerable research and experimentation on the development of a suitable ten-watt, frequency modulated transmitter for use with school projects. His objective was to design a unit costing less than five hundred dollars that was simple enough to be built by educators or students and at the same time meeting the requirements of the Federal Communications Commission concerning such units. After many hours of patient work on this problem, Davey concluded that the construction of such a unit was not feasible.

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[7]Presto model 15-G-2 (three speed) produced by the Presto Recording Corporation; Paramus, New Jersey.

[8]Woodrow Davey; Civil Aeronautics Administration; Missoula, Montana.

This worker contacted the engineering department of the Motorola Radio Corporation[9] and this organization validated his conclusion. Several designs were submitted to the Federal Communications Commission, but in each case the modulation unit of the transmitter did not meet with their approval.

Several manufacturers build transmitters which are suitable for use with the high school radio project. The majority of these units cost well in excess of one thousand dollars, but they are guaranteed by their manufacturers to meet the licensing requirements of the Federal Communications Commission. The Collins Radio Corporation[10] manufactures a radio project kit which includes a transmitter, pre-amplifier, microphone, and various other broadcast accessories. Such a kit is of optimum value to the project sponsor intending to initiate his program with direct radio broadcasting. Much of the equipment in this kit would eventually be accumulated by the sponsor of a group starting on a more limited basis before a transmitter is needed. If purchased separately, the cost of items in this kit will be increased to a considerable extent, but the increased convenience to the sponsor should more than offset this additional expense in the majority of

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[9]Motorola Radio Corporation; 4545 Augusta Blvd.; Chicago 51, Illinois.

[10]Collins Radio Corporation; Cedar Rapids, Iowa.

cases. Long term financing of a project is harmonious with the general plan of school finance.

The Collins 738A (and 738B) ten-watt, frequency modulated transmitter is a broadcast unit designed specifically for educational broadcasting. This transmitter can be placed on any standard desk or table, and power can be secured from any standard one hundred fifteen volt, sixty cycle outlet. It includes a two channel audio amplifier which will accommodate two microphones, or one microphone and one turn-table pickup. This limited input is very definitely one shortcoming of this unit. However, the superb operational characteristics of the transmitter more than offset this limitation.

The Collins transmitter is housed in an all stell cabinet which locks in place and prevents tampering by unauthorized students. When unlocked, however, the cabinet may be easily removed, thus exposing all inner parts of the unit. A unique hinge arrangement allows convenient servicing of the control panel. If at any time after initial installation of the transmitter a greater output is desired, the transmitter can still be used to good advantage because the main chassis and power supply can be placed in any Collins transmitter of higher power, thus saving a substantial portion of the cost of the power increase. With limited educational budgets, this fact should not be ignored by project sponsors.

A feature of the Collins transmitter is the built-in

receiver. This permits monitoring of the program being broadcast. The receiver obtains a small amount of signal from the transmitter output stage. Head-phone jacks are provided on the front panel. One enables connection of head-phones to the output of the tuner and the other connects a-cross the audio circuit.

The Collins Radio Corporation makes an effort to co-operate with educators in every way practical. Their equip-ment is of exceptionally high quality and is in wide use throughout this country. This firm includes a consulting en-gineering staff as a regular part of their service. However, the cost of the equipment manufactured by this firm is rela-tively high.

The Gates Radio Company[11] manufactures an educational broadcast transmitter (model BFE-10) which is very suitable for school use. This unit meets all Federal Communications Commission requirements and is very well constructed for use in a school. All major components of this transmitter are clearly visible at all times due to the structure of its cab-inet. The front and rear of the cabinet include large glass panels to insure safe inspection of component parts by stu-dents. This unit retails for about twenty-two hundred dollars and can be successfully operated with about eight hundred dol-lars worth of studio equipment. Basically, this transmitter

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[11]Gates Radio Company; Quincy, Illinois.

consists of an exciter transmitter of a type used in many higher powered, frequency modulated transmitters. The addition of a power supply, meters, and controls make it a finished ten-watt transmitter. Modulation is accomplished by the phase method which has the advantage of permitting direct crystal control of the oscillator.

When modulation tubes are replaced in many transmitters, extensive adjustments are necessary to maintain the original operating characteristics of the unit because of differences in characteristics of tubes. These adjustments present a real problem to the educational broadcaster because of his limited technically trained staff. The Gates BFE-10 transmitter eliminates any necessity of readjustment after changing modulator tubes by utilizing a unique feed-back circuit. Thus, the excellent operating conditions of this unit obtained by the original factory tune-up may be maintained throughout the operational history of the unit. Frequency stability is maintained by making use of a crystal of low temperature coefficient. An oven, which has a temperature within limits considerably closer than is required for good operation and well within the limits established by the Federal Communications Commission, is provided to house the crystal. The Gates Company also manufactures many other types of broadcast and studio equipment.

The Radio Engineering Laboratories of New York City

produce an outstanding transmitter for use by educational broadcasters.[12] This unit features a device which is relatively well known to those working in the broadcast field. This device is known as a serrasoid frequency modulated modulator. While this device utilizes a very original approach to the problem of modulation, it is in wide use at the present time and is not to be considered as in an experimental stage.

The majority of the early frequency modulated transmitters were modulated by a method known as the phase shift method. Despite certain shortcomings in inherent noise, distortion at the lower modulating frequencies and a tendency of the center frequency to drift, it carried the burden of launching the frequency modulated system. This method of modulation was gradually replaced by the double channel modulator which was brought to a high degree of perfection. However, the channel modulator had the commercial disadvantage common to all frequency modulators of requiring a large number of tubes. This disadvantage is not of much importance in transmitters of powers above one thousand watts, because the cost of the modulator is a relatively small part of the total. For transmitters of low power such as those used in public school radio projects, however, the modulator cost be-

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[12]Radio Engineering Laboratories; 36-40 Thirty-seventh Street; Long Island City 1, New York.

comes a major item.

The serrasoid modulator developed by J. R. Day[13] was designed to overcome the shortcomings of the double channel modulator mentioned in the above paragraph and yet avoid the unfavorable quality of the phase shift modulator when used with low powered transmitters. The unit does these things very well and also improves performance to hitherto unattained levels. The significance of this development is that by its simplicity and reliability it has opened up all sorts of new broadcasting possibilities. The serrasoid modulator meets all requirements of the Federal Communications Commission and yet has only four tubes.

The Radio Engineering Laboratories have incorporated this unusual modulator unit into a ten-watt, frequency modulated transmitter which is suitable for school purposes. The transmitter is of unquestionably high quality and is priced at a reasonably low price. This firm also manufactures a complete line of broadcast equipment.

The General Electric Company[14] and the Westinghouse Corporation[15] do not manufacture ten-watt transmitters, but they do produce a complete line of broadcast equipment. The

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[13]J. R. Day; Radio Engineering Labs., Inc.; Long Island City, New York.

[14]The General Electric Company; Syracuse 1, New York.

[15]The Westinghouse Electric Corp.; Baltimore, Md.

Westinghouse Corporation does produce a one thousand watt, frequency modulated transmitter which is suitable for use by the educational broadcaster who is interested in making use of a unit of this power. However, the regulations governing the use of such units present a problem to the educator.

The Allied Radio Corporation[16] maintains a complete stock of radio parts and broadcast components. This stock is one of the most complete and reliable in the country. The prices of these materials are often lower than those presented by local radio dealers even after postage is taken into consideration.

The Walter Ashe Company[17] also maintains a complete line of radio parts and component broadcast equipment which is very similar to that carried by the Allied Radio Corporation.

Any of the previously mentioned concerns may be consulted by the individual considering the purchase of studio equipment. They will be glad to recommend equipment which will meet the requirements as outlined by the purchaser.

Recording equipment presents a problem to the educational broadcaster, because of its expense and because of its great importance to the radio project. There are a great

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[16]The Allied Radio Company; 833 W. Jackson Blvd.; Chicago 7, Illinois.

[17]The Walter Ashe Radio Company; 1125 Pine Street; St. Louis 1, Missouri.

number of recorders on the market, but many of these are not suitable for use in the typical school radio project. The educator should certainly know what he expects to accomplish with the machine before selecting a recorder. The need for more than one recorder will soon become apparent to the educational broadcaster. Two recorders should be considered a minimum of recording equipment even for the small school.

The present trend in educational recording is toward the tape recorder. Wire recorders are used, but the fidelity limitations of these machines present a real problem and they are being replaced with tape recorders in many localities. Disc recording is not considered practical by most educators because of the high degree of skill required to produce acceptable results. The tape recorder is very acceptable for use with the high school radio project.

The majority of tape recorders now on the market are known as double track recorders. This means that the user may record on both edges of the tape. Thus, thirty minutes of programming may be done on the standard fifteen minute tape. Such an arrangement is very desirable for much of the recording done by the educator. However, the majority of commercial radio stations do not use double track recorders, and this fact should be taken into consideration by the person about to purchase recording equipment. A single

track recording head may be installed on many of the standard recorders. This is usually done by the manufacturer at no additional cost, but only if requested by the purchaser. At least one recorder used by the school radio project should be equipped with a single track recording head to facilitate the editing of tape. Double track tape cannot be edited.

There are many recorders on the market which do not have characteristics suitable for use in radio broadcasting. These are not necessarily the less expensive machines, and the purchaser should investigate a machine thoroughly before purchasing it. Local distributors, radio stations, and leading manufacturers may be consulted for aid in selecting the proper recorder for a specific situation. The National Scholastic Radio Guild[18] may also be called upon to suggest suitable recording equipment.

When selecting the recording equipment for the Missoula radio project, several problems were encountered. These problems were a limited budget, the need for at least three recorders, the need for relatively high fidelity recordings, and the need for highly portable equipment. Local distributors of radio equipment, local commercial broadcasters, owners of recording equipment, and radio engineers were consulted and proved very helpful in making a selection.

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[18]National Scholastic Radio Guild; 351 Fourth Avenue; New York 10, New York.

As a result of these activities, three Eicor[19] tape recorders were purchased and have proved very satisfactory.

Two other recorders are owned by the project, but these are used only in classrooms and are not considered acceptable for use in producing radio programs. One of these recorders is a wire recorder which is being used in connection with speech improvement classes and is producing acceptable results in this capacity. The second machine, which is not used in the studio, is a very antiquated recorder which was donated to the project by a local broadcaster. This machine is used to train announcers and will be disposed of as soon as possible.

The Brush Development Company[20] produces a relatively complete line of high quality recorders and supplies. These machines are known as "Soundmirrors" and are suitable for use in educational broadcasting. The cost of these machines, however, will prove prohibitive in most cases. This concern also manufactures recording tape of acceptable quality and cost.

The selection of proper recording tape is not a difficult task, because there are relatively few types from

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[19]Eicor, Incorporated; 1501 W. Congress Street; Chicago 7, Illinois.

[20]The Brush Development Company; 3405 Perkins Ave.; Cleveland 14, Ohio.

which to select. In general, there are two types; paper backed tape and plastic backed tape. The paper backed tape is not as expensive as the plastic tape, but the paper tape is not considered acceptable for most broadcast purposes. The minute variations in the surface of the paper and the corresponding variations in the thickness of its metalic oxide coat, which is used to produce the magnetic effect needed for magnetic recording, produces a magnetic field of variable strength. This uncontrolled variation of the magnetic field produces undesired fluctuations in the fidelity of the recorded signal.

The tensial strength of paper backed tape is not considerably less than that of plastic backed tape, so this factor does not present a serious problem. However, plastic tape is generally considered stronger because the plastic can yeild somewhat under stress and thus avoid breaking, while the more rigid paper snaps rather than yeilding momentarily. Most recording tapes have a breaking strength of four to five and one-half pounds while normal recorder tape tension is of the order of ounces, so there is an excellent safety factor. Peaks of tension will occur during machine reversal and tape strength will vary somewhat due to variations in humidity and temperature.

The coating on the tape backing consists of a carefully controlled mixture of magnetic material and binder.

The magnetic material is a magnetic oxide of iron and is available in either a black or brown form. The black oxide has a particle size of less than forty millionths of an inch. The brown oxide is produced by heat treating the black under carefully controlled conditions. Although the black oxide may be more easily impressed with a signal than the brown, both have approximately the same high frequency response when they are operated for maximum output. Because the black oxide is more difficult to erase than is the brown, and improvement in high frequency response is small, there has been little use of black oxide in high quality work except for a few highly specialized applications.

The binder used to hold the metalic oxide on the tape backing is one more factor to consider when buying recording tape. Since tape is stored tightly wound on reels for long periods, there must be no tendency for one layer of tape to stick to the next. At the same time, the binder must be made so hard that the tape becomes hard, for then the tape would not seat well on the recording heads. Also, the coefficient of friction between the tape and the metal of the recording heads must be low, or fluttering and squealing will result. Lubricants must not be used on the recording heads or on the tape itself, for this will tend to insulate the tape from the recording head. The recording tape must provide the anti-friction quality.

Uniform quality from one foot of tape to the next prevents modulation noise and assures signal fidelity. High quality recording tapes have coatings of guaranteed uniformity.

Before purchasing tape the buyer should make certain that the edges of the tape have been properly cut. This can be done by holding the reel of tape before a bright light and noticing the uniformity of the layers. Also, a tape of the plastic type will show a clear image while tapes with fuzzy edges will not. Clean precision cutting of tape edges is a must for high quality recording. A fuzzy, curled edge prevents perfect contact of the tape with the recording heads of the recorders and thus produces poor quality. A curled edge may also hide minute cracks in the tape and thus are considered good starting places for breaks during periods of peak mechanical stress on the tape.

The radio project at Missoula County High School uses "audiotape"[21] exclusively, because the superior quality of this product has produced the best results. Undoubtedly, there are other brands of recording tape of equal quality available, but these have not been thoroughly tested by the radio project at Missoula.

Wire recorders are rapidly being replaced with tape

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[21]Audiotape is manufactured by Audio Devices, Inc.; 444 Madison Avenue; New York, New York.

recorders in many installations because of the limitations of the wire recorder. A number of factors have combined to keep the wire recorder from professional success. Recording wire is exceedingly fine; about the size of human hair. Even so, the wire diameter of four one-thousandths inches cannot produce the high frequency response of the six ten-thousandths inch metalic oxide coat of recording tape. Despite the fact that wire is too thick for good frequency response, wire is at the same time too weak and easy to tangle for easy handling.

Rotation of the wire cannot be completely prevented, and this results in the reproducing pole of the recorder touching the surface of the wire in a different region than that used for recording. A resulting decrease of signal fidelity is unavoidable. One turn of recorded wire touching the next on the spool tends to leave an echo of surprising strength and thus gives rise to background noises. Recording wire must be driven at very high speeds in order to secure acceptable quality and this leads to inaccuracy of timing, which cannot be tolerated in the field of radio broadcasting.

Microphones present a problem which cannot be ignored by the educational broadcaster. Microphones with acceptable frequency responses are delicate and expensive. Fine microphones are very difficult to keep in perfect condition when they are being used in the typical high school. Consequently,

the educational broadcaster is forced to consider ruggedness as one criterion when selecting microphones.

Microphones are built for specific purposes and should be purchased accordingly. At least one microphone suitable for broadcasting music should be purchased and used for only that purpose. At other times this microphone should be stored and well protected. Less expensive microphones are suitable for voice broadcasting. A reliable dealer should be consulted before purchasing microphones. Any of the manufacturers mentioned in this chapter may be considered as reliable. If the educator knows why he is buying a specific microphone, he will have a much better chance of securing a suitable instrument.

CHAPTER IV

THE TECHNIQUE OF MAGNETIC RECORDING

The success of an educational radio project cannot exceed the success of the student engineers in mastering proper magnetic recording technique. Because of this fact, a description of acceptable recording technique is included herewith. A reasonably complete understanding of the theory of magnetic recording should go far in aiding the student engineer in mastering the fundamentals of proper recording technique. Obviously, a project sponsor must instruct each new engineer on this subject.

The theory of magnetic recording is relatively easy to understand. Currents of electricity varying with the variations of a sound being recorded are passed into an electric magnet. The resulting magnetic field varies just as the electric current causing the field varies. Magnetic tape or wire is drawn past the poles of the magnet, and the sound is actually recorded as varying degrees of magnetization upon the magnetic tape or wire. To reproduce the signal, the magnetic tape or wire is drawn past a coil of wire. The moving of the magnetic field of variable strength upon the tape or wire past the coil induces a very small current in the coil. This minute electric current varies just as the original recorded signal varied, but this current is too

small to use and must be amplified to raise the current to a usable level.

Two methods of magnetization are used. In transverse magnetization the magnetic poles are induced on opposite sides of the tape or wire, and the direction of magnetization is in the same direction as the thickness of the tape or wire. In longitudinal magnetization the induced magnetic poles are spaced along the length of the tape or wire, and the direction of magnetization is along the length. "Longitudinal magnetization has become the preferred method and is used in all equipment likely to be encountered."[1]

The coil and inducing pole of the electro-magnet mentioned above are often referred to as the head of a recorder. The magnetic track produced by the head is only slightly larger than the pole of the inducing magnet, so several tracks may be produced on one tape one-quarter inch wide. The typical stock recorder takes advantage of this fact by producing a double track. This enables the operator to record twice as much material on a given reel of tape as is possible with a single track machine. However, commercial broadcasters use single track recorders, and a school project which makes tapes for use on commercial stations must also use a single track recording head. Recording ma-

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[1]C. J. LeBel, Fundamentals of Magnetic Recording (New York: Audio Devices, Inc., 1951), p.8.

chines can be ordered with either type of recording head.

In certain instances as many as ten magnetic tracks are induced on a single one-quarter inch tape. In these instances the recording heads are staggered in position rather than side by side. By this means ten different signals may be recorded on the same tape simultaneously.

In order to erase a tape or wire or neutralize the induced magnetic track upon that tape or wire, it must be subjected to a magnetic field so powerful as to obliterate all vestiges of the magnetic variation induced upon it. Thus, the tape or wire is left free to be recorded again. Erasing may be done any number of times without injury to the magnetic material. This erasing may be done by the recorder, but for broadcast purposes a more powerful erasing force should be used. Such a force will eliminate all vestiges of the earlier recording and thus eliminates background noise caused by incomplete erasing. Several electronic erasers are available on the market, and one should be purchased by a radio project as soon as funds become available. The "magnerasor" manufactured by the Amplifier Corporation of America; New York 13, New York is widely used and can be purchased for less than twenty dollars.

Magnetic recording requires a highly developed engineering background. In reference to this problem, C. J. LeBel, Vice President of Audio Devices, Incorporated says:

> So new is this field that many basic phenomena still lack rigorous engineering basis, and leading men in the field are by no means in complete agreement on fundamental points. Some published theories lead to results which fail to check theory by 25 to 50 db. [decibels].[2]

A very detailed account of the operational procedure to be used when recording would be worthless in a paper of this type, because such procedure will vary as one considers the various recording machines which are available. However, microphone technique, tape handling and storage, and equipment care are topics which are suitable for consideration herein.

Proper microphone technique is something which must be learned by the individual involved. Superior radio artists have spent many hours practicing before microphones. Very early in the history of a radio project the sponsor must provide for the training of announcers.[3] Microphone technique is a personal thing and will vary with the artist and even with the microphone type. Some microphones produce best results when the artist talks over them or by them, but not directly into them, while other microphones are suited for speech directed into them. The distance between the mouth and the microphone will also vary with the microphone being used. Extensive recordings should be made by each

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[2]LeBel, loc.cit.

[3]See Figure four.

FIGURE 4

TEACHING MICROPHONE TECHNIQUE AT MISSOULA COUNTY HIGH SCHOOL

artist until a suitable technique is discovered. A personal style of delivery can only be established after many hours of practice. In most cases an artist will unconsciously copy the style of another artist until he has many hours before a microphone and gains a great deal of inner confidence. A music and school news program directed into the school lunch room through a public address system provides an excellent opportunity for offering realistic training for student announcers.

The handling and storage of recording tape is not a very complex procedure, but a definite procedure has become established. The tape itself is relatively durable and may be cut and spliced, or "edited", as desired. This enables the program producer to piece together programs as he desires. The work of various artists may be combined in a single release even though they have been recorded at different times and even at different places. It should be apparent to the reader that editing is an important production technique and can be done only with single track tapes.

The strongest and best splice is a diagonal one. A diagonal splice is made by overlapping an inch of the tape ends to be joined and cutting this overlapped portion at approximately forty-five degrees with a sharp pair of scissors. The cut ends are then placed together but not overlapped on the adhesive surface of a short piece of splicing tape. The

splicing tape should cross the recording tape at an angle equal to that used in cutting the recording tape, and the cut ends should lie in the center of the splicing tape in such a way as to horizontally bisect the splicing tape with the break in the recording tape. The excess mending tape is then trimmed off very close to the edges of the recording tape or even within the edges of the recording tape. A splice of this type will actually have a tensial strength greater than that of the original recording tape if the proper type of splicing tape is used. Splicing tape manufactured for the specific purpose of splicing recording tape can be purchased from any dealer of recording tape. Other adhesive tapes should not be used, because the adhesive materials used on these tapes tends to squeeze out under pressure and stick to the next layer of recording tape.

The actual storage life of modern tapes cannot presently be predicted. The cellulose acetate base which is now widely used is particularly doubtful. A certain manufacturer[4] has laboratory samples of cellulose acetate tape that are still in good condition after periods ranging up to ten years. These samples were stored under ideal conditions, but their survival causes their manufacturer to suspect that consumers can expect cellulose acetate base recording tape

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[4]Audio Devices, Incorporated; 444 Madison Avenue; New York 22, New York.

to last ten years if it is properly stored.

Under some of the most common unfavorable conditions the life of recording tape can actually be shortened to considerably less than one year. Concerning the proper storage of recording tape, C. J. LeBel says:

> Summarizing, we would suggest the following as possibly the best storage conditions for maximum life:
> A. Temperature: 60 to 70 degrees Fahrenheit.
> B. Relative humidity: 40 to 60 per cent.
> C. Peak distortion during recording: 2 per cent (to minimize printing during storage).
> D. Store away from even slight magnetic fields (to minimize printing).
> E. Store in metal cans sealed with adhesive tape.
>
> If one wishes a more certain way to store sound for long periods of time, then phonograph records and metal masters offer the oldest and presently the best proven way. A hundred years of experience with tape may reverse this opinion, but since there is no reliable accelerated long-term aging test, we must rely on time itself to supply authentic data.[5]

Very little damage can be done to recording tape during the recording process or during play back of a tape, but damage often occurs during rewind. The damage that occurs during rewind is often blamed by the inexperienced operator on improper horizontal cutting of the tape. Many recording machines have an ultra high speed rewind. As the rewind reaches maximum speed, the tape is occasionally over stressed by surges and made crooked. As the tape is played or rewound, the crooked spots catch or jam and a tape break results. This can be remedied by placing a variable resistor

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[5]LeBel, op. cit., pp36-37.

in series with the rewind motor which enables the operator to control the speed of the rewind motor. A more common way to control this speed is to apply the thumb lightly to the flange of the reel. Thus, enough load is applied to keep the speed below the point at which trouble results. However, this may cause the rewind motor to over heat and thus cause excessive motor wear. Such a technique, though widely used, can not be considered as the best method of controlling this excessive speed.

Most recording machines use tape with the oxide coat wound toward the inside of the reel. However, a few recorders using tape which has been wound with the oxide coat toward the outside of the reel are available. In either case the operator can make a given reel of tape meet the demands of any recording machine by simply giving the tape a half turn while threading the tape for rewind. After this is done once, the tape will always be wound correctly for the machine. The oxide coat of the plastic base tape may be identified, because this coat presents a much more dull appearance than does the uncoated side of the plastic recording tape.

If a loud sound is recorded, preceded and followed by silence, and the tape is then wound on a reel, an echo of the sound will be heard before and after the recorded sound. This phenomena is known as magnetic printing or

printing through. Printing occurs because the tape is strongly magnetized at the point where the sound is recorded, and this magnetic field has the power to induce a weak magnetic field on the portion of the tape wound immediately above and immediately below this point. Because the printing effect must take place through a layer of the plastic backing of the tape, the effect is small if the recording level is maintained at a reasonably low point. This can be controlled manually on most recorders, and the inexperienced operator should learn the suitable level for the recorder he is using. A series of test recordings at various levels should serve to indicate the proper recording level.

Strangely enough, temperatures above seventy-five degrees Fahrenheit tend to severely increase the printing effect, as will the application of weak magnetic fields to the tape. These facts should serve to emphasize to the reader the necessity of properly storing recording tape. Protecting tape against magnetic fields can be accomplished by storing it in steel cans. A magnetic field such as the one surrounding a current-carrying conductor is sufficient to stimulate the printing of recording tape.

Radio project sponsors cannot afford to neglect the adoption of a policy of preventative maintenance. Through such a policy, operational cost of all equipment is held at a minimum. The project sponsor can secure detailed mainte-

nance data from the equipment manufacturer at the time the equipment is purchased. In many instances the purchaser must ask for such information. Student engineers should learn to lubricate and clean the equipment as a part of the related operational procedure.

Tape recording machines require very little attention, but certain items do require consideration. The surface of the recording head which contacts the moving tape will become worn after considerable use. The magnetic tape coating is an abrasive which is not unlike crocus cloth in some of its characteristics. The wear on the recording head produced by the abrasive action of the tape coating will actually affect the frequency response of the head. When a head becomes badly worn it should be replaced. Most manufacturers will accept worn heads for exchange at a cost considerably below that of new heads.

If the surface of the recording head or the reproducing head become covered with a layer of non-magnetic material, the frequency response of the equipment will be impaired. The layer of non-magnetic material becomes in effect a very effective magnetic insulator. The recorder operator must make certain that the heads of the machine are thoroughly cleaned at regularly established intervals, and before doing an important job. Acetone or nail polish remover applied to a soft cloth is very effective for cleaning the

heads. Care must be taken to keep the cleaning fluid out of the interior of the head of the machine.

Some recording machines are equipped with a capstan or guide which provides a drag on the recording tape. If the surface of the capstan or guide is not perfectly smooth, ridges of foreign material will accumulate on the irregular portion of the surface. After much use the recording tape will polish away such irregularities, but until this occurs the capstan or guide surface must be cleaned periodically. Acetone or fingernail polish remover are excellent for this purpose if applied with a soft cloth.

In many instances users of recording equipment perform no maintenance until it becomes absolutely necessary. This practice inevitably results in unnecessary wear on the machine and a low average level of performance. Weekly cleaning of heads and capstans, following carefully the manufacturers lubrication and adjustment schedule, and once a term, frequency response and distortion and signal to noise checks should constitute a minimum maintenance program. The frequency response and the distortion and signal to noise checks should be made by experts. The dealer supplying the equipment can advise the educator concerning the local facilities for performing these checks.

CHAPTER V

HOUSING A RADIO PROJECT

Plans for school studios are available[1] and should be studied by the radio project sponsor, but such plans have a very limited value to most Montana educators. The majority of Montana high schools were built before much thought was given to educational broadcasting, and the limited budgets of most school districts do not provide for major remodeling. Perhaps the future will include schools with rooms specially designed for broadcast studios, but the lack of such facilities need not rule out educational broadcasting for the present. Ready-made studio plans such as those mentioned above offer a fertile source of construction suggestions, but in most cases they cannot be changed to meet the limitations of the available room in a local physical plant.

A studio may be quite small for a school project. Many fine studios have been built in oversize storage closets and unused rest rooms. A series of adjacent small rooms presents an ideal situation, but large rooms can be broken up with the addition of inexpensive partitions. The studio and control room are often combined for smaller projects, but in a school of over one thousand students two of these combined

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[1]Franklin Dunham, FM for Education, (Washington, D. C.: United States Government Printing Office, 1948), p. 25.

studio and control rooms will be needed. As a result of the need for greater studio space in the larger school, the control room can be adjoined by studios without a control console. Such a procedure will eliminate the need for two control consoles and thus will result in a considerable financial saving to the project.

Partitions used to break a large room up into a series of smaller rooms can be constructed of low cost materials. The wise use of accoustic insulators can reduce cost by an appreciable degree. In certain instances heavy drapes have been successfully used to divide a classroom into small studios. In such an instance, however, complete control of outside noise must be established. The use of a room located well within the outside walls of the building aids in controlling outside noise.

Windows in walls or partitions separating the various units of the station may be desirable. In stations having separate studios and control rooms, windowed partitions or walls are essential. In commercial installations, vacuum windows are used with complete success, but these are too costly for most educational stations. A vacuum window consists of two pieces of plate glass mounted in an air-tight frame with a vacuum between the pieces of glass. The vacuum provides perfect sound insulation. In the school station, double windows with two to three inches of air between the

pieces of glass will provide enough sound insulation for normal conditions.

The use of accoustic tile on plaster walls will do much to improve the accoustic characteristics of a room. If the school cannot afford to cover all of the walls and ceilings with accoustic tile, the covering of the ceiling of the studio with this tile should be considered as a minimum soundproofing precaution. A small ceiling can be covered with accoustic tile for a very few dollars if the work is done by students.

Floors present a problem, because the flooring material used in most schools is not suitable for studio floors. Squeaking wooden floors or hard tile floors introduce a problem, but this problem is one which can be solved very inexpensively in many instances. Several thicknesses of worn carpeting make a very fine studio floor. By using worn carpets, the sponsor of a radio project can change most floors into quiet studio floors. Four to six layers of carpeting are sufficient. The lower layers may be in very bad condition if the outer layer is free of holes. This carpeting will do much toward improving the accoustic characteristics of the studio.

Outside windows should be painted or frosted to prevent the direct rays of the sun from entering a studio or a control room. Much of the material used in a radio project

can be damaged by direct sunlight. Special precautions should be taken concerning sunlight during the summer months.

At a very early date after initiating a project, provisions should be made for a business office. A relatively large amount of office work will need to be done. This fact will, of course, increase the training potential of the project. Many letters must be typed, many scripts must be written and typed, and a financial record of the project must be kept. All of this work can be utilized to provide training for commercial students.

The business office should be located as close to the studio as possible, but this office need not be adjacent to the studio. The office should be large enough to house at least one desk and a file. If possible, a writing table or second desk should also be included so that scripts can be written while other office work is being done.

Much of the work which can be done in building the school radio project's physical plant can and should be done by students. High school students enjoy doing work of this type and can learn much by taking part in this part of the project.

Before making any changes in a portion of a school building, the educator should investigate all related laws and codes. Certain communities have very strict building codes regulating public as well as private building con-

struction or remodeling. All electrical wiring must be inspected in many communities, and the radio project sponsor will do well to investigate the effect of these regulations on the radio project.

CHAPTER VI

PROGRAM PRODUCTION AND SUMMARY

Program production for the school radio project is the responsibility of the project sponsor. The project should have a student who serves as chief of production, and this person should be taught the fundamentals of program production, but nevertheless the project sponsor must always oversee the production. The worth of a project is too often judged on program production alone, which indicates the importance of this phase of the project. After the project has been functioning for some time, the overseeing by the project sponsor may consist of nothing more than listening to programs before their release. This program inspection must be performed far enough in advance of the release time for necessary corrections or revisions to be made.

Production as related to educational radio is limited only by the physical limitations of the studio and equipment and by the imagination of the project sponsor or the chief of production.

As related to production, the programs of a school radio project can be classified in two groups; those programs that have an objective established by someone outside of the project, and those programs that have no objective ready-made when they reach the production phase. In the

former group would be considered such programs as school news programs, sports events, seasonal programs such as Christmas programs, classroom releases, and programs produced for the school administration. Programs such as these are often turned over to the project with definite instructions concerning the purpose of the program and program content.

As the services to the school rendered by the radio project increase in scope, the number of programs which have no ready-made purpose will become very small. Any program which allows project members to establish the chief objective of the program can be considered in this class.

Program objective is the keystone of production, because the objective determines the audience, program length, program content, release time, participating cast, engineering facilities required, and often program finance. The person responsible for producing the program must make certain that he is fully familiar with the program objective. Without such an understanding, the producer will seriously restrict the chances for a successful program.

The selection of the production type and the fundamental approach to the production do not present difficult decisions for the person in charge of production for the school radio project. These two items will often be predetermined by the agency requesting the program or, even

more often, by the physical limitations of the studio and the equipment.

The chief of production should be impressed with the need for establishing criteria for the selection of talent. In the small school this selection may consist only of utilizing available students, but in the school of over one thousand students the selection of talent may be very complex.

At no time should a program which is being produced for public release or for release to an agency outside of the project be used as a training device. The quality of a training program will naturally be subject to question, and the reputation of the radio project should not be established with such programs. If possible, the selection of talent should be limited to those students having experience before a microphone.

The limitation of the talent used on public releases to those students having broadcast experience need not seriously limit the number of students participating in public releases. However, such a limitation should stimulate the project sponsor to insist on maximum utilization of all equipment for training purposes.

The use of music in programs requires special consideration. The use of recorded music is by far the easiest way to utilize music, but the training provided is very lim-

ited. Despite the limited training factor, recorded music is widely used in programs having less than fifty per cent of their air time devoted to music. If programs are to be released through commercial stations, the producer must submit a list of music to be used in advance of release time to make certain that the station is licensed for using the music selected.

The producer of musical programs or programs using more than fifty per cent of their broadcast time for music should consider the use of school musicians. If possible, the cooperation of the music teacher or department head should be obtained. The ideal situation would be one in which the entire musical portion of the production could be handled by the music educators of the school.

Special events programs should not be ignored by the chief of production of the school radio project. This type of program includes such releases as sports events, certain seasonal events, and other events of special interest to a reasonably large audience. Special events programs may provide a host of production and engineering problems and thus are fertile fields for producing educational experiences for the members of the project.

The script for the majority of special events programs will be determined primarily by the event itself, but the introduction and closing portions of the program require

advanced planning. The introduction of the program is usually devoted to presenting a background for the event, and the closing moments of the program are often taken up with a summary of what has occured. However, during such a production the producer should realize that such events rarely proceed exactly as scheduled, and that he and his crew must be prepared for any eventuality. Because most of the programs produced by school radio projects are recorded for release at a later time, any serious production failure need not be released to the public.

Dramatic programs leave the producer with the greatest burden of any type of program. When working with special events or music programs, much of the quality of the program is beyond his control, but this is not the case with the dramatic program. In practice the number of dramatic programs for release to the public from a school radio project will be quite small, but they often present the greatest challenge to the producer. The student acting as chief of production should certainly not be left on his own when producing a dramatic program.

Dramatic programs for school releases are often presented to convey a message concerning a special school problem to the listener. This results in their being closely regulated by the sponsoring agency. Dramatic programs should not be accepted by the project sponsor unless he

feels that the program can be successfully produced. The project sponsor must bear in mind that his first responsibility is to the students participating in the project, and that a program without an excellent chance for success should not be undertaken.

Scripts for dramatic programs can be secured from the National Scholastic Radio Guild.[1] The scripts are written for the use of school radio projects, and they are excellent for that purpose. Many of the problems related to production have been solved in advance by the guild and, at the same time, the opportunity for the chief of production to demonstrate his own resourcefulness still exists.

Despite the type of program being produced, the project sponsor should be on the alert to prevent the broadcasting of unsuitable material. In a paper of this type it is impossible to consider all of the federal and state laws relating to radio broadcasting. In general, the use of good judgment on the part of the project sponsor concerning program content can go far in preventing very serious problems from arising. Broadcasters should avoid the mentioning of military information which has not already been released to the public. The use of improper language, defamatory statements, reference to hard liquor, beer, tobacco, patent medi-

[1]National Scholastic Radio Guild; 351 Fourth Avenue; New York 10, New York.

cines, and controversial religious or political statements should be avoided as a matter of good taste as well as to obey any related laws.

A copy of the National Association of Broadcasters' Code is included in the appendix of this paper,[2] because the code committee of this association is a continuing and active committee which issues interpretations of the basic code of broadcast ethics as the need for such interpretations arise. This code applies chiefly to the commercial broadcaster, but it is nevertheless meaningful to the educational broadcaster. Because the code is so widely recognized as the fundamental standard of broadcast ethics, the entire code has been included. Obviously, certain portions are not pertinent to the educational broadcaster.

The person in charge of the program production must be familiar with the operating procedure of every department in the radio project. This person must understand the techniques of engineering and the limitations of the equipment used by the project. Probably even more important than any of these things, he must understand and appreciate people. Relations with participating students will be the chief problem of the student acting as chief of production. The project sponsor and the station manager can do much to aid the student with this problem.

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[2]See Appendix.

In the preceding chapters the author has attempted to suggest to the Montana educator that a powerful educational tool, educational broadcasting, is waiting to help the educator in his daily struggle with ignorance. This tool may be used in any form which is appropriate to the local situation. Unlike many experiments with educational radio of the past, which were aimed primarily at the listener, the program outlined here is aimed for the most part at the student participating in the creation of the broadcast. Certainly, the listener has not been ignored and in the case of the classroom release has been given primary consideration, but a new emphasis has been placed on the participating student. Educational broadcasting has not been presented herein as a sugar coating for academic subject material, but rather as a means of making academic subject matter more meaningful by making clear the inter-relation of the various subjects, not only to each other, but to the world outside of the school as well.

Many of Montana's schools can benefit considerably from the adoption of a radio project. The interest that has been shown by the students of Missoula County High School in the radio project of that school has demonstrated the educational potential of educational broadcasting.

At the time of the writing of this paper, very little has been done in Montana with educational broadcasting.

The future of this great educational tool in Montana cannot be prophesied at the present time, because there is no past upon which one may base a series of conclusions. A definite need exists for research to be undertaken concerning the present status of educational broadcasting in Montana. An attempt should be made to coordinate the efforts of the various Montana educators now working in this field.

Much of the material contained in the preceding pages were learned by the method of simple experimentation. The radio project at Missoula County High School has been used as a laboratory in which the contents of this paper have been tested. The result of this work seems to indicate that educational broadcasting is practical for Montana high schools or school systems. Several types of projects have been suggested which range in complexity from a single recorder being used within the school to the operation of a ten-watt, frequency modulated transmitter. The scope of a radio project should be adjusted to correspond with the limitations imposed on such projects by local conditions.

The lack of written material on the subject of educational broadcasting has proved a serious handicap in establishing the radio project at Missoula County High School. Much of the material that is available is not appropriate for Montana schools, because the authors do not realize the

budget limitations placed upon most educators. A need exists for much work to be done in this particular phase of the program.

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APPENDIX "A"

CONSTITUTION OF THE MISSOULA COUNTY HIGH SCHOOL RADIO PROJECT

CONSTITUTION OF K O N A

PREAMBLE:

The purpose for the establishment of radio station K O N A is to furnish another educational means for Missoula County High School; to develop the personality and character of the students participating; to give service to the student body, administration, clubs, and organizations of Missoula County High School; to better relations between our public schools and community; to further our knowledge of radio as a medium of communication and to own and operate, as nearly as possible, a radio station of professional quality.

Finally, it is our belief that there is not one outcome of work in the field of educational radio that cannot be used to advantage in any walk of life -- professional, social or artistic.

ARTICLE I

This organization shall be known as K O N A.

ARTICLE II

SECTION I

Students of Missoula County High School in good standing and interested in the aims of this organization shall be eligible for application for membership.

SECTION II

Application for membership must be made in writing

to the recording secretary, who shall conduct necessary investigation of the student's standing and present this to the examining board.

SECTION III

Election to membership shall be by three-fourths majority vote of the examining board at any regular meeting.

SECTION IV

Members must attend meetings and accept responsibilities placed on them.

SECTION V

Each new applicant for membership will be required to serve an apprenticeship for one school quarter. This applicant, if he has proved himself satisfactory, after that time, to the welfare of K O N A, shall be admitted to membership. All matters pertaining to the election of new members shall be governed by the examining board.

SECTION VI

At the beginning of the school year, the roster will be revised to include only active members who are in good standing.

SECTION VII

The examining board will consist of the members in good standing at any regular meeting.

SECTION VIII

The signers of this constitution whose signatures

are affixed to this document before its approval by the Student Council shall be considered charter members.

SECTION IX

During the first quarter of operation, the charter members shall elect to membership no less than fifteen applicants.

SECTION X

A member may be suspended from K O N A if ninety per cent of the bonified members vote in favor of suspension. The length of suspension will be determined at the time this action is taken; however, it should not exceed one semester. If a suspended member does not give notice, before the end of his suspension, in writing to the recording secretary of a desire to return, he shall be dropped from the roster.

ARTICLE III

SECTION I

The officers of this organization shall be as follows: Station Manager, Assistant Station Manager, Corresponding Secretary, Recording Secretary, Program Director, Public Relations Director, Chief Engineer, Treasurer, and Faculty Advisors. All of the officers shall have assistants if needed, recruited by them from the general membership and appointed by the Station Manager or Faculty Advisors.

SECTION II

The duties of the Station Manager shall be as follows:

to preside over all regular meetings; to call special meetings and preside over them; to appoint assistants to the officers which have been recruited and requested by said officers; to coordinate all the activities of K O N A.

SECTION III

The duties of the Assistant Station Manager shall be as follows: to preside in the absence of the Station Manager; to represent K O N A at all general Student Council meetings and such meetings of any organization actively interested in K O N A; to make a typewritten report to the Recording Secretary of his activities prior to each general meeting, and to attend departmental meetings.

SECTION IV

The duties of the Corresponding Secretary shall be as follows: to handle all correspondence of K O N A.

SECTION V

The duties of the Recording Secretary shall be as follows: to take minutes of regular and special meetings; to file all reports of departmental meetings; to be in charge of all secretarial matters: corresponding, recording, monetary, and public relations; that is, to head the Business Department of K O N A.

SECTION VI

The duties of the Program Director shall be as follows: to plan and supervise the execution of all programs; to head

the production department.

SECTION VII

The duties of the Public Relations Director shall be as follows: to guard and promote the good reputation of K O N A. Any activity in the field of public relations that is not a specifically stated responsibility of the Assistant Station Manager shall be the duty of the Public Relations Director.

SECTION VIII

The duties of the Chief Engineer shall be as follows: to head the Engineering Department of K O N A and supervise all technical and engineering phases of the station.

SECTION IX

The duties of the Treasurer shall be as follows: to work in close cooperation with the Business Manager of Missoula County High School, to handle and record monetary transactions of K O N A.

SECTION X

The duties of the Faculty Advisor (or Advisors) shall be as follows: to guide the activities of the student staff and to have final powers of decision in all matters pertaining to the welfare of K O N A. It is urged that the student staff be given as much freedom of action in operating the station as they have proved capable of handling. The Faculty Advisor (or Advisors) shall be requested by the student staff

and appointed by the Administration of Missoula County High School.

SECTION XI

The following officers shall be elected as soon as possible at the beginning of each school semester by a majority vote of members present at a regular meeting: Station Manager, Assistant Station Manager, Recording Secretary, Program Director, and Chief Engineer. Other officers will be appointed by the Station Manager.

ARTICLE IV

SECTION I

Regular meetings shall be held bi-weekly during the school year. These and special meetings will be called by the Station Manager.

SECTION II

Regular and special meetings must be previously announced throughout school.

SECTION III

Only bona fide members or guests authorized by the Station Manager or Faculty Advisor(s) shall attend regular or special meetings.

SECTION IV

Departmental meetings of K O N A may be called by the respective heads of the departments, the Station Manager or the Faculty Advisor(s). If sufficient difference of opinion

about any policy or activity should arise between the head of a department and the Station Manager or the Faculty Advisor and there is enough time, either may call a special meeting of the members; if there is not enough time, the decision lies with the Faculty Advisor(s).

ARTICLE V

SECTION I

The activities of K O N A shall be divided under the following departments: Business, Engineering, and Production.

ARTICLE VI

SECTION I

The program of K O N A will be expanded as deemed necessary and advisable by the examining board, or by the Administration of Missoula County High School with the approval of the examining board.

ARTICLE VII

SECTION I

All monies acquired by K O N A shall be spent for the needs of the organization.

SECTION II

All expenditures must receive the approval of the Faculty Sponsor(s).

SECTION III

The power to dispose of any equipment acquired by K O N A rests solely with the members at any regular or

special meeting.

ARTICLE VIII

SECTION I

The operating procedures and policies of K O N A shall be determined by the discretion of the heads of the several departments in the organization, the Station Manager, and the Faculty Advisor(s), and in accordance with the laws of the State of Montana and the United States of America.

ARTICLE IX

SECTION I

This constitution may be amended by three-fourths vote of all of the bona fide members at any regular or special meeting.

ARTICLE X

SECTION I

Should any situation arise not covered by the Constitution, it will be under the jurisdiction of the Board of Directors.

SECTION II

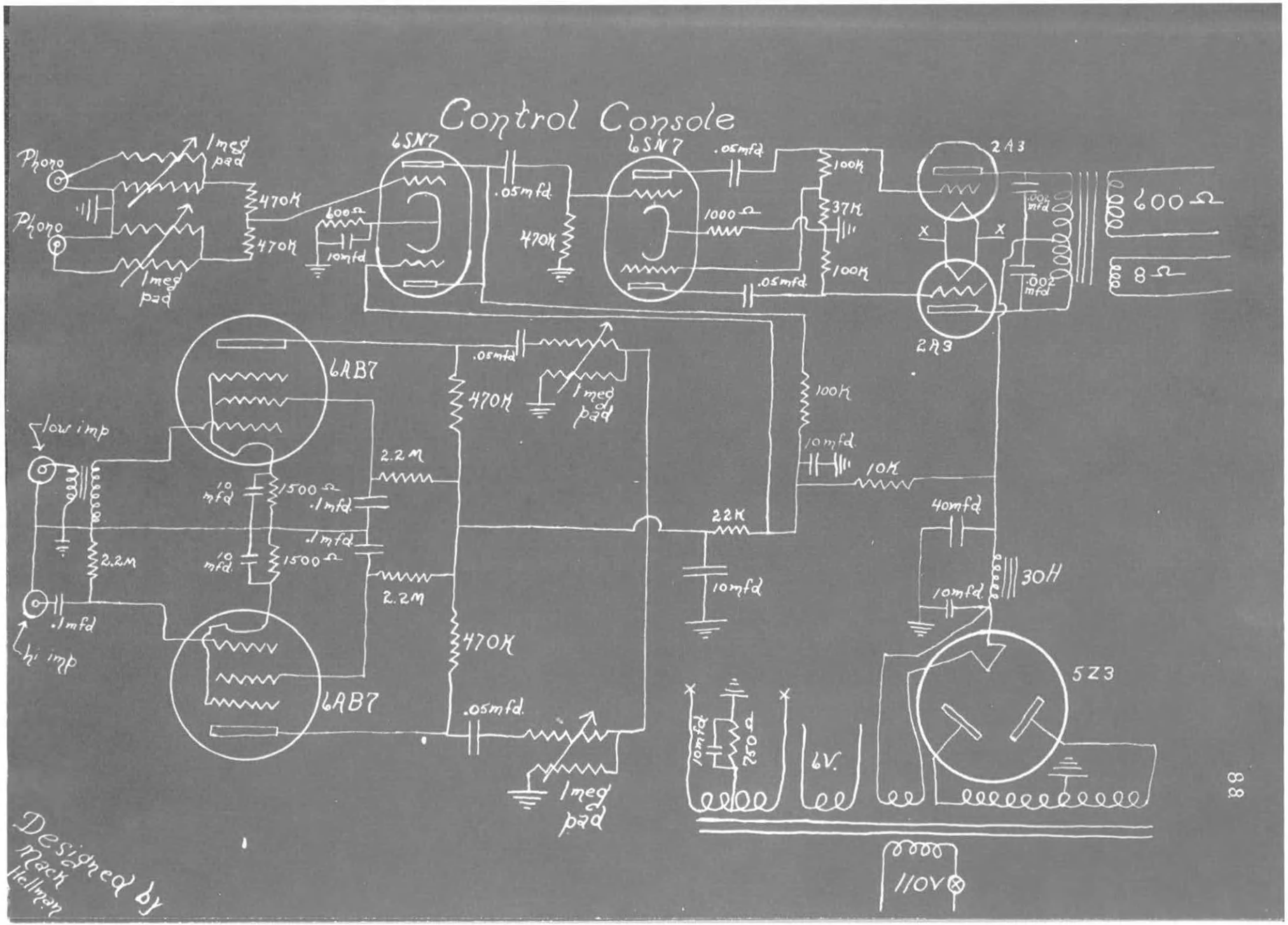
The Board of Directors shall consist of the elective officers and the Faculty Advisor(s).

SECTION III

Any meeting of the Board of Directors shall be called and presided over by the Faculty Advisor(s).

APPENDIX "B"

CONSTRUCTION DIAGRAMS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10K
low imp
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10 mfd
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1500Ω
2.2M
2.2M
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40mfd
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30H
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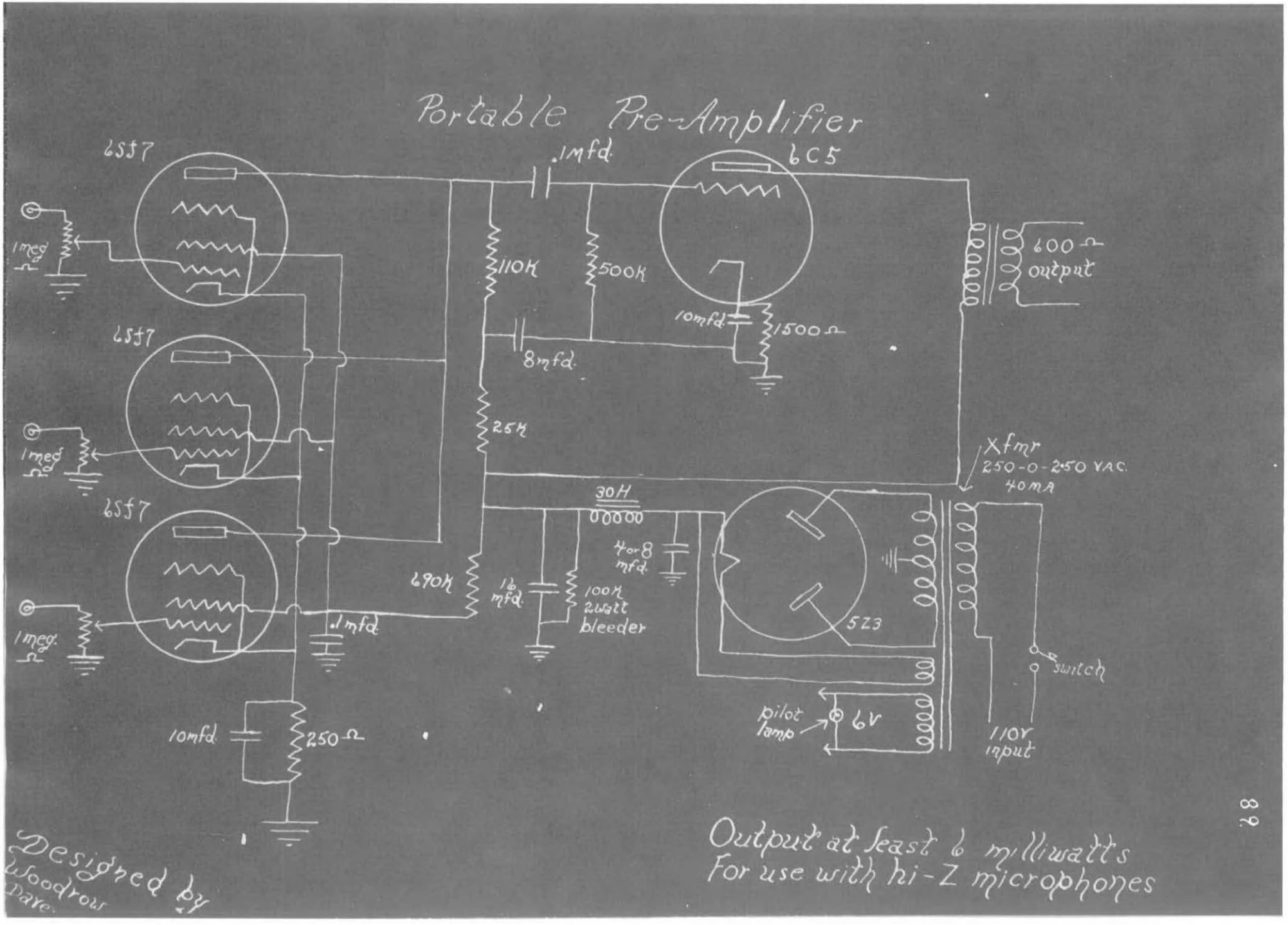
Mack Hellman
88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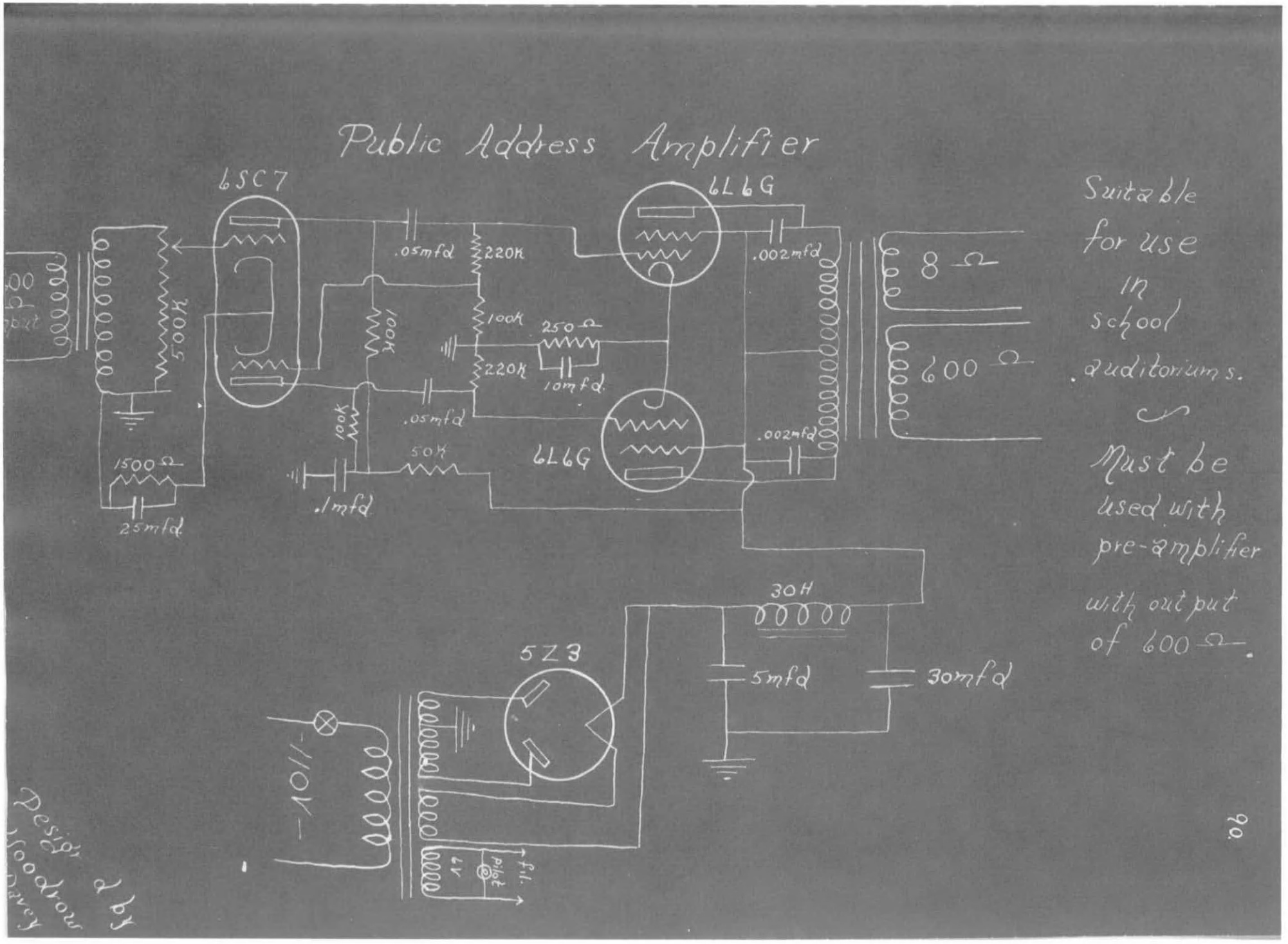
10mfd.
1500Ω
8mfd.
25K
600Ω output
Xfmr
250-0-250 VAC.
40MA
30H
690K
4 or 8 mfd.
1/2 mfd.
100K 2watt bleeder
.1mfd.
5Z3
switch
pilot lamp
6V
110V input
10mfd.
250Ω
Designed by Woodrow Dare
Output at least 6 milliwatts
For use with hi-Z microphones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100K
250Ω
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.05mfd
100K
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50K
.1mfd
1500Ω
25mfd
.002mfd
.002mfd
8Ω
600Ω
30H
5Z3
5mfd
30mfd
-110/-
fil.
pilot
2.5V
Suitable for use in school auditoriums.
Must be used with pre-amplifier with out put of 600Ω.
Design'd by Woodrow Davey
90.

APPENDIX "C"

CODE OF THE NATIONAL ASSOCIATION OF BROADCASTERS

THE TEXT OF THE NAB CODE

Adopted by the Atlantic City Convention, July 11, 1939

Recognizing the importance of radio broadcasting in the national life and believing that broadcasters now have had sufficient experience with the social side of the industry to formulate basic standards for the guidance of all, the National Association of Broadcasters hereby formulates and publishes the following revised Code:

Children's Programs. Programs designed specifically for children reach impressionable minds and influence social attitudes, aptitudes, and approaches, and therefore, they require the closest supervision of broadcasters in the selection and control of material, characterization, and plot.

This does not mean that the vigor and vitality common to a child's imagination and love of adventure should be removed. It does mean that programs should be based upon sound social concepts and presented with a superior degree of craftsmanship; that these programs should reflect respect for parents, adult authority, law and order, clean living, high morals, fair play, and honorable behavior. Such programs must not contain sequences involving horror or torture or use of the super-natural or superstitions or any other material which might reasonably be regarded as likely to overstimulate the child listener, or be projudicial to sound character develop-

ment. No advertising appeal which would encourage activities of a dangerous social nature will be permitted.

To establish acceptable and improving standards for children's programs, the National Association of Broadcasters will continuously engage in studies and consultations with parent and child study groups. The results of these studies will be made available for application to all children's programs.

Controversial Public Issues. As part of their public service, networks and stations shall provide time for the presentation of public questions including those of controversial nature. Such time shall be allotted with due regard to all the other elements of balanced program schedules and to the degree of public interest in the questions to be presented. Broadcasters shall use their best efforts to allot such time with fairness to all elements in a given controversy.

Time for the presentation of controversial issues shall not be sold, except for political broadcasts. There are three fundamental reasons for this refusal to sell time for public discussions and, in its stead, providing time for it without charge. First, it is a public duty of broadcasters to bring such discussion to the radio audience regardless of the willingness of others to pay for it. Second, should time be sold for the discussion of controversial issues, it would have to be sold, in fairness, to all with the ability

and desire to buy at any given time. Consequently, all possibility of regulating the amount of discussion on the air in proportion to other elements of properly balanced programming or of allotting the available periods with due regard to listener interest in the topics to be discussed would be surrendered. Third, and by far the most important, should time be sold for the discussion of controversial public issues and for the propagation of the views of individuals or groups, a powerful forum would inevitably gravitate almost wholly into the hands of those with the greater means to buy it.

The political broadcasts excepted above are any broadcasts in connection with a political campaign in behalf of or against the candidacy of a legally qualified candidate for nomination or election to public office, or in behalf of or against a public proposal which is subject to ballot. This exception is made because at certain times the contending parties want to use and are entitled to use more time than broadcasters could possibly afford to give away.

Nothing in the prohibition against selling time for the presentation of controversial public issues shall be interpreted as barring sponsorship of the public forum type of program when such a program is regularly presented as a series of fairsided discussions of public issues and when control of the fairness of the program rests wholly with the broadcasting station or network.

Educational Broadcasting. While all radio programs possess some educative values, broadcasters nevertheless desire to be of assistance in helping toward more specific educational efforts, and will continue to use their time and facilities to that end and, in co-operation with appropriate groups, will continue their search for improving applications of radio as an educational adjunct.

News. News shall be presented with fairness and accuracy and the broadcasting station or network shall satisfy itself that the arrangements made for obtaining news insure this result. Since the number of broadcasting channels is limited, news broadcasts shall not be editorial. This means that news shall not be selected for the purpose of furthering or hindering either side of any controversial public issue nor shall it be colored by the opinions or desires of the station or network management, the editor or others engaged in its preparation, or the person actually delivering it over the air, or, in the case of sponsored news broadcasts, the advertiser.

The fundamental purpose of news dissemination in a democracy is to enable people to know what is happening and to understand the meaning of events so that they may form their own conclusions, and, therefore, nothing in the foregoing shall be understood as preventing news broadcasters from analyzing and elucidating news so long as such analysis and elu-

cidation are free of bias.

News commentators as well as all other newscasters shall be governed by these provisions.

Religious Broadcasts. Radio, which reaches men of all creeds and races simultaneously, may not be used to convey attacks upon another's race or religion. Rather it should be the purpose of the religious broadcast to promote the spiritual harmony and understanding of mankind and to administer broadly to the varied religious needs of the community.

Commercial Programs and Length of Commercial Copy. Acceptance of programs and announcements shall be limited to products and services offered by individuals and firms engaged in legitimate commerce; whose products, services, radio advertising, testimonials, and other statements comply with pertinent legal requirements, fair trade practices, and accepted standards of good taste.

Brief handling of commercial copy is recommended procedure at all times.

Member stations shall hold the length of commercial copy, including that devoted to contests and offers, to the following number of minutes and seconds:

Daytime

Fifteen-minute programs	3:15
Thirty-minute programs.....	4:30
Sixty-minute programs.....	9:00

Nighttime

Fifteen-minute programs 2:30
Thirty-minute programs..... 3:00
Sixty-minute programs..... 6:00

Exceptions:

The above limitations do not apply to participation programs, announcement programs, "musical clocks," shoppers' guides, and local programs falling within these general classifications.

Because of the varying economic and social conditions throughout the United States, members of the NAB shall have the right to present to the NAB for special ruling local situations which in the opinion of the member may justify exceptions to the above prescribed limitations.

TYPES OF UNACCEPTABLE ADVERTISING

Resolution of Program Standards Committee Adopted by Convention

To clarify the phrase "Accepted Standards of Good Taste" and the canons of good practice set forth in the NAB Code, therefore be it resolved, that member stations shall not accept for advertising:

1. Any spirituous or "hard" liquor.

2. Any remedy or other product the sale of which or the method of sale of which constitutes a violation of law.

3. Any fortune-telling, mind-reading, or character-reading, by handwriting, numerology, palm-reading, or astrol-

ogy, or advertising related thereto.

4. Schools that offer questionable or untrue promises of employment as inducements for enrollment.

5. Matrimonial agencies.

6. Offers of "homework" except by firms of unquestioned responsibility.

7. Any "dopester," tip-sheet, or race-track publications.

8. All forms of speculative finance. Before member stations may accept any financial advertising, it shall be fully ascertained that such advertising and such advertised services comply with all pertinent federal, state, and local laws.

9. Cures and products claiming to cure.

10. Advertising statements or claims member stations know to be false, deceptive, or grossly exaggerated.

11. Continuity which describes, repellently, any functions of symptomatic results of disturbances, or relief granted such disturbances through use of any product.

12. Unfair attacks upon competitors, competing products, or upon other industries, professions, or institutions.

13. Misleading statements of price or value, or misleading comparisons of price or value.

The Code Committee of the National Association of Broadcasters is a continuing and active committee which issues

interpretations on the basic code from time to time as exigencies arise which are of industry-wide importance. Production directors should become familiar with the rulings of this policy committee as they come out. Since most stations have an active participation in the NAB, it is quite simple to follow its proceedings and keep up to date on its decisions.