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THE NEWSPAPER FOR
THE HOBBYIST OF VINTAGE
ELECTRONICS AND SOUND

THE HORN SPEAKER

The author with a 6-foot exponential horn used for an experimental radio loud speaker.

Radio News for April, 1926

The Passing of "Canned Music"

By MAJOR J. S. HATCHER

DURING the past year there was presented to the public what amounts to a veritable revolution in the field of both the phonograph and the radio. At this writing it is possible to obtain either a radio set or a phonograph which will reproduce music with a fidelity and mellowness of tone destined to render obsolete the term of "canned music"—which has been applied with a considerable amount of justice to the radio and phonograph music of the past.

The change is principally due to the fact that the low, or bass, notes which have hitherto been absent from music of this nature, are reproduced fully by these new instruments. Doubtless the reader will recollect instances of having listened to pipe organ music, in which some of the notes were merely a deep rumble. In fact sometimes these notes are so low that they are practically *felt* more than they are heard.

Who can remember having heard such a note from a radio receiver or phonograph, and who can remember having heard the deepest bass of a piano on either one of these sound reproducers? It is now possible to hear the deepest organ notes, and the lowest bass of the piano perfectly reproduced.

The difference between one of these new instruments and the old type is simply indescribable, and must be heard to be appreciated. The best way to realize the difference is to switch the music from one of the new instruments to an old one. Tune in an orchestra program on one of the new radio instruments, and the hearer is enchanted with a tremendous volume of soft and mellow sound, containing all the full rounded tones of the bass as a background for the higher notes. Switch to one of the old instruments and the music changes suddenly to a strident volume of shrill metallic noise. The listener then realizes for the first time what has always been the matter with the phonograph music and radio music of the past. It is "canned music." Some metallic mockery of each note remains, but all the living, mellow tones have been filtered out.

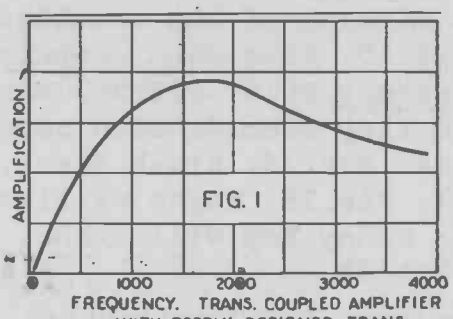
DEVELOPMENT OF REPRODUCTION

Radio is somewhat similar to the phonograph in its general development. It was first announced to the public as a scientific curiosity, capable of sending signals without wires for a short distance. As it developed to a practical agent of communication, it was used for telegraphic code and the developments were all directed towards clarity in detecting dots and dashes. After the vacuum tube amplifier was invented, it was found necessary to have some device to couple each stage of amplification with the next one, and transformers were used for this purpose.

A transformer is essentially an inductance device, and therefore it depends on the frequency of the electrical impulses for its efficiency. In addition to its inductance, every transformer has capacity between the adjacent coils of its winding. This capacity, taken in conjunction with its inductance, will form a tuned circuit which will respond more strongly to some particular frequency to which it is tuned.

It was found by experience that the greatest audibility of code message was obtained when the transformers were made to respond most strongly at about one thousand cycles per second, and accordingly when broadcast speech and music first made its appearance, the transformers on the market were of the type giving a strong response, or peak of audibility, at this point. (See Fig. 1).

When radio first became a popular form



The above curve shows why some transformers produce distorted music in the loud speaker.

of entertainment, reproduced speech had a high-pitched nasal sound, and the music was more metallic than ever. Some makers of loud speakers attacked this defect by making mica diaphragms, or metallic diaphragms which were corrugated in order to break up the vibrations.

Some advertised a wooden horn to introduce a mellow tone. One maker advocated a copper horn, and covered the inside with a rough finish similar to the alcohol-proof finish used on microscopes and optical instruments; the theory being that this roughness would prevent undesirable reflections which would distort the tones.

However, at the beginning of the radio craze, tone quality was really a very secondary consideration, as most of the radio experimenters of several years ago were striving for distance as the most desirable qualification of the radio receiver.

IMPROVEMENTS IN TRANSFORMERS

Lately new audio frequency transformers have been placed on the market which have been specially designed to reproduce the lowest audible frequencies. Several of these give very satisfactory reproductions of tones below one hundred cycles a second. (See Fig. 2.)

Some radio makers have sought to attain tone quality by using these improved transformers. Others have discarded transformers entirely, and are using resistance-coupled amplification, which has the advantage of giving a uniform response over almost the entire range of audible frequencies, but which has the disadvantage of giving less amplification per tube.

In spite of the fact that these improved types of amplifier were given a great deal of publicity in the radio magazines, and were tried by thousands of amateur builders, the improvement in tone quality was not as marked as had been hoped, and many people were disappointed by the improved amplifiers. The reason for this was that these were in most instances used with loud speakers which were not capable of reproducing the low notes, after they had been amplified by the radio set.

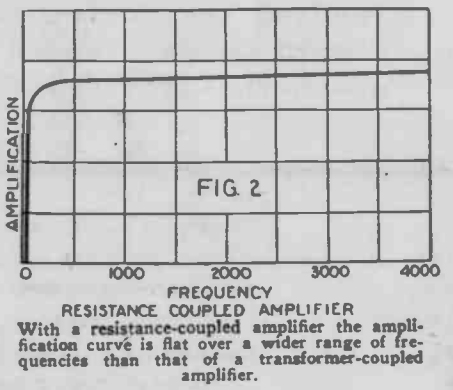
ELIMINATING THE HORN

However, the existence of amplifiers which made it possible to receive the lower audible frequencies, was an incentive to the development of improved types of loud speaker. Before these new amplifiers were produced, there was really no point in getting a loud speaker which would produce the deepest bass notes, because these notes were not present in the radio set, and therefore all loud speakers sounded very much alike.

One of the earliest improved loud speakers is the now well known paper disc type. A sheet of brass has a given frequency at which it will vibrate if struck (that is, it has a given note of its own) but a sheet of paper has no such note or frequency to which it responds. The cone loud speakers consist of a sheet of paper or parchment to which a metallic pin is attached in the center, and this to the armature of an electromagnet which is actuated by the electrical impulses from the radio receiver. The metallic pin moves in unison with the impulses which correspond to the sounds that it is desired to receive, and as the paper is fastened to the pin, it also moves at the same frequency and its large, flat surface being in contact with the air, sets up corresponding air waves which the ear receives as sound.

STUDYING THE HORN

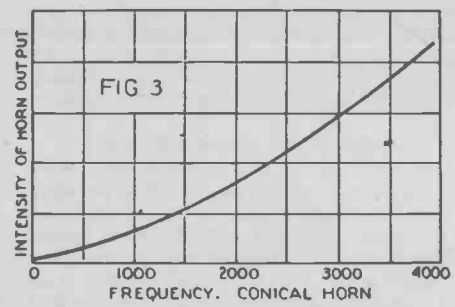
The problem was also attacked in another direction, that of investigating the horn to



With a resistance-coupled amplifier the amplification curve is flat over a wider range of frequencies than that of a transformer-coupled amplifier.

see if it could be made to transmit the deeper notes. Assuming that sound travels at approximately 1,120 feet per second, the lowest audible notes, which are around 30 cycles per second, have a wave-length of approximately 38 feet; whereas notes towards the higher end of the audibility range, say around 5,000 cycles per second, would have a wave-length of only about 3 inches. It will be readily understood that a wave 3 inches long will have time to undergo numerous reflections and re-enforcements in a horn of ordinary length, whereas a wave 38 feet long will not.

It was found that with our ordinary cone-shaped horn, the higher the frequency of the sound, the more strongly will it be transmit-



Compare this curve with Fig. 4 to see the difference in efficiency between the two types of horns.

ted. The low notes are transmitted so weakly that they are practically not heard at all; and this in itself is sufficient to account for the peculiar metallic quality of the radio and phonograph music of the past. This can be better illustrated by reference to the piano keyboard, with the statement that on the average radio or phonograph practically the whole left-hand third of the keyboard, comprising all of the deeper tones, is either omitted entirely, or very seriously slighted.

COMPLEXITIES OF SOUND

Practically no musical instrument gives pure tones in the physical sense, that is, none of the notes are composed entirely of vibrations of one frequency. Take for example, middle "C." This is supposed to represent a frequency of 256 vibrations per second. If this were strictly a pure tone, it would sound the same whether given off by a piano, violin, flute or harp; but as a matter of fact its sound varies greatly, depending upon what instrument produces it.

The reason is that instead of being a pure tone, it is accompanied by many harmonics and over-tones, the number, pitch and intensity of which are determined by the character of the instrument producing the original sound. The harmonics and over-tones determine the character of the various instruments, and if they are slighted or left out, the music sounds unnatural.

Psychological studies have indicated that it is very tiring to listen to music in which the lower tones are omitted. Instead of being reposeful, music of this character is actually a nervous irritant; though as is often the case with eye-strain and other such sources of irritation, the victim may not be conscious of it at the time.

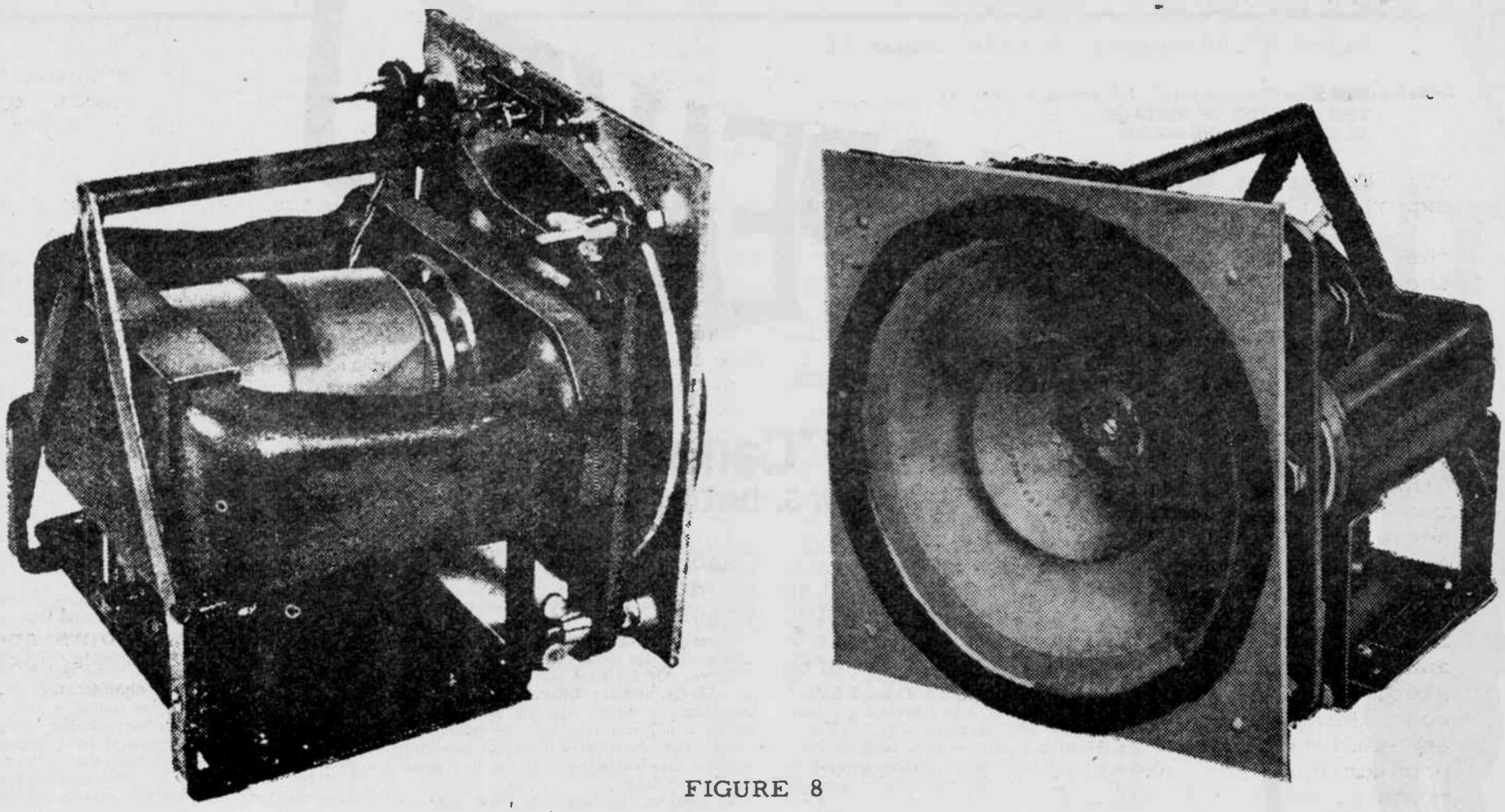


FIGURE 8

The average radio loud speaker will not reproduce notes below about 300 cycles per second. The different investigators in this field have tried various-shaped horns, with a view to overcoming this difficulty. Among the curves tried are the parabola, hyperbola, etc.

SCIENCE IN HORN DESIGN

However, the most successful horn from the theoretical standpoint, is built on what is called the exponential curve. In the cone, as we leave the small end, the horn gradually expands. If, for example, the cone has an opening at the small end 1 inch wide and expands to double its width for the first foot of length, the width at that point will then be 2 inches. At the end of the second foot the width will be 3 inches; at the third it will be 4 inches, and so on, getting an inch wider for every foot of added length.

On the other hand, an exponential horn having an original opening of 1 inch, and an expansion double this amount, or 2 inches at the end of the first foot, would again double, or have 4 inches at the end of the second foot, 8 inches at the end of the third foot, and so on; for each unit of length adding a given percentage, not of the original opening, but of the opening at the last measurement.

This exponential rate is sometimes called the "law of organic growth," as it is the rate at which plants, trees and other organic materials increase in size. If, for example, a tree increases ten per cent. in size every year, the amount added each year will be ten per cent. of the total size the year before.

In any phonograph or radio horn the sound waves generated at high pressure in the small end, are gradually expanded as they travel along the horn until, when they reach the large end, they are released into the room at atmospheric pressures.

(Continued on page 9)

off the record

Continued from last month.

Re: RESULTS OF RECENT MAIL AUCTION OF COLLECTIBLE PHONOGRAPH RECORDS.

L. R. "Les" Docks, of San Antonio, Texas, reports that supplying record collectors' wants remains a "sound business." Docks' assessment is based upon the results of his largest record auction to date,

The Rhythm Rockers, Oasis 104, $38.25 (a bid of $106.13 was received after the closing of the auction!); Bill Riley, Brunswick 55085, $24.10; Doug Sahm, Warrior 507, $22.06; Schoolboy Cleve, Feature 3013, $25.76; Ronnie Self, Columbia B-2149 (an Extended Play record, with cover), $100.50; Eddie Skelton, Starday 294, $76.16; Frank Starr, Lin 1009, $25.00; Roy Wayne, Clif 101, $48.25; Wayne Williams & The Sure Shots, Sure 1001, $300.00; Sonny Boy Williamson, RCA Victor 50-0005 (orange plastic), $58.51.

The auction, sent to over 2,000 collectors on Mr. Docks' mailing list, drew bids from over 400, of whom about 300 won at least one record. Mr. Docks' mailing list includes collectors from almost every country in the free world; indeed, as many as half of the winning bidders are outside the U.S.A.

The conclusion of the auction coincided with the task of proof-reading the forthcoming second edition of Mr. Docks' "American Premium Record Guide," which will benefit from the inclusion of considerable up-to-the-minute information.

POSTAL IDENTIFICATION STATEMENT
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Horn Contour

continued by Bruce C. Edgar

SB: Tell me about your early experiments with stereo.

VOIGT: A few years before the war, I gave a lecture to the Radio Society of Great Britain on sound reproduction and demonstrated with a pair of my corner horns side by side to give 180 degree distribution. The climax to that lecture was the reproduction of a small live orchestra playing in another room there. Initially the two small speakers were connected in parallel as would be correct for mono reproduction. Then, the two speakers were separated by about the distance between the two mikes (6 feet) and their circuits were separated. As far as I know, that was the first demonstration to an audience of two channel reproduction in Britain. The meeting was reported on in WIRELESS WORLD, April 10, 1936. It is a pity that they call two channel by the name stereo these days. That is not stereo. Real stereo needs not only headphones but mike placing which has in mind that the listener will be wearing headphones.

However, in my stereo demonstrations I was following Blumlein, who in 1931 invented the stereo record groove (British Patent no. 394,325). Blumlein's brilliant idea is now incorporated in every regular stereo record made. I regarded Blumlein as head and shoulders above myself in ability. If Blumlein had not been killed during the war in a plane accident while developing a radar system, we would have had more ideas from him in addition to the ones which originated while he was alive.

SB: How did your association with Lowther begin?

VOIGT: I first met Lowther at RadiOlympia in 1934. It was young O.P. Lowther's ambition to market the best possible radiogramophone, which naturally needed the best possible speaker. This meeting developed into a very friendly alliance with the Lowther Manufacturing Company, that made excellent tuners and amplifiers. These together with Voigt speakers made up the Lowther-Voigt Radiogram, which set a very high standard of performance.3

SB: Describe the research developments in the late 30's.

VOIGT: In those days, I had set a tone burst system, and was experimenting with permanent magnets. However, I was unable to obtain magnets which provided the flux density obtainable with my excited field units. I had hoped that a P.M. unit being made in time for the 1939 annual radio exhibition period would do the trick. It was so late in coming that they had to deliver it direct to the address where we had rented space, together with Lowther, near the Olympia building. Upon comparing it to one of our excited field units it sounded poorly and was removed from view. When I measured the flux density it was not up to standard in spite of the large dimension of the magnetic overcoat.

It was on Sunday, a few days after the Radiolympia exhibition had started that Prime Minister Chamberlin announced that as Hitler's forces had invaded Poland, Britain was at war with Germany. That altered everything. On the Monday, instead of the public exhibition, everything was being dismantled. I could not resume my tone burst tests as the noise might be mistaken for some enemy action. Our sales collapsed.

SB: What were your activities during World War II?

VOIGT: With the help of my wife who did the drafting and booking chores, we kept Voigt patents alive doing maintenance work on the Voigt cinema horns. This work was deemed necessary for keeping up the home front morale. The admiralty did give us some research money, which surprised us because of my German parents. They could be quite "sticky" about such matters.

SB: Describe your postwar research efforts.

VOIGT: In 1939, when Hitler walked into Poland, Britain had sterner tasks on hand, and speaker research stopped in its tracks. by the time the war was in its last stages, newer magnetic materials, known variously as Ticonal, Alcomax and Alnico V had proved their worth and were able to provide a magnetomotive force far exceeding that obtainable with 40 to 50 watts of electrical excitation. When research could be resumed, it was with these newer materials in mind.

This time I concentrated on producing a P.M. unit with the magnetic material in the center and as a matter of policy retained the old styling as far as possible. the idea was that it might eventually be practical to convert existing excited - field speakers to P.M., thus enabling Voigt speaker owners to bring their speakers up to date at minimum expense.

Our policy on diaphragms had been similar and when the twin cone came out in 1933 they were mounted so as to make them interchangeable with earlier single cones. Again in 1938 when the light coil twin was introduced, this too was interchangeable. As that required a gap of 1 1/2 mm, liners were made which could be fitted to existing magnets. With these the flux density went up to the 18,000 - 19,000 gauss region.3

SB: What was the relationship between yours and Lowther's P.M. loudspeaker research and development?

VOIGT: In the postwar period, Mr. Chave, once Mr. Lowther's chief technician who had become owner of the firm shared my opinion that the excited - field speaker would be regarded as obsolete and that therefore a P.M. version of it was required.

Mr. Chave pushed on with experiments he had started with a P.M. version of the excited - field speaker, using the magnetic material externally, while I carried on with my experiments, using an internal magnet block. At my suggestion we worked independently and did not compare notes till completion.

The outcome of Mr. Chave's work was the Lowther P.M. series (British patent no. 618,802 and no. 628,432) and the outcome of my work was reviewed in WIRELESS WORLD, March 1949. Subsequently, the design was improved still further, but it is no longer in production as my company became dormant some years after I emigrated to Canada. (See Figure 8.)

The diaphragms used on the early Lowther P.M. speakers were supplied by my company, so the speakers were in more ways than one a true Lowther- Voigt combination and were sold as such. The diaphragms used by Lowther's even now differ but little from the genuine Voigt diaphragms of the 30's and 40's. the reason is simple. When my health started giving me trouble in 1946/47, I realized that I could no longer supervise the manufacture of

(Continued on page 9)

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BACK ISSUES

AND FREE **Index**

THE HORN SPEAKER for 1972 has only 4 pages except for two editions. T.H.S. for 1973 through 1974 carried 8 pages with the first eight editions of 1974 on a superior printing paper all other editions are on newsprint. The April 1974 used two color.

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IN THE COMING MONTHS THIS INDEX WILL BE CAUGHT UP TO THE PRESENT TIME

ALL BACK ISSUES OF THE HORN SPEAKER... 1975-1981 ... 75 CENTS EACH, POSTPAID.

ALL BACK ISSUES SENT POSTPAID

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72-01-A	ADS-4 PAGES, SOME NEWS	NONE	SALES	RADIO	WR SP	NO PK
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1973

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date	title	author	class	k1	k2	k3
73-01-C	DEFOREST PROGRESS-1902	SCI AMERI	WIRELES	RSPON	1902	COHER
73-01-C	1887 ELECTRIC PHONOGRAPH	SCI AMERI	PHONO	EDISO	CYLIN	1887
73-01-C	SHIPWRECK	HUM INT	STORY	SHIP	REPUB	1914
73-01-C	WILL ROGER PIX- ROPING	THS	PERFORM	TRICK	ROPE	1930S
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73-02-C	NORIEGA'S TELEPHONE	SCI AMERI	TELEPHO	NORIE	DIAPH	1894
73-02-C	COMPRESSED AIR FOR PHONO	SCI AMERI	PHONO	AMPLI	AIR	1906
73-02-C	US BLOWS UP TESLA TOWER	AFA	WIRELES	GERMA	SPIES	1916A
73-02-C	PIXS OF 1925 BATTERY SETS	RN 1925	RADIO	PICTU	BATTE	1925
73-02-C	MAKE AN OSCIL TRANSFORMER	M E 1910	WIRELES	CONST	AMATE	1910
73-02-C	SAWYER MAN ELECTRIC LAMP	SCI AMERI	LIGHTS	LIGHT	HOME	1894
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73-02-E	ECHOPHONE V4 - 1925	THS	RADIO	BATTE	75.00	TUBES
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73-03-E	EXPERIMENTERS INFO SERVIC	THS	RADIO	LEUTZ	ARMST	1925
73-03-E	UNUSUAL OSCILL. TRANSFORM	J L HOGAN	WIRELES	CONST	BUPNE	1908
73-03-E	PIXS OF 1925 BATTERY SETS	RN 1925	RADIO	PIXS	SPECS	1925
73-03-E	ARMSTRONG SUPERHETRODYNE	BOOK	RADIO	INFO	LAYOU	1925
73-03-E	DON'T PEEK BEHIND THE MIC	D WIMBROW	PERFORM	SOUND	EFFEC	1930
73-04-C	PARIS EXHIBITION-PHONOGRA	SCI AMERI	PHONOGR	EDISO	SOUND	1889
73-04-C	AMERICAN BELL TELEPHONE	SCI AMERI	TELEPHO	BELL	WES E	1884
73-04-C	MARCONI WIRELESS TELEGRAP	SCI AMERI	WIRELES	RELIC	PAPER	1903
73-04-C	FILLER - CRACKS AND HOLES	POP SCIEN	REPAIR	SHOP	FIX	1927
73-04-C	MAKE AN ELECTROLYTIC DET.	M E 1908	WIRELES	CONST	ELECT	1908
73-04-C	PIXS OF BATTERY SETS	RN 1925	RADIO	PIXS	SPECS	1925
73-04-C	PHONOGRAPH	SCI AMERI	PHONOGR	RECOR	PERFO	1889
73-04-C	CBS PROGRAMS 1943	CLIPPING	PERFORM	PROGS	STARS	1943
73-05-D	HAVEN'S NEW TELEPHONE	SCI AMERI	PHONOGR	INVEN	HAVEN	1877
73-05-D	APCS PRICING SURVEY	APCS	PHONOGR	PRICE	WHY	1973
73-05-D	SIMPLE PONOGRAPH	SCI AMERI	PHONOGR	MANUA	DIAPH	1878
73-05-D	PIXS OF BATTERY SETS	R N 1925	RADIO	PIXS	SPECS	1925
73-05-D	CRYSTAL RECEIVER	M STROCK	RADIO	CONST	HOW	1923
73-06-D	SIXPENNY PHONOGRAPH	SCI AMERI	PHONOGR	SIMPL	NOVEL	1879
73-06-D	FRENCH TELEGRAPHIC ANNEX	SCI AMERI	TELEGRA	PIX	DRAWI	1879
73-06-D	BERLINER TELEPHONE PATENT	SCI AMERI	TELEPHO	PATEN	BERLI	1896
73-06-D	ROYAL E HOUSE TELEPHONE	SCI AMERI	TELEPHO	HOUSE	INVEN	1868
73-06-D	EDISON'S CARBON RHEOSTAT	SCI AMERI	ELECTRO	HOW	INV	1878
73-06-D	PIXS OF BATTERY SETS	RN 1925	RADIO	PIXS	SPECS	1925
73-06-D	BARE POINT ELECTROLYTIC	M E 1908	WIRELES	CONST	DETEC	1908
73-06-D	CONSTRUCT LITE- OLD TUBES	R. CANE	LIGHT	CONST	TUBES	1973
73-06-D	WILL ROGERS	P O'BRIEN	PERFORM	HISTO	PIXS	1935
73-07-E	NIKOLA TESLA,HALL OF FAME	THS	PIONEER	NOMIN	H O F	1973.
73-07-E	FIRST MEET FOR ARCA	THS	CLUB	FIPST	MEET	1973
73-07-E	THE PHONO AND MR. EDISON	SCI AMERI	PHONO	PIX	LARGE	1878
73-07-E	MUSICAL INSTRUMENT	SCI AMERI	MUSIC	AUTOP	NOVEL	1879
73-07-E	BUCKEYE COL'S. CLUB	THS	CLUB	RADIO	PHONO	1973
73-07-E	NIKOLA TESLA,HALL OF FAME	THS	PIONEER	NOMIN	H O F	1973.
73-07-E	FIRST MEET FOR ARCA	THS	CLUB	FIRST	MEET	1973
73-07-E	THE PHONO AND MR. EDISON	SCI AMERI	PHONO	PIX	LARGE	1878
73-07-E	MUSICAL INSTRUMENT	SCI AMERI	MUSIC	AUTOP	NOVEL	1879
73-07-E	BUCKEYE COL'S. CLUB	THS	CLUB	RADIO	PHONO	1973
73-07-E	CBS PROGRAMS	CBS	PERFORM	PIXS	STARS	1943
73-07-E	CONST. TRANS. TUNING COIL	M E 1908	WIRELES	CONST	COIL	1908
73-07-E	PIXS OF BATTERY SETS	R N 1925	RADIOS	PIXS	SPECS	1925
73-07-E	ANTISEPTIC ATTACHMENT	SCI AMERI	TELEPHO	PHONE	MOUTH	NONE
73-07-E	IHRS CLUB EXHIBIT PHOTO	THS	CLUB	PIX	EXHIB	1973
73-07-E	OWNERS OF EDISON PHONO	EDISON CO	PHONOGR	SERVI	CARE	1904E

BACK ISSUES OF THE HORN SPEAKER,

date	title	author	class	k1	k2	k3
73-07-E	CBS PROGRAMS	CBS	PERFORM	PIXS	STARS	1943
73-07-E	CONST. TRANS. TUNING COIL	M E 1908	WIRELES	CONST	COIL	1908
73-07-E	PIXS OF BATTERY SETS	R N 1925	RADIOS	PIXS	SPECS	1925
73-07-E	ANTISEPTIC ATTACHMENT	SCI AMERI	TELEPHO	PHONE	MOUTH	NONE
73-07-E	IHRS CLUB EXHIBIT PHOTO	THS	CLUB	PIX	EXHIB	1973
73-07-E	OWNERS OF EDISON PHONO	EDISON CO	PHONOGR	SERVI	CAPE	1904E
73-08-J	SOUND EFFECTS	C.B.S.	PERFORM	PIXS	METHO	1930
73-08-J	W B T MUSEUM	THS	RADIO	NC	PIONE	1973
73-08-J	CURRENT ATWATER KENT CO.	THS	RADIO	CURRE	STERE	1973
73-08-J	HISTORY OF THE HORN	SCI AMERI	SOUND	EDISO	HORN	1878
73-08-J	BERLINER PICTURES	THS	PHONO	FIRST	DISC	1888
73-08-J	1915 RECORDS	THS	PHONO	LIST	PERFO	1915
73-08-J	PIXS OF BATTERY SETS	RN 1925	RADIO	PIXS	SPECS	1925
73-08-J	EXPENSIVE EDISON EXPERIE.	M E 1910	TELEPHO	EDISO	W. U.	1910
73-08-J	SENDING CONDENSER	M E 1910	WIRELES	CONST	CONDE	1910
73-08-J	INTRO. THE TELEPHONE	SCI AMERI	TELEPHO	BELL	DEMO	1877
73-08-J	MAHLON LOOMIS- PIONEER	R N 1922	RADIO	PIONE	PATEN	1872
73-09-E	BETTINI, EARLY HI FI	R GELATT	PHONOGR	BETTI	RARE	1888
73-09-E	AMATEUR RADIO TRAIL	R N 1925	WIRELES	AMATE	HISTO	1922
73-09-E	PIXS OF BATTERY SETS	R N 1925	RADIO	PIXS	SPECS	1925
73-09-E	RADIO TRADE SHOW	THS	RADIO	PIXS	CONSO	1935E
73-10-E	HOW TO TUNE A REGEN. SET	E H FELIX	RADIO	TUNIN	REGEN	1922
73-10-E	PORTRAIT OF EDISON	SCI AMERI	INVEN	OLD	PIX	1902
73-10-E	RADIO DAYS- J W DAVIS	J PUETT	RADIO	DAVIS	DALLA	1930S
73-10-E	SIR WILLIAM CROOKES	KAEMPFFER	SCIENCE	CROOK	ELECT	1922
73-10-E	EDISON'S VACUUM APPARATUS	SCI AMERI	LAMPS	METHO	VACUU	1880
73-10-E	CALVIN COOLIDGE PICTURE	THS	PERFORM	PIX	LARGE	1924
73-10-E	PIS OF BATTERY SETS	RN 1925	RADIO	PIXS	SPECS	1925
73-10-E	VICTOR-VICTROLA 1910	THS	PHONOGR	PIXS	PRICE	1910

1974

74-01-D	SCIENTIFIC USE OF PHONO.	M HOPKINS	PHONOGR	TESTI	HYDRO	1890
74-01-D	NEW ENG. WIRELESS MUSEUM	THS	WIRELES	MERRI	HOUCK	1974
74-01-D	CHAPTERS FOR PHONO COLLS.	THS	PHONOGR	APCS	BOSCO	1973
74-01-D	NEW LEADERS	THS	RADIO	WOOTE	RMAW	1974
74-01-D	TUBE WITH AN INNER TUBE	W HEMRICK	TUBE	SODIO	TUBE	1922
74-01-D	HOW MAKE TALKING MACHINE	C W NOYES	PHONOGR	CONST	PHONO	1905
74-01-D	SILVER GHOSTS	J PUETT	RADIO	SCOTT	PHILH	1974
74-01-D	SONATRON AMPLIFIER	THS	RADIO	SONAT	AMPLI	1925
74-01-D	PIXS OF BATTERY SETS	R N 1925	RADIO	PIXS	SPECS	1925
74-01-D	CINCINNATI MUSEUM	THS	RADIO	GRAY	WCET	1974
74-01-D	LONG DISTANCE TELEPHONY	SCI AMERI	TELEPHO	TRANS	CROSS	1891
74-01-D	PARAGON DESIGNER DIES	THS	RADIO	GODLE	DIES	1974
74-01-D	AWA RECEIVER CONTEST	THS	RADIO	REGEN	T R F	1973
74-01-D	RADIO	THS	PERFORM	PIXS	STARS	1943
74-01-E	TELEGRAPH INSTRUMENT	SCI AMERI	TELEGRA	SMITH	MORSE	1891
74-02-D	LODGE, SIR OLIVER JOSEPH	MUNN	PIONEER	PHOTO	LARGE	1903
74-02-D	THE PHONOGRAPH	LESLIE'S	PHONOGR	DRAWI	ARTIS	1878
74-02-D	UNCLE JOSH	C STEWART	PERFORM	PUNKI	LIFE	1905
74-02-D	EDISON ELECTRO-CHEM PHONE	SCI AMERI	TELEPHO	EDISO	TELEP	1879
74-02-D	RADIO DISPLAY SHOW SALE	THS	RADIO	DINGM	DISPL	1974
74-02-D	BREHM'S RAD-WRLES MUSEUM	THS	RAD-WR	BREHM	DISPL	1974
74-02-D	GANGBUSTERS	THS	PERFORM	LORD	CARNE	1930E
74-02-D	PIXS OF BATTERY SETS	R N 1925	RADIO	PIXS	SPECS	1925
74-03-D	CLASSIC RADIO	J PUETT	RADIO	SCOTT	SILVE	1974
74-03-D	AERIALS	W HEMRICK	RADIO	AERIA	ANTEN	1974
74-03-D	SIMPLE SOUND RECORDER	M HOPKINS	PHONOGR	RECOR	SIMPL	1882
74-03-D	DR I Q, JIMMY MCLAIN	THS	PERFORM	PIXS	SHORT	1930S
74-03-D	SILICON DETECTOR	M E 1908	WIRELES	DETEC	SILIC	1908
74-03-D	EDISON PHONOGRAPHS	THS	PHONOGR	CONCE	GEM	1906

BACK ISSUES OF THE HORN SPEAKER,

date	title	author	class	k1	k2	k3
74-03-D	PIXS OF BATTERY SETS	R N 1925	RADIO	PIXS	SPECS	1925
74-03-D	FRENCH RADIO 1922	THS	RADIO	FOREI	REGEN	1922
74-03-D	EARLY DECTORS	HAWKINS	WIRELES	DETEC	CRYST	1920B
74-04-D	AERIOLA GRAND	THS	RADIO	RCA	M RG	1922
74-04-D	BAIRD TELEVISION	THS	TELEVIS	BAIRD	TV	1930
74-04-D	AERIOTRON VACUUM TUBES	THS	TUBES	AERIO	TUBES	1922
74-04-D	BETTINI	SCI AMERI	PHONOGR	BETTI	DIAPH	1890
74-04-D	ELEC LIGHT FROM SPIGOT	S AND INV	LAMP	SPIGO	LIGHT	1921
74-04-D	THE CLASSIC RADIO	J PUETT	RADIO	SILVE	MCMUR	1974
74-04-D	PIXS OF BATTERY SETS	R N 1925	RADIO	PIXS	SPECS	1925
74-04-D	WORLD WAR II RADIO	THS	PERFORM	BENNY	JOLSO	1943
74-05-D	AFTER-THOUGHTS ON SPKRS	W HEMRICK	RADIO	SPKRS	HISTO	1927
74-05-D	WILLIAM BORUFF EXHIBIT	THS	PHONOGR	PHOTO	LARGE	1974
74-05-D	GALVANOMETER, DEPREZ	M HOPKINS	ELECTRI	DEPRE	GALVA	1886
74-05-D	BRCADCAST EQUIP, THEN	J F RIDER	RADIO	RIDER	HISTO	1931
74-05-D	PHONOGRAM	THS	PHONOGR	QUEST	ANSWE	1907
74-05-D	THE CLASSIC RADIO	J PUETT	RADIO	SILVE	MASTE	1930S
74-05-D	PIXS OF BATTERY SETS	R N 1925	RADIO	PIXS	SPECS	1925
74-05-D	TRANSFORMER REWINDING	THS	RADIO	REWIN	TELEV	1974
74-06-D	MAJESTIC MIRACLE	R N 1930	RADIO	MAJES	PRODU	1930
74-06-D	THE CLASSIC RADIO	J PUETT	RADIO	SCOTT	COMMU	1945
74-06-D	TELEVISION RECEIVER KIT	REPLOGLE	TV	TV	KIT	1931
74-06-D	BUILDING A RADIOVISOR	REPLOGLE	TV	TV	CONST	1931
74-06-D	EDISON, AN HOUR WITH	SCI AMERI	INVENTO	EDISO	PHONO	1878
74-06-D	PIXS OF BATTERY SETS	RN 1925	RADIO	PIXS	SPECS	1925
74-06-D	DISC SOUND RECORDING	J SALIBA	PHONOGR	DISC	RECOR	1932
74-06-D	KATE SMITH	THS	PERFORM	SMITH	DOWNE	1931
74-07-D	NERNST GLOWER	F LYONS	LAMP	NERNS	LANE	1897
74-07-D	RADIO BAZOOKA	BOB BURNS	PERFORM	BURNS	BAZOO	1936
74-07-D	FIND OF THE MONTH	A W DIAZ	RADIO	DIAZ	PUP	1974
74-07-D	PIXS OF BATTERY SETS	R N 1925	RADIO	PIXS	SPECS	1925
74-07-D	CLASSIC RADIO, SCOTT LIST	J PUETT	RADIO	SCOTT	LIST	1925-
74-07-D	LETHER ELBOWS FOR DISC--	THS	PHONOGR	DISC	ELBOW	1901
74-07-D	ECHOPHONE, MODEL 5	THS	PHONOGR	ECHOP	M 5	1904E
74-07-D	RADIO EXHIBIT, DAL. CONV.	THS	RA-PHON	FIRST	CONVE	1974
74-07-D	MICHIGAN RADIO, G DOCKTER	THS	RADIO	DOCKT	MICHI	1974
74-08-D	CLASSIC RADIO, SCOTT BIO.	J. PUETT	RADIO	SCOTT	LIFE	1924
74-08-D	MR. THOMAS A EDISON	SCI AMERI	PHONOGR	EDISO	LOOKS	1878
74-08-D	ELECTRIC LAMP FOR A SHIL.	SCI AMERI	LAMP	TOY	LAMP	1879
74-08-D	RHEOSTAT, IMPROVED	SCI AMERI	ELECTRI	RHEOS	RESIS	1879
74-08-D	TROUBLESHOOTING GRID LEAK	W HEMRICK	REPAIR	GRID	LIST	1974
74-08-D	MEETING FOR DALLAS COLL'S	THS	CLUB	FIRST	SVRPS	1974
74-08-D	FIND OF THE MONTH	THS	NEWS	DIAZ	FIND	1974
74-08-D	SEARCH, FINDING SETS	THS	COLLECT	FIND	WRECK	1974
74-09-A	RADIO PICTURES	R B 1926	RADIO	PIXS	DESCR	1926
74-09-A	MORRIS N. BEITMAN	B DINGMAN	RADIO	BEITM	DINGM	1974
74-09-A	THOMSON-HOUSTON EXHIBIT	SCI AMERI	LAMP	THOMS	HOUST	1884
74-09-A	PHONOGRAM	PHONOGRAM	PHONOGR	STARS	RECOR	1907
74-09-A	TELEGRAPH KEY	SCI AMERI	TELEGRA	KEY	VAN D	1890
74-09-A	CLASSIC RADIO	J PUETT	RADIO	SCOTT	TUBES	1974
74-09-A	SEARCH	THS	RADIO	SEARC	TALKS	1974
74-09-A	DALLAS COLLECTORS	THS	CLUB	MEET	DALLA	1974
74-09-A	FOUND BY RADIO	BOUCHERON	RADIO	STORY	ARCHE	1922
74-09-A	TUBE CHART, EARLY	THS	TUBE	199	200	1923E
74-09-A	SERVICE NOTES	R C 1932	RADIO	SERVI	HINTS	1932
74-09-A	HOW WIRELESS DEVELOPED	I.R.E.	WIRELES	WIREL	DEVEL	1917
74-10-A	HI FI REPRO. FROM RECORDS	GERNSBACK	PHONOGR	ELECT	RECOR	1935
74-10-A	WALKING WIRELESS STATION	M E 1909	WIRELES	WIREL	PORTA	1909
74-10-A	FIRST RECORDING ARTIST	THS	PHONOGR	HOFMA	STAR	1888
74-10-A	CLUB NEWS- WVRC, MARC SVR	THS	CLUB	CLUB	NEWS	1974
74-10-A	FINDS OF THE MONTH	COLLECTOR	COLLECT	SETS	RARE	1974
74-10-A	RECEIVING DON'TS	A COLLINS	RADIO	IDEAS	DON'T	1933

handmade diaphragms and that I would have to subcontract this work and that we would continue on the final test and inspection. All special tools and jigs needed were loaned to the subcontracting firm and I taught them all the special techniques involved. That subcontracting firm was the Lowther Manufacturing Company and so when I am credited with being responsible for the P.M.-2, this is partly correct. But Mr. Chave is responsible for the transition from the Voigt excited field to the Lowther P.M. His work has merit and it would not be proper for me to accept all the credit.3

(Editorial note: Part of the confusion between Lowther and Voigt was inadvertently started by George Augspurger7 in an article on horn loudspeakers where he gave Voigt credit for the Lowther P.M. speaker. See also the letter by Chave8 with a different opinion on the subject.)

SB: What was the nature of your health problems in 1946?

VOIGT: Briefly, in the latter 40's after the war, I was experiencing sensations of pressure in my left chest. These were fatigue related and slowed me down. If at an exhibition, I walked past the stands slowly, no one noticed. But, if at a restaurant, I could not follow the head waiter to my table in a normal fashion and it was extremely noticable.

I consulted a sequence of medical doctors who applied the standard tests. They could not find any reason for my trouble and assured me that there was nothing physically wrong with me. They made suggestions and eventually tried to convince me that I was imagining it all.

Finally, I found an osteopath who diagnosed the problem as being a malformation of the spine. A spinal brace was made for me and initially, produced a day to day improvement.

SB: What were the factors in deciding to move to Canada in 1950?

VOIGT: The war had reduced us to a skeleton basis and I could see no chance of recovery unless I could build up sufficient export trade on which there was no British purchase tax nor rationing of materials, which tended to reduce our British sales till they were of no consequence.

It was in April 1950 that my wife and i crossed the Atlantic, leaving my business, Voigt Patents, Ltd., running on a skeleton basis in London, England. The purpose of our crossing was to build up export sale of my corner horn loudspeaker on this continent specifically to make sure that I did not have "all my eggs in one basket."

My wife had been in Toronto for a year or so somewhere around 1926, so for her, it was not a blind shot and she had friends there. I had one helpful audio contact there and another in New York. From a general point of view Toronto is within 600 miles of 1/3 of the population of this continent and from a personal point of view I felt it would be more satisfying to operate from a part of the British dominions than from the U.S. Not only had they come in late for both world wars but that inventor Armstrong had committed suicide because of legal patent troubles had not been overlooked in the British radio journals at the time.

SB: What happened to the Canadian venture?

VOIGT: Default by a company, I thought I could trust, upset the financial situation and an almost total failure of communications ensured that my Canadian venture would be doomed. The company ran on its own momentum into the mid 1950's but without substantial export trade, it could not and did not survive.

I have two important things to be thankful for. Had the Canadian venture suceeded, there is no doubt that I would have overtaxed my strength and long ago become the "late" Mr. Voigt. Instead, I am 79 now and in better shape than when I left England in 1950.

SB: What was your latest development in loudspeaker design?

VOIGT: The week before we sailed, April 1950, I applied for something for ensuring that the spacing between the inner and outer poles of the P.M. speaker magnet would automatically be accurate upon assembly.

(To be continued)

3. Voigt, P.G.A.H., Letter to Editor, Radio-Electronics, 30, pp 16, 20, 22, Mar. 1959.

7. Augspurger, G.L., Horn-Type Speaker Systems, Radio-Electronics, 26, p 82-86, May 1955.

8. Chave, D.M., Letter to Editor, Radio-Electronics, 26, p 16, July 1955.

By extensive calculations it has been demonstrated that, in order to amplify the different tones equally, there must be the same proportion of expansion for each unit of extension in length. The exponential horn fulfills these conditions, and gives a practically uniform amplification of all frequencies within the range for which it is designed.

LIMIT OF RANGE

It is found, however, that there is a certain point called the "cut-off," and the exponential horn will not reproduce frequencies below this point. The "cut-off" point, or lowest frequency at which the horn will reproduce, is dependent on the rate of expansion. The wider the conical angle, or the greater the rate of expansion, the higher will be the "cut-off" point. The horn illustrated will bring in notes as low as 29 cycles, and the result is that the music which it gives off creates the impression that a real orchestra, or a real singer, is present in the room. In every instance where a visitor has heard this outfit, the result has been an instant desire to obtain something similar.

(To be continued)

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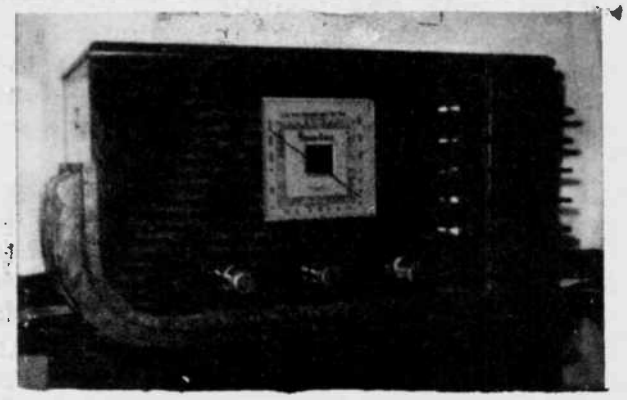
FOR SALE: SURPLUS TUBES OR REMOVED from equipment (new and used) please send S.A.S.E., for price lists. Elmer Nelson, 11 S. Church St., Princeton, IL 61356.
****
FOR SALE. OLD RADIO AND T.V. LITERATURE, CATALOGS AND MAGAZINES. LARGE S.A.S.E. FOR LIST. FOTHE, 10 JACKSON ST., SLOATSBURG, NY 10974. (914) 753-2090.
****
--------- TRADE LIST ---------
1. Paragon RA-10
2. Kennedy 220 & 525 amp.
3. Federal 61
4. AK breadboard 10A no. 4550
5. Westinghouse RA-DA
6. Golen Leutz Plio -6
7. Atwater Kent 32
8. Radiola 21
9. Crosley 50
10. Crosley 51
11. Crosley 52
12. Entertain-A-Phone model 2
13. Freshman Masterpiece
14. Scott FM Phantom Deluxe
15. Scott Allwave 15
16. Remler Infradyne amp.
17. Crosley Trirdyn
18. Aeriola Sr. with brass based tipped WD11
19. Silver Marshall Super Het
20. Silver Marshall Sargent Ramant Seven
21. Magnaformer Super Het
22. Burns Horn
23. Magnavox M-6 Horn
24. Dictograph Horn
25. Super Speaker (Jewel Co.)
26. Panel, Cabinet & 1 knob for Chicago Radio Labs Paragon
27. Crosley RFL
28. Zenith 12
29. Kellog wavemeter
30. 2 stag audio amp (General Radio parts)

LARRY R. WRIGHT.D.D.S., 131 HILLTOP DRIVE, LAKE IN THE HILLS, IL 60102. (312) 658-7328.
****
FOR SALE: DeFOREST DL5. GOOD FILAMENT, GOOD EMISSION, $25 PLUS SHIPPING. DAVID EVANS, 206 ALLEN, FERNDALE, MI 48220 (313) 548-9340.
****
SALE/TRADE: 2 DIFFERENT RADIO SHOP 3 TUBE SETS, CATHEDRAL CONE SPEAKERS, GENERAL RADIO 650A IMPEDANCE BRIDGE, MISC 1920'S MAGAZINES, SASE; W6THU, 1545 RAYMOND, GLENDALE, CA 91201
****
EARLY RADIOS, old record changers, turntables, speakers and tubes. Large SASE for list. JOHN B. DREW, 97 FRANKLIN ST., WESTERLY, RI 02891.
****

Wanted



PLEASE HELP. I LOVE MIRRORED GLASS RADIOS. IF YOU HAVE ONE OR KNOW WHERE THERE IS ONE, PLEASE LET ME KNOW. I'M ALSO INTERESTED IN ANY "WILD LOOKING" RADIOS FROM THE 1930'S LIKE COLORED CELLULOID RADIOS (FADA, EMERSON, ETC.) AND CHROME RADIOS. BARBARA GORTON, BOX 1252, DAYTON, OH 45401. (513) 253-5073.

WANTED: EARLY CEILING OR TABLE FANS. ESPECIALLY ODD OR UNUSUAL TYPES. RICHARD CANE, 8391 N.W.

OLDE TYME RADIO COMPANY
ANTIQUE TUBES AND PARTS

* SPECIAL - GENERAL SERVICE HEADPHONES $3.00 each or 2 pair for $5.00
* MERIT POWER XFMRS -- 300-0-300 V 90 MA. 5V AT 3 A, 6.3 V AT 3.5 A -- $15.00 EACH
* CRYSTAL SET ITEMS -- galena xtals ..$1.45 each -- cats whiskers (package of 2) ..$1.10 -- crystal detector .. $3.35 each ass'y with xtal -- Headphone replacement cords Brandes and baldwin types ..$4.25 each -- Olde tyme speaker replacement cords (above cords are 5 ft.) ..$3.00 each -- Headphone replacement pin jack tips .. 5 for $1.00 or 25 cents each
* INTERSTAGE AUDIOS -- Stancor A53C (new) ..$7.00 each -- Mil spec 2:1 good for Radiola III and IIIA (used) ...$2.50 each
* RF, OSC, ANT COILS (new) ..$2.00 each
* IF TRANSFORMERS (new) ..$2.00 each (higher for special units-- write)
* CAN'T PROVIDE WD-11s but we can provide WD-11s made with 864 in WD-11 base. Works better than WD-11 -- $15.00 each or 2 for $25.00
* DIAL LAMPS -- many types, state your needs..25 cents each.
* NEED NAME PLATE OR ESCUTCHEON SCREWS? WE HAVE THEM. guage-0, 1/4" -- guage-0, 3/8" guage-1, 1/4" -- guage-1, 3/8" -- guage-2, 1/4" -- guage-2, 3/8" ... any 10 for 50 cents.
* OLDE TYME RADIO TUBES tubes from the 20s, 30s, 40s, 50s, and 60s -- used and new -- write for quote.
* EXACT REPLACEMENT RADIOLA II OR VIII LEATHER HANDLES ONLY .. $4.25 each.
* SCHEMATIC FOR SETS MANUFACTURED FROM 1920 THRU 1940 .. $1.50 each.
* OLDE TYME BAKELITE BINDING POSTS -- singles .. 50 cents each or 3 for $1.00 -- triples $1.00 each or 3 for $2.50.
* RESISTOR LINE CORD REPLACEMENT KITS: 4-tube .. $3.50 -- 5-tube .. $4.50.
* IF YOU DON'T SEE IT, ASK
* OLDE TYME BATTERY CABLE - all cloth AK style -- 5-conductor .. .75/ft. -- 6-conductor .. 1.00/ft. -- brown silk type power cord .. .30/ft. -- single conductor hookup wire (cloth) .. .12/ft.
* OLDE TYME AC PLUGS .. $1.10 each or 3/$2.9
* 60 uf 250 V ELECTROLYTIC CAPACITORS axial leads 50 cents or 3 for $1.00.
* 10- 10 uf/450 V caps -- $1.00 each or 12 for $1.00
* TUBES SPECIAL -- 6F8, 38, 6C4 - all new in original boxes .. 50 cents each or 3 for $1.00
* OUR SHIPPING POLICY -- Please send sufficient funds to cover shipping costs. Overages if under $1.00 will be credited to future orders - or refunded if requested. Overage over $1.00 will be returned with your order when it is shipped.

1981 OLDE TYME RADIO WINTER SPECIALS
OLDE TYME RADIO -- 2445 Lyttonsville Road, Silver Spring, Maryland, 20910
(301) 585-8776

21st ST., SUNRISE, FL 33322.

CASH FOR DECEMBER 1915 TO DECEMBER 1921 QST'S FOR PERSONAL COLLECTION. KEN MILLER, K6IR; 16904 GEORGE WASHINGTON; ROCKVILLE, MARYLAND 20853. (301) 774-7709.

WANTED: SCOTT PHILHARMONIC. Prefer Napier console. Dick Howe, 9318 Wickford, Houston, TX 77024 or call (713) 680-9945 collect.

WANTED: INDIVIDUAL RADIO REPAIR AND SERVICE MANUALS FROM 1930 TO 1950 FOR G.E., PHILCO, ZENITH, AIRLINE, CROSLEY, SILVERTONE, STEWART WARNER, EMERSON, AND R.C.A. INTERESTED IN ANY QUANITY. SEND PRICES. CHARLES TEAGUE, 330 SEMINOLE, BOULDER, CO 80303

I PAY MORE FOR MIRRORED GLASS RADIOS (BLUE, PEACH). BOB, (305) 628-8755. P. O. BOX 312, WINTER PARK, FLORIDA 32790.

WANTED: ANY TYPE OF PART FOR BATTERY CROSLEY OR PILOT RADIOS, AUDIOS, DIALS, TUBE SOCKETS, KNOBS, RHEOSTATS, CONDENSERS, ETC. ESPECIALLY NEED IMMEDIATELY DIAL POINTER FOR CROSLEY MOD. 5SSD. BOB, W6ME, 4178 CHASINSTREET, OCEANSIDE, CA 92056.

WANTED: T.V. GUIDES. ESPECIALLY PRE-1970. ALSO WANT ALL TYPES OF OCEAN LINER MEMORABILIA. DESCRIBE AND PRICE. RICHARD HEBERT, BOX 603, AUBURN, NY 13021.

WANTED: 1923 OR EARLIER RADIO NEWS, Science and Invention, Modern Electrics, Any pre 23 mags or catalogs. Also any Grebe receivers or amps. Also need HZ. Ray Garner, Rt. 1, Box 320, Big Sandy, TN 38221.

A.K. MODEL 84 CHASSIS WANTED IN REPAIRABLE CONDITION. SPEAKER NOT REQUIRED. 5-OHM GREBE THUMBWHEEL TYPE. RHEOSTATS ALSO WANTED. N. S. BRAITHWAITE, 1410 NORMAN DR., REDDING, CA 96002.

NEED DESPERATELY: 2 RF TRANSFORMERS FOR FEDERAL 61 (cylinder type) no. 35 - 220 - 550 meters. No. 31 - 500 - 1000 meters. Also I need 4 contacts that go through the front panel on the same radio. They make connection when you turn the rheostat for the big coil for selectivity. John Case, 680 Morning St., Worthington, OH 43085. Phone (614) 885-5925.

WANTED: GREBE: YEAR 1927 model C7 or Synchrophase Seven or year 1928 model AC7. Each set complete and with speaker. Details and shipping costs in first letter. Norman Crane, P.O. Box 12564, Tucson, AZ 85732.

WANTED - CABINET FOR FEDERAL - 110, CARL KNIPPEL, MORTON, IL, RT3 61550.

WANTED: VIBROPLEX, McELROY, LOGAN, AND JOHNSON SPEED KEYS. NEED JUNKERS FOR SPARE PARTS. B. N. McEWEN, 1128 MIDWAY, RICHARDSON, TX 75081.

WANTED: OPERATING INSTRUCTIONS for Radiola IIIA, Freshman Masterpiece, Freed Eismann NR-7, Weston 547. Good copies OK. Want 8-P-6 power supply and cable to radio, knob, good 4-gang tuning condenser for Majestic 180. W. A. Kernaghan, Box 2065, Sierra Vista, AZ 85635.

DIAL GLASS FOR RCA K80 CONSOLE; ORANGE, GREEN AND BEIGE MARKINGS; 3 BANDS; ABOUT 10 BY 3 INCHES. I RASKIN, 5120 WILSON LANE, BETHESDA, MD 20814 (301) 652-1695.

JANUARY

THE HORN SPEAKER

1982