

The Principle of Gramophone Pick-ups

ELECTRICAL pick-up units first started to appear in radio circles early in 1926 states an excellent article in "Radio Broadcast." Since then several dozen different types have been manufactured, and as many articles have appeared covering their operation. Yet, at a recent public demonstration of a particular make in one of the large New York stores, nine out of ten people were amazed that such a device was in existence, and, of course, knew much less of its workings. For the benefit of the uninitiated, let it be here stated that an electrical pick-up unit is nothing more than an electrical sound box for your phonograph.

The name "pick-up" unit has been

given to that particular arrangement suited for connecting your old type phonograph with your radio receiver. This has required a few circuit kinks, which are new, but the fundamental principle employed goes back to the early stage of the telephone and the phonograph. Alexander Graham Bell about 1875, discovered that when a thin piece of magnetic metal was vibrated in front of an electro-magnet, currents were created in the windings of the magnet. These currents were exactly similar in their electrical vibration to the mechanical vibration of the magnetic metal directly in front of the pole pieces of the magnet. Thus, when he talked directly against this thin piece of iron, it would vibrate and

create currents in the windings of the magnet similar to his voice vibration. This was the first electric telephone.

FEW people realise that the telephone receiver to-day is practically unchanged from Bell's original conception of the complete electric telephone. As the art developed, other more sensitive principles were used for the telephone transmitter or mouthpiece, but nothing has been found better for the receiver. And even now, the receiver, when used as a transmitter, produces better tone quality, but less volume than the ordinary telephone transmitter.

Now, Thomas Edison brought out the phonograph a couple of years after Bell's telephone. This was a device that took the minute vibrations of the thin iron disc, and, instead of changing them into electrical impulses, recorded them on a wax cylinder which was rotated when recordings were made. This was done by attaching a sharp needle on to the centre of the thin disc at the end of a horn, and the needle

well from the modern loud speaker. Here is where the radio receiver comes into the picture. So far, we have only used the turn-table, motor, and record of the old phonograph. The electrical pick-up unit has taken the vibrations off the record, and has transformed them into electrical currents; now they are to be amplified by the radio set.

Only the Audio is used.

THESE currents are not radio currents at all. They are merely the amplified music and voice from the record. Hence, only the audio amplifying end of the radio set is utilised, and the pick-up unit must be so designed as to be readily attached to this audio amplifying section of the radio receiver. The currents are then amplified through the audio amplifier and are reproduced through the loud speaker, just as the radio programmes are amplified and reproduced after they are detected by the detector tube. One would guess from this that the pick-up units are attached in some way to the detector tube, at the beginning of the audio amplifier. Most of them are arranged to operate in the plate circuit of the detector, although one is arranged to work into the grid of the detector tube and thus gain the amplification of the detector tube.

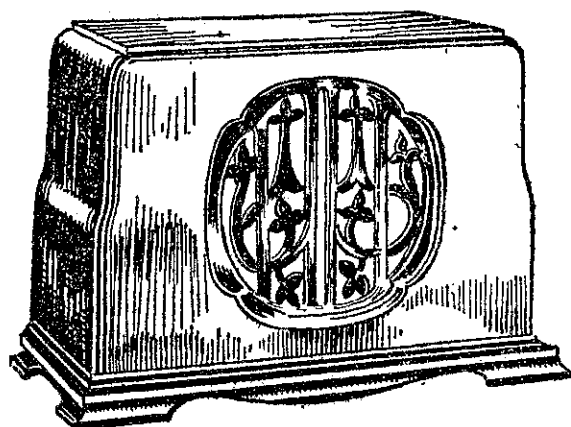
A careful study of the constructional details of quite a number of different designs shows the necessity of some sort of damping on the vibrating piece of thin iron. Naturally, everything has a natural or inherent period of vibration. Just as a tightly stretched piano string will vibrate at a certain pitch when plucked with the finger, so will the thin iron reed in front of the pole pieces of the magnet tend to vibrate at some particular pitch whenever it is set in motion. If this were not damped or stopped in some way, the unit would rattle on certain notes, and blast and distort the music. This damping is accomplished by mounting pieces of soft rubber tightly between the iron reed or diaphragm, and the pole pieces. In the Amphon Revelaphone the entire vibrating iron reed is pivoted in sponge rubber. The reed is thus left free to vibrate between the pole pieces, but it is damped by the rubber mounting at its pivot. The Bosch Recreator also operates on the damping principle of a rubber pivot, rather than rubber between the pole pieces. The Baldwin Needlephone has a rubber damped pivot as well as damping rubber between the pole pieces.

Volume Control.

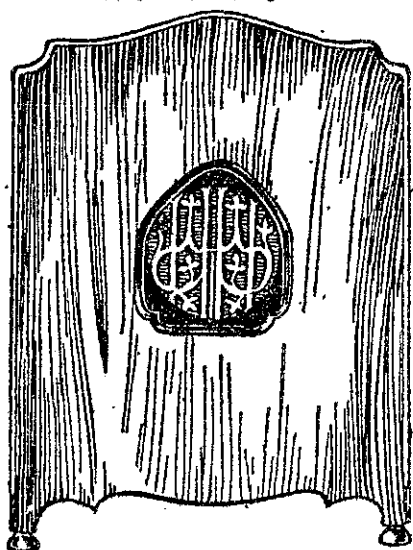
THE regulation of volume of tone has brought forth almost as many ideas as there are different electrical pick-up units. In general, these volume control boxes are variable resistances which shunt out some of the electrical currents generated in the pick-up unit. An adjustable knob enables the volume to be reduced to an almost inaudible whisper.

The question of weight on a record is indeed a serious problem. Records as well as needles, wear out, and we are quite familiar with the fact that needles should be changed rather frequently. However, one is not accustomed to think in terms of "record wearing." Nevertheless, this is quite an important factor, if the electrical pick-

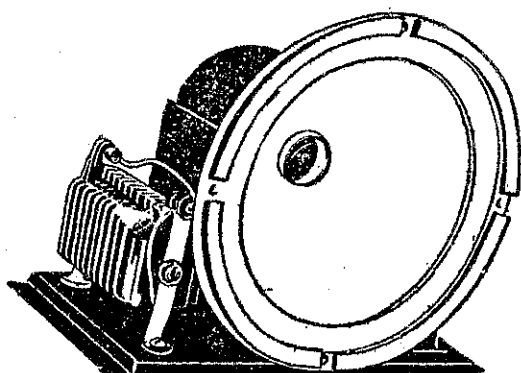
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"The Beverley."



"The Belvedere."



"The Magnavox Unit."

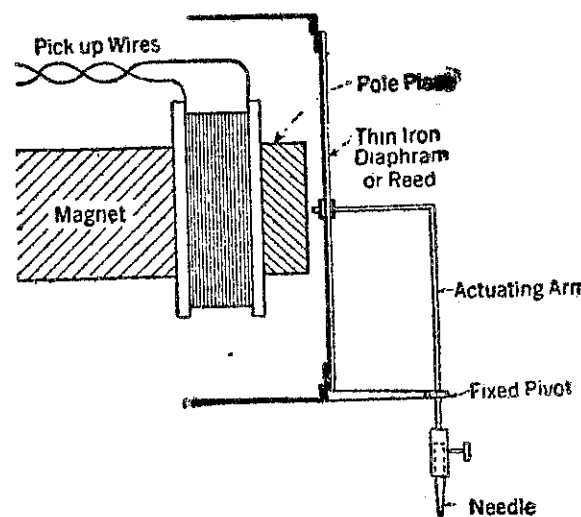
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SPEDDING, LTD., Auckland.
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Magnavox Dynamic Speakers used in conjunction with a Gramophone Pick-up give results equal to the highest-priced Electric Gramophones. The Magnavox Company control the patents for the famous "Dynamic" Speaker which word they applied to this new type of sound reproducing instrument. Magnavox Speakers are a revelation in sound reproduction, and will carry as much volume as can be imposed by a Radio Set or through amplification. There is no distortion or rattle. Magnavox Dynamic Speakers created a sensation at the American Radio Convention this year, and the largest and best manufacturers are equipping their sets with Magnavox Dynamic Speakers. There is a type for every kind of electrical current. Complete speakers or units which can be placed into the present cabinet of your gramophone or speaker can be supplied as follows:

D.6	6 Volt D.C.	Current
D.7	110/220 D.C.	Current
D.8	6/12 Volt D.C.	Current
D.80	230 Volt A.C.	Current

Also complete Unit and Amplifier for 230 Volts A.C.



Cross-Section of Electric Pick-up

was made to travel over the impression in the wax cylinder as the disc moved to and fro under the influence of the person's voice. Then, when it was desired to hear the record, the thin disc was placed at the end of a horn and the needle was made to travel over the same waving path which it had previously cut. The wax groove forced the needle to and fro, which in turn actuated the diaphragm.

AN electrical pick-up is merely the combination of these two inventions. A phonograph needle must be attached to the pick-up device. This needle actuates a thin strip of iron mounted directly in front of the pole pieces of an electro-magnet. As the needle is forced back and forth by the waving nature of the grooves of the phonograph record, the thin iron diaphragm is forced to vibrate in unison in front of the electro-magnet. This vibrating magnetic metal induces electrical currents in the windings of the magnet whose vibrations are similar in nature to those of the diaphragm, and in turn to the grooves in the record.

Of course, these currents are extremely weak, although very clear and excellent in tone quality. If we should place a pair of headphones across the output of this electric pick-up unit, we would hear some very fine music. The only problem that now remains is to amplify this sufficiently to be heard