

# How the Talkies Talk

## The Final Link

(By MEGOHM)

Concluded from last week.)



HERE is one of the most interesting parts of the whole outfit—horn speakers are used for reproduction, but the unit is entirely different from the ordinary type, and is the most efficient of any yet produced. The ordinary magnetic unit has only an "efficiency" of 1 per cent. or less! The moving-coil cone speaker may have an efficiency anywhere between 10 and 14 per cent., but this talkie unit has an ordinary working efficiency of 20 to 25 per cent., while under laboratory conditions an efficiency of 50 per cent. is easily obtained!

This unit adopts the moving-coil principle, with a coil working in a strong magnetic field excited by electric current, but a small dome-shaped duralin (aluminium alloy) diaphragm about 2 inches in diameter takes the place of the paper or fabric cone usually attached to the coil in a moving-coil cone speaker.

Whereas the largest speakers previously constructed had a capacity for 5 watts input, the design of this unit allows of a continuous electrical input of 15 watts, with a high conversion efficiency over the frequency range from 60 to 7500 cycles, the efficiency being 30 per cent. over a considerable portion of this range.

Combining the increased efficiency with the five or sixfold increase in power capacity, a single unit of this type is capable of delivering from 100 to 200 times the sound output of anything previously available.

The gradually increasing horn has an opening measuring 4ft. 10in. square, the length giving a 14ft. column of air. The large part of the horn is made of three ply wood, while the narrower part is of cast iron, bolted together in sections. From one to six speakers are used in New Zealand theatres, one for small halls and three in the average theatre. The unit and metal portion of the horn total 130lb. weight.

As the horns are placed behind the screen so that the sound may seem to come from the picture, a special screen is necessary in order that the sound may readily get through, while retaining sufficient density of surface to do full justice to the projected picture. This condition is effected by the use of fabric impregnated with white compound, and afterward punched with innumerable holes about 1-16in. diameter, arranged in irregular rows. These holes remove about one-fifth of the entire surface, so that only 20 per cent. of the projected light is lost.

### The Speaker Unit.

NOW to describe the speaker unit. Reference to the diagram of a section of the unit shows clearly the aluminium diaphragm to which the moving coil is attached by one edge. The diaphragm, which includes the dome-shaped portion and the flattish circular portion round the sides, is stamped from one piece of duralin about the thickness of ordinary tinfoil (.002 in.)—in fact, so thin is the diaphragm that only a slight push with the finger damages it.

Around the outer portion of the diaphragm will be seen numerous tangential pleats—these form a non-resonant flexible coupling that give the diaphragm great freedom of movement in the required direction only, so that the dome portion moves as a whole. The diameter of the dome is two inches, and in this form will reproduce the high audio-frequencies up to 6000 cycles per second. This is assisted by an obstruction C, of solid metal, placed in the sound aperture, having the same shape as the dome, and fitting into it, leaving a narrow air-space. This has the effect of causing all the high-frequency vibrations to travel an approximately equal course, hence the high cut-off at 6000 cycles.

The moving coil itself is a masterpiece of construction compared with the usual coil for dynamic speakers, in

volts from a 12-volt accumulator forming part of the equipment.

Referring to the diagram, a funnel-shaped aperture is seen in the centre of the field magnet, filled with cotton wool, supported by a cover plate of metal at the wide end and by wire gauze at the narrow end. This aperture was originally intended to be left open to ease the back-pressure from the diaphragm, and that construction was at first followed, giving good reproduction up to 6000 cycles. At a later stage the effect of filling the space with wool as a damping agent was tried, with the amazing result that frequencies up to 14,000 were reproduced, though not with such great volume as those around or below 6000 cycles.

It is thus seen that although the principle of the moving coil has been adopted, there is a carefully worked-out improvement of many details, resulting in a striking gain of efficiency which is a good example of how highly-trained minds can tackle a problem and produce something worthy of their thought and labour.

### The Pick-up.

HERE again we see the idea that "something better" must be produced in order to make the system as nearly perfect as possible, and so a special pick-up is produced with remarkable characteristics. The notable feature is the level output without "peaks" from 60 cycles to 5000 cycles—a great achievement when one glances

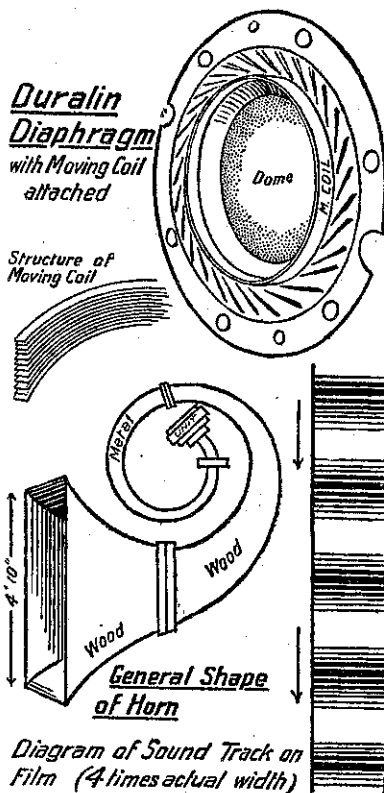
at the peak or sagging curve of the average pick-up.

This desirable property is attained by employing a stretched diaphragm of thin steel, about 1½in. in diameter. The two magnet poles are in the form of rings, one inside the other, with the annular faces close to the diaphragm, the flux then passing through the diaphragm as being the shortest path. An excellent damping system is obtained by filling the space between magnets and diaphragm with oil. The needle is attached to the centre, and parallel to the surface of the diaphragm, and moves fairly freely. A sideways movement to follow the wave in the record groove is all that is required, so in order to prevent movement along the groove, a stiff rib, horizontally placed, forms part of the diaphragm. This arrangement reduces very materially the reproduction of scratch which might be produced by roughness of the bottom of the groove.

An arm over 12in. in length is used, the pick-up being counterbalanced so that only the necessary effective weight rests on the record.

### In Conclusion.

AN examination of the sound film plant cannot fail to impress the observer that efficiency at every point is well worth striving for. The usual prevailing idea that only two, or at most three, audio stages are possible, looks rather weak beside the fact that in this system as many as seven stages of audio amplification are employed without loss of quality, and with a tremendous gain in volume. A perusal of this article will, the writer hopes, enable talkie patrons to know a little more about what is going on literally "behind their backs"—in the projector room.



which ordinary thin wire is used. The coil consists of a thin aluminium ribbon 0.015in. (1/64) wide and 0.002 thick. This ribbon runs round a former which is afterwards removed, leaving the aluminium self-supporting with the turns adhering and yet separated by a film of insulating lacquer. The requisite number of turns is built up, and when complete is so compact that it resembles a ring made up of 22's brass sheet.

The field magnet, corresponding to the "pot" of the dynamic speaker, consists of an annular hollow casting into which the winding is fitted, a circular hole in the centre giving ventilation to the field coil. The field magnet is excited by current of 1½ amp. at 7

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