PATENT SPECIFICATION

Application Date: July 31, 1935. No. 21675/35. **460,775**

Complete Specification Left: July 31, 1936.

Complete Specification Accepted: Feb. 1, 1937.

PROVISIONAL SPECIFICATION

Improvements in and relating to Microphones

We, CHARLES MATTHIAS STREETE, a British subject, of 84, Riversdale Road, Highbury, London, N.5 and SHAFTESBURY MICROPHONES LIMITED, a British Company, of 24, Aldersgate Street, London, E.C.1, do hereby declare the nature of this invention to be as follows:—

It relates to that kind of microphone known as the ribbon, or velocity type, in which a corrugated ribbon of thin metal foil is suspended in a magnetic field.

It has been found that an increase in the length of ribbon does not produce a corresponding increase in output from this type of microphone. Similarly if two or more ribbons are mounted in close proximity to each other but between different sets of magnetic poles, the increased output which might be expected to result from connecting them in series, is not realised in practice.

This is believed to be due to a ripple, or wave movement which is set up towards the ends of the ribbon by the flow of self-generated currents which in turn are developed by the mechanical movement of the ribbon whilst the microphone is in use.

This means that while the centre, or major portion of the ribbon is moving away from the source of sound another lesser portion is moving in the opposite direction and vice-versa, thus tending to neutralise the currents set up by the major portion of the ribbon and so reducing the output.

The same neutralising movement will occur if either one long ribbon is used or if several shorter ones are connected in series, as, in the latter instance, the total amount of current generated mutually is flowing through all simultaneously.

In the present invention this wave, or neutralising movement is checked by fixing the ribbon to some rigid support at one or more intermediate positions throughout its length, thereby dividing it into two or more free sections without breaking its continuity. The number of free sections each ribbon is divided into being determined by its total length. The support or supports preferably consist of thin pieces of insulating material commercially known as ebonite, compressed fibre or similar suitable material, which bridge the gap between the poles of the magnet or magnets at the aforementioned positions.

The same object can however, be attained by securing the ribbon to the poles at the aforementioned positions by means of a suitable adhesive such as fish glue, the film of adhesive preventing the ribbon coming into actual contact with the poles and thereby short circuiting.

This device also serves to keep the ribbon in a central position in the magnetic field.

Although this device is applicable to a single long ribbon, its main object is to make the use of several ribbons of medium length mounted in close proximity but in separate gaps, advantageous.

The ribbons are preferably connected in series, as aforementioned.

Dated the 31st day of July, 1935.

CHARLES MATTHIAS STREETE,
SHAFTESBURY MICROPHONES LIMITED.
For and on behalf of
Shaftesbury Microphones Ltd.,
JAMES A. ON EWING,
Director.

COMPLETE SPECIFICATION

Improvements in and relating to Microphones

We, CHARLES MATTHIAS STREETE, a British subject, of 84, Riversdale Road, Highbury, London, N.5 and SHAFTESBURY MICROPHONES LIMITED, a British Company, of 24, Aldersgate Street, London, E.C.1, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

[ ]

This invention relates to that kind of recording or transmitting microphone known as the ribbon microphone, in which a light metallic ribbon, usually made of corrugated metal foil, is suspended in a magnetic field produced in any suitable manner, e.g. by a permanent magnet or a magnet energised by a field coil, the ribbon constituting the current carrying conductor, and being freely accessible to air or sound vibrations from both sides. Such microphones when employed as sound pick-up devices respond wholly to the velocity or pressure gradient component of the sound wave, or they can be adapted to respond to the pressure component only or to a combination of the velocity and pressure component of the sound wave.

It has been found with this type of microphone that there is a tendency for certain neutralizing effects to arise, when with a view to obtaining a greater output a longer ribbon than the normal of about 50 m.m. is employed. These neutralizing effects apart from limiting the output by reducing the current flowing through the ribbon, produce a distorted output resulting in what may be called blasting in the reproduction. It is believed that these neutralizing effects arise by reason of a ripple or wave movement which is set up towards the end of the ribbon by the flow of self generated currents which in turn are developed by the mechanical movement of the ribbon whilst the microphone is in use. This means that while the centre or major portion of the ribbon is moving in one direction—e.g. away from the source of sound—another smaller portion of the ribbon is moving in the opposite direction, and vice versa. Thus the tendency of these oppositely moving smaller portions of the ribbon is to neutralize the current set up in the major portion of the ribbon, and so reduce the amount and quality of the output.

The object of the present invention is to provide an improved ribbon microphone wherein a comparatively high impedance can be obtained by using a long ribbon and the neutralizing effects which are likely to arise by the use of such a long ribbon are compensated for by being checked or eliminated for all practical purposes so that a greater output with minimum distortion and a true response over the whole of the audible frequency range is obtained.

According to this invention a microphone of the ribbon type is characterised in that a ribbon of a length greater than the normal (i.e. about 50 mm.) to obtain a comparatively high impedance but forming a single element electrically, i.e. with only two output terminals is mounted such that it lies substantially in a single plane between its fixed ends and is rigidly fixed to one or more insulated supports disposed intermediate its ends so as to divide the ribbon virtually into two or more freely vibratable parts without breaking its continuity, the length of the ribbon and the disposition of the supports being such that the said parts vibrate substantially without ripples occurring towards their ends so as to avoid current neutralising effects herein referred to.

The poles of the magnet producing the magnetic field in which the ribbon vibrates may be constructed to form the supports for the ribbon, the ribbon being fixed to said support or supports with the interposition of insulating material. In one form where the magnet system includes main pole pieces and a series of secondary pole pieces as hereinafter described, the material which secures the ribbon to the supporting point or points of the main poles also insulates the ribbon from the said poles. Such material can for example be a fish glue, a film of which is disposed between the ribbon and the main poles.

According to another form of the invention each support consists of a strip of insulating material bridging the gap between the poles of the magnet producing the magnetic field in which the ribbon vibrates, the insulating strip being disposed with its edge lying against and secured to the face of the ribbon.

Two embodiments of the invention will now be described with reference to the accompanying drawings wherein:—

Figure 1 is a side elevation of one embodiment wherein a plurality of ribbon lengths are supported in parallel relation in the air gaps between a plurality of magnet poles, each ribbon length being supported intermediate its ends by insulating bridge pieces,

Figure 2 is a plan of Figure 1, and

Figure 3 is a section on the line III—III of Figure 1.

Figure 4 is a plan view of the second embodiment wherein a continuous ribbon bent into a number of spaced apart parallel ribbon lengths is supported intermediate its ends by main pole pieces, with secondary pole pieces disposed in the spaces between the ribbon lengths.

Referring firstly to Figures 1—3, a permanent magnet 1 has a plurality of parallel pole pieces 2, 2a disposed in parallel relation. In the air gaps between the pole pieces are disposed four lengths of corrugated ribbon 3 of any suitable material, each ribbon length being connected in series with the next to form a single continuous current carrying con-

ductor the ends of which are fixed to terminals 4, 5. In the embodiment shown, a single piece of corrugated ribbon material of about 3 to 4 m.m. width is bent at right angles to itself at points 6 along its length to form the ribbon lengths, the ends of which are secured to the magnet, with the interposition of suitable insulating material (not shown) by clamping plates 7. The portion of each ribbon length 3 between the clamped ends may be from 85 to 90 m.m. long, and at two intermediate points between these clamped ends the respective ribbon lengths 3 are secured to the edges of insulated bridge pieces 8 which span the air gaps between the pole pieces. Thus each ribbon length 3 is virtually divided into three freely vibratable parts without breaking the continuity of the ribbon length.

The air path to the rear of the ribbon lengths inlcudes a plurality of parallel transverse slots 9 formed in the respective intermediate pole pieces 2*a*, these slots extending from side to side of the said pole pieces. Each of the bridge pieces 8 is fixed in one of the slots 9, and in the embodiment shown the bridge pieces are spaced at different distances from the clamped ends of the ribbon lengths so as to provide freely vibratable ribbon portions of different effective lengths giving an improved response of the microphone over the audible frequency range.

Instead of four ribbon lengths and five magnet poles as shown, one, two, three or more than four may be employed, and each may be supported at a single intermediate point or at more than two points, although in the latter case a longer ribbon length may be necessary or desirable. However, the embodiment shown has been found to be satisfactory in practice, giving a very true response without appreciable distortion.

The modification shown in Figure 4 provides a permanent magnet system having two main pole pieces 10, 11 supported in spaced apart parallel relation with a number of inwardly projecting secondary pole pieces 12 parallelly arranged at right angles to the main pole pieces. In each of the air gaps between the secondary pole pieces 12 is disposed a freely vibratable corrugated ribbon length 13, which forms part of a single continuous piece of corrugated ribbon constituting the current carrying conductor the ends of which are secured to the terminals 14 and 15. This single piece of corrugated ribbon is bent as shown in Figure 2, to form the parallelly disposed ribbon lengths 13, and the ends of the latter are secured to the main pole pieces by insulating strips 16 of fish glue or the like which may be additionally supported on the base 17 of the magnet system by means of end pillars 18. As in the previous case, therefore, there is provided a continuous ribbon piece bent into a sinuous form and supported at several intermediate points between its fixed ends 14, 15 to form the number of freely vibratable ribbon lengths 13. If desired, these ribbon lengths may be virtually divided into two parts by providing bridge piece supports 8 across the air gaps, as in Figures 1 to 3. For preference, it will be noted that where these bridge piece supports 8 are employed, they are disposed with their edges towards the face of the ribbon, the ribbon being secured to these edges in any suitable manner.

In the embodiment shown in Figure 4, the respective freely vibratable ribbon lengths are from about 50 to 55 m.m. long and approximately 3 to 4 m.m. wide, and the total length of vibrating ribbon may be from 30 m.m. upwards and approximate to that shown in Figures 1 to 3.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. A microphone of the ribbon type wherein a ribbon of a length greater than the normal (i.e. about 50 mm.) to obtain a comparatively high impedance but forming a single element electrically i.e. with only two output terminals is mounted such that it lies substantially in a single plane between its fixed ends and is rigidly fixed to one or more insulated supports disposed intermediate its ends so as to divide the ribbon virtually into two or more freely vibratable parts without breaking its continuity, the length of the ribbon and the disposition of the supports being such that the said parts vibrate substantially without ripples occurring towards their ends so as to avoid current neutralising effects herein referred to.

2. A microphone according to Claim 1, characterised in that the poles of the magnet producing the magnetic field in which the ribbon vibrates, are constructed to form the supports for the ribbon and that the ribbon is fixed to said support or supports with the interposition of insulating material.

3. A microphone according to Claim 2, wherein the material which secures the ribbon to the said support or supports also insulates the ribbon from the poles.

4. A microphone according to Claim 1 or 2, wherein each support consists of a strip of insulating material bridging the gap between the poles of the magnet pro-

ducing the magnetic field in which the ribbon vibrates, the insulating strip being disposed with its edge lying against and secured to the face of the ribbon.

5. A microphone according to Claim 4, wherein one pole of the magnet is provided with a plurality of parallel transverse slots extending from side to side of the pole and constituting a part of the air path to the rear of the ribbon, each support strip being mounted in one of said slots.

6. A microphone according to Claim 4 or 5, wherein two or more of said ribbons each supported at one or more intermediate points, are mounted in parallel relation in the air gaps between three or more parallel poles of a magnet, preferably a permanent magnet, the ribbons being connected in series to form a single current carrying conductor.

7. A microphone according to Claim 6, wherein the conductor is constructed from a single piece of ribbon.

8. A microphone according to Claim 6 or 7, wherein the ribbon is about 3 to 4 m.m. wide and each ribbon length between a pair of poles is from about 85 to 90 m.m. in length and is supported at two intermediate points.

9. A microphone according to Claim 6, 7 or 8, wherein four series connected ribbon lengths are supported in the air gaps between five magnet poles.

10. A microphone according to Claim 4, 5, 6, 7, 8 or 9 wherein each ribbon length is virtually divided into two or more freely vibratable parts of different relative effective lengths for the purpose specified.

11. A microphone according to Claim 1, constructed as herein described with reference to Figures 1, 2 and 3 of the accompanying drawing.

12. A microphone according to Claim 1, comprising a single length of ribbon bent into a series of spaced apart parallel ribbon lengths, from about 50 to 55 m.m. long, in combination with a magnet e.g. a permanent magnet having a pair of main pole pieces across which the series of ribbon lengths are secured at their ends, and a plurality of secondary pole pieces disposed in the spaces between the ribbon lengths.

13. A microphone according to Claim 12, wherein the width of the ribbon is from about 3 to 4 m.m. and the total length of ribbon is from about 300 m.m.

14. A microphone according to Claim 12, constructed substantially as herein described with reference to Figure 4 of the accompanying drawings.

Dated this 31st day of July, 1936.

KINGS PATENT AGENCY LIMITED.
BERTRAM T. KING,
Director,
Registered Patent Agents,
146a, Queen Victoria Street,
London, E.C.4,
Agents for the Applicants.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1937.

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig.1.

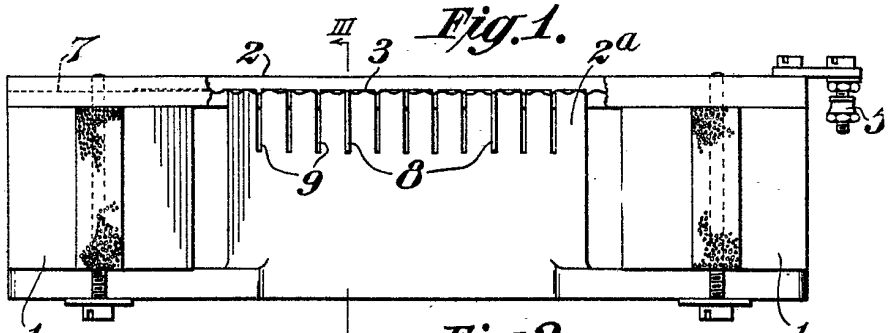


Fig.2.

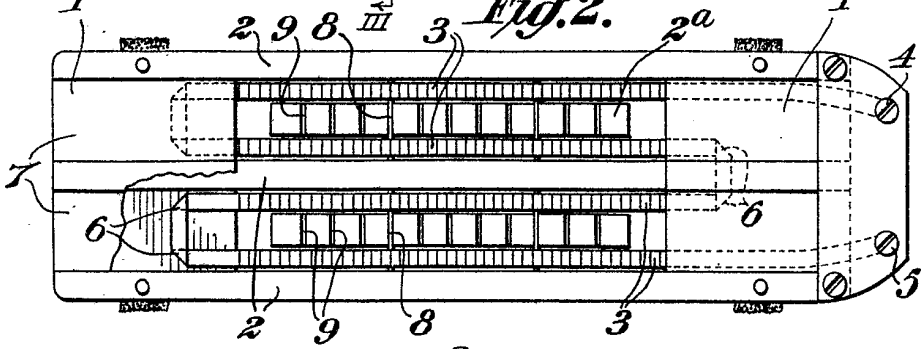


Fig.3.

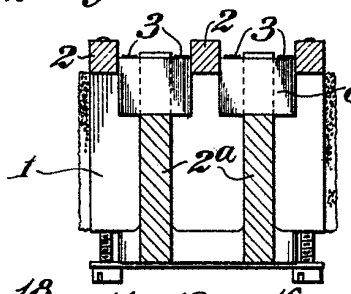
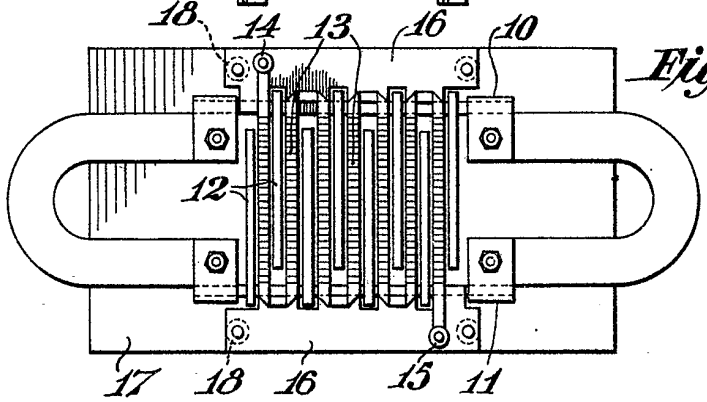


Fig.4.



Malby & Sons, Photo-Lith.