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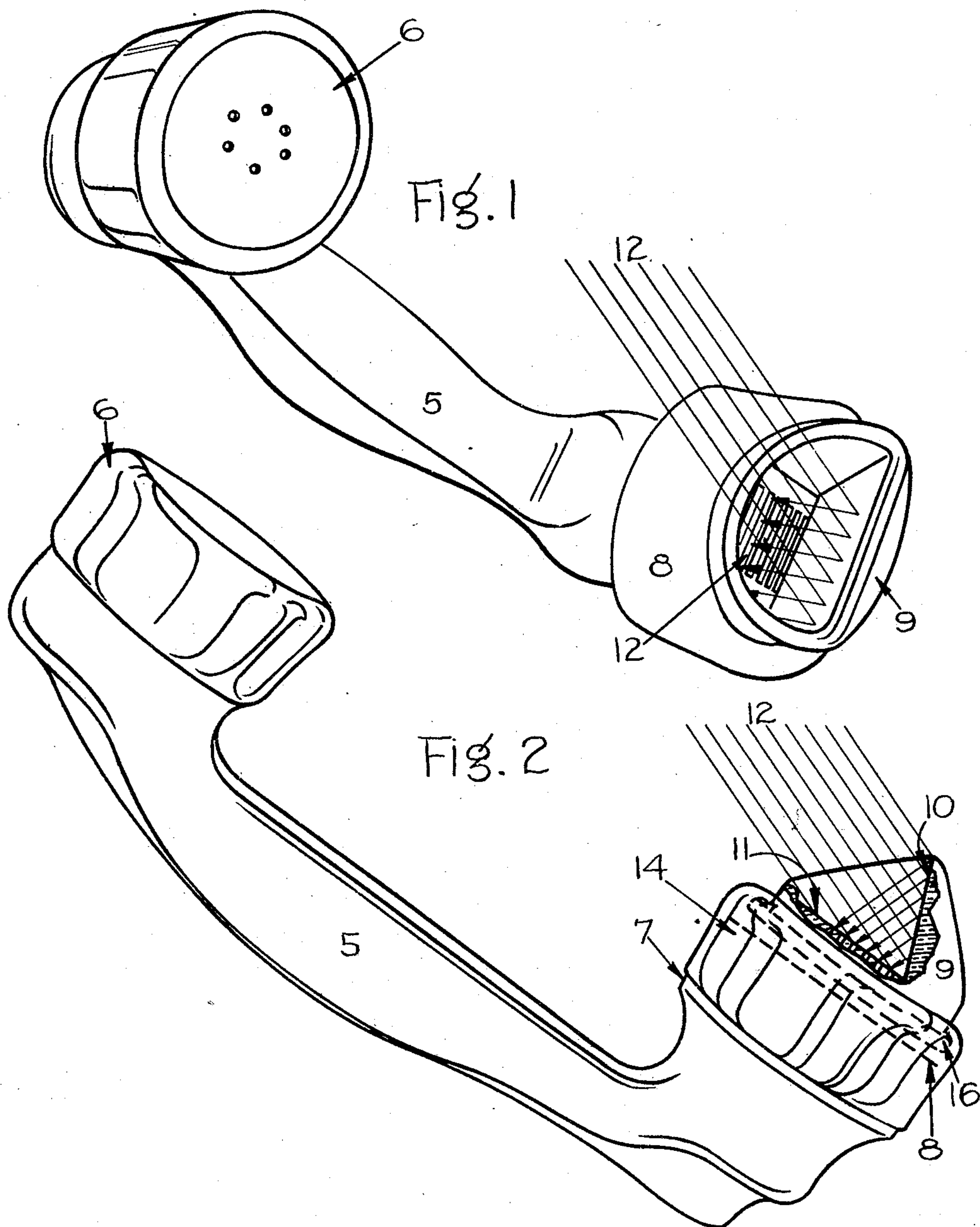
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1,797,891

COMBINED RECEIVER AND MICROPHONE

Filed Oct. 17, 1928

2 Sheets-Sheet 1



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Fig. 4

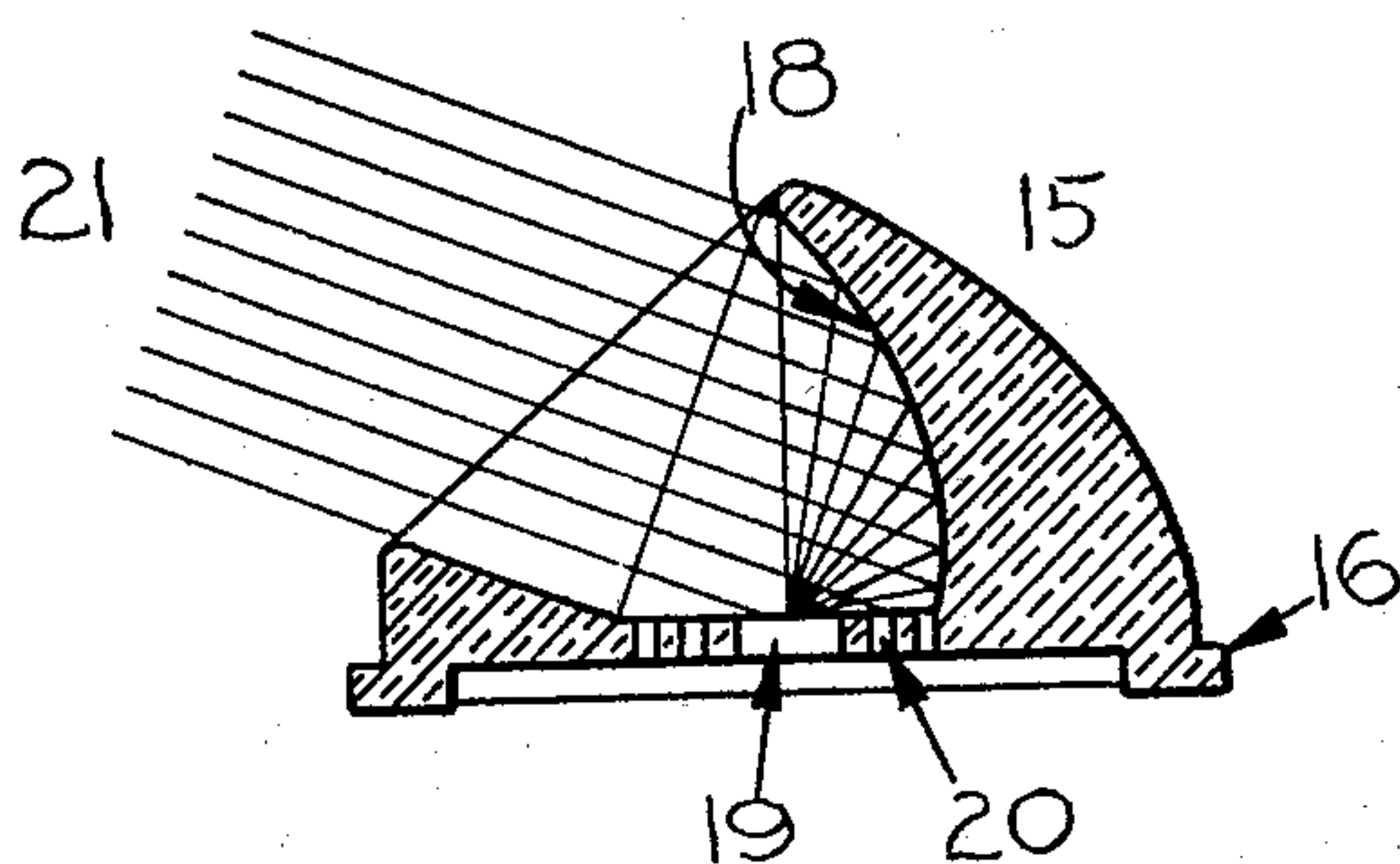
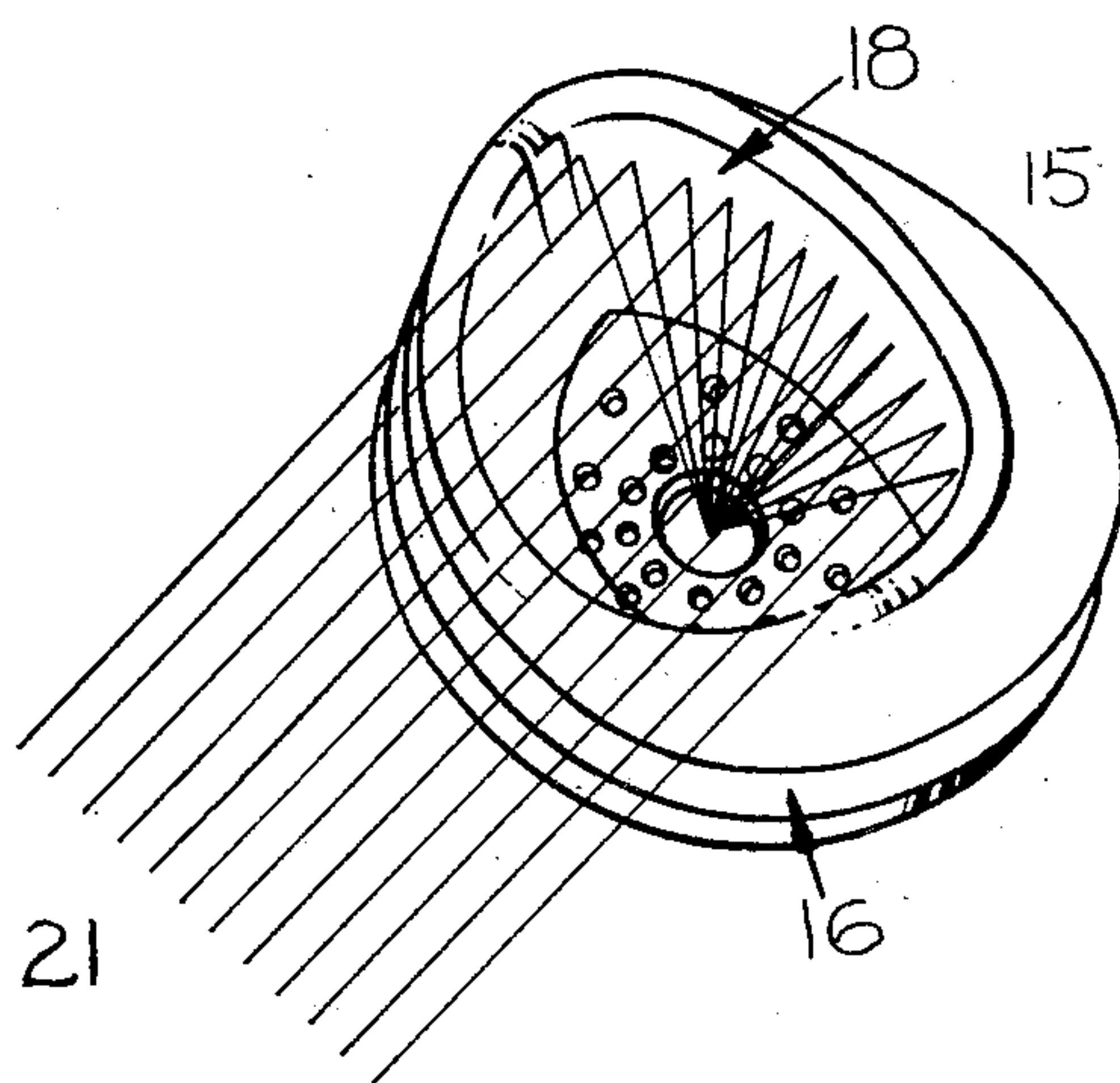


Fig. 3



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UNITED STATES PATENT OFFICE

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COMBINED RECEIVER AND MICROPHONE

Application filed October 17, 1928. Serial No. 313,013.

This invention relates to a combined receiver and microphone known in the art as a hand set.

Combined receivers and transmitters or hand sets have long been recognized as a convenient form of telephone instrument but they have not come into extensive use because of the fact that there was a tendency for howling due to interaction between the receiver and microphone. In addition, the transmission through such types of telephone instruments has not been up to the standard of the well-known desk set since the sound waves were inefficiently applied to the microphone.

In accordance with the present invention a hand set has been designed which practically eliminates all howling or interaction and which greatly improves speech transmission.

The deficient speech transmission of former combined receivers and microphones was due to the fact that in order to provide a hand set that was compact and convenient for use it was necessary to have the microphone diaphragm substantially parallel to the plane of the receiver so that when the receiver was applied to the ear of the user the voice waves were not transmitted directly against the diaphragm but were propagated at an angle of about 20 degrees to the plane thereof. Funnel-shaped mouthpieces have been used to direct speech against the diaphragm, but such a design has failed to take into consideration the fact that substantially all of the voice waves which strike the transmitter diaphragm under these conditions must be reflected waves. These mouthpieces have usually developed interference between the various reflected sound waves so that the efficiency thereof was greatly reduced.

One of the features of the present invention includes the proper relation between the receiver, microphone and mouthpiece of the microphone, so that the voice waves are efficiently reflected toward the proper portion of the microphone diaphragm when the receiver is applied to the ear of the telephone user. Other features will appear from the detailed description and from the claims.

Referring to the drawings, Figure 1 is a

perspective view and Figure 2 is a side view with portions broken away, showing the construction of the mouthpiece of a combined receiver and microphone or hand set. Figures 3 and 4 represent a cross sectional view and a perspective view respectively of a different form of mouthpiece for use instead of the mouthpiece shown in Figures 1 and 2.

Referring to the form of the invention shown in Figures 1 and 2, 5 designates a handle of proper contour to be easily grasped and held by the user. At the upper end of this handle there is secured a flat receiver 6 of any well-known type, while the lower end of the handle is provided with a hollow, externally threaded extension 7 at right angles to the main portion of the handle, in which there is mounted a microphone or transmitter having a diaphragm 8 indicated by a heavy dotted line. The diaphragm of the transmitter is in a plane substantially parallel to but at the right of the plane of the receiver diaphragm as shown in Figure 2 so that the receiver 6 and transmitter may be properly positioned for listening and talking. The transmitter and its diaphragm are covered by a mouthpiece generally designated 13 which is provided with suitable lugs to properly position it with respect to the handle and with a shoulder 16. A ring 14 of cast material engages the shoulder 16 and is screwed on to the extension 7. The mouthpiece 8 has an inner surface 11 substantially parallel with the transmitter diaphragm and an extension 9, the inner surface 10 of which is a plane. The surface 11 has a series of elongated openings 12 therein of such length and so positioned that they are adjacent a predetermined area near the center of the transmitter diaphragm. The flat surface 10 defines such an angle with the surface 11 that the sound waves represented by the parallel lines 12 strike the surface 10 where they are reflected through the slots 12 and are concentrated on an area near the center of the diaphragm 8.

In the past various funnel-shaped mouthpieces have been used but in these the reflecting surface was such that many of the waves instead of being reflected against the trans-

mitter diaphragm were dissipated against the interior of the mouthpiece and even those that were reflected against the transmitter were inefficiently used. Even in the cylindrical type of mouthpiece the sound waves were reflected at various angles and struck the diaphragm at different angles and in addition had unequal concentration upon the effective surface of the diaphragm. Furthermore, the lengths of the paths of the different reflected waves were not equal and therefore the waves arrived at the diaphragm out of phase with each other especially at frequencies above approximately 1000 cycles. It will be recognized that this materially reduced the efficiency since one wave frequently tended to neutralize another. However, where a plane reflecting surface such as shown in Figures 1 and 2 is used certain of these difficulties have been removed since substantially all of the sound waves are reflected through the same angle and these waves impinge upon the diaphragm in such a manner that all of the angles of incidence are equal. In addition to these reflected sound waves, certain of the direct waves strike the diaphragm as indicated by the three left hand rays of the group designated 12 in Figure 2. In this arrangement, since the slots 12 are properly positioned, there is a uniform distribution of the reflected sound waves over the used part of the diaphragm with a resulting improvement in efficiency.

In the arrangement shown in Figures 3 and 4 there is disclosed an arrangement for efficiently applying reflected sound waves to the diaphragm of the transmitter. It will be understood that the mouthpiece shown in these figures may be substituted for that shown in Figures 1 and 2. This mouthpiece includes a cup-shaped molded structure generally designated 15 which may be attached to the extension 7 of the handle of Figure 2 by any suitable means although a ring engaging shoulder 16 on the mouthpiece may be provided with screw threads to engage similar threads on the extension 7. The inner surface 18 of the mouthpiece is defined by a paraboloid of revolution with its axis parallel to rays 12 representing sound waves and with its focal point at the opening 19 in the portion of the mouthpiece adjacent the diaphragm of the microphone. This opening 19 is near the center of the diaphragm so that sound waves reflected therethrough strike its most sensitive portion. The mouthpiece also has a series of openings 20 uniformly spaced surrounding the opening 19 for a purpose to be described. With this mouthpiece sound waves represented by the parallel lines 21 strike the surface 18 and are reflected in such a manner that they strike the center of the diaphragm. It will be noted that the lengths of all these paths from the source of sound to the diaphragm is the same which means that

there will be no interference between the several waves. All the waves entering the mouthpiece are utilized to actuate the diaphragm since even the unreflected waves pass through the series of openings 20 and strike the diaphragm although these waves are not as efficiently used as those that are reflected.

It will thus be seen that applicant has produced a mouthpiece for a combined receiver and microphone in which both direct and reflected sound waves are utilized and in which the reflected waves are uniformly distributed over a predetermined area near the center of the transmitter diaphragm.

What I claim is:

1. A mouthpiece for a combined receiver and transmitter having a plurality of openings uniformly spaced in a plane adjacent a predetermined area of a transmitter diaphragm and having a reflecting surface intersecting said plane such that sound waves entering the mouthpiece pass through said openings with substantially no reflection of any sound waves outside of the mouthpiece.
2. A mouthpiece for a combined receiver and transmitter mounted adjacent the diaphragm of said transmitter, said mouthpiece having a central opening and a plurality of uniformly spaced openings leading to said diaphragm, said mouthpiece having a surface defined by a portion of a paraboloid of revolution for reflecting sound waves through said first opening, said surrounding openings serving to pass direct sound waves to said transmitter diaphragm.
3. A mouthpiece for a combined receiver and transmitter mounted adjacent the diaphragm of said transmitter, said mouthpiece having an opening to said diaphragm and a surface defined by a portion of a paraboloid of revolution for reflecting sound waves through said opening, said paraboloid of revolution having one of its foci adjacent said opening and said diaphragm.
4. In a combined receiver and transmitter a handle having a receiver with its flat surface mounted on and parallel to the long axis of said handle, a transmitter including a diaphragm mounted on said handle in spaced relation to said receiver, said transmitter being mounted in a plane substantially parallel to but at a greater distance from said handle than said receiver, and a mouthpiece for said transmitter having an opening therein adjacent said diaphragm and having a surface defined by a portion of a paraboloid of revolution for reflecting sound waves into said opening, said paraboloid of revolution having one of its foci adjacent said opening.
5. A mouthpiece for a combined receiver and transmitter mounted adjacent the diaphragm of said transmitter, said mouthpiece having an opening leading to said diaphragm and having a reflecting surface defined by a

portion of a paraboloid of revolution whose axis is parallel to the normal direction of movement of sound waves against said surface.

5 6. A mouthpiece for a transmitter provided with a diaphragm, said mouthpiece having a perforated portion substantially parallel to said diaphragm and a second portion
10 joined to said perforated portion at an angle thereto for reflecting through said perforated portion substantially all of the sound waves striking said second portion.

In witness whereof, I hereunto subscribe my name this 8th day of October, A. D. 1928.

15 FREDERIC C. YOUNG.

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