

Oct. 29, 1929.

E. L. NORTON

1,733,554

MAGNETIC DEVICE

Filed Oct. 30, 1926

Fig. 1.

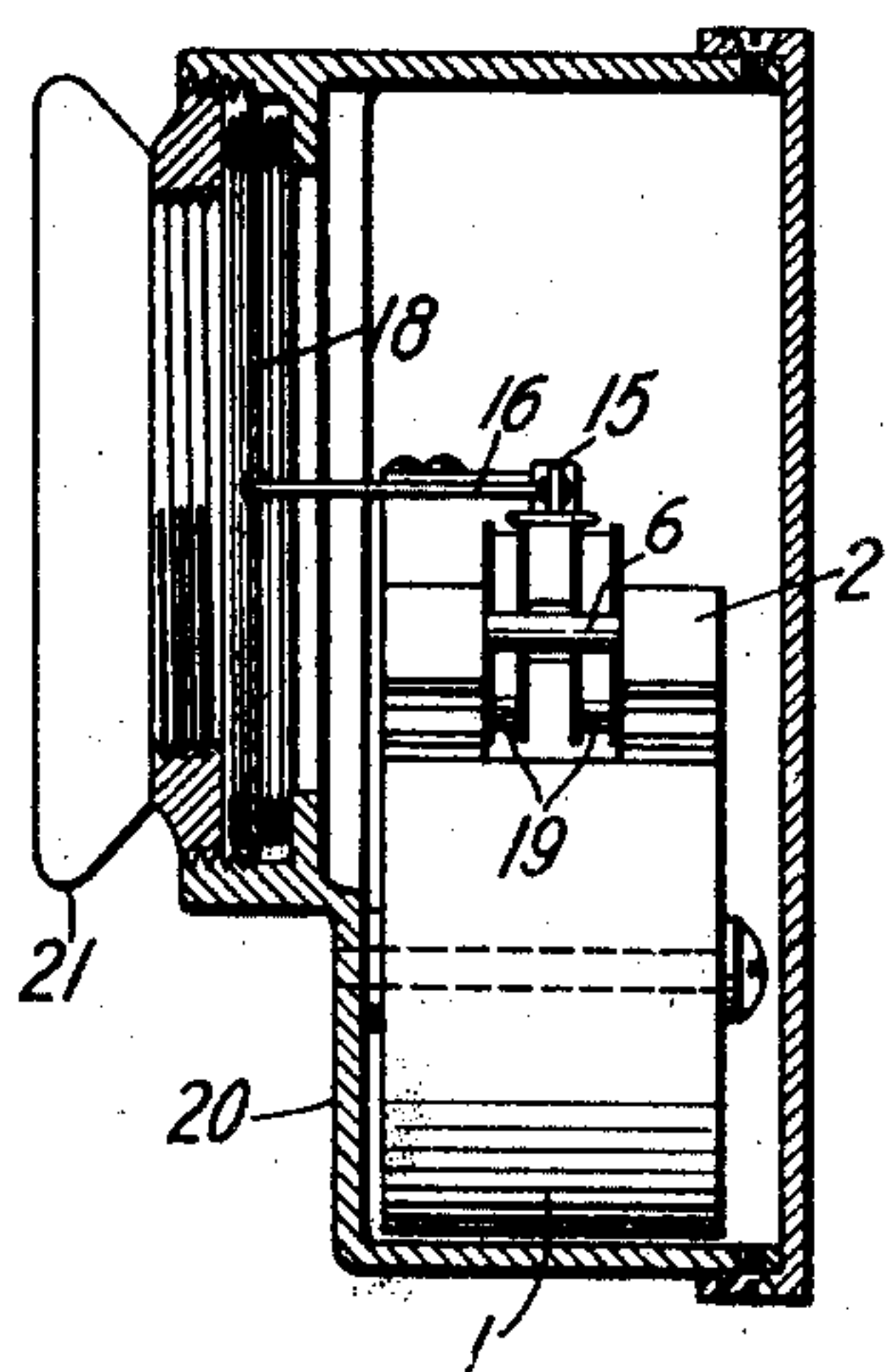


Fig. 2.

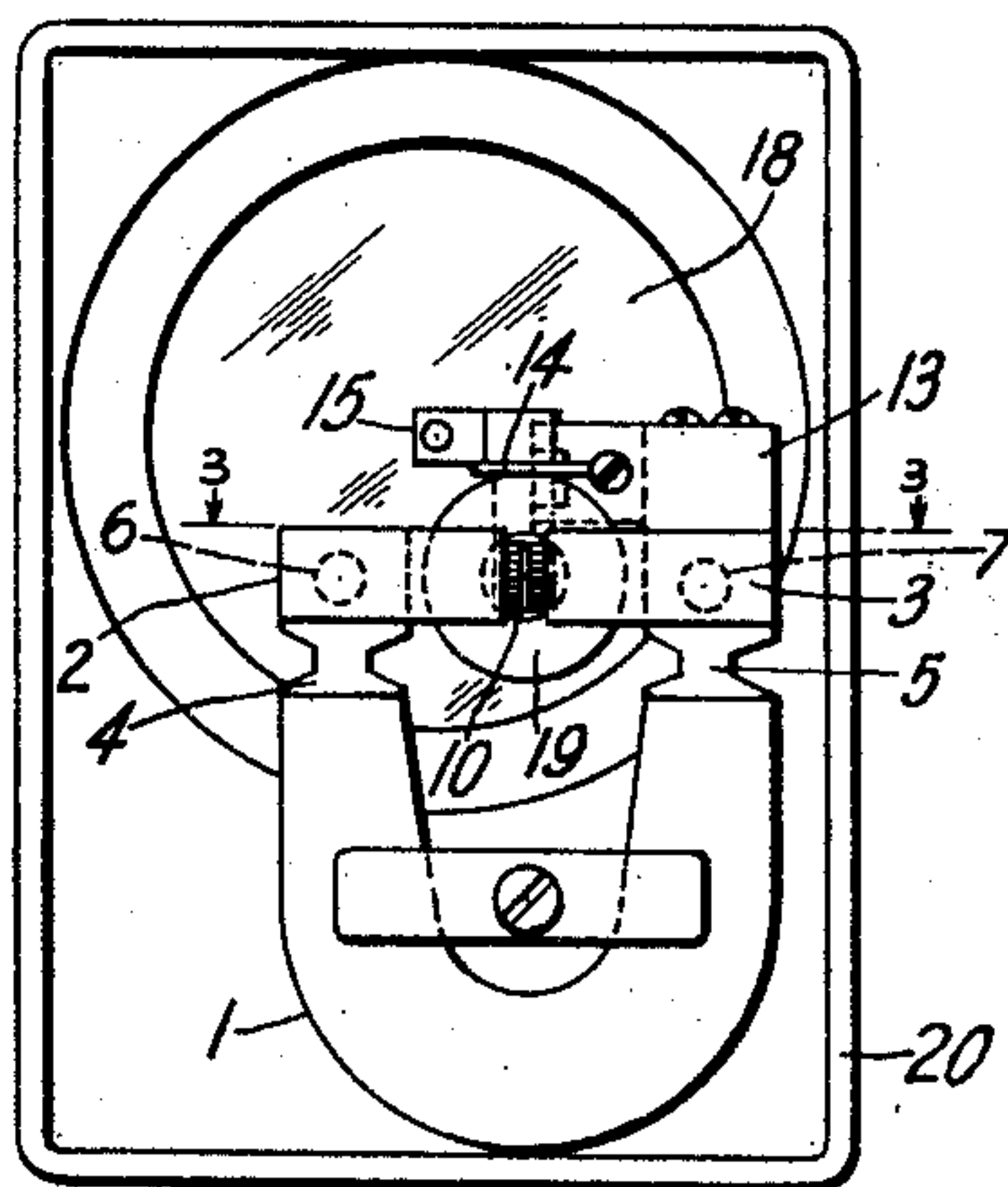


Fig. 3.

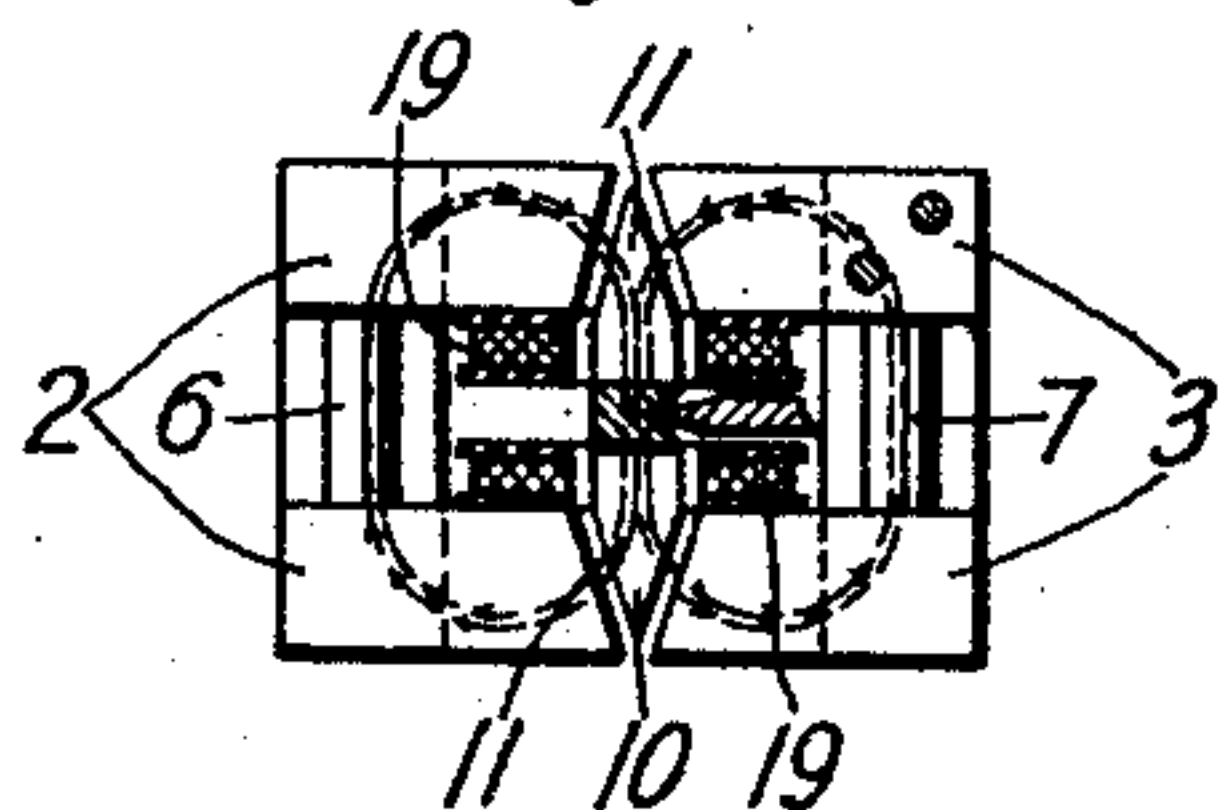
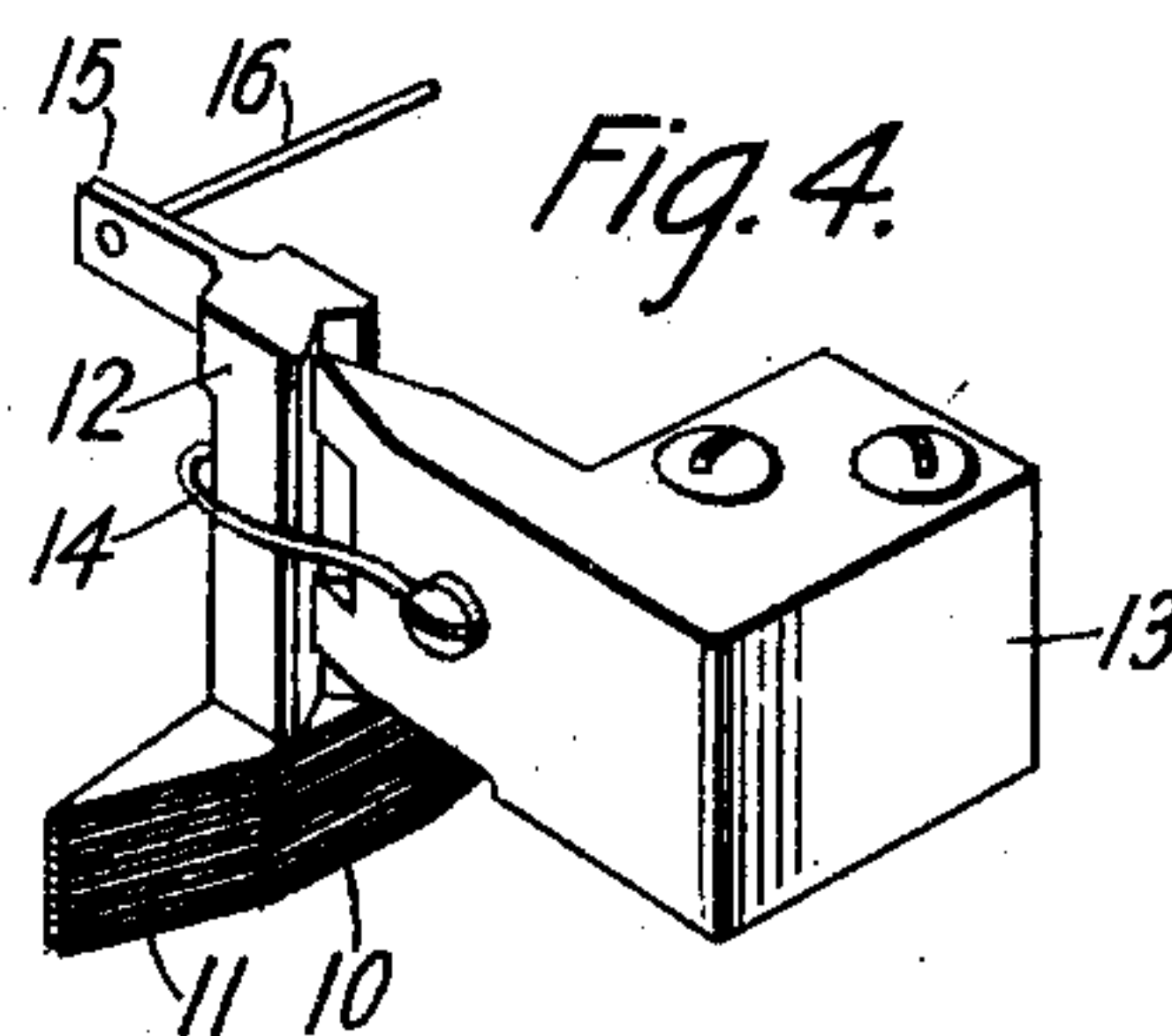


Fig. 4.



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UNITED STATES PATENT OFFICE

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MAGNETIC DEVICE

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This invention relates to magnetic devices and more particularly to an arrangement for controlling the magnitude of response of signal actuated devices such as telephone receivers.

In accordance with this invention there is provided a telephone receiver in which acoustic shock is eliminated by the use of inserts of magnetic material in the flux circuit which saturate abruptly and from which the major portion of the direct flux from the permanent magnet is at all times excluded. Since that variety of permalloy composed of $78\frac{1}{2}\%$ nickel and $21\frac{1}{2}\%$ iron is a material in which saturation sets in abruptly, it is preferred to use this material for the flux limiting elements, however, other varieties of permalloy may be used. Permalloy may be defined as an alloy containing nickel to the extent of 30% or more, balance chiefly iron, and having the characteristic property of high initial permeability.

By excluding the major portion of the flux of the permanent magnet from the flux limiting elements it is possible to make these elements small and to avoid decrease in the cut-off point which would otherwise occur as the permanent magnet deteriorates in strength. Moreover the differences in strength of various magnets as ordinarily employed in the manufacture of receivers may be neglected in the design of these flux limiting elements.

A device constructed on this principle may take the form of an electromagnetic structure of the general type disclosed in U. S. Patent of H. C. Harrison, No. 1,709,571, granted April 16, 1929, modified in accordance with this invention by splitting each pole piece transversely and inserting a section of permalloy between the split parts. This embodiment of the invention is described in detail in the following specification and illustrated in the drawings.

Fig. 1 is a side elevational view, partly in section, of a telephone receiver containing

electromagnetic elements constructed in accordance with this invention; Fig. 2 is a rear elevational view of the electromagnetic elements shown in Fig. 1; Fig. 3 is a cross section taken on line 3—3 of Fig. 2; while Fig. 4 shows the armature of the electromagnetic device and its suspension means.

Referring now to the drawing, the electromagnetic device comprises a permanent steady-field U-shaped magnet 1, on the ends of which are mounted pole pieces 2 and 3, which, however, are separated from direct connection with these ends by means of permalloy inserts 4 and 5. These inserts are provided to give uniform magnetic action from magnets varying in strength, as described and shown in the above mentioned patent. They constantly limit the flux by virtue of being constantly saturated.

It will be noted that the pole pieces 2 and 3 are each split in two parts and connected together respectively by pins 6 and 7 of reduced cross sections. These pins are preferably made of permalloy or other suitable material. Between the pole pieces 2 and 3 is mounted the armature 10 having wedged shaped extensions 11 in position to be acted upon by the separate parts of the pole pieces 2 and 3. This arrangement is clearly shown in Fig. 3. The armature is secured to a mounting member 12 extended at right angle to the extensions 11. This member is provided with a groove registering with a knife-edged portion extending from the mounting block 13, which in turn is attached by means of screws to the upper surface of one part of the pole piece 3. The armature is held in place by a spring 14 secured at one end to the mounting block 13 and extending beyond and over the member 12 so as to press it against the knife edge on the block 13. The spring 14 is also used to balance the armature against the pull of field. The angular extension 15 on the member 12 is employed to transmit motions of the armature to the diaphragm 18

through the connecting rod 16. The energizing coils 19 for the armature are mounted on either side of the member 12 around the extensions 11 of the armature 10 so that the armature is free to move in and be influenced by electromagnetic fields produced by the coils when energized by fluctuating currents. A housing 20 is provided for enclosing this magnetic structure and the ear piece 21 is arranged therein as shown for the purpose of utilizing the electromagnetic element as a receiver.

Referring now to the functions of the device it is evident that when the coils 19 are energized by a fluctuating current, such as, for example, the talking current in ordinary telephone circuits, the varying magnetic flux component produced by these coils initially passes primarily through the main portions of the armature, the extensions 11, pole pieces 2 and 3 and the permalloy inserts 6 and 7, along the paths indicated by the arrow points in Fig. 3. This flux tends to displace the armature from its balanced position between the pole pieces in accordance with the fluctuations of the energizing current. In view of the restricted paths for the flux through the permalloy inserts 6 and 7 and due to the fact that these inserts reach the saturation point on a rather small increase in the magnetic flux beyond the maximum operating value, the armature will not be noticeably displaced beyond the maximum operating limit by abnormal currents, such as ordinarily produce acoustic shock. The displacement effects up to the saturation point are, as in the usual construction, substantially proportional to the amplitudes of the current variations, and the armature, therefore, under such circumstances acts to reproduce corresponding acoustic effects through the diaphragm as in any ordinary receiving unit having a similar structure.

In the embodiment of the invention herein described it is impracticable to exclude all of the flux derived from the permanent magnet from the flux limiting elements except when the armature is in a balanced condition; that is, midway between the poles. When the armature moves from this position the system is unbalanced with respect to the flux from the magnet. Some of this flux then passes through the armature lengthwise and some of it through the permalloy inserts. But this unbalanced variable component may be made small compared with the total flux and will therefore vary but little with relatively large variations in the strength of the permanent magnet. The current limiting elements may, therefore, as explained above, be designed to have a cut-off point just above the operating range without danger of moving the cut-off point within the operating range or removing it unnecessarily far from the operating range by changes in the

strength of the magnet or the substitution of a different magnet.

It is evident that the invention is not limited to any particular construction but may be applied in various ways to different types of apparatus. For example, the flux limiting inserts or sections may be located either in the armature itself or in the magnetizing system therefor provided they are not placed so as to be traversed by the steady flux component.

What is claimed is:

1. A magnetic device comprising means for producing magnetic flux having a steady component and a variable component, and means traversed by the variable flux component but not by the steady flux component for preventing abnormal flux densities in the variable flux path.

2. A telephone receiver comprising means for producing magnetic flux comprising a steady component and a variable component, and means traversed by the variable flux component but not by the steady flux component for limiting the flux in the variable flux path.

3. An electromagnetic device comprising a field magnet, an armature, a coil for variably energizing said device, and means in the path traversed by the variable flux component for limiting the maximum flux through said path and so arranged as not to be traversed by the steady flux component.

4. An electromagnetic device comprising a field magnet, pole pieces for said magnet, an armature between said pole pieces, a winding for producing variable flux through said armature and said pole pieces, and means in said pole pieces for limiting the maximum value of the variable flux component.

5. An electromagnetic device comprising a field magnet, an armature, a coil for variably energizing said device, and a permalloy section traversed by the variable flux but not by the steady flux for limiting the maximum flux through the variable flux path.

6. An electromagnetic device comprising a permanent magnet, a coil for variably energizing said device, and means comprising permalloy sections in the path traversed by the variable flux component for limiting the maximum flux through said path, said permalloy sections being so placed as not to be traversed by the steady flux component.

7. An electromagnetic device comprising a field magnet, an armature, means for variably energizing said device, and means for limiting the maximum response of the armature to variable energizations to substantially uniform displacement for energizations tending to displace the armature beyond said uniform displacement limit, said means being associated with the field magnet in such a manner as to be independent of the steady flux produced thereby.

8. An electromagnetic device comprising a

field magnet, an armature between the poles
of said magnet, a winding for producing a
variable magnetic flux through said arma-
ture and poles, and means comprising perm-
5 alloy sections in the pole pieces of said mag-
net for limiting the variable flux to a prede-
termined amount substantially irrespective of
the changes in the amplitude of the energiz-
ing force in said winding tending to produce
10 magnetic flux above said amount.

In witness whereof, I hereunto subscribe
my name this 29th day of October A. D. 1926.

EDWARD L. NORTON.

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