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1,690,201

W. E. MOUGEY

SIGNALING CONDUCTOR

Filed Jan. 31, 1927

Fig. 1.

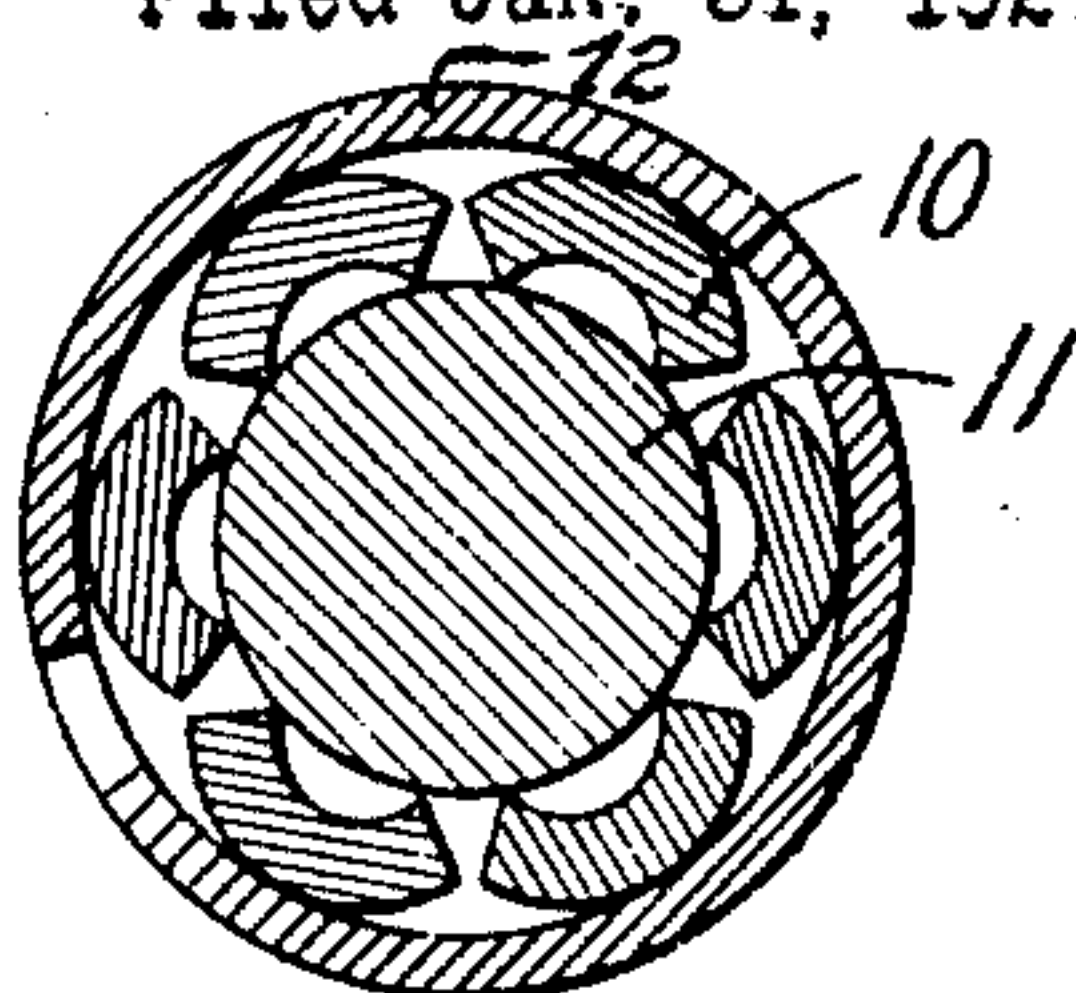


Fig. 2.

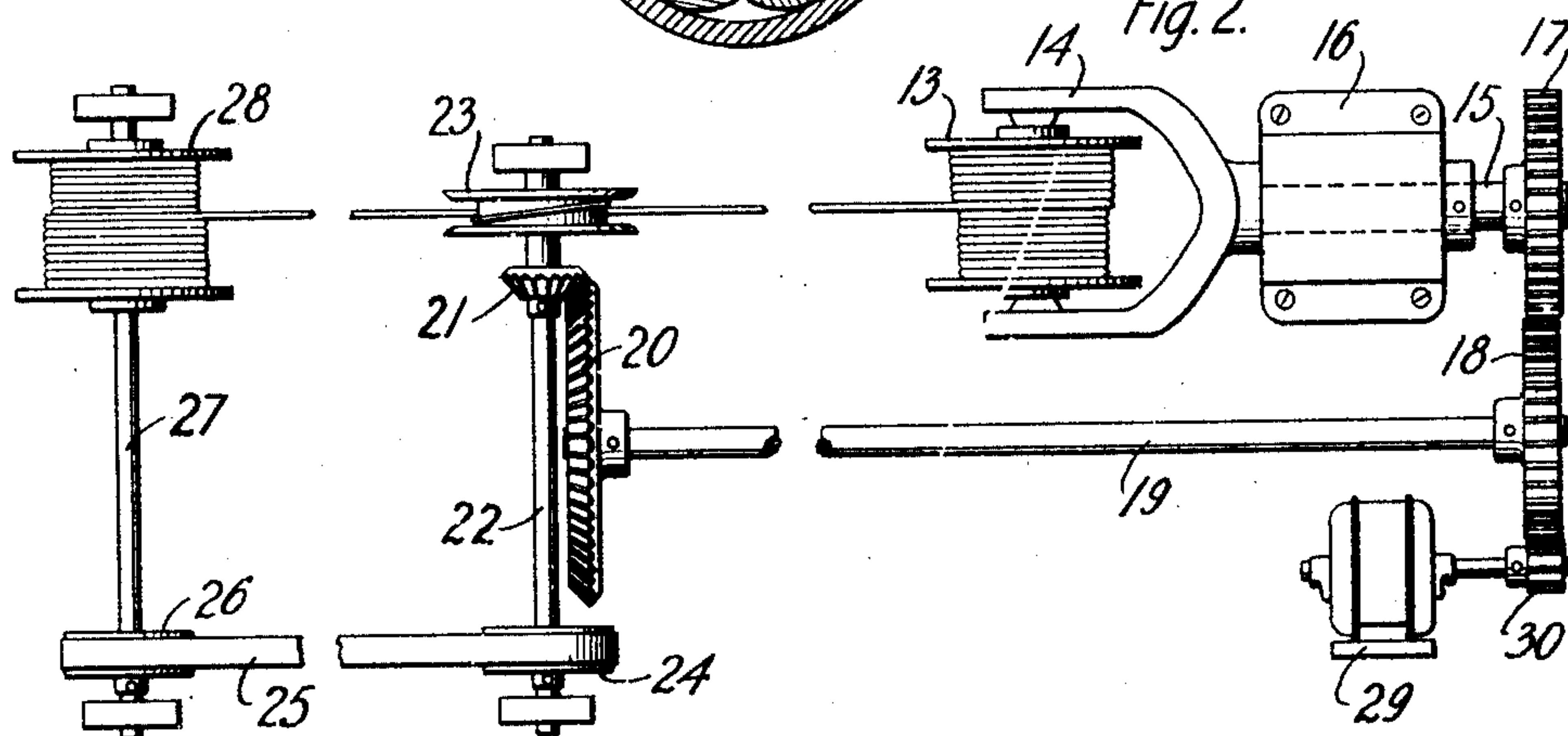


Fig. 3.

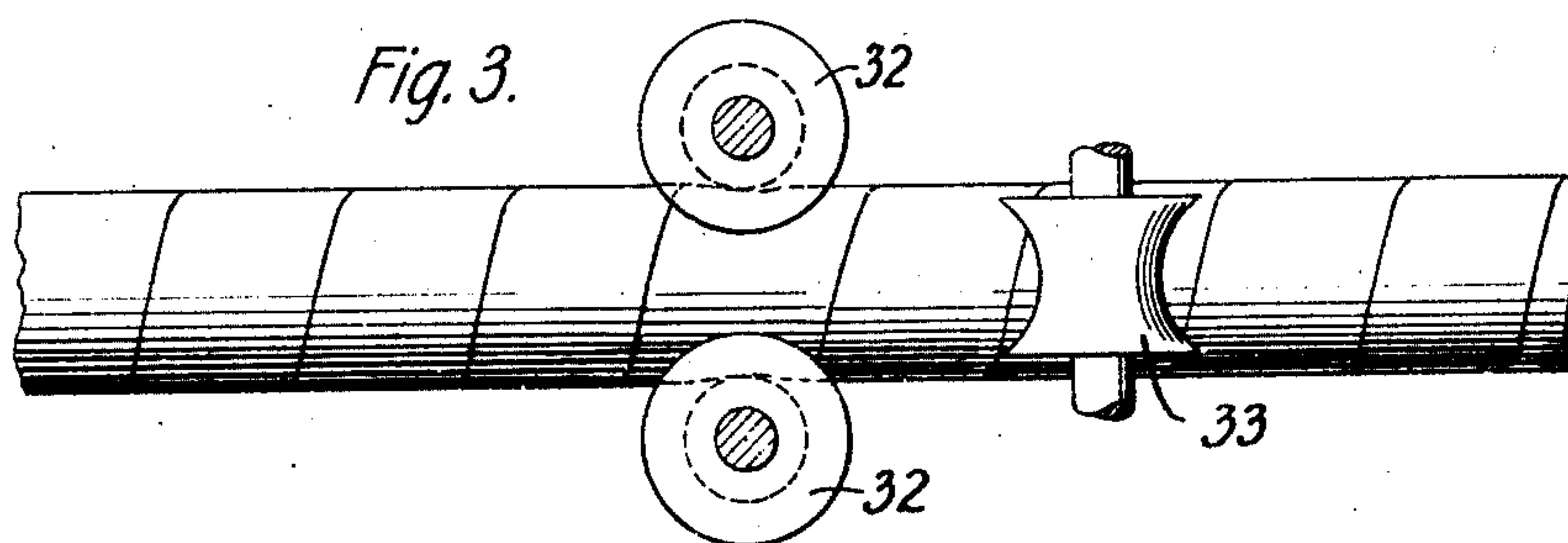


Fig. 4.

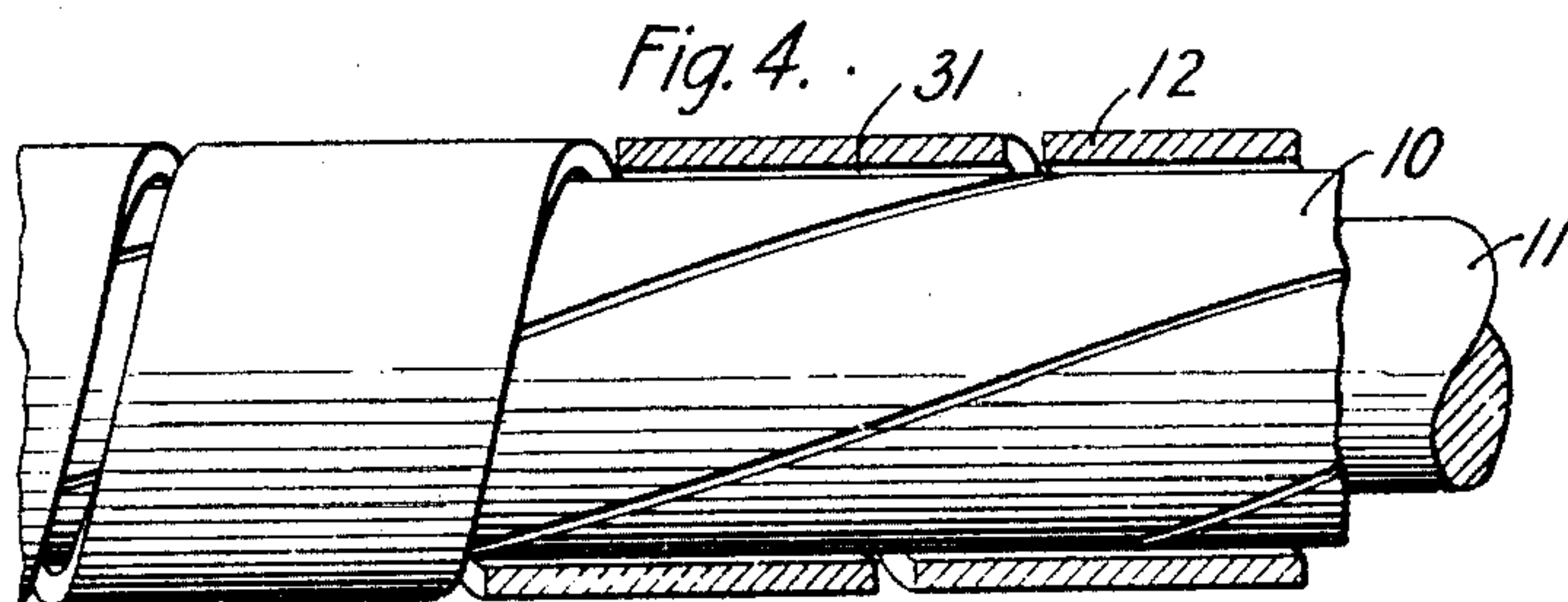
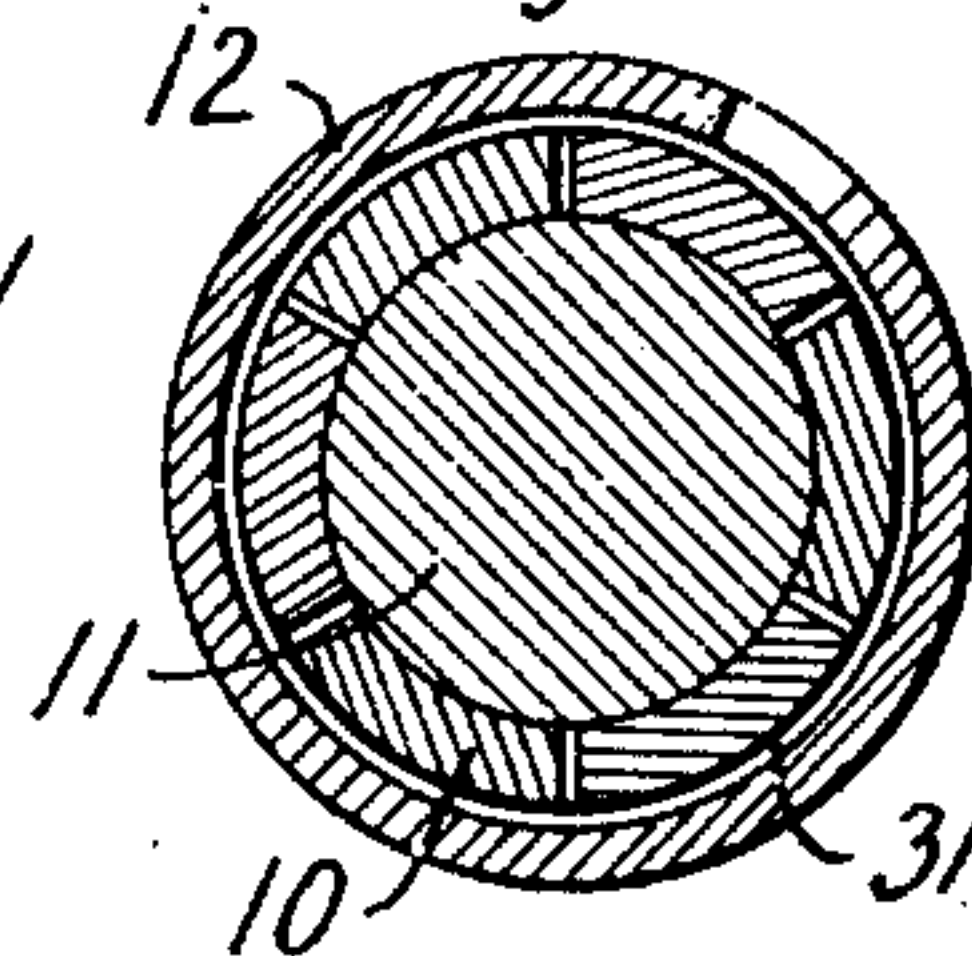


Fig. 5.



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UNITED STATES PATENT OFFICE.

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SIGNALING CONDUCTOR.

Application filed January 31, 1927, Serial No. 164 795, and in Great Britain June 15, 1926.

This invention relates to loaded conductors and more particularly to conductors which are loaded with a uniform covering of magnetic material.

5 The object of the invention is to obtain a slight spacing of the magnetic covering from the conductor to permit the loaded conductor to be heat-treated without deleterious effects which are present when no spacing
10 is provided.

In the attainment of this object the usual form of conductor comprising a central copper wire overlaid with spiralled copper tapes, is employed, but these tapes are applied to
15 the central wire in such a manner that only their edges are in contact with the central wire, and, after the loading material has been laid on in the usual manner, the completed conductor is compressed to force the copper
20 tape to conform more closely to the surface of the central wire, thus reducing the effective diameter of the stranded copper conductor. The applied force is insufficient to produce a set or permanent deformation in the loading
25 material. Another method of causing the tapes to conform more closely to the shape of the central wire is to subject the conductor to twisting in such a direction as to force the tapes into closer contact with the central wire.

30 Various magnetic materials have been proposed for inductive loading. In the continuous form of loading, the usual procedure is to form the material into wire or tape, which is then wound around the conductor to
35 form a continuous layer of magnetic material. Among the most suitable materials for loading are certain alloys including metals of the magnetic group, notably nickel and iron, in various proportions, with or without other
40 ingredients. In order to obtain high permeability, or constancy of permeability, or certain other desirable characteristics in alloys of this sort, it is found to be necessary or at least desirable to subject the material,
45 after it has been applied to the conductor, to a heat treatment. It has been found, for example, that if loading material comprising about 78½% nickel and 21½% iron, is wound tightly on the conductor its permeability after heat treatment may be very much
50 less than if the material is spaced from the conductor. Various explanations have been proposed to account for this observed effect. It has been suggested that stresses which ad-

versely affect the permeability of the loading 55 material, are set up due to the unequal expansion or contraction of the conducting and loading materials during the heat treatment or subsequent cooling. It has also been suggested that during the heat treatment ad- 60hesion takes place between the copper conductor and the loading material which sets up stresses which adversely affect the permeability of the loading material.

It has been found that this undesirable ef- 65fect may be reduced, and indeed substantially eliminated, if some provision is made to provide a small space between the loading material and the conductor during heat treatment or to prevent the conductor and loading ma- 70terial from being forced into intimate contact during heat treatment.

It is common practice in making a loaded conductor to provide a central conducting wire, with a circular cross-section, and to 75strand upon the periphery of the wire a plurality of flat tapes. The whole is usually rolled so that the flat tapes are pressed into contact with the central wire and the composite conductor is given a substantially circular periphery. The loading material, in the 80form of wire or tape, is wound about the stranded conductor.

A more detailed description of the invention follows and is illustrated in the accom- 85panying drawing.

Fig. 1 illustrates in cross-section the initial relative positions of the strands and the magnetic material on the central wire;

Fig. 2 shows one method of securing loose- 90ness between the conducting strands and the magnetic material by twisting the conductor;

Fig. 3 illustrates an alternative method of securing looseness in the conductor by pass- 95ing between rollers;

Fig. 4 is an enlarged view of a section of the conductor with portions cut away to clearly illustrate the invention; and

Fig. 5 shows in cross-section the composite conductor with the copper strands conform- 100ing to the surface of the central wire thereby providing a spaced between the strands and the magnetic material.

Referring to Fig. 1 of the drawing, a plu- 105rality of conducting strands 10 are applied spirally and relatively loosely to a cylindrical central wire 11 to form the conducting element of a loaded signaling conductor. The

conducting strands 10 are arcuated before being applied to the central wire 11 so that their inner surfaces have a radius of curvature smaller than the surface of the cylindrical central wire, whereby the conducting strands are only in contact with the central wire along their inner edges. A layer of magnetic material 12 preferably of a nickel-iron alloy in the form of a tape is wound over the conducting strands 10 to form the composite conductor.

Any suitable number of copper strands or tapes, for example four or six, may of course be employed and the width of these should be chosen so as to allow room for them when they are forced to conform more closely to the central wire.

The conducting strands 10 are then compressed by any suitable means into more complete contact with the central wire. One method of accomplishing this result is shown in Fig. 2 in which a supply reel 13 upon which the loaded conductor is wound, is mounted in a forked support 14, the rotatable shaft 15 of which is supported by a suitable bearing 16. Upon the end of the shaft 15 there is securely fixed a gear 17 which meshes with a similar gear 18, rigidly secured to a driving shaft 19 upon the opposite end of which is mounted a bevelled gear 20. The bevelled gear 20 meshes with a bevelled pinion 21 mounted on a shaft 22 which also carries a capstan 23, and a pulley 24 at opposite ends thereof. A belt 25 passing over pulley 24 and a similar pulley 26 on a shaft 27 is arranged to rotate a reel 28 upon which the loaded conductor is wound from the capstan 23. The driving shaft 19 is rotated by means of a motor 29 upon the shaft of which is a pinion 30 engaging the gear 18 and since the capstan 23 and the reel 13 are driven by the shaft 19, the reel 13 is rotated with respect to the linear travel of the conductor. The rotation of reel 13 causes the length of conductor extending between reel 13 and the capstan 23 to be twisted in such a direction that the copper strands 10 are tightened upon the central wire 11 and since the magnetic tape 12 is wound in an opposite direction, this material is loosened and a slight spacing therefore occurs between the tape and the conductor strands. The relative positions of the central wire, the strands and the magnetic tape is more clearly shown in Figs. 4 and 5 in which the strands 10 conform to the surface of the central wire 11 and the magnetic tape assumes a loosened position around the copper strands with a small spacing 31 between the strands and the tape.

Another method of obtaining the same result is shown in Fig. 3 in which one pair of opposed grooved rollers 32 and a second pair of grooved rollers 33, one of which is shown, arranged at right angles to the rollers 32,

force the copper strands 10 into conformity with the central wire and thereby provide the necessary spacing between the strands and the magnetic tape. The loading tape 12 assumes a loosened position around the conductor because of its springy character, while the soft copper strands remain in more complete contact with the central wire 11. These arrangements provide a sufficient space for the expansion and contraction of the conducting element of the conductor during the subsequent heat treatment and cooling process without seriously affecting the magnetic properties of the loading material.

While the above detailed description relates to a specific embodiment of the invention various other modifications may be devised to accomplish the same result and the invention is only to be limited within the scope of the appended claims.

What is claimed is:

1. The method of producing a signaling conductor having an inner portion and a metallic covering fitting said inner portion loosely, which comprises applying a strand having edges to a cylindrical strand so that only the edges of the strand are in contact with the cylindrical strand to form the inner portion, applying a metallic covering over said inner portion, and forcing said applied strand into substantially complete contact with said cylindrical strand, to space said metallic covering therefrom.

2. The method of producing a signaling conductor having an inner conducting portion and a metallic wrapping on said conducting portion, which comprises applying a strand having edges to a cylindrical strand so that only the edges are in contact with the cylindrical strand, wrapping a metallic layer about said strand, and twisting the wrapped conductor, to force the applied strand to conform to the surface of the cylindrical strand.

3. The method of producing a signaling conductor having a conducting portion and a metallic covering fitting said conducting portion loosely which comprises forming a conducting strand of material which may be comparatively easily deformed and of such shape that it will have contact only at its edges with a central strand upon which it is to be wrapped, wrapping said conducting strand about said central strand to form said inner portion, applying the metallic covering by wrapping helically thereabout a material which is less easily deformed, and subsequently deforming said easily deformed strand without permanently deforming the covering.

4. The method of loading a signaling conductor with loading material which requires heat treatment to give it a desired electrical or magnetic characteristic, which comprises applying a metallic strand to a cylindrical central strand, said applied strand being arcu-

ated and having a surface curvature of less radius than the surface of said central strand so as not to conform to the cylindrical surface of the central strand, applying a layer
5 of loading material around said arcuated strand, and subsequently forcing said arcuated strand into conformity with the surface of said central strand.

10 5. The method of loading a signaling conductor with loading material which requires heat treatment to give it a desired electrical or magnetic characteristic which comprises wrapping around a cylindrical strand a plu-
15 rality of metallic strands so shaped as to have contact with the cylindrical strand only at their edges, wrapping the loading material around said metallic strands, and subsequently changing the diameter of said me-

tallic strands whereby the loading material is loosened.

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6. The method of loading a signaling conductor with loading material which requires heat treatment to give it a desired electrical or magnetic characteristic which comprises
25 wrapping around a cylindrical strand a plurality of metallic strands so shaped as to have contact with the cylindrical strand only at their edges, wrapping the loading material around said metallic strands, and subsequently
30 twisting the loaded conductor to reduce the diameter of the wrapped metallic strands whereby the loading material is loosened.

In witness whereof, I hereunto subscribe my name this 29th day of January, A. D., 1927.

WILBUR E. MOUGEY.