No. 826,627. PATENTED JULY 24, 1906.

L. H. THULLEN.

SLOW RELEASE MAGNET.

APPLICATION FILED DEC. 22, 1903.

4 SHEETS—SHEET 1.

Fig. 1.

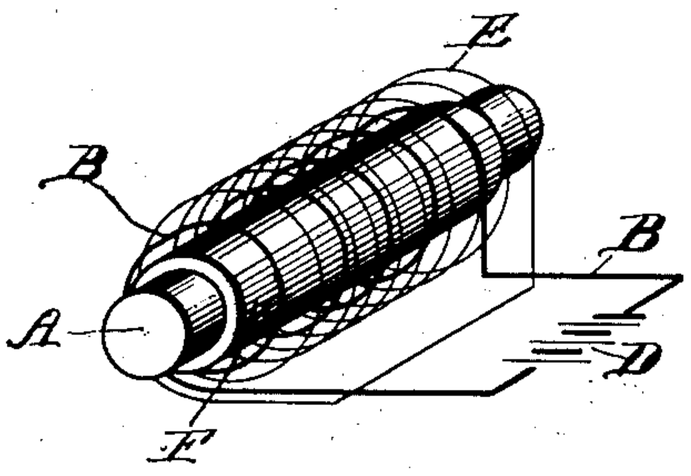

Fig. 2.

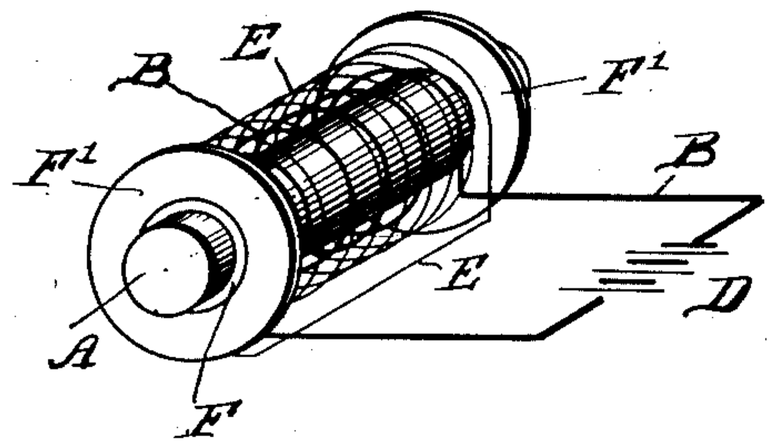

Fig. 3.

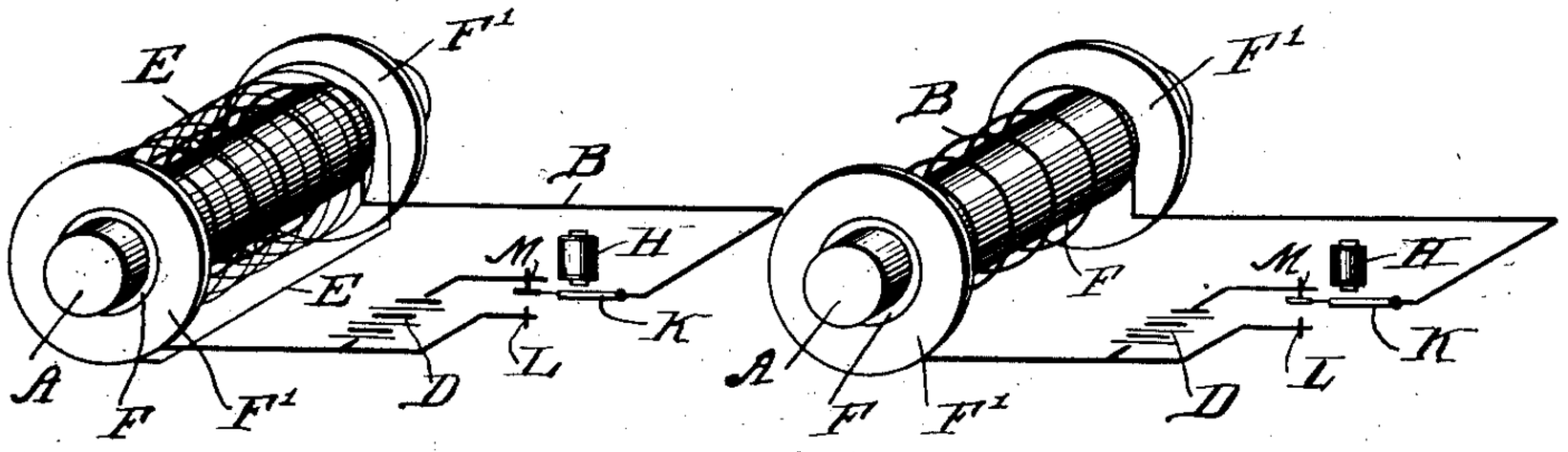

Fig. 4.

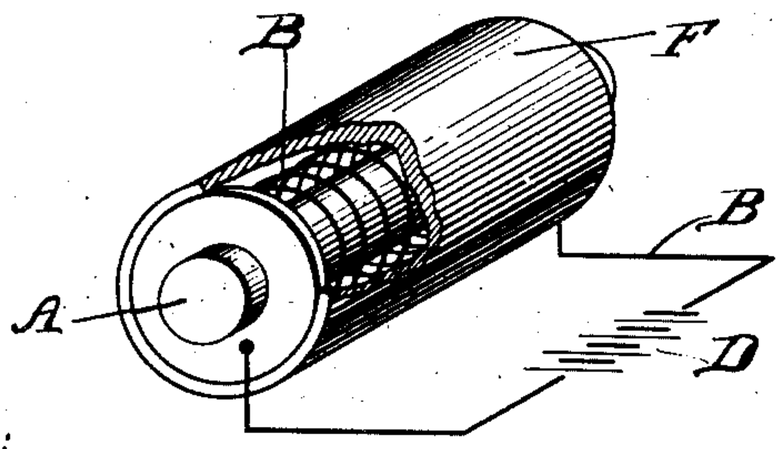

Fig. 5.

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G. Herman Wegner

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His ATTORNEY

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4 SHEETS—SHEET 2.

Fig. 6.

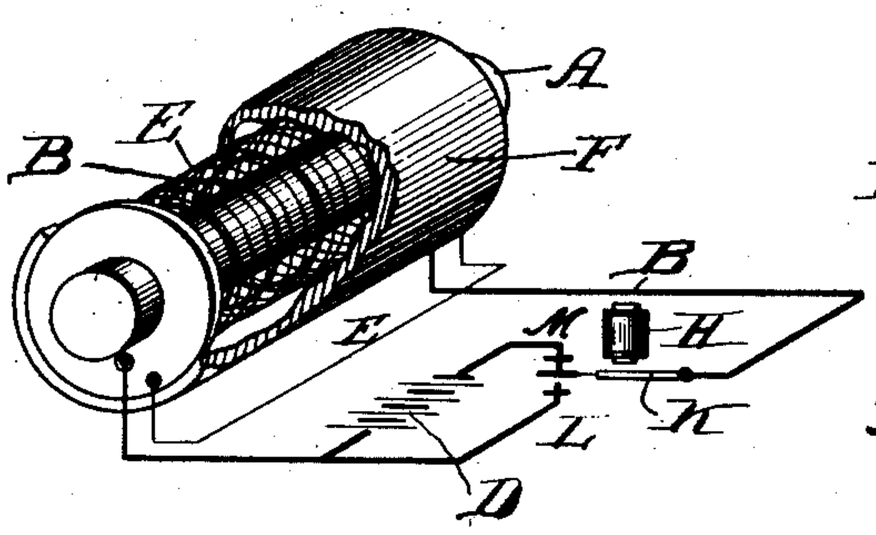


Fig. 7.

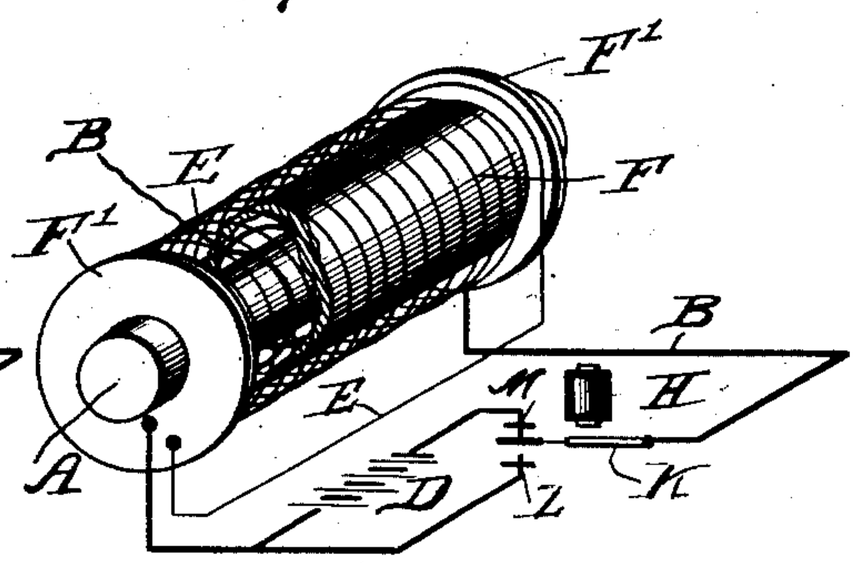


Fig. 8.

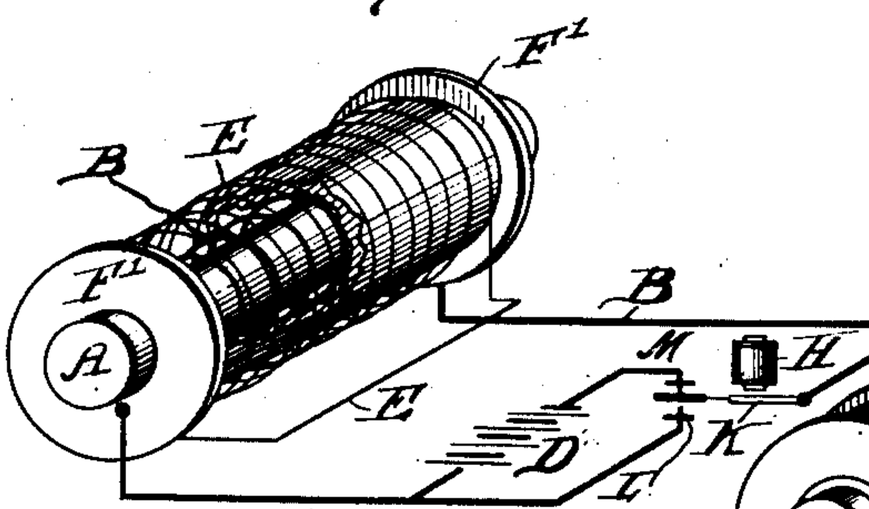


Fig. 9.

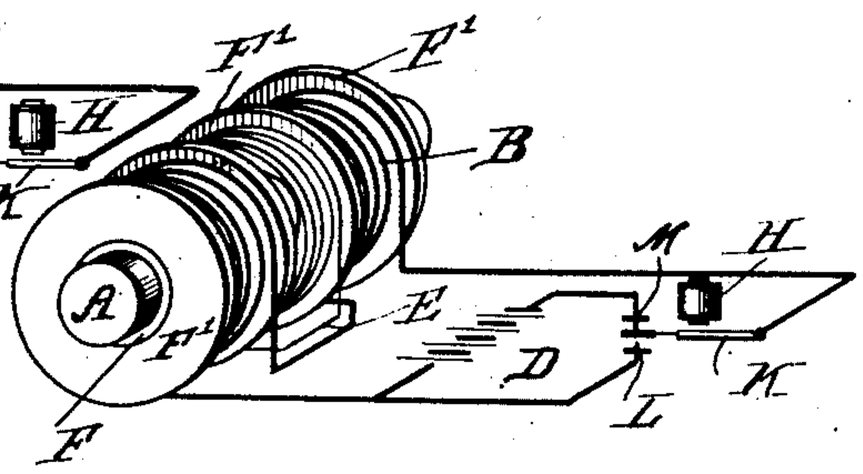
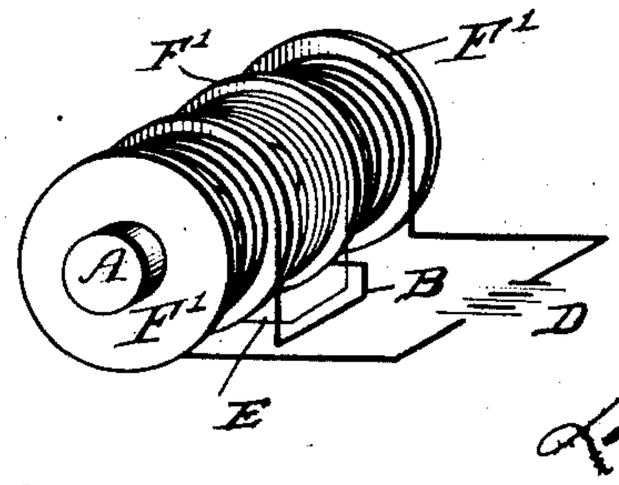


Fig. 10.



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4 SHEETS—SHEET 3.

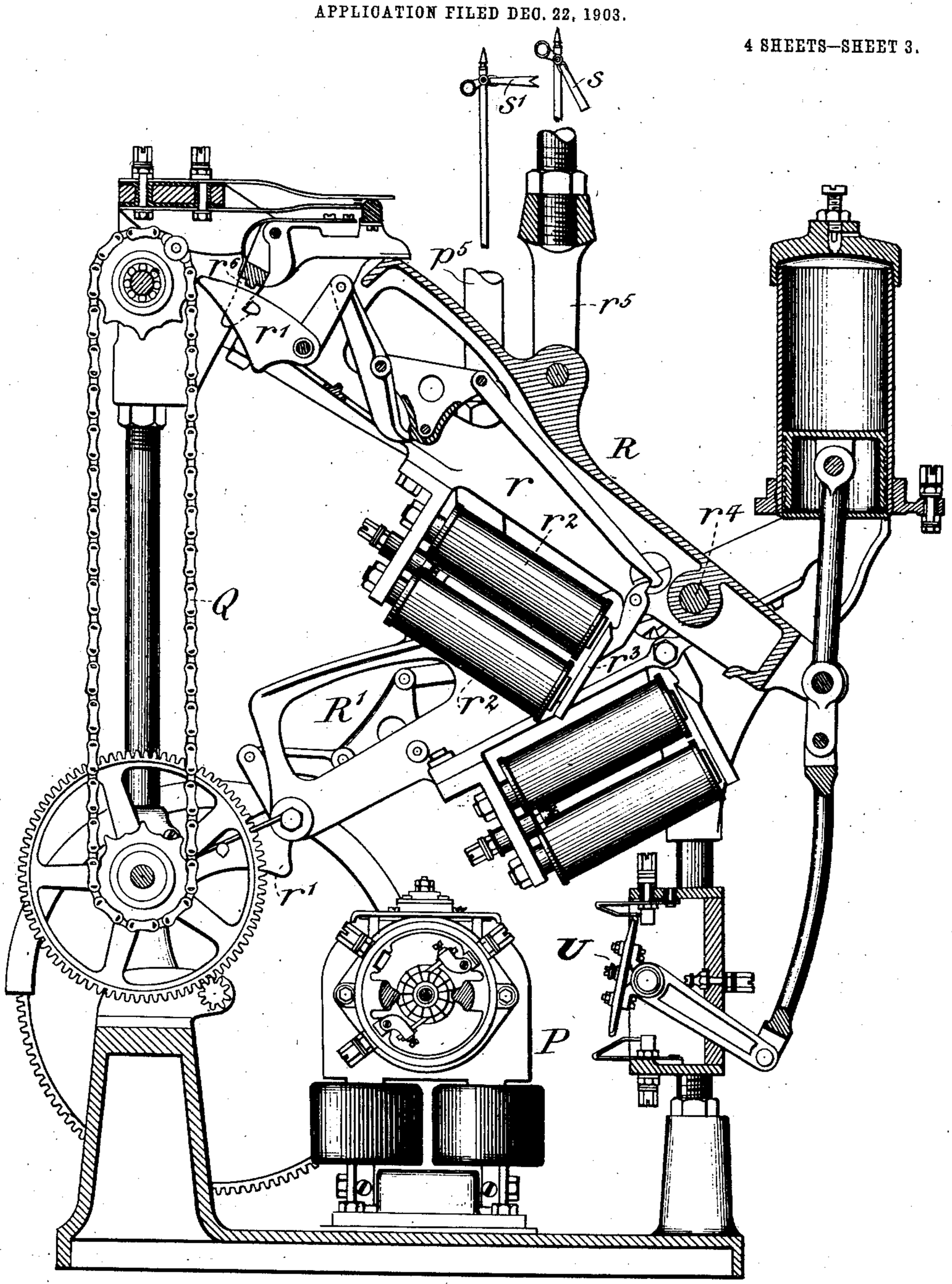

Fig. 11.

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4 SHEETS—SHEET 4.

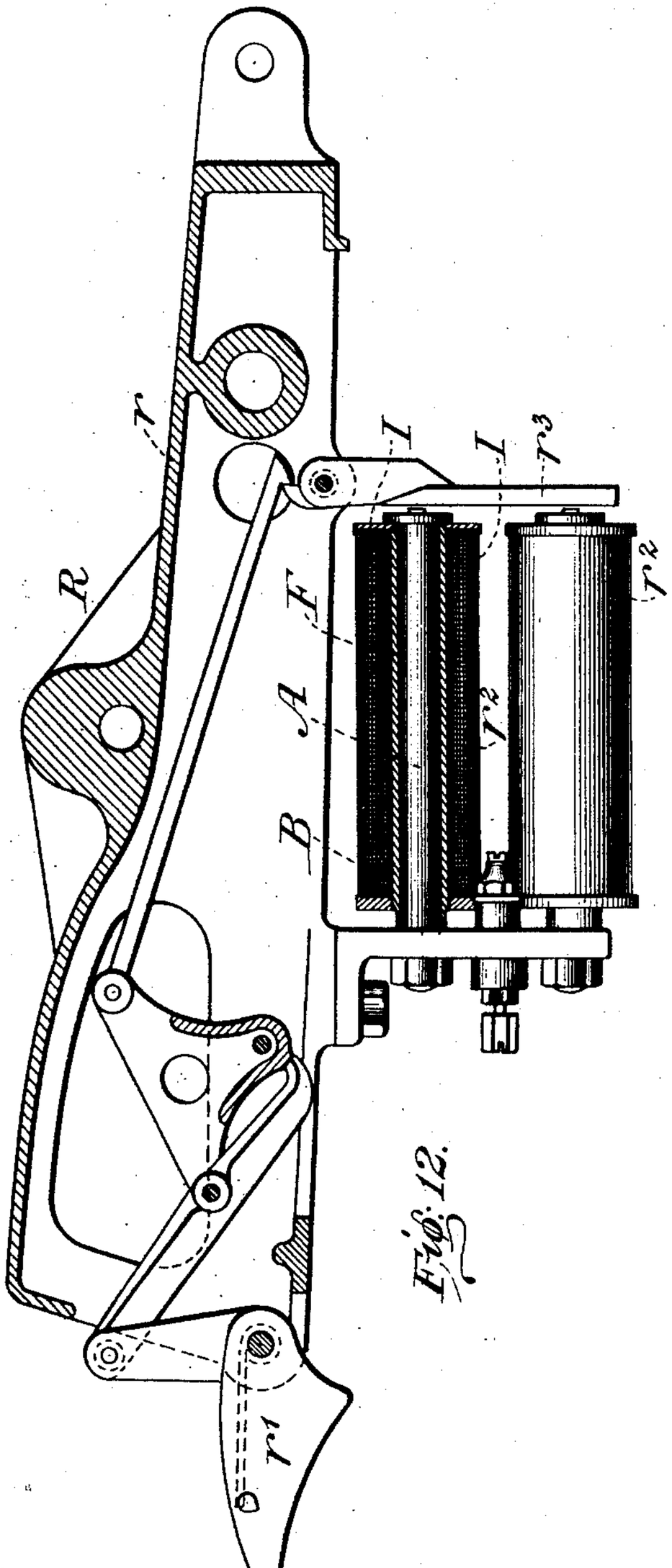

Fig. 12.

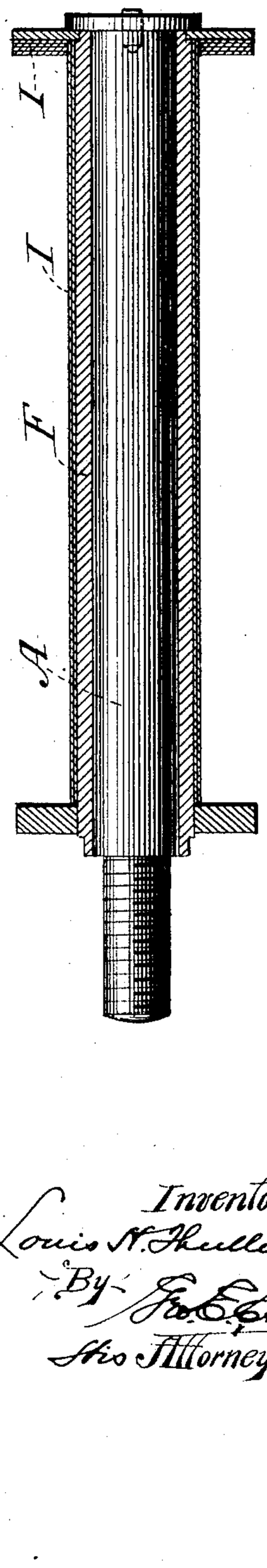

Fig. 13.

Witnesses:
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UNITED STATES PATENT OFFICE.

LOUIS H. THULLEN, OF EDGEWOOD, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL CO., OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

SLOW-RELEASE MAGNET.

No. 826,627. Specification of Letters Patent. Patented July 24, 1906.

Application filed December 22, 1903. Serial No. 186,183.

To all whom it may concern:

Be it known that I, LOUIS H. THULLEN, a citizen of the United States, residing at Edgewood, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Slow-Release Magnets, of which the following is a specification.

My invention relates to slow-release magnets, and it is particularly adapted for railway signaling purposes. For example, it may be used to great advantage in the "slot" mechanism shown in United States Patent No. 611,943, granted October 4, 1898, upon invention of J. G. Schreuder or in any other signal mechanism or signal system where it is desired to have a slow release of an armature from its magnet or to prevent the release of an armature from its magnet for a period of time.

I will describe a slow-release magnet and several modifications thereof and its application to a railway-signal of the type illustrated in said patent, each embodying my invention, and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a diagrammatic and perspective view of a magnet embodying my invention. Figs. 2 to 10, inclusive, each diagrammatic and perspective view showing modifications, each of which embodies my invention. Fig. 11 is a view, partly in elevation and partly in vertical section, of a railway-signal of the type referred to in Patent No. 611,943 having my invention applied thereto. Fig. 12 is a detail view of the slot mechanism of the mechanism of said patent having my invention applied thereto. Fig. 13 is an enlarged detail view.

Similar letters of reference designate corresponding parts in all of the figures.

Referring now to the drawings, and particularly to Fig. 5, which shows a simple form of magnet embodying my invention, A designates a soft-iron magnet-core; B, an energizing magnetizing-winding for the core; D, a source of current-supply for the winding, and F a winding of low resistance. This latter is preferably in the form of a copper tube or cylinder. Instead a plurality of short copper tubes or cylinders may be employed or a plurality of copper washers. This form of the invention is preferably used in a slot mechanism of a railway-signal, (see Figs. 11 and 12,) with the exception that the copper tube F is placed next the iron core instead of the energizing-winding B, as illustrated in Fig. 5. Also in the form of the invention in Figs. 11 and 12 insulation I in the form of paper or other similar material is placed between the energizing-winding B and the tube F. This is more clearly illustrated in Fig. 13. This use of the paper I or other suitable insulation I do not claim to be new.

Any dimensions of tubes or washers may be employed.

Referring now to Fig. 1, A designates the soft-iron core; B, the energizing or magnetizing coil; E, a high-resistance coil or winding which is closed upon itself, and F a copper tube. As shown in this figure, the copper tube is placed next the core instead of outside the winding B, as in Fig. 5, the magnetizing-winding B next to the copper tube, and the high-resistance winding next to the magnetizing-winding.

D designates the source of current-supply for the magnetizing-winding.

So long as the circuit of the magnetizing-winding is uninterrupted the core A will be magnetized and will attract and hold to it a suitable armature. As soon as the circuit of the magnetizing-winding is opened or interrupted a change of flux occurs in the magnetic circuit. This change in flux in turn causes a current to flow in both the copper tube and all short-circuited circuits, which current is in a direction similar to the magnetizing-current. This current flowing in this direction sets up a counter magnetizing flux to that due to breaking the circuit of the magnetizing-winding and has a tendency to retard the change of flux, due to the opening or interruption of the magnetizing-circuit for a period of time. The copper tube being a circuit of low resistance, the current induced in it is at its maximum at a period of time closely following the opening or interruption of the magnetizing-circuit, and the retardation due to this low-resistance circuit is at a period closely following the opening or interruption of the magnetizing-circuit. In other words, were not this low-resistance winding

provided the core would drop its armature immediately upon the opening or interruption of the energizing-circuit.

In the construction shown in Fig. 1 the winding E, which is closed upon itself, has a high resistance, and therefore more self-induction than the copper tube, which causes the period of maximum current induced in this winding to be at a time later than that of the copper tube. This current being at a later period, further retards the demagnetization of the iron core, and hence adds to the value of the copper tube.

The construction shown in Fig. 2 is the same as that shown in Fig. 1, with the exception that the copper tube is provided with a head or washer F′ at each of its ends, the purpose of which is to reduce as much as possible the resistance of the copper tube.

The construction shown in Fig. 3 is like that shown in Fig. 2, with the addition that a relay or magnet H controls the magnetizing circuit or winding B. The armature K of the magnet H is movable between two contacts M and L. When the magnet H is energized, it holds its armature against the contact M, and when the armature K is against the contact M the source of current-supply D is included in the magnetizing-circuit. When the magnet H is deprived of exciting-current or is deënergized, the armature K engages contact L and closes the magnetizing-winding on itself. With this construction the advantages set forth in regard to the construction shown in Fig. 1 are obtained, and the following additional advantage is also obtained: The current generated in the magnetizing-coil due to the change of flux in the magnetic circuit upon the opening or interruption of the magnetizing-circuit is not in phase or in step with the current generated in the copper tube—that is, the induced current reaches its maximum value at a period of time later than the current induced in the copper tube, and this current being out of phase or step in the copper tube, and at a later period it prolongs the magnetization of the core A to a period of time later, due to the current in the copper tube. The magnetizing-winding of coil is composed of a great number of turns, which gives it considerable self-induction, and this causes the current induced in it to be out of step with the current in the copper tube, the copper tube having very little self-induction.

In the construction shown in Fig. 4 the winding of low resistance—that is, the copper tube—is shown as being next to the iron core and as being provided with copper heads or washers F′, the purpose of which has been hereinbefore explained. In addition a relay H or other source of controlling power is provided to control the source of current-supply D and to close the energizing-winding on itself when the relay H is deënergized.

In the construction shown in Fig. 6 the magnetizing-winding B is placed next to the core, and next to this is placed the high-resistance winding, which is closed on itself, and outside of all is the copper tube F. In addition the relay H and its armature K, working between the contacts M and L, is employed.

The construction shown in Fig. 7 is the same as that shown in Fig. 6, with the exception that the copper tube is located between the two windings. Fig. 8 is the same as Fig. 7, with the exception that the copper tube is provided with copper heads F′.

In Fig. 9 I employ a number of copper washers F′ on the tube F. The magnetizing-winding B is wound either between all the washers or between two or more. The high-resistance winding E is wound either between all the washers F′ or between two. Fig. 10 is the same as Fig. 9, except that the copper tube is omitted and no relay is employed.

Figs. 11 and 12 illustrate the application of my invention to a slot mechanism of a railway-signal, and the great advantage referred to in the preamble of the specification will now be explained. The construction of the "slot-arm" is clearly set forth in the Patent No. 611,943, hereinbefore referred to, as is the operating mechanism. I will therefore only herein briefly describe the parts of such slot-arm and the railway-signal.

Referring now to Fig. 11, P designates an electric motor, which through a train of gears drives an endless chain or chains Q always in the same direction. The number of chains driven by the motor depends upon the number of slot-arms employed. In the present instance there are two chains and two slot-arms R R′. Each slot-arm, as shown, comprises a frame r, a chain of levers, a finger r', which coacts with an endless chain Q, a magnet or magnets r^2, embodying my invention, and an armature r^3, which when attracted by the magnet r^2 holds the finger r' rigid, so that the frame r may be moved by the endless chain. When the armature is released by the magnet, the finger is free to be disengaged from a catch r^6 or the endless chain. The frame is pivoted at r^4 and is connected with an "up-and-down" rod r^5 at one of its ends, the other end of the up-and-down rod being operatively connected with a signal device S S′. When the frame is moved upward by the endless chain, the signal device is moved from a horizontal position indicating "danger" to an inclined position indicating "caution" or "safety," and when the finger r' is disengaged from the catch r^6 or endless chain the weight of the signal device and rod r^5 causes the frame to drop and the signal device to move to its horizontal or danger position of indication. In Fig. 11 I have shown one frame elevated and the signal device with which it is connected in its inclined position and the other frame in its lowermost position ready to be elevated and

the signal device connected therewith in its horizontal position. It will be understood, of course, that different forms of slot mechanisms may be used so long as they employ a magnet, and also that different forms of signal-operating mechanisms may be used, and the signal-operating mechanism arranged to move the signal device to two inclined positions from a horizontal position.

In order now that the great advantage heretofore referred to may be understood, it will be necessary to describe a system of signaling in which a railway-signal comprising a slot mechanism is employed. In the Schreuder patent, No. 611,943, referred to, a home and distant signaling system is illustrated and described. In this type of system a home signal S and a distant signal S′ are located at the same point, and generally for the sake of economy, as in this patent, both the home and distant signals are operated by the same motor. In such a system it often happens that the home signal will be in one position of indication, while the distant signal will be in a different position of indication. For example, consider two block-sections and a home and distant signal located at the entrance end of each block-section. When a train enters the first block-section, both the home and distant signals of that block-section will move to their danger position, this being accomplished by breaking the circuit on the magnets r^2 of the slot-arms. When the train moves out of the first block-section into the second block-section, both the home and distant signals of the second block-section move to their danger positions, while the home signal of the first block-section is moved to its safety position, leaving the distant signal at the first block-section in its danger position, this signal being held in its danger position until the home signal of the second block moves to "safety," at which time the distant signal moves to "safety." In other words, the position of a distant signal is controlled by the position of its home signal, except of course when a home signal immediately above a distant signal is in a danger position. The above operations take place as a train moves through successive block-sections. The movement of the home and distant signals are controlled from track-circuits, which, as well known in the art, comprise a source of current at one end of the block-section and a relay at the other end, whose armature or armatures close local circuits on the magnets of the slot mechanisms and motor of the operating mechanism of the railway-signals.

In the system to which my invention is particularly applicable the relay is of a "polarized" type—that is, the relay comprises a neutral and a polar armature. The neutral armature controls the circuit of the home signal of that block-section, while the neutral and polar armature controls the circuit of the distant signal. The polar armature is moved to close the circuit of the distant signal only when the current from the battery flows in a determined direction, and this determined direction is obtained through what is known as a "pole-changer," which is operated from every home signal. A pole-changer is illustrated in Fig. 11 and designated U. The pole-changer, as is well understood, is connected with the track-battery and track-rails of a block-section. Thus it will be seen that when a home signal is moved, say, from its safety position to its danger position it operates its pole-changer to such a position as to have the polar armature move to open the circuit on the distant signal, and when the home signal is moved from its danger position to its safety position the pole-changer is again operated; but this operation causes the current to flow in such direction to move the polar armature to close the local circuit. This system is well known in the art.

In operating a pole-changer it is apparent that at some instant the battery of a block-section is cut off from the track-rails, thereby deënergizing the relay of that block-section. Therefore if the home signal of that block-section should be in its safety position it would move to its danger position, thus giving a false indication. By my invention this is prevented, for when the current is cut off from the slot-magnet comprised in the slot mechanism for the home signal the copper tube has induced in it a current which tends to build up the rapidly-dying magnetism of the iron core, and thus prevent the release of the armature. The momentary break by the pole-changer in the connection of the track-battery with the track-rails is only for an instant, so that the retardation of approximately a second is sufficient to prevent the release of the armature. Without this retardation the home signal would move to its danger position or nearly to its danger position, thus requiring an operation of the motor and a consequent loss of energy.

What I claim as my invention is—

1. The combination in a slot-arm for railway-signals with a suitable frame, an engaging finger and levers carried thereby, and a magnet and armature which armature when attracted by the magnet holds the finger and levers rigid, said magnet being provided with a closed circuit which upon interruption of the current normally flowing through the winding of the magnet retards the release of the armature.

2. In a railway-signal, the combination with a signal device, means comprising a motor for moving it from one position to another position, a slot mechanism for holding it in the position to which it has been moved, said slot mechanism comprising a magnet and armature, said magnet comprising a closed cir-

cuit of low resistance which upon interruption of the current normally energizing the magnet retards the demagnetization of the core of the magnet and therefore retards the release of the armature.

3. The combination in an electromagnet-clutch or slot mechanism for railway-signals, of means for maintaining a closed circuit around the magnet-cores of the device after interruption of the circuit normally energizing the magnet, said circuit deriving its electrical energy through the self-induction of the magnet and thereby maintaining for a short period the magnetic energy of the cores after interruption of its normally energizing current.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LOUIS H. THULLEN.

Witnesses:
W. L. McDANIEL,
GEO. McCORMICK.