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PATENTED AUG. 13, 1907.

L. H. THULLEN.  
ELECTROMAGNETIC APPARATUS FOR RAILWAY PURPOSES.

APPLICATION FILED MAR. 24, 1906.

3 SHEETS—SHEET 1.

Fig. 2.

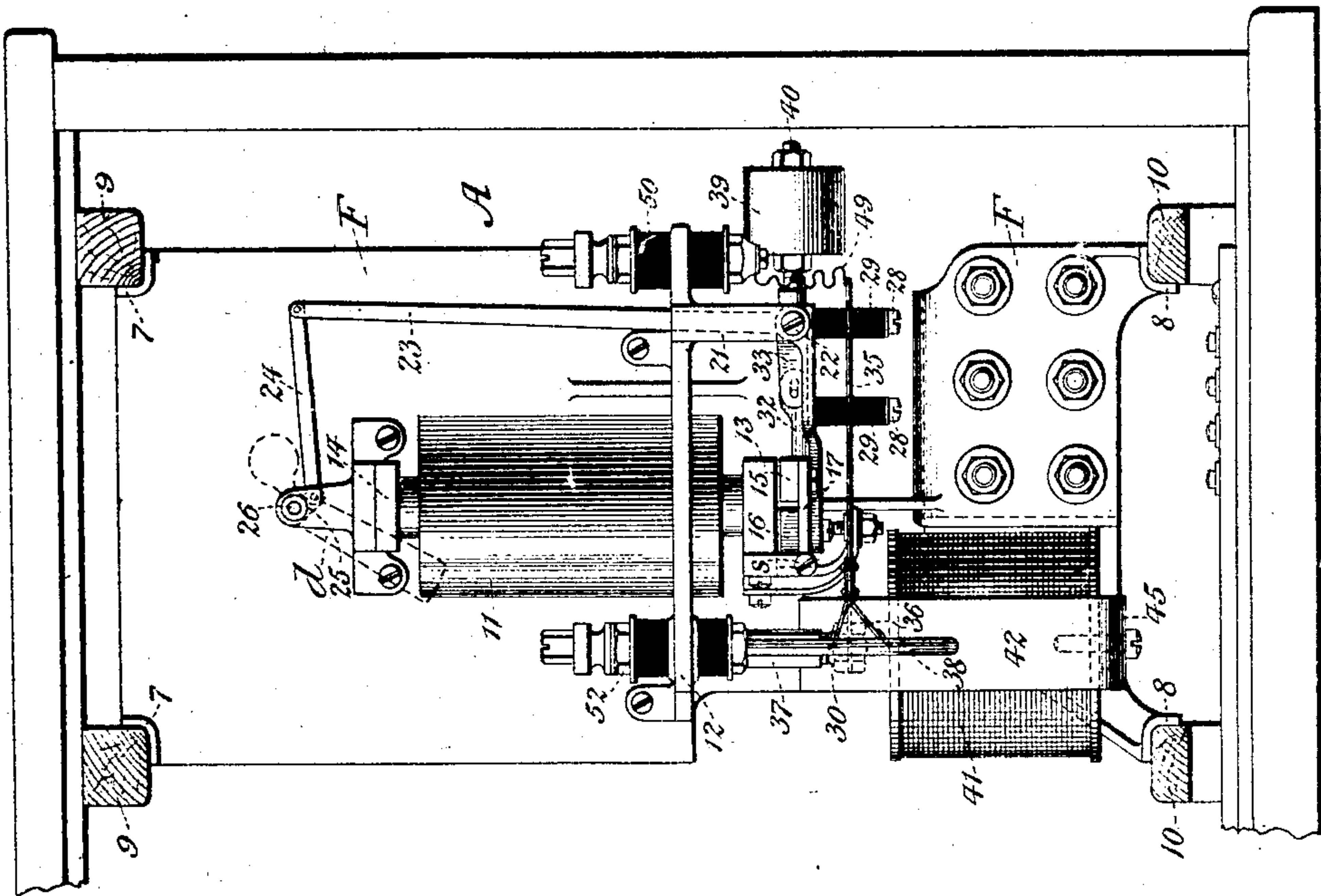
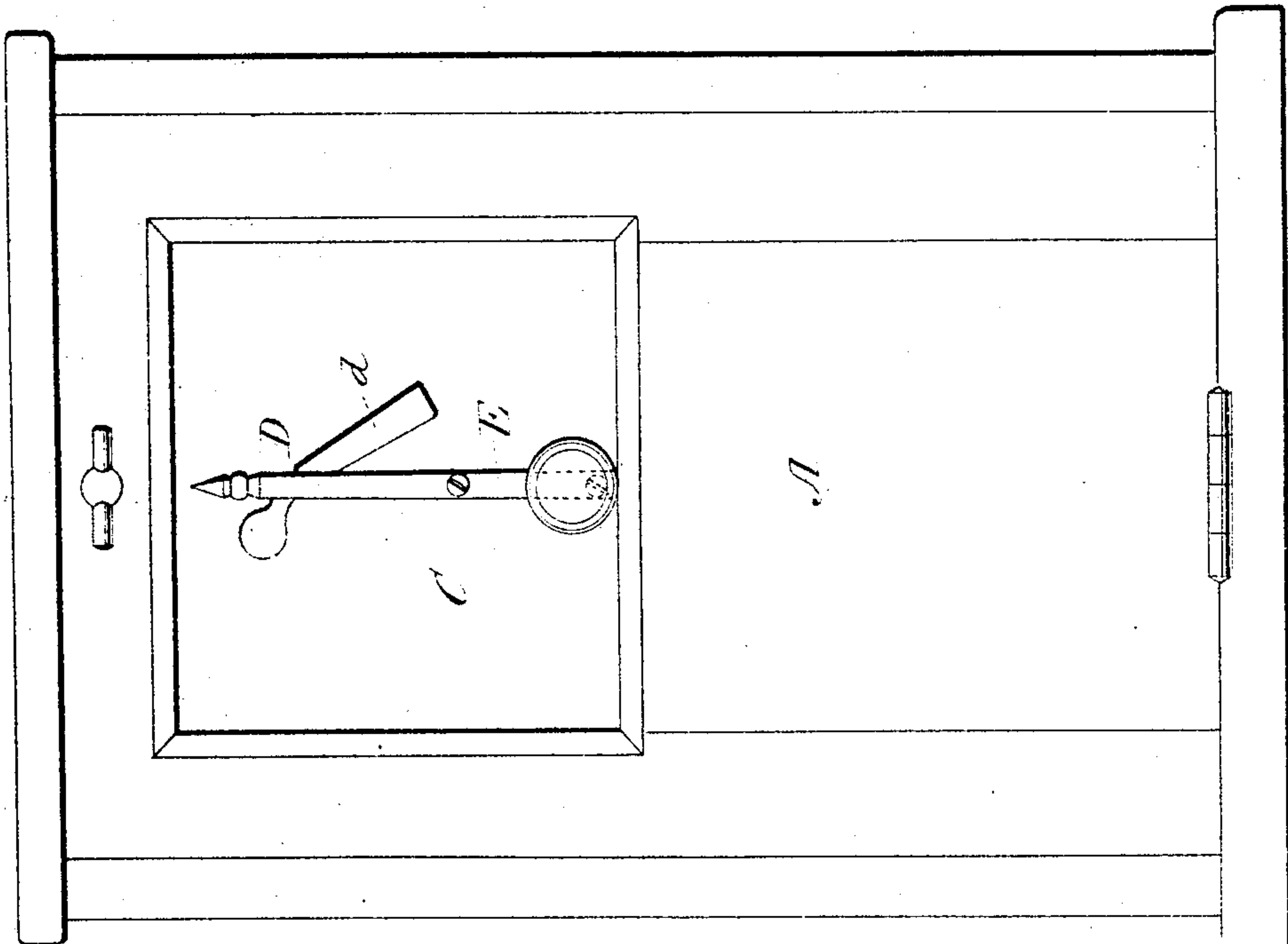


Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 4.

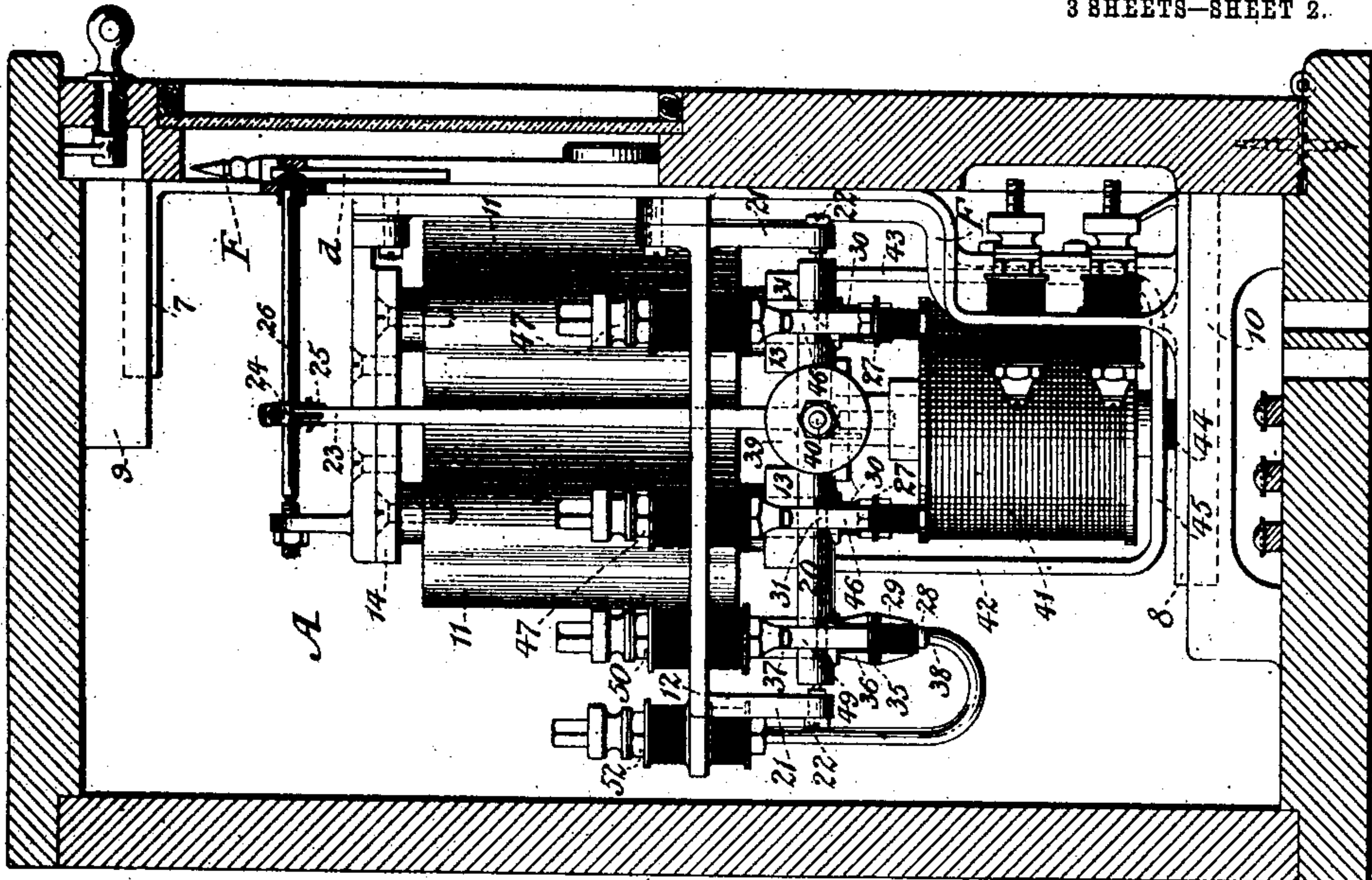
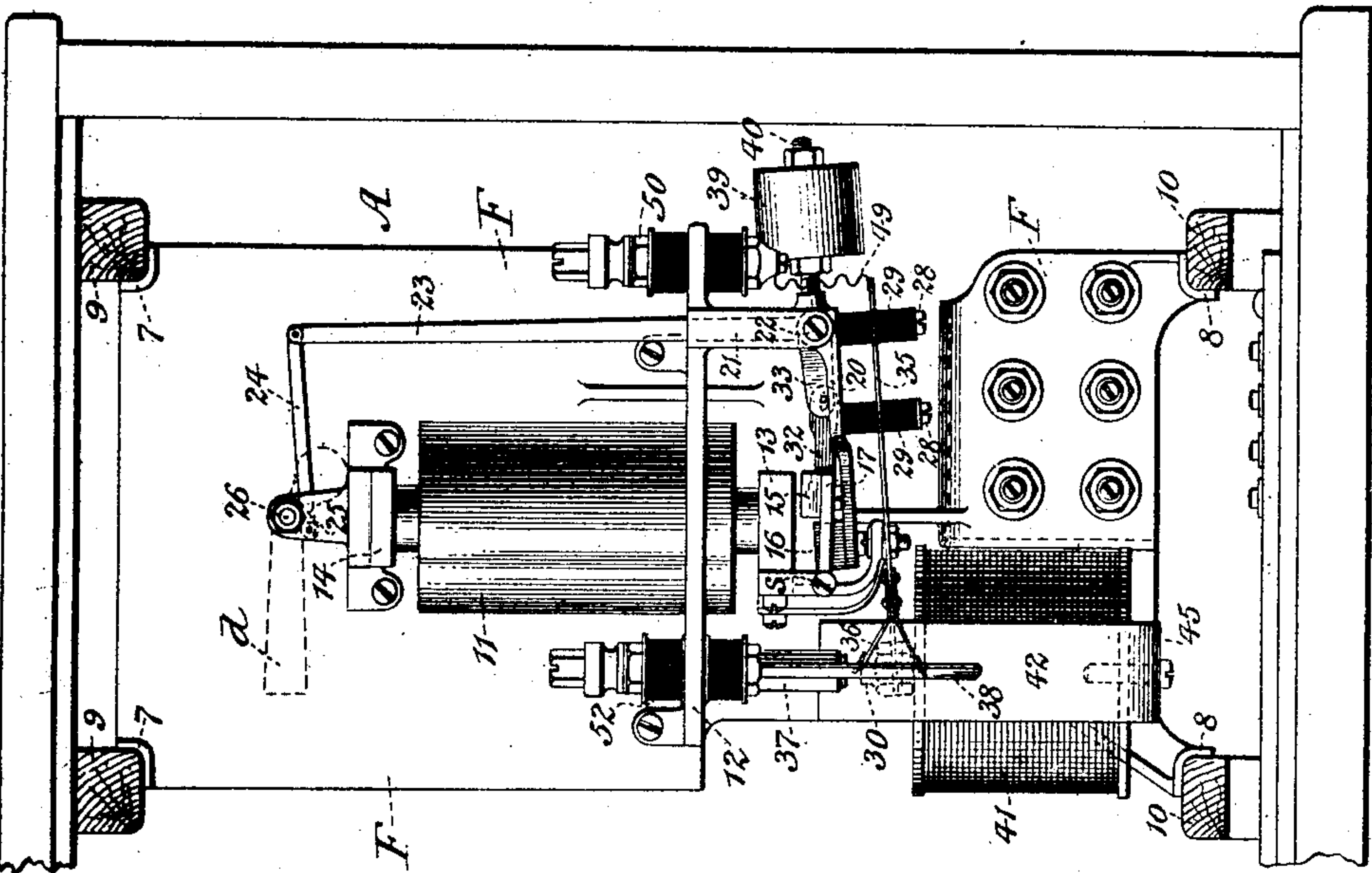


Fig. 3.



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3 SHEETS—SHEET 3.

Fig: 6.

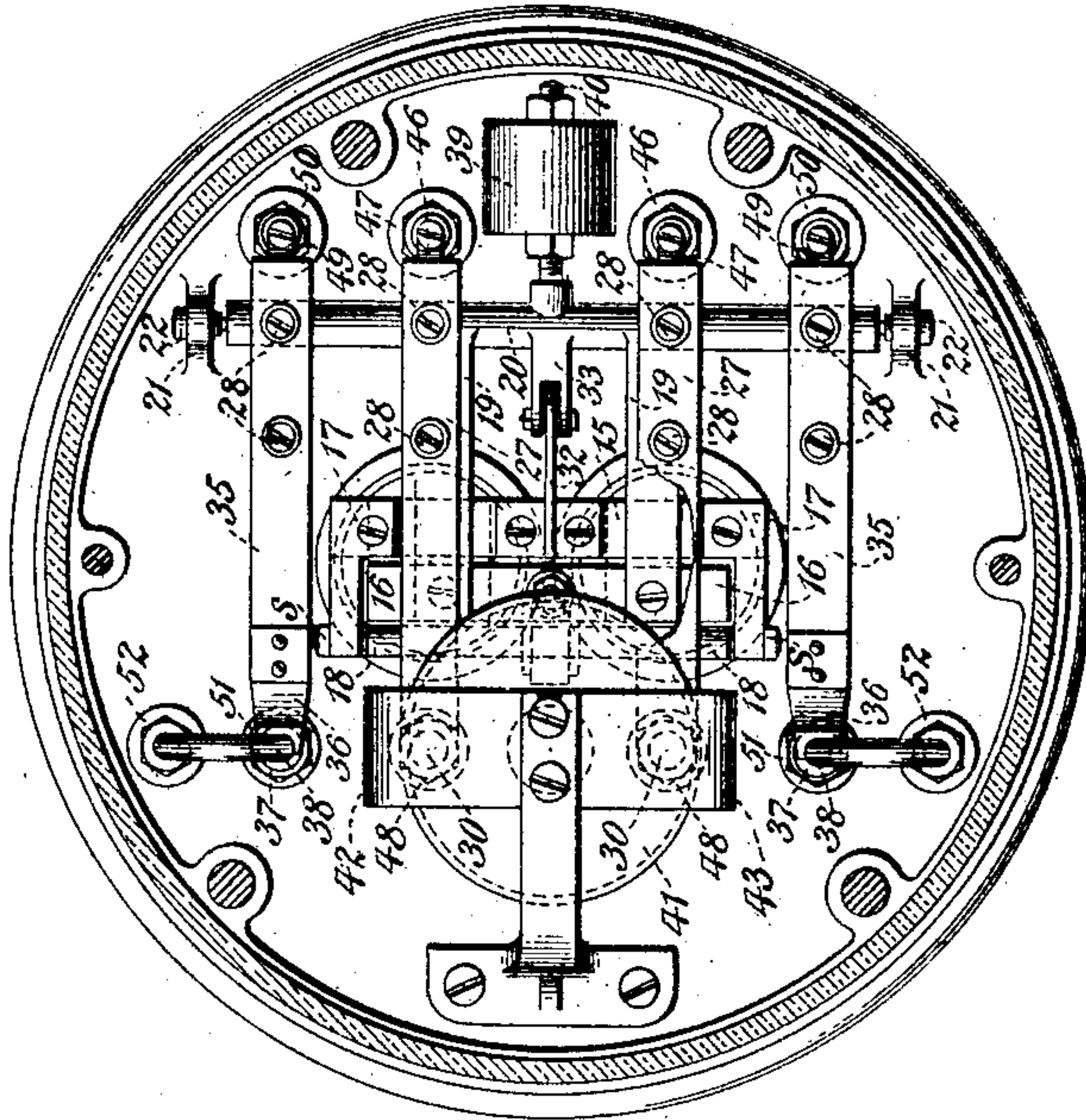
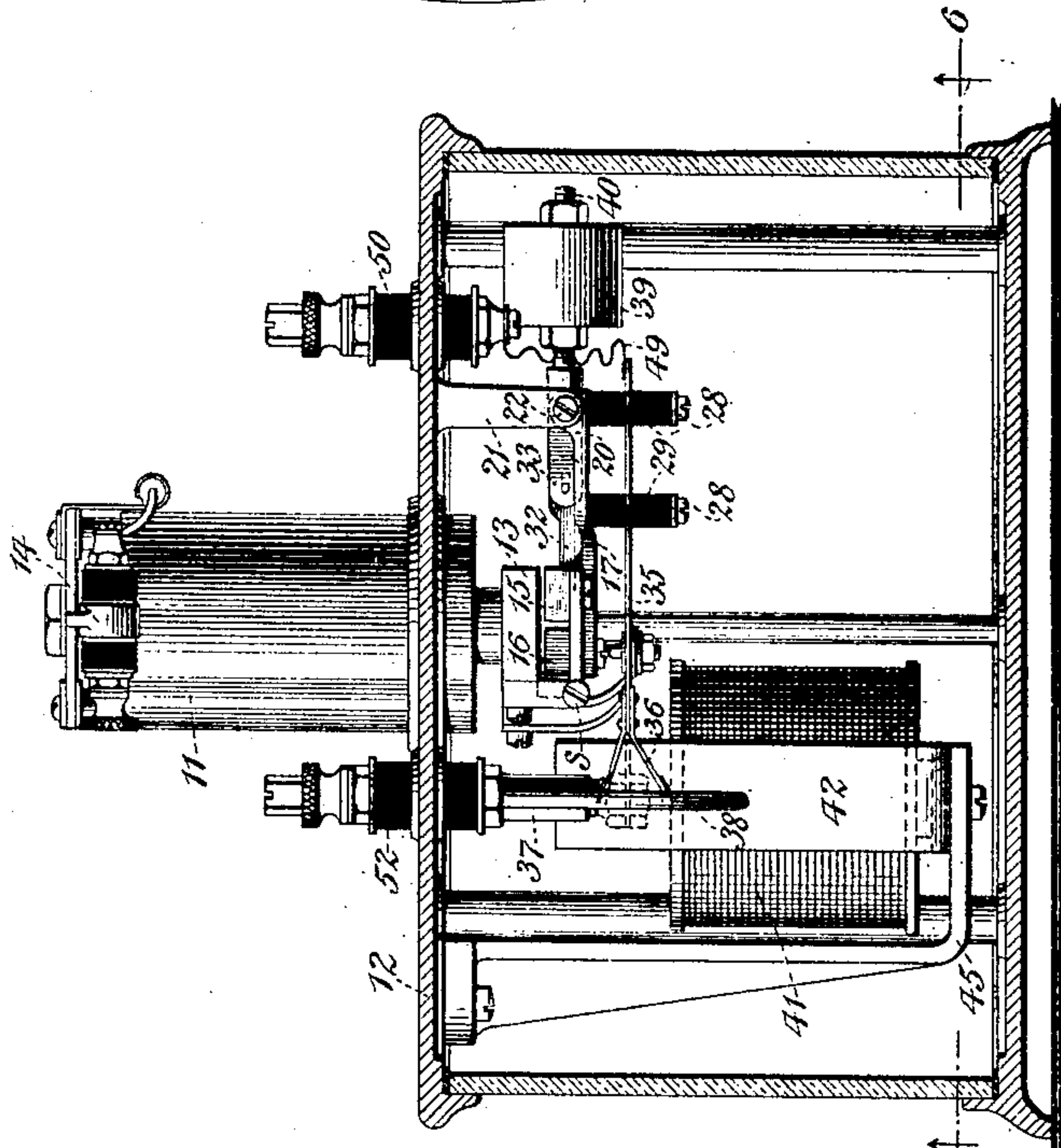


Fig: 5.



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# UNITED STATES PATENT OFFICE.

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## ELECTROMAGNETIC APPARATUS FOR RAILWAY PURPOSES.

No. 863,332.

Specification of Letters Patent.

Patented Aug. 13, 1907.

Application filed March 24, 1906. Serial No. 307,832.

*To all whom it may concern:*

Be it known that I, LOUIS H. THULLEN, a citizen of the United States, residing at Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Electromagnetic Apparatus for Railway Purposes, of which the following is a specification.

My invention relates to electro-magnetic apparatus comprising electro-magnets and co-acting armatures, the same being so constructed and arranged as to be operable at a small or medium of potential of current and adaptable for controlling circuits through which heavy currents flow.

The construction of electro-magnetic apparatus herein shown and described, is particularly adapted for use in connection with railway signaling systems where heavy currents are used, and where the current of the track circuit, whose total energy is generally of small potential, may be employed as a means for opening and closing the circuits for such heavy currents.

It is desirable in the operation of such an apparatus, and under all conditions to have the shunting point of the electro-magnets as near as possible to their picking up point.

My invention may be said to comprise an electro-magnet or electro-magnets and two armatures, of which one will have a limited movement, while the other will have a comparatively and much greater movement, so that one armature will, under all conditions, maintain the shunting point of the relay close to the picking up point. The other armature having the greater movement, is so arranged as to exert its maximum of leverage upon the first armature and, therefore, in certain instances, gives a maximum of pressure on the contact points of a circuit or circuits for operating the indicator, and controlled by the relay. The movements of the armatures may be availed of to operate railway appliances such as indicators, locks of interlocking machines, etc.

I will describe an electro-magnetic apparatus embodying my invention and then point out the novel features in claims.

In the accompanying drawings Figure 1 is a front elevation of an indicator for railway purposes embodying my invention. Fig. 2 is a rear elevation thereof, a portion of the casing being removed. Fig. 3 is a view similar to Fig. 2, showing the parts in a different position, that is, when current is absent from the coils of the relay magnets. Fig. 4, is a view partly in side elevation and partly in vertical section of the device illustrated in Figs. 1, 2 and 3. Fig. 5, is a sectional elevation, showing my invention in the form of a relay. Fig. 6, is a horizontal section thereof, taken on the line

6, 6, of Fig. 5, looking upwardly in the direction of the arrows. In these two latter views the operative parts are precisely similar to those illustrated in Figs. 1 to 4, the casing alone being different and the indicator connections being omitted.

Similar reference characters designate corresponding parts in all the figures.

Referring to said drawings, A designates an indicator, B a casing having an opening C therein, through which is exposed to view a signal D. This signal may be of any of the well known types, although a miniature semaphore *d*; is generally used in indicators of this class, and I prefer to employ such a signal in connection with my present invention, the same being pivotally mounted on a post E, and adapted to move under certain conditions to assume an inclined position for one indication, as shown in Figs. 1, 2 and 4, and under other conditions to move to assume a horizontal position for another indication as shown in dotted lines in Fig. 3.

The signal is caused to assume its different positions by the mechanism which I will now describe, and which constitutes the essential feature of my invention.

F, designates a frame-work or housing for supporting the various parts, and, as shown in Figs. 2, 3 and 4, both extremities of this frame-work or housing is preferably provided with angular extensions 7, 7, and 8, 8, respectively, which are adapted to engage cleats or tracks 9, 9, and 10, 10, located within and running transversely of the casing at its top and bottom. This arrangement renders easy the removal and replacing of the frame F, and the mechanism supported thereby, when necessary.

11 designates electro-magnets, and as shown, are arranged on and secured to a suitable table or plate 12, which, in Figs. 2, 3 and 4, projects from, and may form part of the framework or housing F; and which, in Figs. 5 and 6, constitutes the upper closure for a casing. The cores of the magnets project below this plate or table 12, and are provided with the usual pole pieces 13. The upper extremities of the pole pieces are bridged over by a yoke or bridge-piece 14, in the ordinary manner.

15 and 16, designate, respectively, two armatures so arranged that the movement of one will effect a movement of the other, both being supported in proper relation with the pole pieces 13. The movement of the member 15, which I will term the "picking up" armature, will be small or slight, while the movement of the other member 16, which may be appropriately termed the "holding" armature, will be greater. This arrangement is for the purpose, on the one hand, of maintaining the shunting point as close as possible to the picking up point, and on the other hand, for obtaining a maximum of leverage, and consequently a maximum



of pressure on the contact points, as previously mentioned.

The armature 15, is carried by arms 17, 17, of brass or other non-magnetic material which are pivotally mounted in downwardly projecting end portions of a cross-piece 18. (see Fig. 6) of similar brass or non-magnetic material which may, for convenience, be fastened to the pole pieces 13. The pivotal mounting of the arms 17, 17, as shown, comprises screws *s*, *s*, extending through the end portions of the cross piece 18.

The armature 16, is carried by arms 19, 19, (see Fig. 6), of a frame 20, composed of brass or other non-magnetic material. The frame 20, is pivotally mounted in downwardly projecting portions 21, formed on or carried by the plate 12. The pivotal mounting may be any desired, but, as here shown, it consists of pointed screws 22, extending through the portions 21.

The frame 20, (see Figs. 1, 2, 3 and 4) by its movements is designed to move the signal *D*. As shown, it is connected to the signal device by suitable pivotal connections which comprise a link or rod 23, which extends upwardly, as shown in Figs. 2, 3 and 4, and connects with a link 24, the other end of which is pivotally secured to the end of an arm 25, fastened to a shaft 26, upon which the signal device or semaphore blade *d*, is mounted. Thus, movement of the frame 20 on its pivots 22 will, through the connections just described, rotate the shaft 26, in one direction or the other, and cause the signal device or semaphore arm *d*, to move or be moved either to an inclined position indicating "safety" (full lines Fig. 1, and dotted lines Fig. 2), or to a horizontal position indicating "danger", (dotted lines Fig. 3). The frame 20 also has connected to it, contact arms 27, the connection being effected by screws 28, and sleeves 29, of suitable insulating material. The arms 27, carry carbon pieces 30 at their free ends, which, when the armatures 15 and 16 are attracted to the pole piece of the magnets, will engage appropriate contacts 31 (dotted lines Fig. 4), also composed, preferably, of carbon pieces and carried by suitable binding posts in the usual manner.

The armature 15, is employed to primarily move the contact arms 27, and this is accomplished by means of a suitable connection between it and the frame 20. As shown, this connection comprises an arm 32, connected with the armature 15, an arm 33, carried by the frame 20, and a loose connection between the two arms 32 and 33, which is preferably in the form of a pin and slot.

It will be observed that the armature 15, is arranged close to the pole pieces 13, which will permit of its being attracted by a small amount of current in the magnets 11. This slight movement is multiplied by the connections between it and the arms 27, so that a slight movement of the armature 15, in either direction will move the arms 27, to make and break contact between the contacts 30 and 31. As this movement of the armature is slight, the picking up and shunting point can be made about the same. The movement of the armature 16, is greater than the armature 15, when attracted to the pole pieces. Part of the movement of the armature 16, is produced by the upward movement of the armature 15, when the latter is attracted to make contact between 30 and 31. The further movement of the armature 16, is produced by the magnetism of the magnets 11, and this further movement is availed of to

produce a maximum of pressure on the contacts 31, by the contacts 30 (dotted lines Figs. 2 and 5) and located, as previously mentioned, one at the free end of each of the arms 27.

Additional contact arms similar to the contact arms 27, may be carried by the frame 20 and used for the purpose of making and breaking other circuits through which light currents may pass, as well as serving as a stop to limit the movement of both armatures 15 and 16. Suitable front and back contacts are also provided with which said contact arms will engage. 35, 35, designate these contact arms, which, as shown in Fig. 6, may be arranged, one on either side of the contact arms 27, and connected to and insulated from the frame 20 by screws 28 and insulations 29, similar to those shown in Figs. 2, 3 and 4, or when desirable, a single contact arm 35, only, may be used at one side of the frame 20. In either case the outer free end of each contact arm will be provided, preferably, with a yielding contact piece 36, which, when the frame 20, swings on its pivots 22, will be moved to engage an appropriate front contact 37 or a back contact 38, as the case may be.

A device for counter-balancing or overcoming the weight of the working parts is preferably provided, and, as shown, this device may take the form of a weight 39, adjustably mounted on a rod 40, secured to or forming part of the rear end of the frame 20. By adjusting this weight on the rod 40, it will be apparent that the working parts may be properly balanced so that the armatures 15 and 16 may readily respond to the influence of current in the magnets 11, 11.

In the construction herein shown and described, an arc may be formed by the opening of the circuit at the contact points 30 and 31, and for the purpose of extinguishing such arc, I provide a magnet 41, which is disposed between the contact points 31, in such manner as to create a high magnetic field between the poles 42, 43, of said magnet, and in which field the contact points 31, are included. The magnet 41 is supported in any suitable manner, as upon a block of insulating material 44, to which latter a bar 45, forming the poles 42, 43, is secured, and it may be impressed by the current that is broken at the contact point 31, but it is understood, of course, that it may receive current from any other or independent source.

Suitable conductors 46 lead from the contact arms 27, to binding posts 47, and the contacts 31, connect respectively with similar binding posts 48, as shown in dotted lines in Fig. 6. Similar conductors 49, are also provided for the contact arms 35, which connect with binding posts 50, and the front and back contacts 37, 38, respectively connect with binding posts 51, 52.

It will, therefore, be seen that my invention comprises electro-magnets, two armatures to be attracted by the electro-magnets, and means between the two armatures to produce successive movements thereof, the movements of which are availed of to operate or control devices or apparatus involved in railway signaling and interlocking.

Having thus described my invention, what I claim is:—

1. An indicator for indicating the approach, departure or presence of a train or vehicle on a railway track section comprising a signal device, an operating mechanism for controlling the movements of the signal device com-



prising a magnet, two armatures for said magnet, and means between the two armatures which act to produce a movement of one armature upon a movement of the other armature.

- 5 2. An indicator for indicating the approach, departure or presence of a train or vehicle on a railway track section or the condition of a signal thereon, comprising a signal device, a relay for controlling the movements of the signal device, comprising a magnet, two armatures for
- 10 said magnet, connections between the relay and the signal device, and means between the two armatures which act to produce a movement of one armature upon a movement of the other armature whereby the signal device is operated.
- 15 3. An indicator for indicating the approach, departure or presence of a train or vehicle on a railway track section or the condition of a signal thereon comprising a signal device, a relay for controlling the movements of the signal device comprising a magnet, two armatures for
- 20 said magnet, a contact arm operated by the two armatures, connections between the relay and signal device, and means between the two armatures which act to produce a movement of one armature upon a movement of the other armature whereby the signal device is operated.
- 25 4. An indicator for indicating the approach, departure or presence of a train or vehicle on a railway track section or the condition of a signal thereon, comprising a signal device, a relay for controlling the movements of the signal device comprising a magnet, two armatures which
- 30 have different degrees of movement, a contact operated by either of the two armatures, connections between the relay and signal device, and means between the two armatures which act to produce a movement of one armature upon a movement of the other armature, the arrangement being such that one armature acts to move the contact arm to make a contact while the other acts to produce pressure on the made contact.
- 35 5. An indicator comprising a signal device adapted to assume different positions, a relay for controlling the movements of the signal device comprising a magnet, pivotal connections between the relay and signal device, two armatures for said magnet, and means between the two armatures which act to produce a movement of one armature upon a movement of the other armature and
- 40 whereby the signal device is operated.
- 45 6. An indicator comprising a signal device adapted to assume different positions, a relay for controlling the movements of the signal device comprising a magnet, two pivoted armatures for said magnet, a contact arm operated by either of the two armatures, link connections between the relay and signal device, and means between the two armatures which act to produce a movement of one armature upon a movement of the other armature, whereby one armature acts to move the contact arm to
- 50 make a contact while the other acts to produce pressure on the made contact.
- 55 7. An indicator comprising a signal device adapted to assume different positions, a relay for controlling the movements of the signal device comprising a magnet, two pivoted armatures for said magnet, a plurality of contact arms operated by either of said armatures, and means
- 60

between the two armatures which act to produce a movement of one armature upon the movement of the other armature, whereby one armature acts to move the contact arms to make contacts while the other acts to produce pressure on the made contacts. 65

8. A relay comprising a magnet, two armatures for said magnet, a contact arm operated by the two armatures, and means between the two armatures which act to produce a movement of one armature upon a movement of the other armature. 70

9. A relay comprising a magnet, two armatures for said magnet, a plurality of contact arms operated by either of the two armatures, and means between the two armatures which act to produce a movement of one armature upon the movement of the other armature. 75

10. A relay comprising a magnet, two armatures which have different amounts of movement, a contact arm operated by either of the two armatures, and means between the two armatures which act to produce a movement of one armature upon a movement of the other, the arrangement being such that one armature acts to move the contact arm to make a contact while the other acts to produce pressure on the made contact. 80

11. A relay comprising a magnet, two pivoted armatures, an arm provided with a slot carried by one of said armatures, a pin carried by the other armature member and adapted to enter said slot whereby a movement of one armature effects a movement of the other armature, and a contact point carried by one of said armatures and adapted to engage another contact. 85 90

12. A relay comprising a magnet, two pivoted armatures, an arm provided with a slot carried by one of said armatures, a pin carried by the other armature and adapted to enter said slot whereby a movement of one armature member effects a movement of the other armature, a contact point carried by one of said armature members and adapted to engage another contact, and a counter-balance for said armatures. 95

13. In a relay, the combination with a magnet, two pivoted armatures, one having a small movement and the other a greater movement, contacts made and broken by the movement of the armatures, and means between the two armatures which permit of the armature having the small movement to make the contacts and the armature having a greater movement to produce pressure on the made contact. 100 105

14. In a relay, the combination with a magnet, two pivoted armatures one having a slight amount of movement to and away from the armature, while the other has a greater amount of movement, a movable contact arm, and means between the two armatures which upon a movement of the first mentioned armature moves the contact arm and the second mentioned armature and upon a further movement of the second armature to produce pressure on the contact arm. 110 115

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

LOUIS H. THULLEN.

Witnesses:

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