No. 660,819. Patented Oct. 30, 1900.

C. H. NORTH.

MAGNETIC SIGNAL.

(Application filed Apr. 21, 1900.)

(No Model.)

Fig. 1.

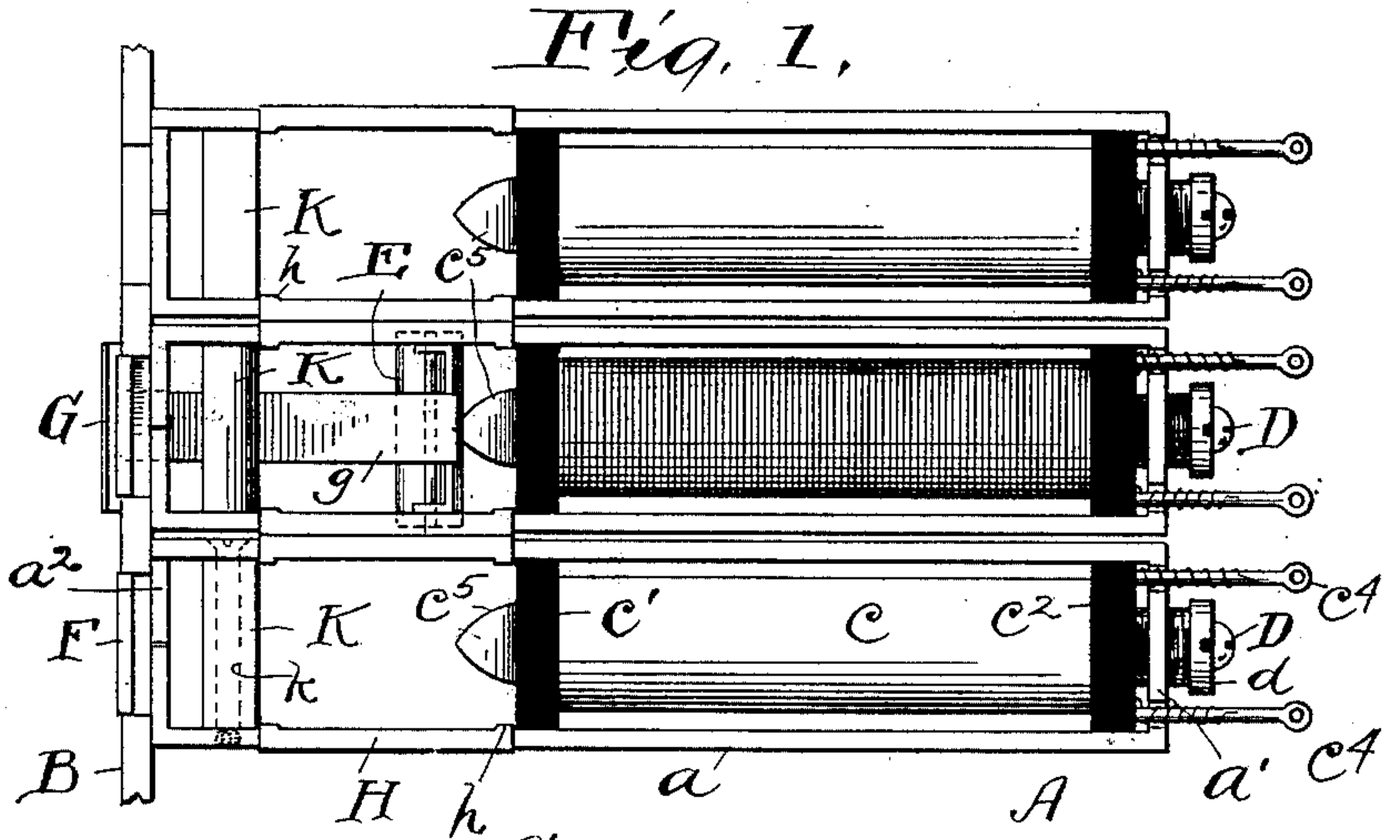


Fig. 2.

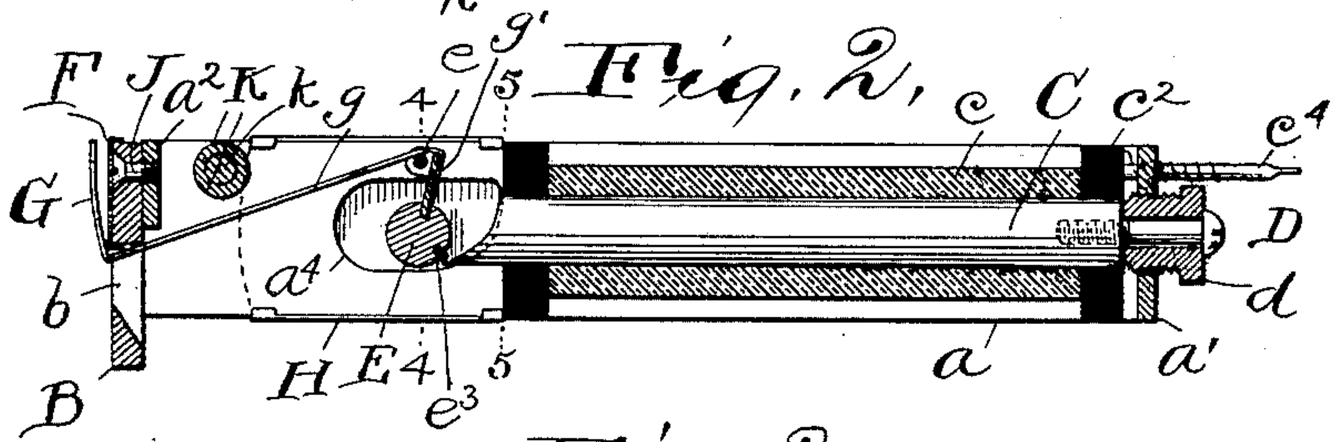
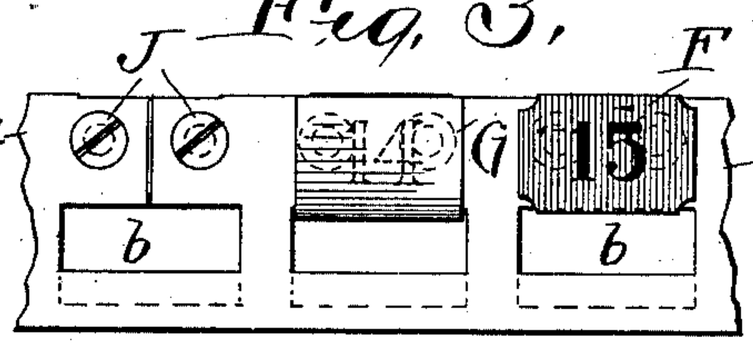


Fig. 3.



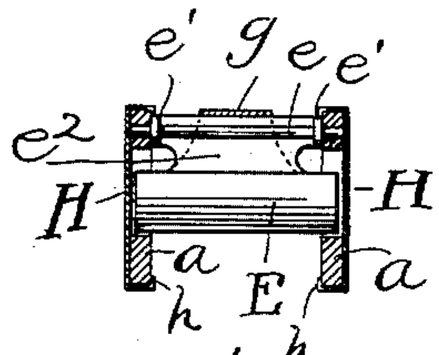


Fig. 4.

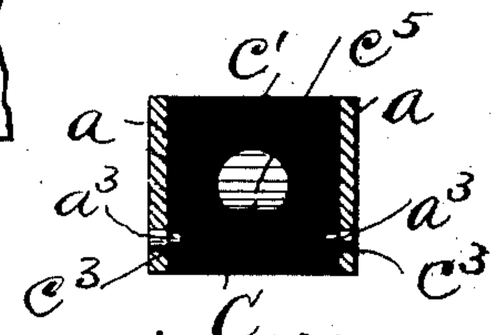
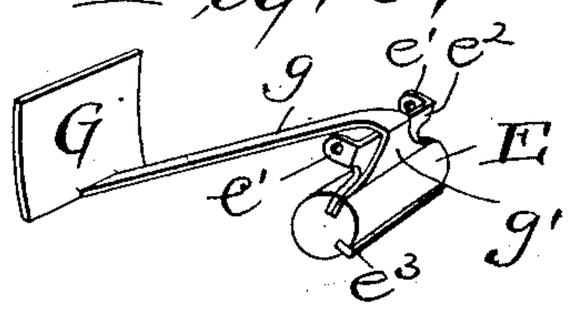


Fig. 5.

Fig. 6.



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UNITED STATES PATENT OFFICE.

CHARLES H. NORTH, OF CLEVELAND, OHIO, ASSIGNOR TO THE NORTH ELECTRIC COMPANY, OF SAME PLACE.

MAGNETIC SIGNAL.

SPECIFICATION forming part of Letters Patent No. 660,819, dated October 30, 1900.

Application filed April 21, 1900. Serial No. 13,689. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. NORTH, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Magnetic Signals, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The object of my invention is to provide a magnetic signal which while being very simple and cheap in construction shall be particularly sensitive to its own magnetism, but not be disarranged by external magnetic influences. The signal is particularly designed for use as the line-signal of a telephone-switchboard.

It consists, broadly, of a suitably-supported magnet and a pendulum-armature therefrom, the projecting magnet-core being curved to correspond to the swinging of the armature on its pivot when attracted and the armature when thus swung operating to cause the indication.

The invention includes also the means I employ for supporting and adjusting the magnet and for protecting the signal against accidental operation from the magnetic influence of adjacent signals.

The particular embodiment herein shown and described is also of my invention.

The invention may thus be conveniently summarized as consisting of the combinations of parts hereinafter specified, and definitely set out in the claims.

The drawings show the invention embodied in a signal forming part of the telephone-switchboard.

Figure 1 is a plan through such switchboard, showing three signals side by side, the armature portion of the outer signals being omitted. Fig. 2 is a longitudinal section through the signal. Fig. 3 is a front view of the signals shown in Fig. 1. Figs. 4 and 5 are vertical sections through the signal, being substantially on the lines 4 4 and 5 5 of Fig. 2. Fig. 6 is a perspective view of the pendent armature and the indication-shield.

Referring to the parts by letters, A represents a frame of the signal, consisting of a plate of iron bent into the four-sided box-like form shown, thus providing the two parallel sides a a, the rear end a', and the front a^2, composed of the two extreme ends of the plate. Near their forward ends the sides a a are held together by the screw k, taking through the distance-sleeve K.

B represents a plate of the switchboard, and the forward ends a^2 a^2 of the frame A are secured to the rear side of this plate by screws J, which screw through the plate B into those ends.

Within the frame is the operating-magnet. This includes the core C, the winding c therefor, and the insulating-heads c' and c^2. The head c' has in its edges a pair of notches c^3, into which take pins or lugs a^3, projecting inward from the side plates a of the frame. At the rear end the magnet is supported by a screw-bolt D, which screws into its rear end through a bushing d, which bushing screws into a threaded opening in the back side a' of the frame. The rear end of the core C abuts against the end of the bushing. By slightly loosening the screw D the bushing may be turned in one direction or the other to move the magnet forward or backward as desired, and then when the screw D is tightened the bushing is clamped to the core and the adjustment locked. The ends of the winding c are secured to a pair of binding-posts c^4, projecting rearward from the head c^2 through notches in the frame end a'.

The armature (whose movement governs the indication, as hereinafter explained) consists of the billet-shaped piece E, of soft iron, which is pivoted to the frame by means of the pin e, which passes from one side of the frame to the other through ears e', carried by an upwardly-extending plate e^2, which is set into the billet E, the armature thus being a pendulum. The forward end of the magnet-core is curved downward and forward, as shown at c^5 on a center which is approximately the axle of the pin e. The armature hangs normally just at the point of the projecting core and when the latter is magnetized swings rearward on its support e, thus always being very close to the core. A projecting strip of brass or other non-magnetic material e^3 is set

into the armature to prevent the latter actually contacting with the core and thereby sticking.

The curve c^5 of the magnet-core and the latter's adjustment are such that the strip e^3 just clears the core during the effective swing of the armature and contacts with the core at the end of such swing, thus obviating the necessity of an additional stop. This is accomplished by making this curve c^5 depart slightly from a perfect circular curve or making it a circular arc on a slightly different center from the center of suspension of the armature. Thus the curve c^5 may be a circular arc about a point just a little in front of the axis of the pin e. With the projecting end of the core so curved and the armature provided with a projecting non-magnetic strip e^3 I am enabled to adjust the core, so that it may be at all times extremely close to the armature without any danger of the latter sticking. Thus a very sensitive operation is secured.

The indicator which the signal discloses, which, as shown, is a numeral, is on a small plate F, which is secured on the front side of the plate B, preferably by upper and lower flanges on the plate F, projecting rearward onto the upper edge of the plate B and into an opening b in that plate. This indicator is normally covered by a shield G, which is carried by an arm g, extending through the opening b and over the pin e and then bent downward, as at g', on the rear side of the plate e^2, being set into the armature E alongside the plate e^2. The shield and its supporting-arm are very light, being preferably made of aluminium. When the armature hangs by gravity directly beneath its support e, the indication is covered by the plate or shield G. As soon as the core C is energized, however, the armature is drawn rearward, thus swinging down the shield and disclosing the indication.

In order to make as effective as possible the magnetic pull, the armature should be acted upon by both poles of the magnet, the iron frame constituting one pole. If the armature be simply swung between plane side plates of the frame, it is very difficult to guide the armature lightly and at the same time accurately enough so that one end or the other would not stick to the frame-plate without increasing the air-gap between the armature ends and the plates sufficiently to largely weaken the effective pull of those plates. I reconcile these two opposing factors by making recesses a^4 in the side plates of the frame, into which recesses the armature extends.

The recesses, it will be noticed, are of such shape as to remove the walls of the side plate some distance from the armature above it and in front of it, while at the rear side they are approximately concentric with the curve of oscillation, thus always remaining close to the armature. By this means the air-gap is reduced to a minimum, sticking prevented, and the retarding magnetic influence of the plates in front of the armature removed. The armature swings freely, and its whole guiding is dependent upon the ears e', and it has no opportunity or tendency to work into contact with anything. Moreover, the recesses or openings a^4 allow the use of a sufficiently long and heavy armature to conveniently counterbalance the weight and leverage of the arm g and shield G.

It is most convenient to construct the recesses a^4 by punching an opening clear through the side plate. In order to prevent the magnetization of one signal from influencing the armature of an adjacent signal sympathetically at such opening, I place on each side of the frame outside of the openings a^4 a protecting-plate H, of magnetic material, which thus operates to confine the magnetic lines of each signal to itself, preventing it disturbing the adjacent signal. This also increases the efficiency of each signal, saving lines of force otherwise wasted. These plates H may be conveniently made of tin-plate, secured in place by flanges bent over the upper and lower edges of the frame-plates a a and ears h on the flanges taking onto the inner side of these plates. As shown in Fig. 1, the signals abut against one another; but owing to the construction described there is no sympathetic influence from one to the other.

Having described my invention, I claim—

1. In a magnetic signal, the combination of a box-like frame including two iron side plates and a rigid iron end plate connecting them, a magnet-core and winding within said frame, means engaging the rear end of the magnet-core and said end plate for adjusting said magnet longitudinally, means engaging the forward end of the core and the side plates and adapted to slidably support said core, a pendulum-armature between the side plates and pivotally supported by them in proximity to the magnet-core, and an indicator governed by said armature, substantially as described.

2. In a magnetic signal, in combination, a frame including a pair of parallel side plates and an end plate connecting the same, a magnet within the frame, said magnet being slidably supported at its forward end by the frame, a bushing screwing into the rear end plate of the frame and adapted to bear against the magnet, and a screw-bolt passing through the bushing into the magnet-core and adapted to clamp the magnet-core to the bushing, and a signal device operated by the energization of said magnet, substantially as described.

3. In a magnetic signal, in combination, a frame having a pair of parallel side plates and an end plate connecting the same, a magnet between said side plates, a forward head for said magnet surrounding the core of the magnet and engaging the side plates and having a pair of notches in its edges, lugs or pins carried by the side plates extending into said

notches, adjustable means engaging the rear end of the core and said rear end plate for adjusting the magnet backward or forward within said frame, and a suitable signaling device operated by the energization of said magnet-core, substantially as described.

4. In a magnetic signal, in combination, a frame including the two parallel side plates and an end plate, a magnet within the frame consisting of a core, a pair of heads carried by said core, and an electric winding around the core between said heads, said heads engaging with the inner sides of the side plates, means for slidably supporting the forward head on said side plates, means at the rear end of said magnet for adjusting it backward or forward within the frame, a pair of binding-posts carried by the rear head and receiving the terminals of the electric winding and passing freely through openings in the rear end plate, and a suitable signaling device operated by the energization of the magnet-core, substantially as described.

5. In a magnetic signal, in combination, a frame having two parallel side plates and an end plate connecting the same, a magnet-core within the frame, a forward head on said magnet-core, notches in the edge of said head, and lugs carried by the side plates extending thereinto whereby the head is slidably supported by the side plates, a bushing screwing into the rear end plate and adapted to bear against the end of the magnet, a bolt passing through said bushing into the magnet-core and adapted to clamp the bushing thereto, a pendulum-armature carried by said side plates in proximity to the forward end of the magnet-core, said forward end of the core being curved on an arc approximately concentric with the path of oscillation of the armature, and a suitable indicating device governed by such oscillation, substantially as described.

6. In a magnetic signal, in combination, a magnet having a concave curved pole-face, a pendulum-armature which converges toward said pole-face as it swings, a non-magnetic member projecting into the space therebetween whereby contact between said pole and armature is prevented, substantially as described.

7. In a magnetic signal, in combination, a pendulum-armature, a longitudinally-adjustable magnet supported in proximity thereto and having a projecting core curved on an arc substantially concentric with the path of oscillation of the armature, a non-magnetic protection carried by the armature to prevent its contact with the core, and a suitable signaling device governed by said armature, substantially as described.

8. In a magnetic signal, the combination of a pendulum-armature, an arm extending forward substantially from the pivot thereof, a plate carried by said arm and adapted to disclose a signal according to the position thereof, and an electromagnet adjustably supported at the rear of said armature and having its core in proximity therewith, substantially as described.

9. The combination of a switchboard-plate, a magnetic signal whose frame is secured at the rear side of said plate, a pendulum-armature carried by said frame, an arm extending forward from said armature through an opening in said plate, a shield carried by said arm and adapted to cover a suitable indication carried by said plate, a magnet at the rear of said armature and adapted to attract it and draw it rearward and thereby swing said shield to uncover said indication, substantially as described.

10. In a magnetic signal, the combination of a pair of side plates, a magnet adjustably supported between said plates, an armature E for said magnet, said armature having secured to it a plate e^2 carrying ears e', a pin carried by the frame extending into said ears, an arm g rigid with the armature and extending from approximately the center of oscillation thereof, a plate or shield G carried by said arm, and a suitable indication disclosed thereby when the magnet attracts the armature, substantially as described.

11. In a magnetic signal, in combination, a pair of side members of the frame, a magnet supported between the same, an armature for said magent, said armature having secured to it a plate e^2 which has ears e' near its upper edge, a pin e pivoting each ear to the frame, an arm g secured to the magnet alongside of the plate e^2 and extending upward parallel therewith, and over the upper edge of said plate and projecting forward, a shield G carried at the forward end of said arm, a suitable indication adapted to be uncovered by said shield when the armature is attracted, said magnet having its core projecting into proximity to said armature and being curved on an arc approximately concentric with the arc of oscillation of the armature, substantially as described.

12. In a magnetic signal, the combination of a magnet including a core and winding, a frame therefor including a pair of iron side plates on opposite sides of the magnet, means for adjustably but magnetically connecting the core with said side plates whereby the core forms one pole of the magnet and the two side plates the other pole, and a pendulum-armature pivotally supported in proximity to the forward end of the core, both of said poles of the magnet being curved in the rear of the pendent position of the armature on an arc substantially concentric with the arc of oscillation of the armature, substantially as described.

13. In a magnetic signal, the combination of a frame including a pair of side plates, a magnet between the plates, a pendulum-armature pivoted between the plates in proximity to the forward end of the magnet, recesses in said side plates in the vicinity of the ends of the armature, said armature ex-

tending into said recesses, substantially as described.

14. In a magnetic signal, the combination of a pair of frame-plates, a magnet with a core, a pendulum-armature between the plates in front of the magnet, recesses in said plates in the vicinity of the ends of the armature into which recesses the armature extends, the walls of said recesses being comparatively distant from the armature on the forward side thereof and comparatively close to the path of oscillation of the armature on the rear side thereof, said magnet-core being in magnetic connection with said plates, substantially as described.

15. In a magnetic signal, the combination of an iron frame including a pair of side plates, an electromagnet having its core in magnetic connection with the side plates, recesses in said side plates in the vicinity of the free end of the magnet-core, a pendulum-armature extending into said recesses and thereby adapted to be attracted both by the core and by said frame, said recesses having extending across them a protection of magnetic material preventing the sympathetic influence from adjacent signals, substantially as described.

16. A plurality of magnetic signals arranged side by side, each signal including an iron frame and a magnet whose core is in magnetic connection with the frame and an armature therefor, there being openings through the frame into which the armature extends, combined with magnetic plates carried on the outer sides of the frame in the vicinity of the armature, substantially as described.

17. In a magnetic signal the combination of an iron frame including a pair of side plates, a pendulum-armature between the plates, openings through said side plates in the vicinity of the ends of the armature, the armature extending into said openings, magnetic protecting-plates on the outside of the side plates extending across said openings, a magnet for actuating said armature, and a signal governed by said armature, substantially as described.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

CHARLES H. NORTH.

Witnesses:
ALBERT H. BATES,
H. M. WISE.