G. W. HENRY.

ELECTROMAGNET.

APPLICATION FILED JULY 31, 1907.

904,871.

Patented Nov. 24, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

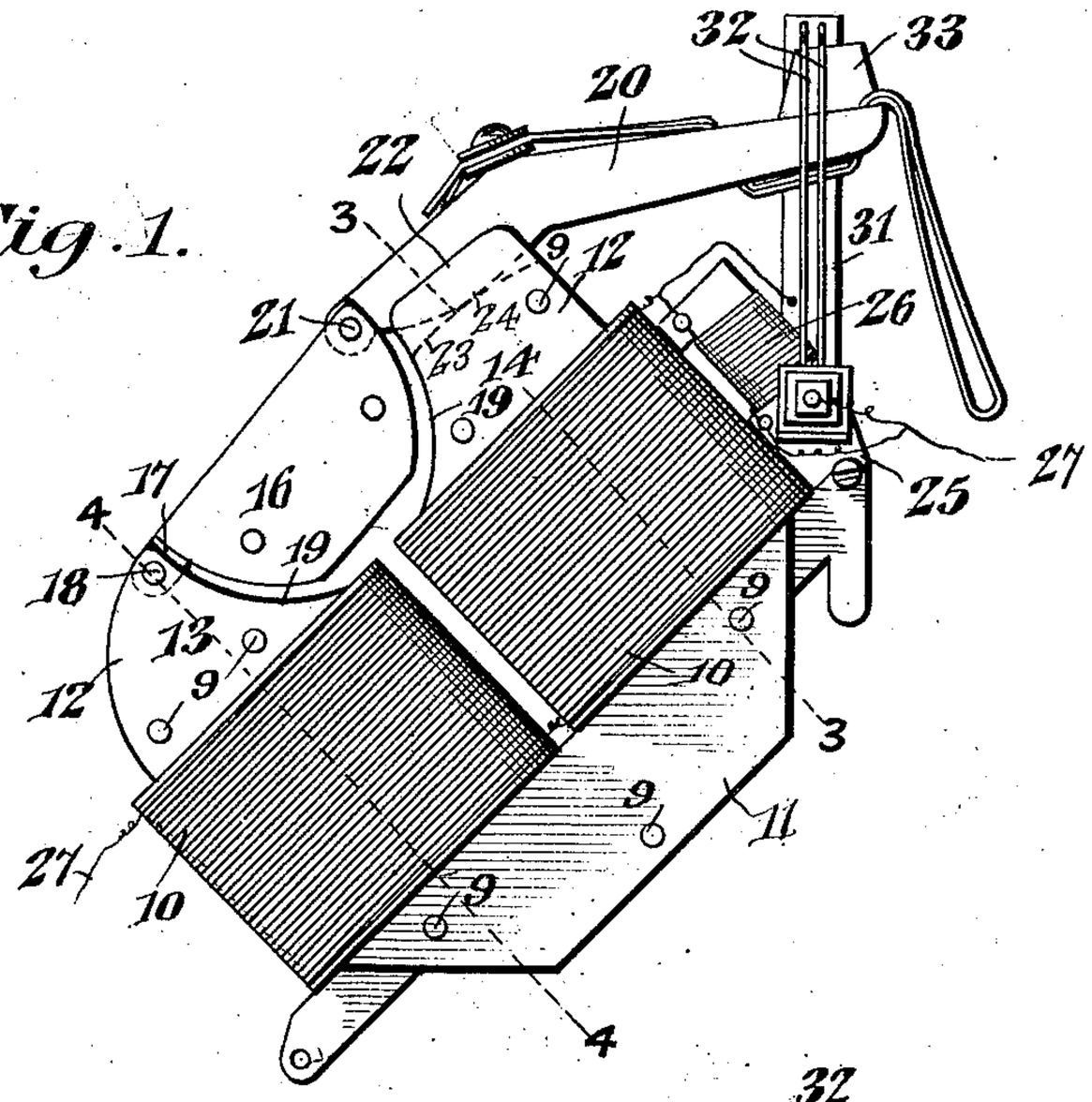
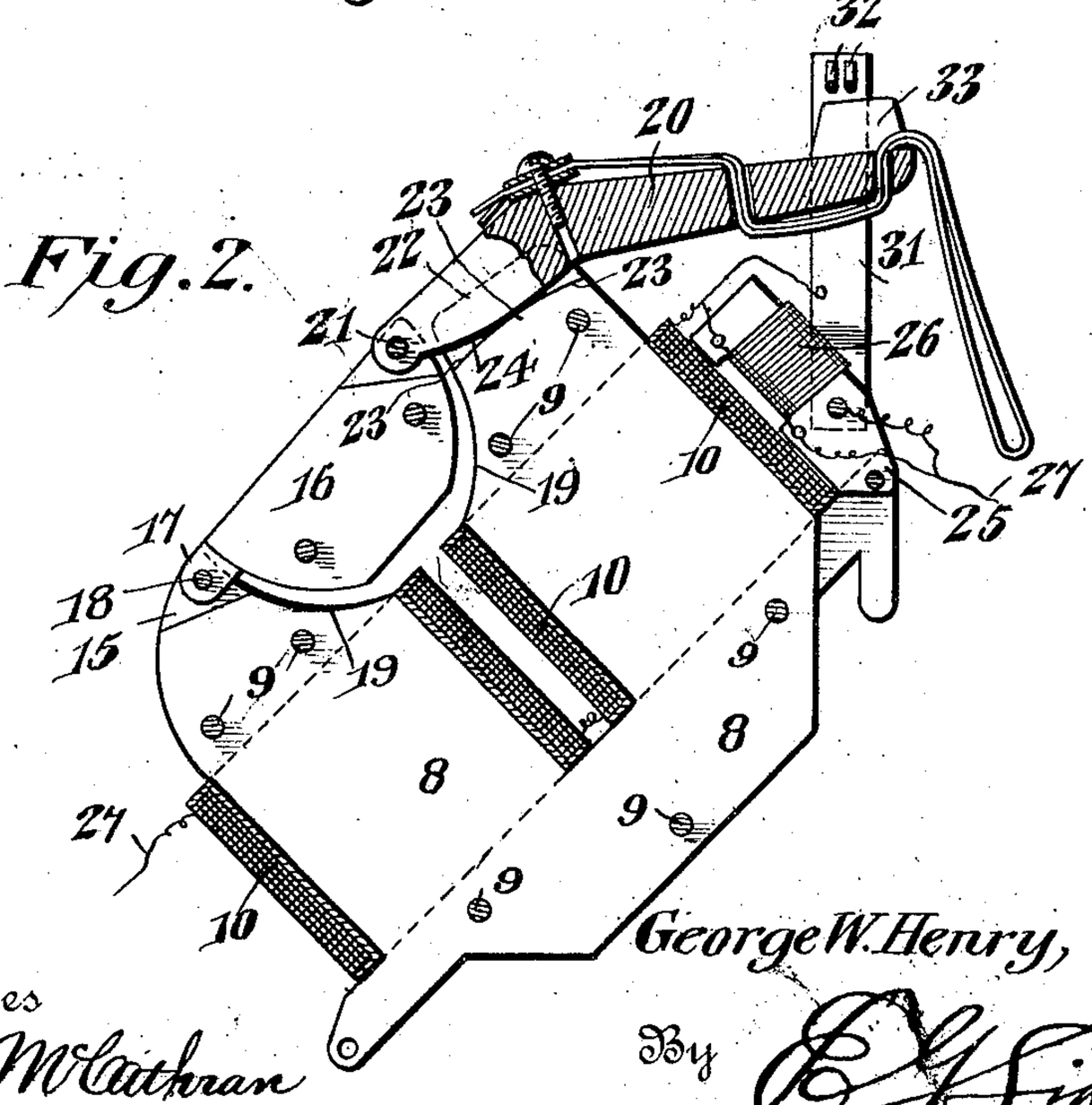


Fig. 2.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 3.

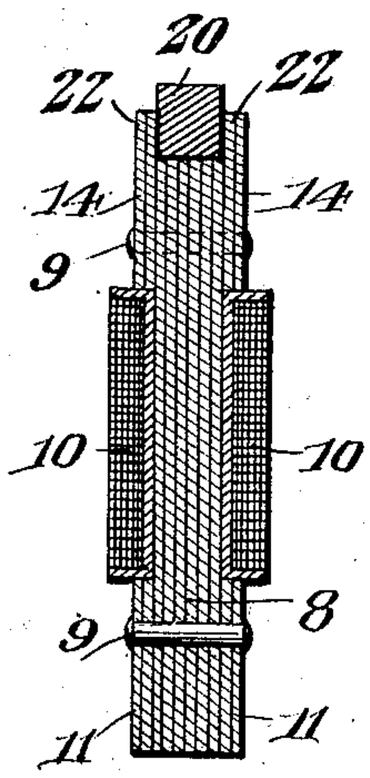


Fig. 4.

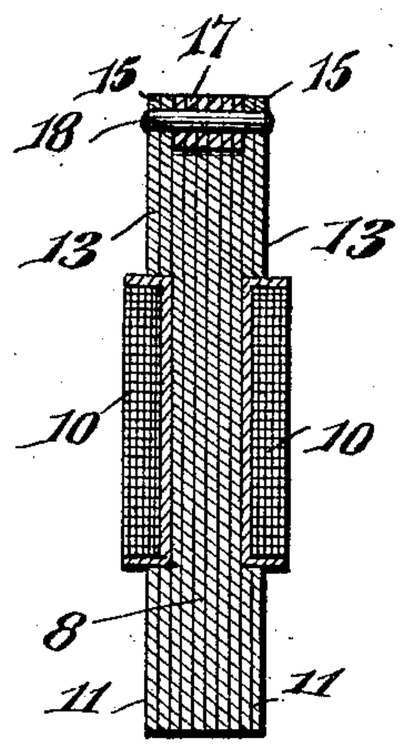


Fig. 5.

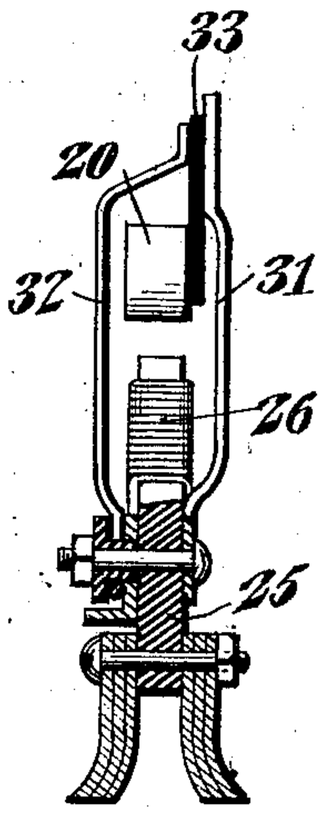


Fig. 6.

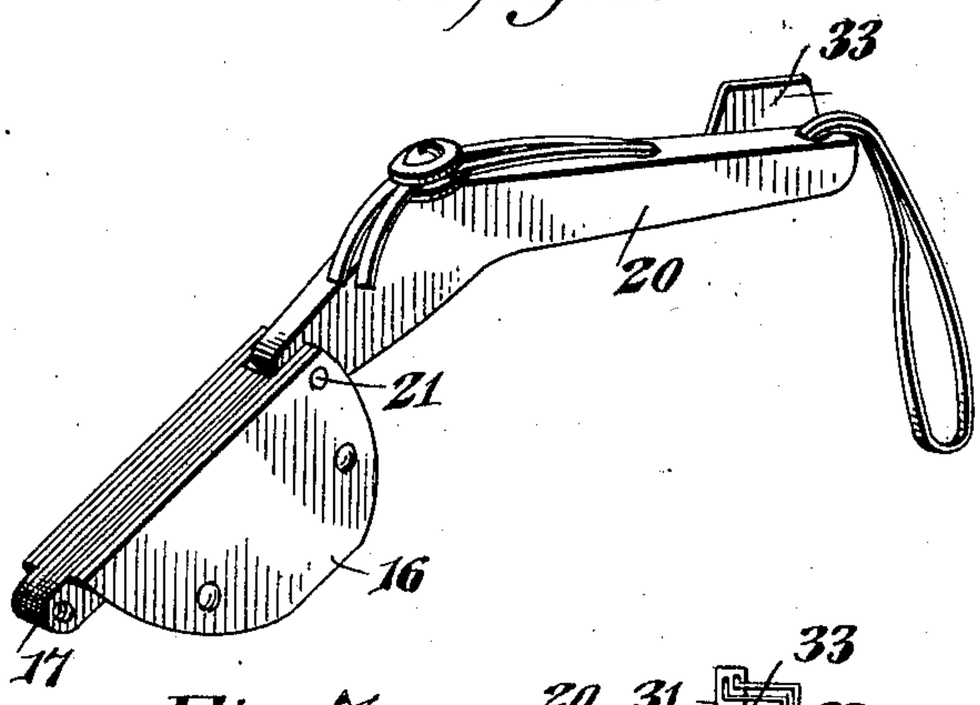
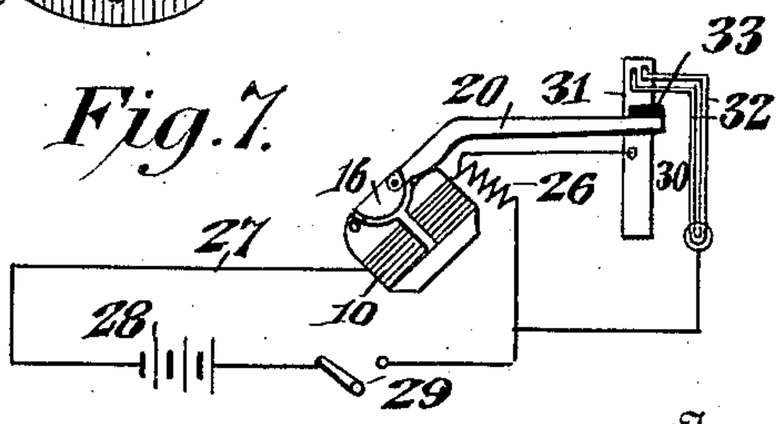


Fig. 7.



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UNITED STATES PATENT OFFICE.

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ELECTROMAGNET.

No. 904,871. Specification of Letters Patent. Patented Nov. 24, 1908.

Application filed July 31, 1907. Serial No. 386,480.

To all whom it may concern:

Be it known that I, GEORGE WASHINGTON HENRY, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a new and useful Electromagnet, of which the following is a specification.

One of the important objects of the present invention is to provide a novel, simple and powerful magnet, in which the increasing power of the armature due to its approach to the poles of the magnet is resisted by the change of leverage of the operating member actuated by said armature, so that the operating power developed by the magnet remains substantially constant during the entire movement of the armature.

A further object is to provide a novel construction of magnet wherein certain parts are made to perform a plurality of functions, thus greatly simplifying the structure.

Still another object is to provide novel means for cutting down the amount of current flowing through the magnet after an armature has been attracted thereto, whereby waste of electrical energy is prevented, while sufficient is utilized to hold the armature.

The preferable embodiment of the invention is illustrated in the accompanying drawings, wherein,

Figure 1 is a side elevation of the magnet. Fig. 2 is a longitudinal sectional view therethrough. Figs. 3 and 4 are respectively cross sectional views on the line 3—3 and 4—4 of Fig. 1. Fig. 5 is a detail sectional view showing the means for breaking the short circuit. Fig. 6 is a detail perspective view of the armature and operating lever. Fig. 7 is a diagrammatic view illustrating the circuits.

Similar reference numerals designate corresponding parts in all the figures of the drawings.

In the embodiment illustrated, an electromagnet is employed that has a horse-shoe laminated core, the plates 8 thereof being held together by rivets 9 or other suitable fastening means. Flat coils 10 are located on the arms of the core, and abutted against plates 11 secured to the opposite sides of the core plates. Spaced poles 12 project from the coils, and include retaining plates or laminæ 13 and 14 riveted respectively to the opposite sides of the core plates, and abutting against the ends of the coils, as illustrated in Figs. 3 and 4, thus effectively maintaining the coils against detachment.

It will be observed by reference to Fig. 4 that the plates or laminæ 13 project beyond the ends of the core plates 8, thus forming ears 15, and a laminated armature 16 is provided with an ear 17 located between the ears 15 and pivoted thereto, as shown at 18. The armature is substantially in the form of a half disk, and coacts with both poles, operating in recesses or cut-away portions 19, formed in the opposing edges of the poles. It is to be noted that the cut-away portions provide convergent inner walls to the poles of the magnet, and that the coacting convergent edges of the armature are movable into and out of engagement therewith. An operating lever 20 is pivotally connected as shown at 21 to the free end of the armature and operates between guide flanges 22 formed by the extension of the side plates 14 beyond the ends of the core plates. Said ends are preferably rounded slightly, as illustrated at 23, and the lever has a rocking bearing or shiftable fulcrum 24 upon the rounded ends.

A bracket 25 is secured to one end of the magnet, and a resistance coil 26 is mounted thereon. An electric circuit 27, which includes the coils 10 and resistance 26, also includes a suitable source of electrical energy 28 and a suitable circuit controlling device 29, the latter parts being illustrated diagrammatically in Fig. 7. A short circuit around the resistance 26, includes the coils 10 of the magnet, the source of electrical energy 28 and a circuit closer 30. This circuit closer consists of relatively movable contact elements 31 and 32, the terminals of which are normally in engagement. The outer arm of the lever 20 operates between the contact elements 31 and 32, and carries an insulator plate 33 that is movable between the engaging terminals of said elements to separate them, and thus break the short circuit.

The operation of this device is substantially as follows. With the parts, as illustrated in Figs. 1, 2 and 7, if the circuit 27 is closed, the current will pass through the short circuit and through the coils of the magnet. Thus said magnet will be energized, and the armature 16 drawn toward the poles. It will be evident that as said armature approaches the poles, the power thereof

will be increased. During the initial movement, the fulcrum 20 will be at a comparatively great distance from the armature, but as said armature moves toward the pole, the fulcrum will shift toward the armature. Consequently as the power of the armature increases, the power arm of the lever decreases, while the load arm of said lever is lengthened. The result is that the power delivered at the free end of the arm 20 remains substantially constant throughout the movement of the armature. As said armature approaches the limit of its movement, the insulator plate 33 will pass between the engaged terminals of the contact elements 31 and 32. Therefore the short circuit being broken, the electric current will have to traverse the resistance 26, reducing the force of said current to a point at which it is only sufficient to hold the armature 16 to the magnet. Thus a simple and practicable magnet is provided, the power of which remains substantially constant, as already described, said magnet being provided with means for cutting in and out resistance for the purpose of preventing waste of current. Moreover, in this structure, the pole plates 13 and 14, beside adding to the mass of the poles, constitutes retaining means for the coils, as well as connections and guides for the armature and lever.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art, without further description, and it will be understood that various changes in the size, shape, proportion, and minor details of construction, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. The combination with a magnet, of an armature coöperating therewith, and a lever having a shiftable fulcrum separate from the armature, said lever having a movable connection with the armature that is separate from the fulcrum.

2. The combination with a magnet, of a swinging armature coöperating therewith, a lever having a shiftable fulcrum separate from the armature, and a connection between said lever and armature that is separate from the fulcrum and constitutes means for transmitting motion from the armature to the lever.

3. The combination with a magnet, of an armature operated thereby, a bearing, and a lever pivotally connected to the armature and having a curved fulcrum portion that rocks upon the bearing.

4. The combination with a magnet, of an armature coöperating therewith, and a lever having a rocking fulcrum bearing and a pivotal connection with the armature that is separate from the fulcrum bearing.

5. The combination with a magnet, of a swinging armature coöperating therewith, a lever having a rocking fulcrum between its ends, and a pivotal connection between the armature and one arm of the lever.

6. The combination with a magnet having spaced poles, of a lever fulcrumed on one pole, and an armature movably mounted on the other pole and having a movable connection with the lever.

7. The combination with a magnet having spaced poles, of a lever having a shiftable fulcrum on one pole, and an armature coacting with the poles and connected to the lever.

8. The combination with a magnet having spaced poles, of a lever having a rocking bearing on one pole, and an armature coacting with the poles and pivotally connected to the lever.

9. The combination with a magnet having spaced poles, of a lever fulcrumed between its ends on one pole, and an armature pivoted to one of the poles and to the inner end of the lever.

10. The combination with a horse shoe magnet, of a lever fulcrumed on one pole of said magnet, and an armature pivoted to the other pole and pivotally connected to the lever.

11. The combination with a horse shoe magnet having spaced poles, of an armature pivoted to one pole and operating between said poles, and a lever having a shiftable fulcrum on the other pole and connected to the armature.

12. The combination with a horse-shoe magnet having spaced poles provided with convergently disposed inner sides, of an armature operating between the poles and having convergent opposite sides that are movable into and out of coaction with the convergent inner sides of the poles, and a lever connected to the armature and having a shifting fulcrum.

13. A magnet including a horse shoe core, the poles of which have their opposing portions cut away forming convergent inner walls, and an armature pivoted to one of the poles and coacting with both, said armature operating in the cut away portions and engaging the inner walls.

14. A magnet having a laminated core provided with a pole, certain of the laminæ of the core being spaced apart by other laminæ and projecting beyond the edges of said other laminæ to form spaced ears, and an armature pivoted to and between the ears.

15. A magnet having a laminated core provided with a pole, certain of the laminæ of the core being spaced by other laminæ and projecting beyond the ends of said other

laminæ to form guide flanges, a lever operating between the flanges and against the ends of the laminæ between the same, and an armature connected to the lever and coacting with the magnet.

16. A magnet having a laminated core provided with a pole, certain of the plates of the core projecting beyond the others to form guide flanges, the plates between having their ends curved to provide a bearing, a lever having a shifting fulcrum on the bearing between the plates, and an armature coacting with the magnet and connected to the lever.

17. A horse shoe magnet having a laminated core provided with spaced poles, certain of the plates of the core projecting beyond the ends of the others to form ears and guide flanges respectively on the ends of the poles, an armature pivoted to the ears, and a lever having a shiftable fulcrum between the lever and pivoted to the armatures.

18. A magnet including a core having a pole, a coil surrounding the core, and plates secured to opposite sides of the pole and constituting parts thereof, said plates also constituting retaining means for the coil.

19. A magnet including a core having a pole, a coil surrounding the core, plates secured to opposite sides of the pole and constituting parts thereof, said plates also constituting retaining means for the coil and projecting beyond the end of the pole forming ears, and an armature movably mounted on the ears.

20. A magnet including a core having a pole, a coil surrounding the core, plates secured to opposite sides of the pole and constituting parts thereof, said plates also constituting retaining means for the coil and projecting beyond the end of the pole forming spaced guide flanges, a lever operating between the flanges, and an armature coacting with the magnet and connected to the lever.

21. A horse shoe magnet including a laminated core having spaced poles, coils surrounding the arms of the magnet, plates secured to opposite sides of the pole and constituting retaining means for the coils, said plates projecting beyond the ends of the poles forming respectively spaced ears and spaced guide flanges, an armature pivoted to and between the ears, said armature coacting with the poles, and a lever having a shiftable fulcrum between the guide flanges and pivotally connected to the armature.

22. The combination with a magnet including a horse shoe core and coils mounted on the arms of said core, of an armature cooperating with the poles of the magnet and pivoted to one of the same, a lever fulcrumed on the other pole and pivoted to the armature, an electric circuit including resistance and said coils, a short circuit around the resistance including the coils, and a circuit closer operated by the lever upon the short circuit when the armature is operated by the magnet.

23. The combination with a magnet including a horse shoe core and coils mounted on the arms of said core, of an armature coacting with the poles of the magnet and pivoted to one of the same, a lever fulcrumed on the other pole and pivoted to the armature, an electric circuit including resistance and said coils, a short circuit around the resistance including the coils, and a circuit closer comprising relatively movable contact elements normally in engagement, and an insulator operated by the lever and movable between the contact elements to separate them when the armature is operated by the magnet.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

GEORGE WASHINGTON HENRY.

Witnesses:
M. E. NESTOR,
JOHN C. KNIGHT.