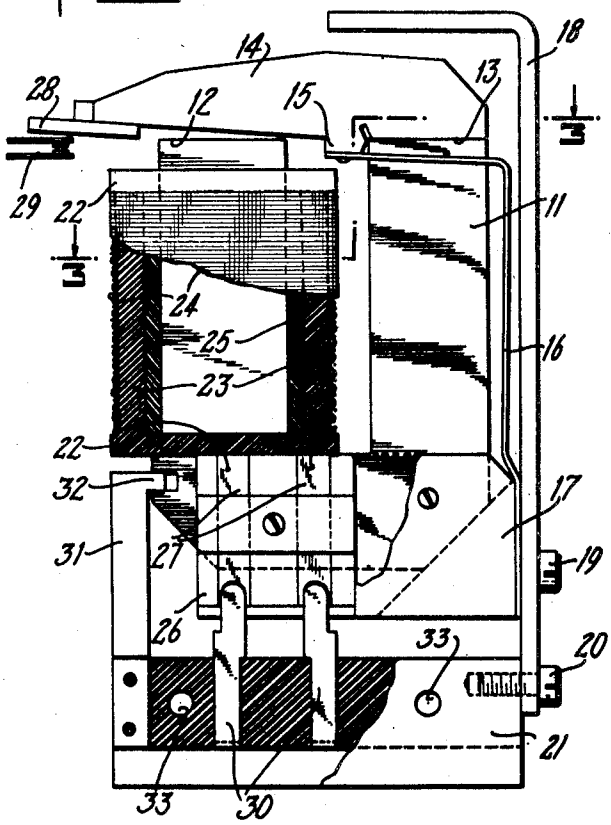
Jan. 10, 1950 J. LAST 2,493,885

ELECTROMAGNET

Filed Dec. 18, 1946

Fig. 1.



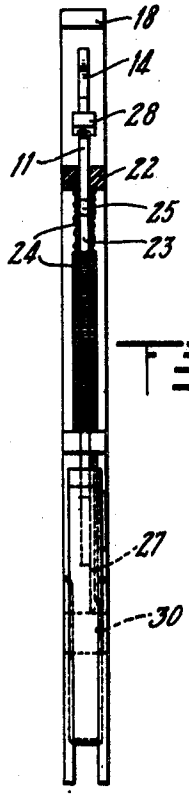


Fig. 2.

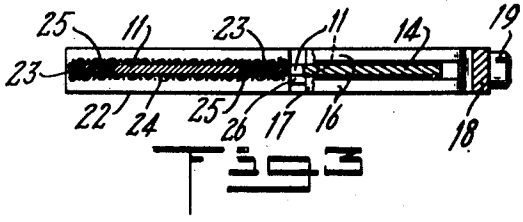
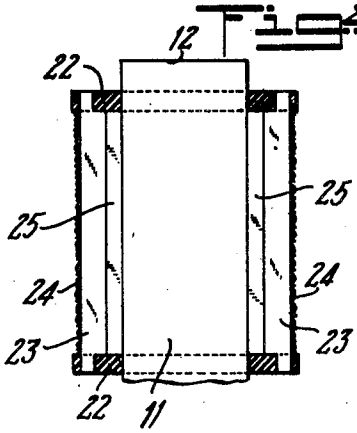


Fig. 3

Fig. 4.



INVENTOR.
JAMES LAST
BY John B. Sponsler
AGENT

Patented Jan. 10, 1950 2,493,885

UNITED STATES PATENT OFFICE

2,493,885

ELECTROMAGNET

James Last, Southampton Row, England, assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application December 18, 1946, Serial No. 717,050
In Great Britain February 13, 1946

2 Claims. (Cl. 175—336)

1

This invention relates to electromagnets and other such devices wherein electromechanical action is obtained.

In particular, the present invention is related to improved types of electromagnets having reduced physical dimensions thereby enabling the use of devices in apparatus wherein space is limited as, for example, in electrical accounting machines.

Accordingly it is an object of this invention to provide an electromagnet of improved design and arrangement of parts tending to reduce the overall size to a minimum.

It is a still further object of the present invention to provide an electromagnet of compact size having windings capable of producing high speed operation without incurring liability to damage from over-heating when the device remains energized for prolonged periods.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated of applying that principle.

In the drawing:

Fig. 1 is a side elevation view of an electromagnet selected to embody the present invention.

Fig. 2 is a front elevation view of the device shown in Fig. 1 less certain components.

Fig. 3 is a sectional view of Fig. 1 approximately along the lines 3—3.

Fig. 4 is a partial view of a portion of Fig. 1 illustrating an alternate embodiment of certain features of the invention.

With reference to Fig. 1 a substantially flat U-shaped core 11, having uniform cross section and coplanar pole faces 12 and 13, is provided with an armature 14 of similar cross section. A lug 15 is formed on the armature 14 so that the pole face 13 provides a pivotal line on its inner edge about which the armature 14 may turn, the pole face 13 being overlapped on its surface by a portion of the armature 14 and on its side by the lug 15. The overlapping portion of the armature 14 is cut with a slight degree of angularity on its contacting surface with respect to the remaining surface of the armature so that when the electromagnet is not energized an air gap is obtained between the hanging portion of the armature and the pole face 12. A flat L-shaped spring 16 is fastened at one end to the lug 15. A rectangular slot cut into the spring 16 permits the core 11 to protrude through the spring with a predetermined clearance. The other end of the spring 16 is fastened to a non-magnetic block 17 which in turn

2

is secured to the core 11. The spring 16 is so arranged and tensioned that the armature 14 is seated on the pole face 13 and capable of being rotated about the pivotal line previously mentioned against the urging of the spring 16 to retain in normally from contacting the pole face 12. A guard bar 18 is also fastened to the block 17 by a screw 19 which also provides the means for holding the one end of the spring 16 in proper position. Provision is also made on the bar 18 whereby a mounting screw 20 may mount the electromagnet to a block 21 hereinafter described.

An insulating winding form is fitted over the core 11. In the mode of the invention described herein a single winding is provided on one leg of the core 11. The winding form may be a solid molding as shown in Fig. 1 or a composite member as shown in Fig. 4 having two end flanges 22 and a pair of winding supports 23 separating the flanges 22 between which a winding 24 is applied. In either modification the winding form is open over the principal area of the core. The spacing between the outer edges of supports 23 may be variably selected to vary the length of wire without varying the number of turns in the winding 24 thereby controlling the resistance without materially affecting the self inductance of the winding. Since the principal flux linking the winding occurs where the turns of the winding 24 pass close to the faces of the core 11 between the supports 23, it is possible by so selecting the distance between the outer edges of the supports 23 to vary the resistance over great limits without materially changing the self inductance of the winding so that the speed of actuation can be kept high. To assist in assembling the winding form to the core 11 the mica spacers 25 may be used. An insulated block 26 is fastened to the core 11 to carry two contact strips 27 to which the ends of the winding 24 are attached to provide electrical contact. The armature 14 is provided with an interposing element 28 at its free end to furnish a means by which the electromagnet may be utilized to do work such as the closing of a pair of contacts 29.

The block 21, previously mentioned, is of insulating material and carries two contact receptacles 30 spaced to admit and contact the strips 27. An arm 31 on one end of the block 21 has formed upon it a tooth 32 which is capable of engaging a notched portion of the core 11 thereby providing, together with the receptacles 30, a quick means for mounting the electromagnet. The other end of the block 21 is threaded to receive a screw 20 which clamps the electromagnet

securely to the block 21 through a hole in the guard bar 18. Two holes 33 are provided in the block 21 by which a plurality of blocks may be clamped together to mount several electromagnets in a bank.

By way of illustration, an experimental electromagnet following the teaching of this invention was constructed with a core of .04 inch thickness and .45 inch across each pole face. The armature was approximately 1.5 inches long and of .04 inch thickness having an under surface angularity difference of 1.5 degrees between the overlapping portion and the hanging portion. The winding supports were spaced to a total width of .8 inch, and 5220 turns of #45 wire were wound on the winding form. The resulting electromagnet was approximately 3.5 x 2 x .168 inches overall. In operation the electromagnet, so constructed, was actuated by a potential of 30 volts to close its armature in 2.5 milliseconds. A steady state current of 32 milliamperes was drawn at the above potential to cause the temperature to rise from 15 to 35 degrees centigrade in a period of one hour.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. An electromagnetic device comprising a thin U-shaped plate having its arms spaced from each other a distance many times the thickness of the plate, each said arm having a width many times its thickness, an armature consisting of a second thin plate disposed against the ends of the said arms, said armature being shaped and arranged to pivot near its one end on a knife edge formed by the intersection of the end and the inner edge of one said arm, a spring normally biasing the armature away from the end of the other said arm, and a winding around the last mentioned arm for setting up flux therein to attract and operate the armature to overcome the said spring, the said winding having turns each consisting of portions lying closely adjacent to the faces of the said arm and other portions extending beyond the edges of said arm a distance many times the thickness of said plate, whereby the length of said other portions may be variably selected without variations in the length of the turns materially affecting the amount of flux induced in said arm by the winding.

2. An electromagnetic device comprising a thin U-shaped plate having its arms spaced from each other a distance many times the thickness of the plate, each said arm having a width many times its thickness, an armature consisting of a second thin plate disposed against the ends of the said arms, said armature being shaped and arranged to pivot near its one end on a knife edge formed by the intersection of the end and the inner edge of one said arm, a spring normally biasing the armature away from the end of the other said arm, and a winding around one of the said arms for setting up flux therein to attract and operate the armature to overcome the said spring, the said winding having turns each consisting of portions lying closely adjacent to the faces of the said arm and other portions extending beyond the edges to a distance such that their remoter parts negligibly affect the amount of flux induced in the core by the winding, whereby the length of said other portions may be variably selected without variations in the length of turns materially affecting the amount of flux induced in said arm by the winding.

JAMES LAST.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,585,630	Carpenter et al.	May 18, 1926
2,351,377	Warsher	June 13, 1944