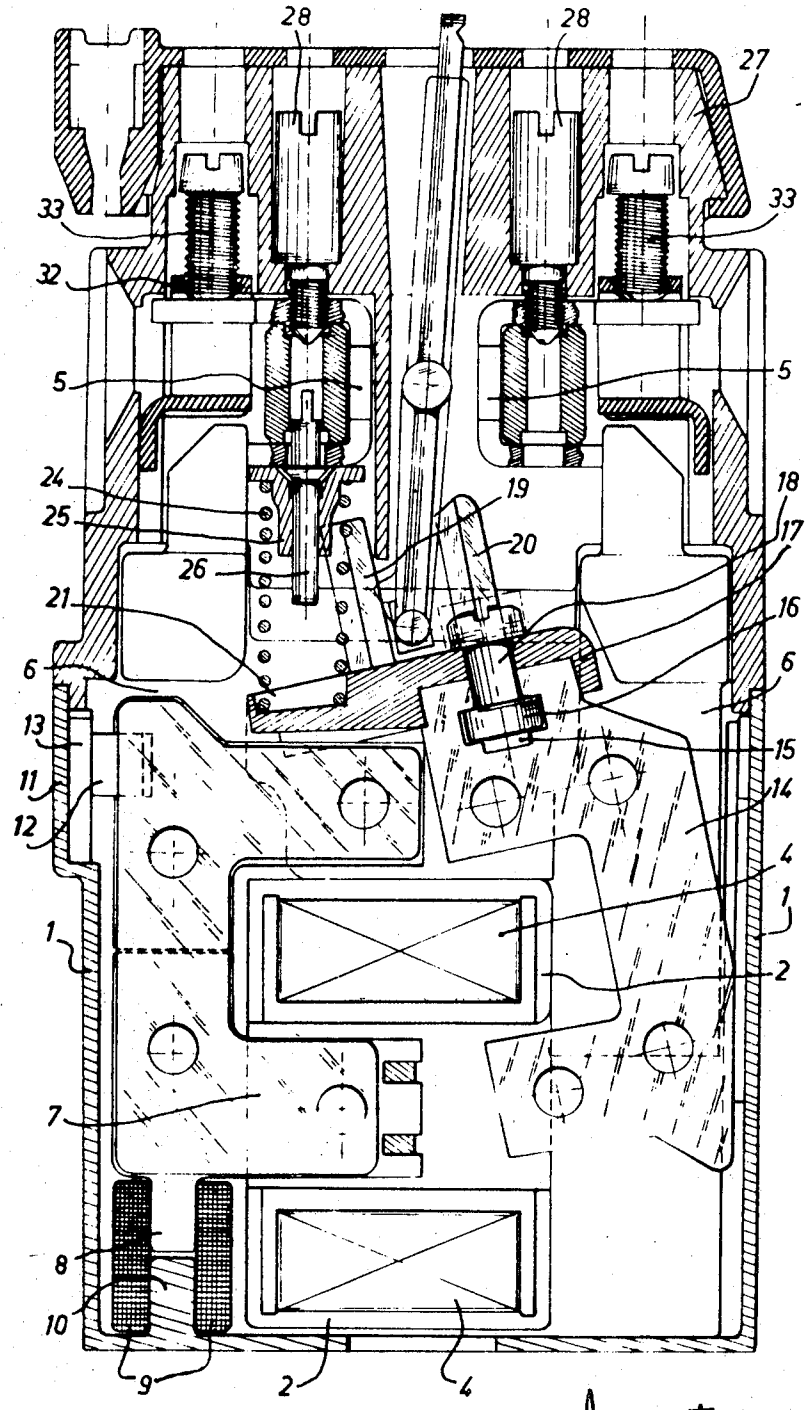
July 7, 1970 A. G. FAFFART 3,519,968

CONTACTOR WITH IMPROVED ELECTROMAGNETIC OPERATING DEVICE

Filed Jan. 17, 1969 4 Sheets-Sheet 1

FIG.1

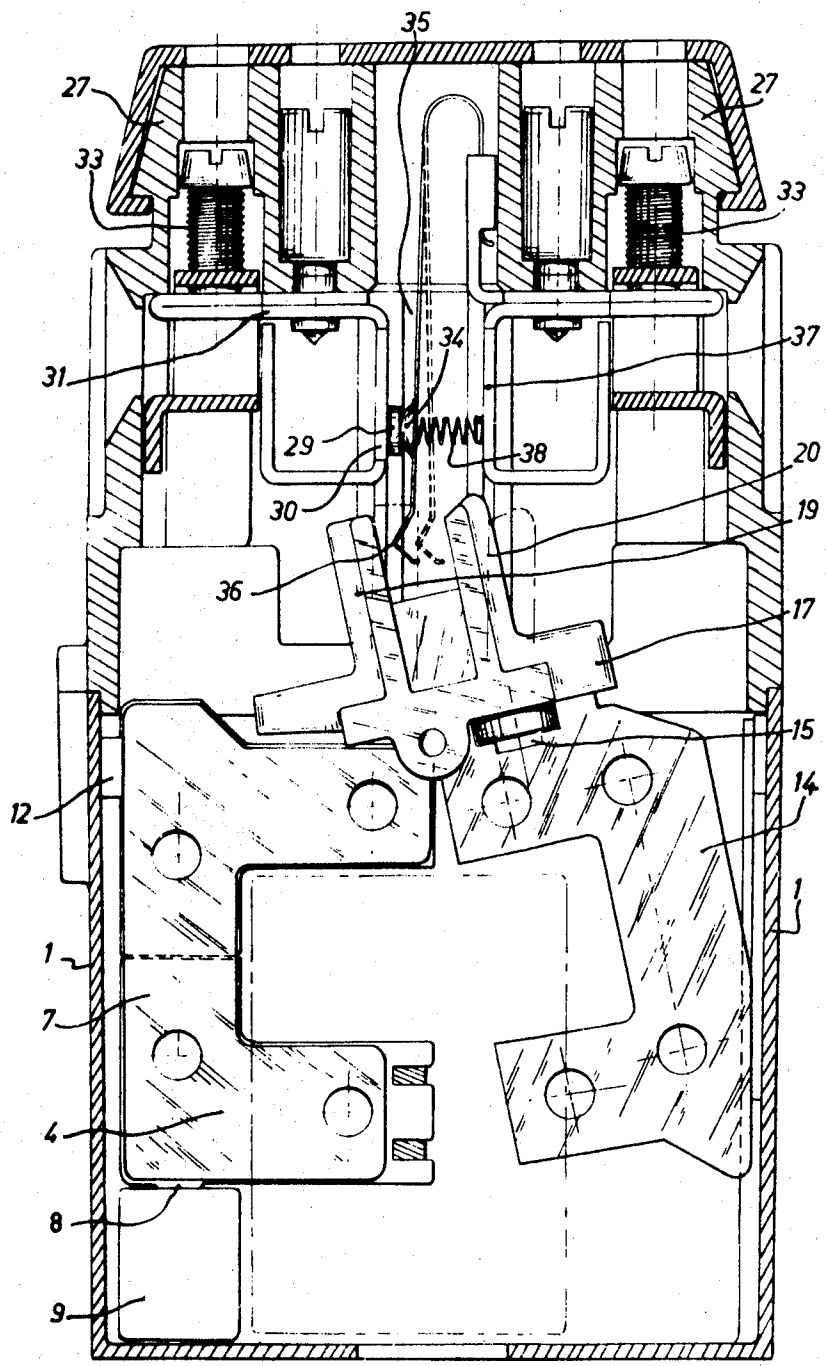


Inventor:
Andre Georges Faffart
By
H.A.W. Flocks
Attorney

CONTACTOR WITH IMPROVED ELECTROMAGNETIC OPERATING DEVICE

Filed Jan. 17, 1969 4 Sheets-Sheet 2

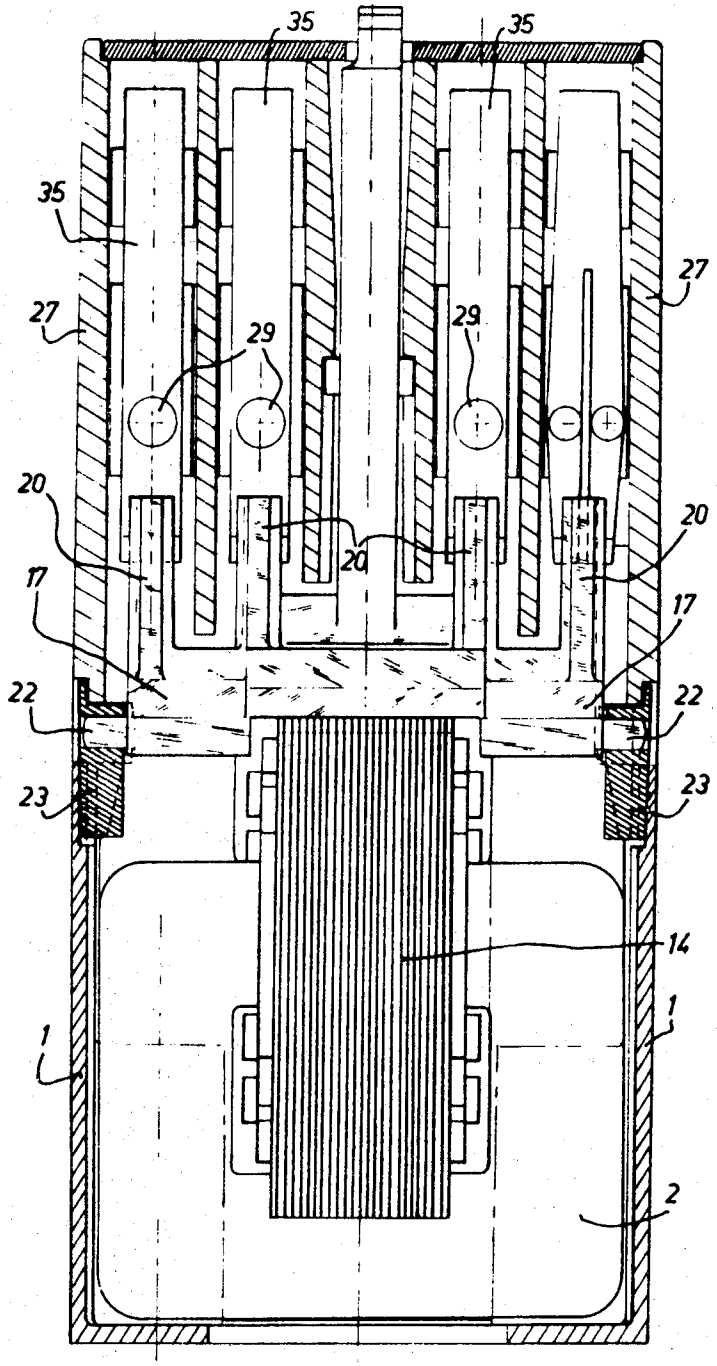
FIG. 2



CONTACTOR WITH IMPROVED ELECTROMAGNETIC OPERATING DEVICE

Filed Jan. 17, 1969 4 Sheets-Sheet 3

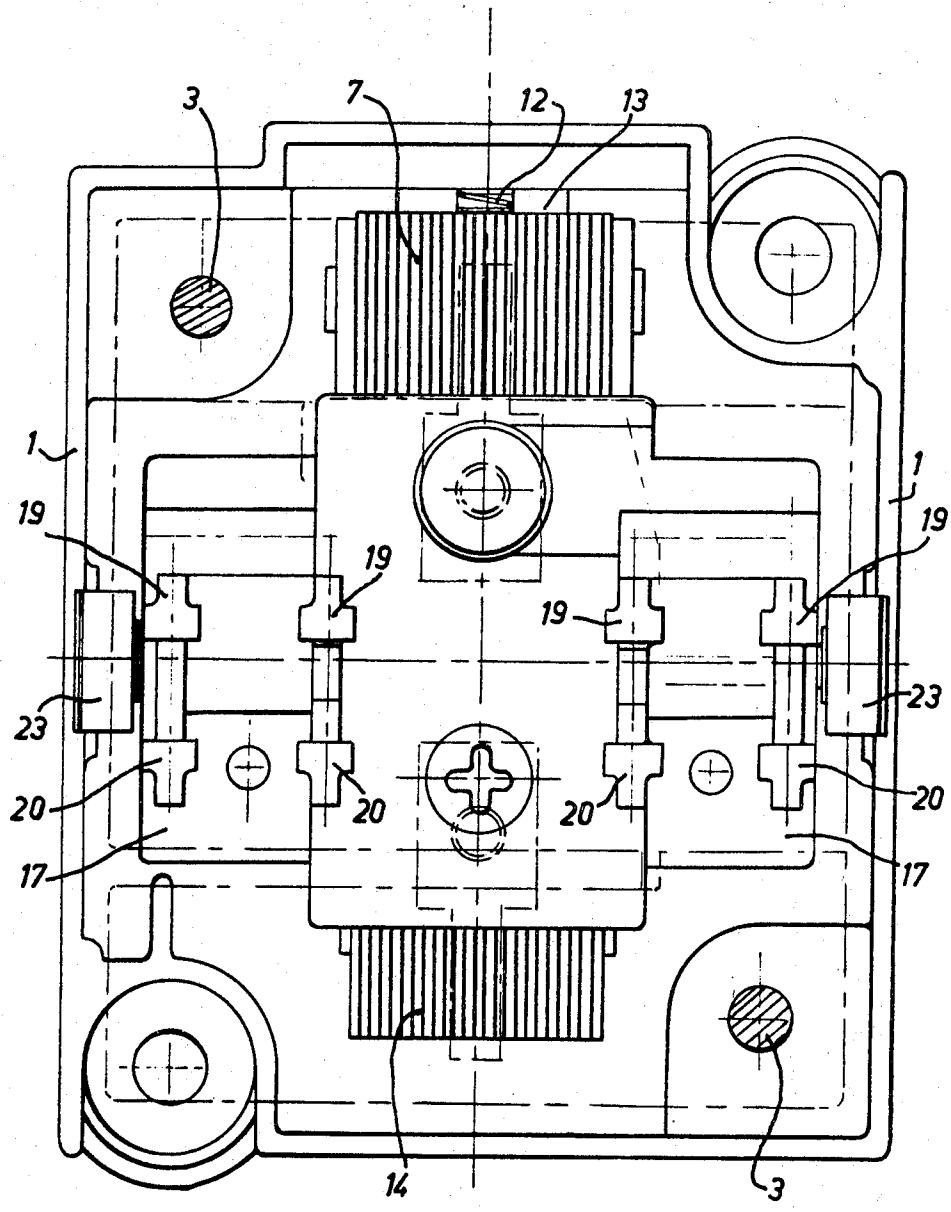
FIG. 3



CONTACTOR WITH IMPROVED ELECTROMAGNETIC OPERATING DEVICE

Filed Jan. 17, 1969 4 Sheets-Sheet 4

FIG.4



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CONTACTOR WITH IMPROVED ELECTROMAGNETIC OPERATING DEVICE

Andre Georges Faffart, Nanterre, France, assignor to La Telemecanique Electrique Nanterre, Hauts-de-Seine, France, a joint-stock company of France

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Claims priority, application France, Jan. 23, 1968, 137,135
Int. Cl. H01h 3/54
U.S. Cl. 335—185 7 Claims

ABSTRACT OF THE DISCLOSURE

A contactor with electromagnetic control comprising a pivoted electromagnet core provided with a coil and having flat pole faces, and an armature oscillating about an axis, having flat pole faces respectively facing the pole faces of the pivoted core and on which an insulating member is rigidly mounted opposite the pole face with respect of the axis of oscillation and which comprises at least one insulating fork, said oscillating armature being restored by a calibratable elastic means. At least one moving contact, carried by a flexible blade is mounted facing at least one fixed contact, each connected to a terminal, the free extremity of the flexible blade being engaged with play between the arms of the insulating fork, said blade being released by the arms of the fork in closed position of the contact, while a calibrated spring applies said moving contact against said fixed contact.

The present invention relates to an improved operating device for a contactor with electromagnetic control. It is also concerned with a contactor comprising the said device.

Contactors with electromagnetic control devices are already known, and generally comprise two complementary elements, namely the driving device and the contact-carrier portion, the mounting of which cannot be effected without being obliged to carry out an adjustment of the moving contacts. This adjustment is made especially necessary by the manufacturing tolerances, the required contact pressure and the adverse effects of bouncing. An adjustment of this kind involves in its turn the presence of elements which can themselves get out of adjustment. As furthermore the adjustment can only be made when the apparatus has been assembled and closed, it is only possible to carry out a purely visual adjustment so that regular performances cannot be obtained. Finally, the number of moving parts and the friction which they introduce is such that it becomes necessary to overdimension the electromaget and to terminate with excessive consumption and volume with respect to the rupturing capacity of the apparatus.

The present invention overcomes these disadvantages by providing an operating device for a contactor with electromagnetic control, in which the adjustment of the contacts may be effected in a stable and reliable manner before the assembly of its elements, ensuring regular performances with an acceptable volume and consumption of energy.

The device in accordance with the invention is essentially characterized by the fact that it comprises, in combination:

An electromagnet core comprising a coil and flat pole faces co-operating with an oscillating armature having flat pole faces, this latter being provided with an insulating member having one or a number of forks in alignment, located opposite the pole faces with respect to the axis of oscillation of the said armature.

One or a number of moving contacts co-operating respectively with one or more corresponding fixed contacts, each of the said moving contacts being fixed on a flexible blade, one extremity of which is mounted with play between the arms of one of the insulating forks, the said flexible blade co-operating with an elastic member providing a mechanical closure of the contacts and its extremity being in contact with one of the arms of the insulating fork only when the corresponding fixed contact and moving contact are in the open position.

In accordance with other characteristic features:

The electromagnet armatures and the control coil of the said armatures are contained in a single casing.

The fixed contacts, the moving contacts and the electric current lead-in connections are contained in a single cover.

The said cover and the said casing can be assembled together.

The oscillating armature and the insulating member with forks are movable in rotation about an axis passing through the plane of one of its pole faces and coinciding with the extreme edge of the pole face of the limb of the core from which it moves away least.

The core is able to pivot about a housing rigidly fixed to the casing and can be brought back automatically to a position of rest.

Each moving contact is carried by a bent-back flexible blade, one extremity of which is fixed to a connection terminal in electrical contact therewith.

The insulating member comprises, on the side opposite to the core, a recess on the bottom of which is supported the extremity of an armature return spring, the other extremity of which is supported on a cup coaxial with the said spring, the said cup being adjustable in position along its axis by means of a screw adjustment device.

The screw adjustment device is coaxial with one terminal of the excitation coil, the said terminal being pierced with an axial opening up to the head of the screw.

Other characteristic features and advantages of the invention will be brought out more clearly in the description which follows below of one preferred form of construction of an apparatus utilizing the above device, this description being made with reference to the accompanying drawings, in which:

FIG. 1 shows a view in elevation of the apparatus with a cross-section of the cover at the level of the coil terminals;

FIG. 2 represents a view in elevation of the same apparatus with a cross-section of the cover at the level of the contact terminals;

FIG. 3 is a cross-section taken in a plane passing through the axis of the armature pivots;

FIG. 4 shows a plan view of the apparatus with the switch unit removed.

Referring now to FIGS. 1, 2, 3 and 4:

The apparatus comprises a casing **1** provided with fixing lugs, in which is placed a coil body **2**, fixed by means of screws **3** which are accessible from the lower face of the casing **1**. This coil body **2** is constituted by an insulating body such as for example of thermoplastic or or thermo-hardening resin moulded over a winding **4**, of which the connections **5** in the form of a square are directed upwards and are also coated over a part of their path by the said resin, which thus forms two vertical columns **6**.

The casing **1** also comprises a fixed core **7** of a usual type composed of a stack of magnetic steel sheets assembled together by rivets. These sheets are cut-out so as to form a housing foot **8**, housed in a block of elastic material **9**, such as rubber, having an opening centered on a nipple **10** moulded integrally with the bottom of the cas-

ing 1. At the upper portion of the casing is formed a recess 11 intended to receive one of the extremities of an elastic member 12 such as for example a spring or a block of rubber, rigidly fixed to a support 13 embedded in the vertical wall of the casing. The core is thus capable of carrying out any pivotal movement within the space round its housing foot 8 and to return to its position of rest due to the action of the elastic member 12.

The above casing 1 further comprises a moving armature 14 made-up of stacked magnetic steel sheets assembled together by rivets, and the upper portion of which is provided with an opening 15 produced by punching-out the sheets before assembly. In this opening, which is wider in the interior than at the surface, is housed a nut 16 of rectangular shape which serves to fix the armature 14 on an oscillating member 17 by means of a screw 18.

This oscillating member is constituted by a part made of insulating material, such as plastic material for example, which comprises a certain number of forks, constituted by arms 19 and 20, a blind housing 21 and two pivots 22. These latter are housed in bearings 23 of insulating material, plastic material for example, which are located in recesses formed in the two opposite vertical walls of the casing 1.

In the blind housing 21 there is supported for returning the armature, the extremity of a compression spring 24, the other extremity of which is supported on a cup 25, the axial position of which can be modified by an adjusting screw 26. The pivotal axis of the oscillating member passes through the plane of the upper pole face of the armature and is practically coincident with the edge of the core formed by the intersection of the pole face with the outer surface of the upper limb of the core.

In addition, the lower face of the insulating member 17 forms a slightly obtuse angle with the pole face of the armature. Thus, when the whole of the magnetic circuit is assembled, the above edge of the core is supported by the elastic member 12 on the upper pole face of the armature. In consequence, the core, which has two degrees of freedom is automatically located in a position such that the pole faces of the armature are applied against its own pole faces, and this is the case over their whole surface and not along a single line as might be the case if the core did not have this amount of freedom.

The upper portion of the apparatus is closed by a switch unit 27 in which are mounted the contacts, and which is rigidly fixed to the casing, for example by means of two clamping screws 28 which are engaged in the connections 5 leading the current to the coil body 2, this coil body being in turn fixed on the bottom of the casing. The cover comprises a certain number of pairs of contacts, each pair comprising a fixed contact and a moving contact which are mounted in fixed positions inside the cover.

The fixed contact of each pair is constituted by a contact stud 29 fixed on a stirrup 30, for example by means of a rivet, the stirrup being formed by bending a strip cut-out from a steel sheet. This stirrup comprises an extension 31 on which is threaded a conducting ring 32 of oblong shape, which can be brought into a high position by means of a clamping screw 33 so as to form the electrical connection with an external conductor. Each moving contact is constituted by a contact stud 34 fixed on a contact carrier 35 by means of a rivet for example. This contact carrier is formed by an elastic blade with two arms made of a metal which is a good conductor of electricity, in which the lower extremity 36 of one of the arms is engaged with play between the arms 19 and 20 of the corresponding fork carried by the oscillating member of the armature. The upper portion of the elastic blade is bent back and has one arm shorter than that previously referred to and parallel to the latter, this arm being fixed by insetting on the extension of a stirrup 37, which is furthermore of a shape generally similar to that of the stirrup 30 which carries the fixed contact stud.

A compression spring 38 is mounted between the stirrup 37 and the face of the elastic blade opposite to that which carries the moving contact stud 34 and at the same height. The function of this spring, which is held in position by projecting portions on the two elements against which it is supported, is on the one hand to apply the moving contact stud 34 against the fixed contact stud 29 when the arm 19 of the fork has, due to the play provided, released the lower extremity of the moving contact-carrier blade, and on the other hand to apply the said extremity against the arm when this latter is required to drive it.

FIG. 2 shows the operation of a "rest contact," that is to say established when the electromagnet is de-energized, but it is clear to those skilled in the art that the same result could be obtained by means of a "working contact," obtained by turning round in the contact carrier 35 the assembly constituted by the elastic blade, the fixed contact and the moving contact.

In the contactor described above, which comprises a lower portion including the driving elements and an upper portion including the fixed contacts and the moving contacts together with the supply terminals for the coil, an arrangement which facilitates its construction, the driving elements and the contact elements can be regulated separately during assembly, which permits accurate prior calibration of the spring 24 and the springs 38, thus precluding any interaction of these elements. Furthermore, there are excluded on the one hand the effects of possible movements of the armature due to its mobility, such as vibrations or bouncing, by reason of the arrangement of the fork arms with respect to the extremities of the operating blades of the corresponding moving contacts, the arms of these forks acting on the extremities of the said blades solely when the contact has not been established and by acting in opposition to the forces applied by the springs 38 which tend to bring them into a closed contact position. On the other hand, the effects due to friction of parts in movement between each other are reduced to a minimum because this friction is reduced to that of the extremities of the shaft of the oscillating member in their respective bearings.

In addition, the elements of the driving portion of the contactor, such as the core and armature, are located and arranged in such manner that no adjustment of position should be effected after the assembly of the two parts, due to the fact, on the one hand, that the axis of rotation of the armature, the geometric position of which is defined precisely, passes through the plane of one of the pole faces of the armature, and that, on the other hand, it coincides constantly with the upper edge of the corresponding pole face of the core, by means of the elastic member which acts on the rear face of the said core, conjointly with the pivot with which it is provided, in such manner that the contact between the core and the armature is effected at the level of the axis of rotation of the said armature.

Finally, the fact that the connection elements are placed in the upper portion of the apparatus constitutes a further advantage of the arrangement described above, the conducting clamping screws 28 permitting rapid checking of all the voltages.

It will of course be understood that the above apparatus may compirse alterative forms in its construction. Thus for example, the elastic block 9 may be replaced by a swivel joint or again the fork arms may be replaced by nipples located between the arms of an end fork of the elastic blades.

More generally, it will also be understood that the present invention has been described and shown solely by way of indication and not in any limitative sense and that any useful modification may be made thereto without thereby departing from its scope.

I claim:

1. A contactor with electromagnetic control acting by the effect of an over-voltage of predetermined value and

without bouncing of contacts, comprising, in a casing:

an electromagnet core provided with a coil pivotally mounted in said casing and having flat pole faces;

an armature oscillating about an axis, having flat pole faces respectively facing the pole faces of the pivoted core;

an insulating member rigidly fixed to the oscillating armature and mounted opposite the pole faces with respect to the axis of oscillation, and comprising at least one insulating fork;

at least one moving contact and at least one fixed contact mounted facing each other, each connected to a terminal, the moving contact being carried by a flexible blade, the free extremity of which is engaged with play between the arms of the insulating fork, said blade being released by the arms of the fork in the closed position of the contacts, the terminals being mounted on an insulating block in the form of a cover for the said casing;

a calibrated spring applying a force to said moving contact against said fixed contact; and

a calibratable elastic restoring means for the oscillating armature.

2. A contactor with electromagnetic control as claimed in claim **1**, in which said insulating member forms a slightly obtuse angle with the pole face of the armature in such manner that the edge of the limb of the core located on the side of the axis of rotation of said armature may be elastically supported against the pole surface of the armature.

3. A contactor with electromagnetic control as claimed in claim **1**, in which the pivotal shaft carried by the insulating member is coincident with the edge of the limb of the core which is supported against the pole surface of the armature.

4. A contactor with electromagnetic control as claimed in claim **1**, in which the elastic pivotal member of the core is constituted by a housing foot cut-out in said core

and embedded in a block of elastic material having an opening centered on a moulded nipple in the bottom of said casing and by a spring interposed between the internal wall of said casing and the face of said core opposite its pole faces.

5. A contactor with electromagnetic control as claimed in claim **1**, in which the oscillating armature and the core with its coil are mounted in an open casing having the shape of a can, while the flexible blades carrying the moving contacts are bent back at their fixed extremities into a loop and connected to terminals forming part of an insulating unit which is mounted on said casing, so that the free extremities of said flexible blades can be freely engaged between the arms of the forks of said insulating member.

6. A contactor with electromagnetic control as claimed in claim **1**, in which the insulating member is provided with a recess on the side opposite to the core, on the bottom of which recess is supported the extremity of a restoring spring for said armature, while the other extremity is engaged in a cup coaxial with said spring, said cup being adjustable in position along its axis by means of a regulating screw.

7. A contactor with electromagnetic control as claimed in claim **6**, in which said regulating screw for the restoring spring of the oscillating armature is coaxial with a terminal of the excitation coil, said terminal being pierced with an axial opening down to the head of said screw.

References Cited

UNITED STATES PATENTS

2,969,444	1/1961	Deissler	335—192
3,319,199	5/1967	Bauer	335—128
3,388,353	6/1968	Isler	335—132

BERNARD A. GILHEANY, Primary Examiner

H. BROOME, Assistant Examiner