Aug. 27, 1963 J. BAUDET 3,102,174

SWITCH OF THE SCREW SELECTOR TYPE

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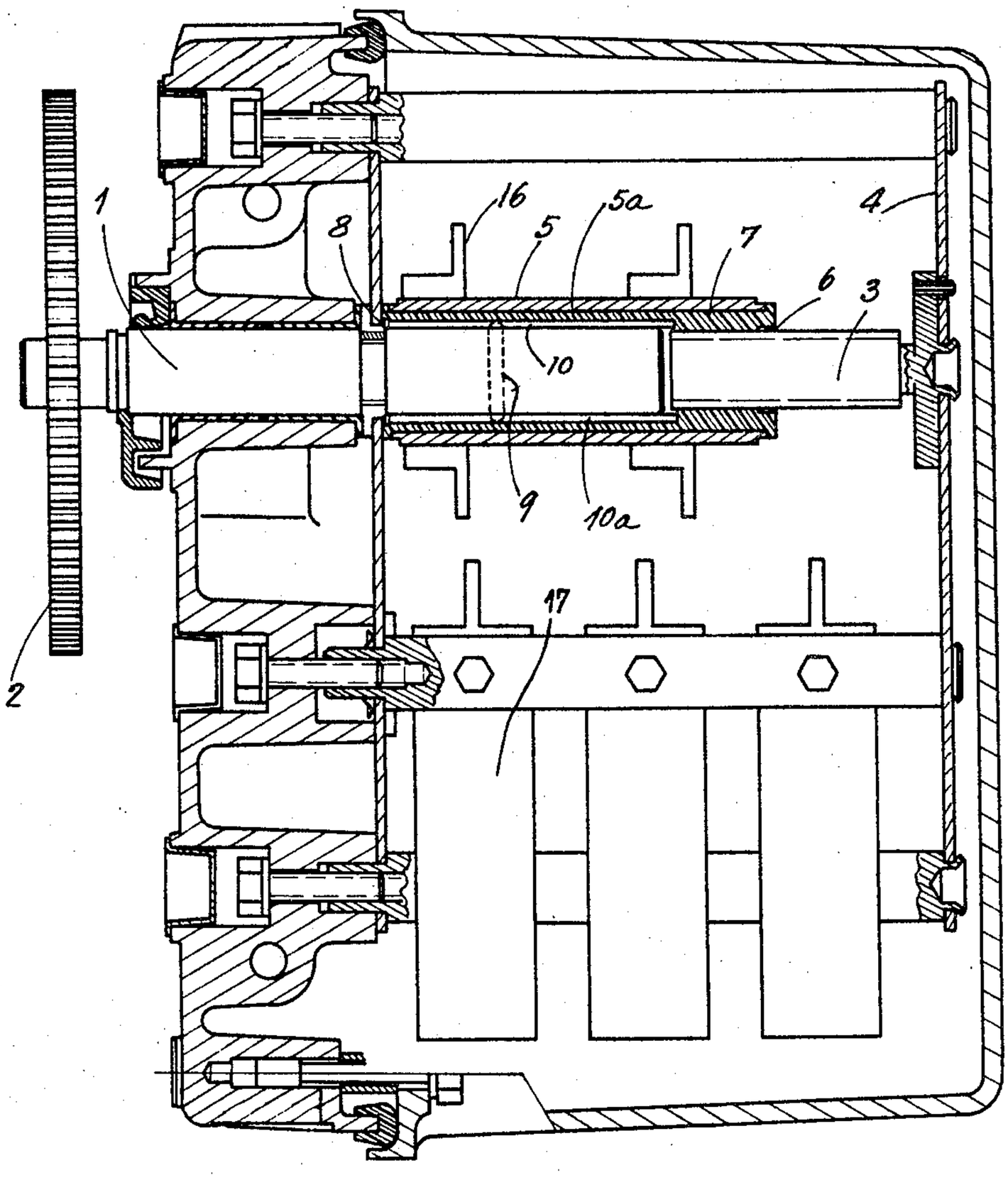
Fig.1.



Inventor:
Jacques Baudet

By Kenneth W. Flocks
Attorney

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SWITCH OF THE SCREW SELECTOR TYPE

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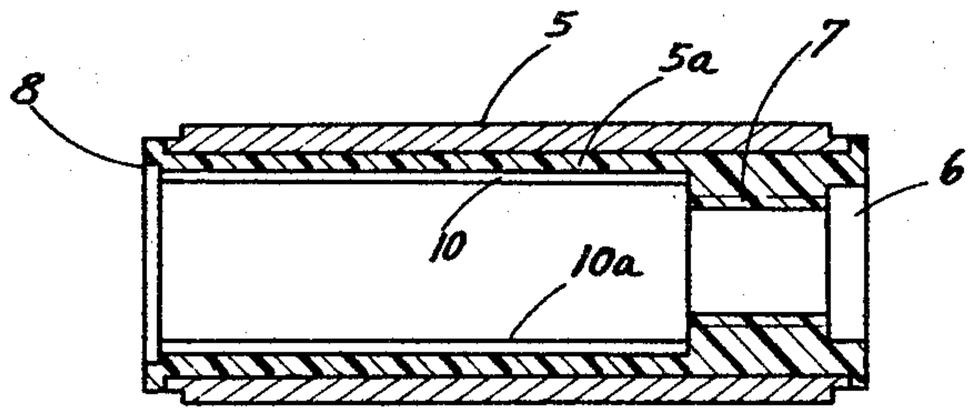
Fig.2.



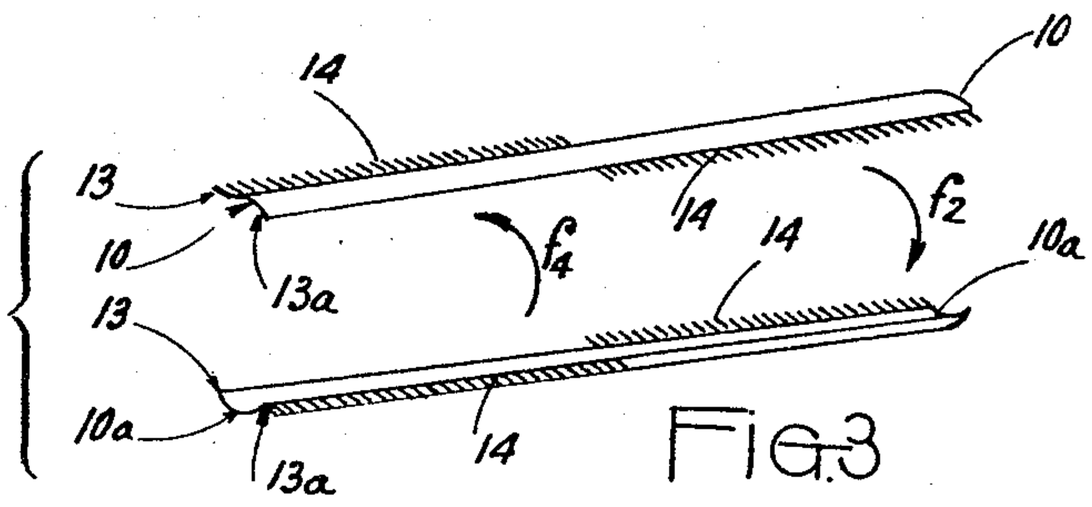


Fig.3

Inventor:
Jacques Baudet
By Kam W. Flocks
Attorney

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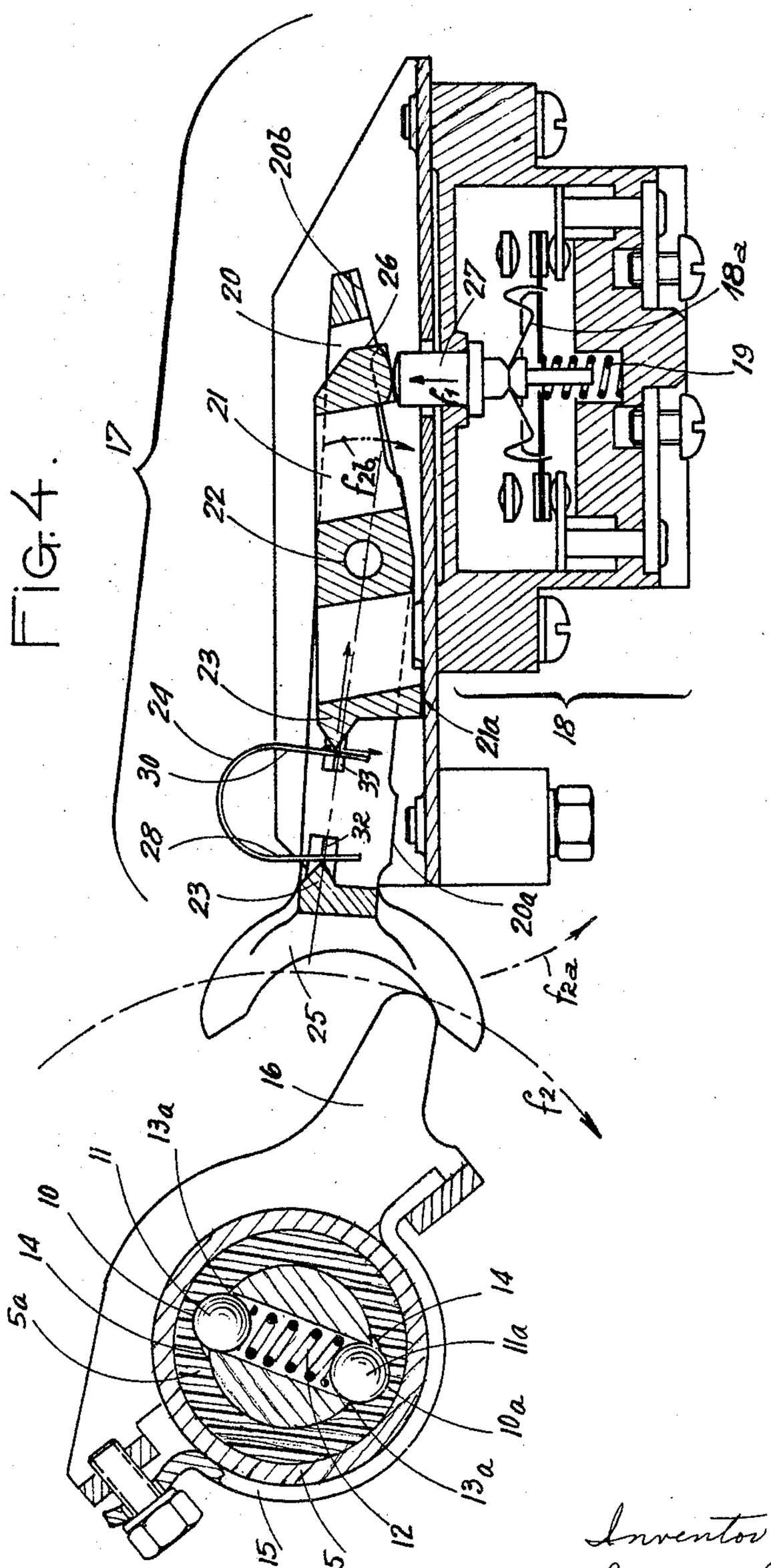
FIG. 4.



Inventor:
Jacques Baudet
By Karl W. Flocks
Attorney

Aug. 27, 1963 J. BAUDET 3,102,174

SWITCH OF THE SCREW SELECTOR TYPE

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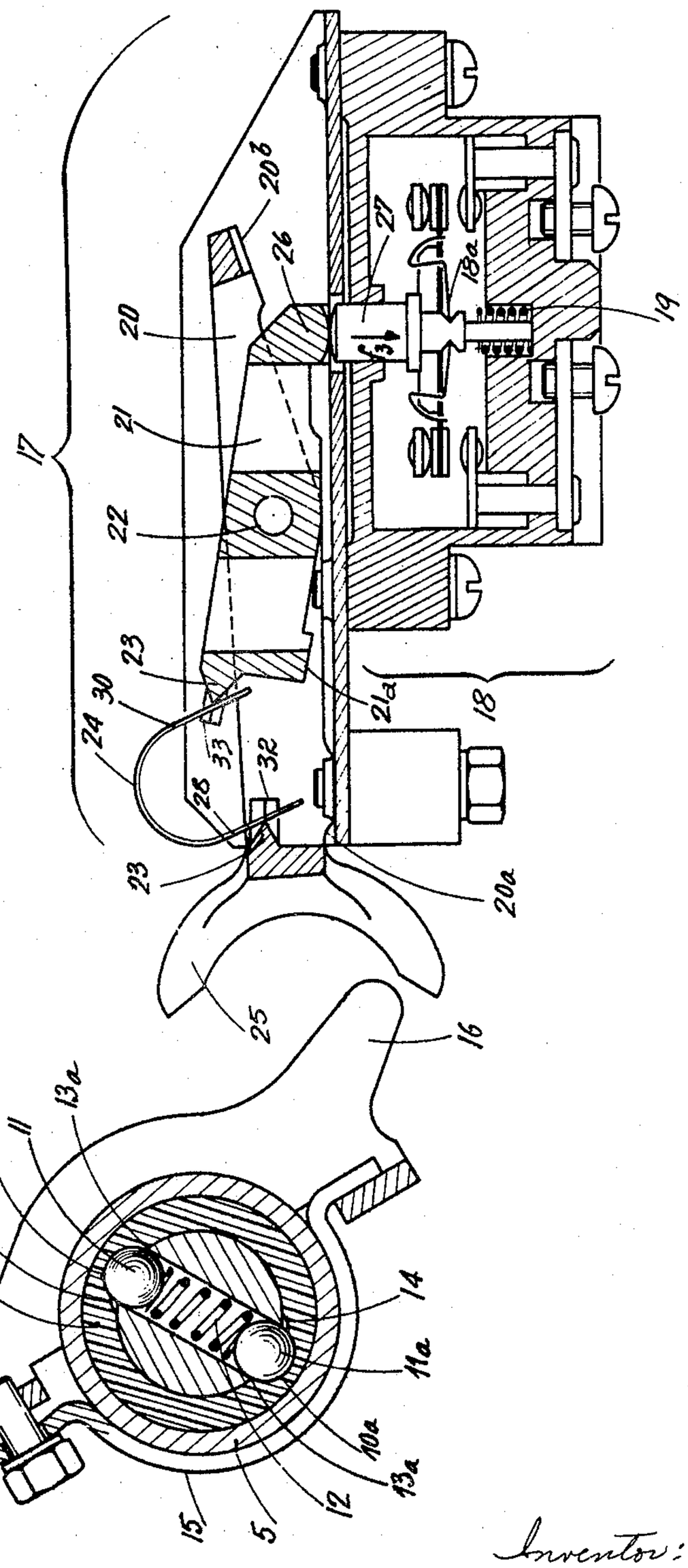
Fig.5.



Inventor:
Jacques Baudet
By Kenneth J. Flocks
Attorney

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SWITCH OF THE SCREW SELECTOR TYPE

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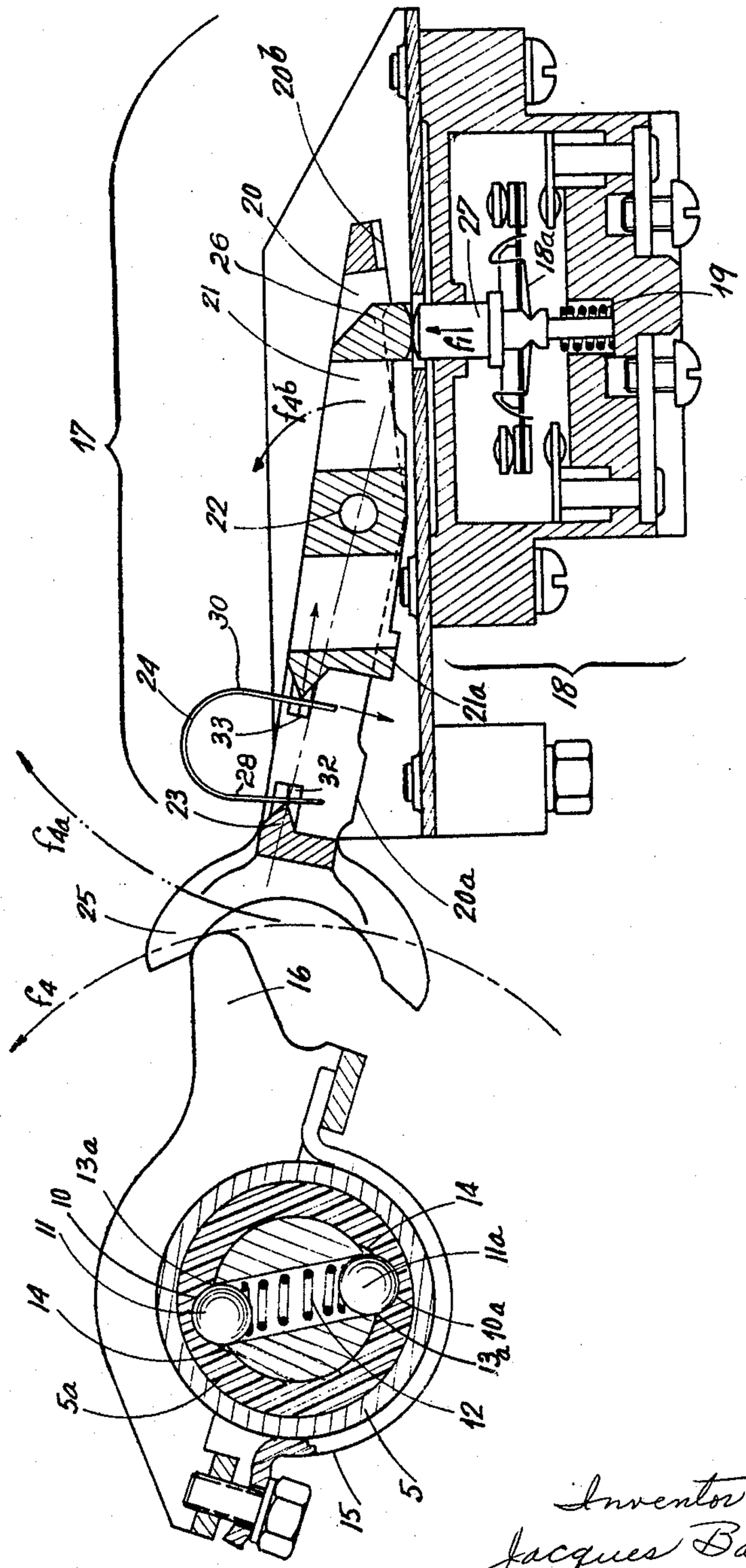
FIG.6



Inventor:
Jacques Baudet
By
Karl W. Flocks
Attorney

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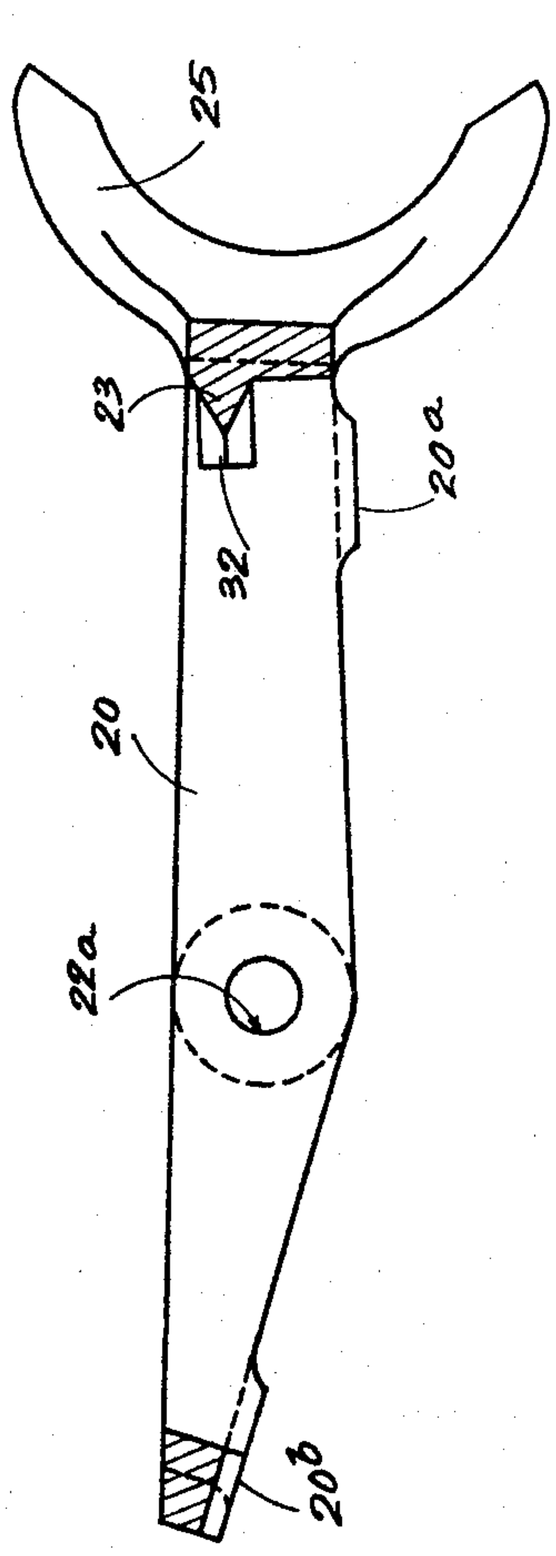

FIG. 7.

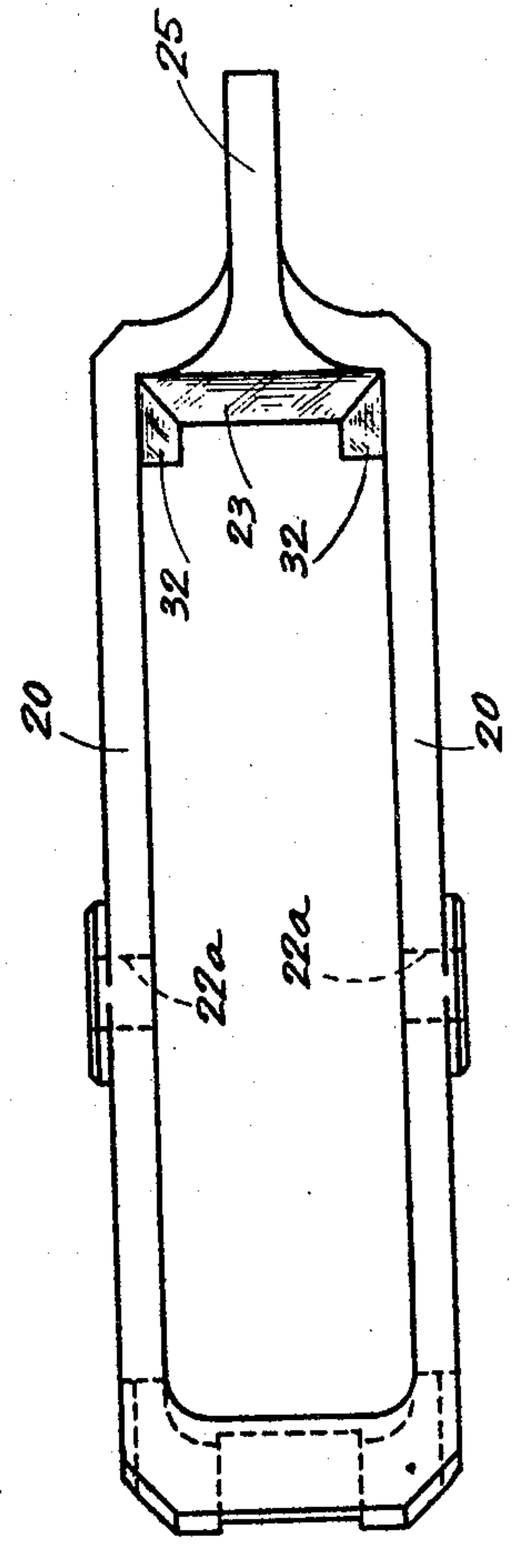

FIG. 8.

Inventor:
Jacques Baudet
By Karl W. Flocks
Attorney

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Fig.11.

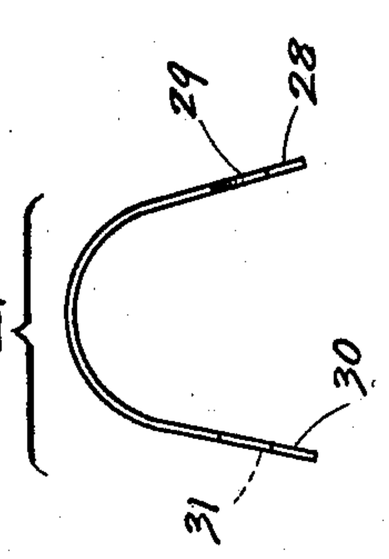


Fig.12.

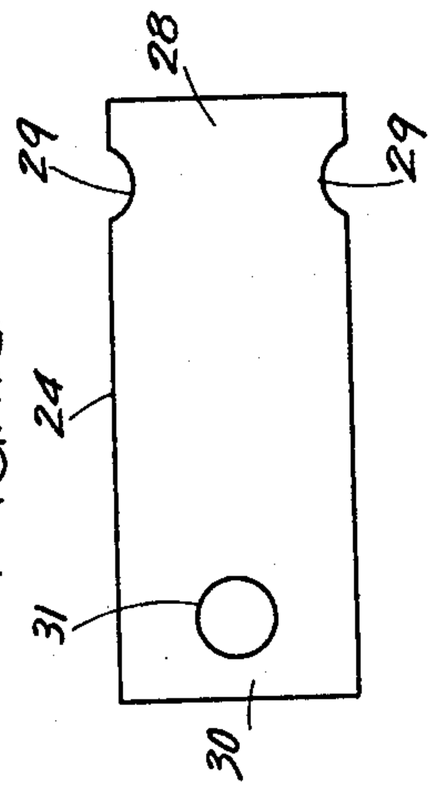


Fig.9.

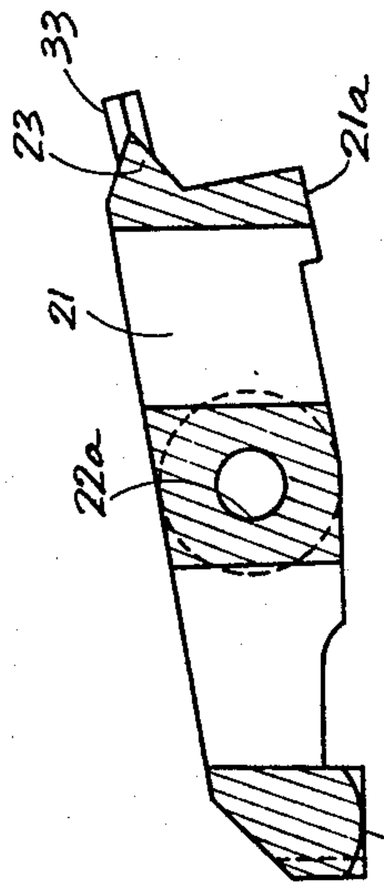
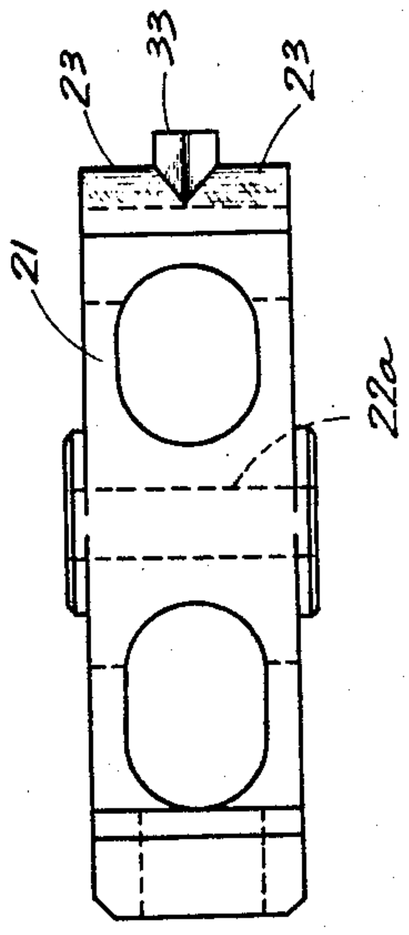


Fig.10.



Inventor:
Jacques Baudet
By Kirk W. Flocks
Attorney

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3,102,174

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SWITCH OF THE SCREW SELECTOR TYPE

Jacques Baudet, Suresnes, Seine, France, assignor to La Telemecanique Electrique, Nanterre, France, a joint-stock company of France

Filed Dec. 19, 1961, Ser. No. 160,471
Claims priority, application France Dec. 23, 1960
9 Claims. (Cl. 200—33)

The present invention relates to an electric switch for operating or controlling an industrial apparatus such as a lifting device or the like, having an alternating movement, as for example a hydraulic pressure accumulator.

In this type of apparatus, contacts must be operated as a function of the real position of the member in operation.

This type of switch usually comprises one or more arms mounted on a shaft, which follow a helical path and actuate tumblers which changeover or break contacts, as a function of the length of travel of the operating member.

The operating shaft can carry out a number of revolutions, being coupled for example to the cage of a lift by means of a suitable step-down gearing, so that the total length of the helix described by the operating arms is in relation to the total height of displacement of the cage.

Selector apparatus of this kind already known are heavy and bulky, and do not offer all the desired guarantees with regard to rapidity and accuracy of operation of the contacts.

It should be observed that by reason of the very considerable step-down ratio between the number of revolutions of the shaft of the switch and the travel of the controlled apparatus, the helicoidal movement is very slow and sometimes even hesitant if there exists any considerable play in the mechanical transmissions.

However, the rocking movement of the contacts must be free, rapid and definite for the same direction of operation of the apparatus.

To this end, use may be made of rocker devices of the type with a double rocking movement, comprising two levers, one of which is forked.

In the event of the device getting out of order, the forked lever may break. In order to avoid this happening, attempts have been made in prior constructions to provide this lever with a flexible system, but this is complicated and costly.

Furthermore, micro-switches are known which themselves comprise two pivoted levers of unequal length and coupled together by a U-shaped or omega-shaped spring, one of these levers being actuated by an operating member and transmitting this actuation to the other lever which carries a contact stud moving between two fixed studs.

This transmission of the control is effected by means of two springs arranged symmetrically on each side of the first controlled lever and by means of the U-shaped spring.

In addition, again because of the inaccuracy of transmission between the controlled apparatus, for example in the case of lifts, due to the elongation of the cables, the helicoidal travel of the shaft may become out of adjustment with respect to the movement of the moving device.

In the prior apparatus, it has already been suggested to provide a substantial lost travel at each extremity of the travel of the member in helicoidal movement, in order that the latter cannot come into abutment against the fixed portions and thus cause a breakage. It has also been proposed to construct this member in the form of a sleeve screwing on a screw rigidly fixed to the frame of the apparatus.

The present invention relates to a switch of the screw-selector type comprising in combination a driving sleeve having a bore which can slide on a rotating shaft, and comprising a threaded portion screwing on a screw rigidly fixed to the frame of the apparatus, a micro-switch with a snap-action blade and return spring, and a double acting rocker device for operating the said micro-switch, absolutely independent of the latter, and in which only a U-spring causes the abrupt movements of the micro-switch.

The rocker device comprises two levers of unequal lengths articulated like scissors and coupled together by the U-spring bearing on blades of these levers.

The lever of smallest length rocks inside the lever of the longer length, which is operated directly by the actuating member.

A driving device with balls rigidly fixed to the rotating shaft transmits the rotation of the said shaft.

The balls of the driving device find their position in longitudinal grooves formed in the interior of the rotating sleeve.

The ball device operates also as a de-clutching limiter, and to this end, the edges of the grooves are flattened over about half their length, and facing a flattened portion of an edge is a non-flattened portion of the opposite edge of the other groove.

The grooves are formed in an internal liner of the rotating sleeve, the liner being made of plastic material to permit dry friction.

Other particular features and advantages of the present invention will become apparent from the description which follows below with reference to the accompanying drawings, in which:

FIG. 1 is a view in cross-section of a switch of the screw selector type in accordance with the invention.

FIG. 2 is a view in longitudinal section of the sleeve with a helicoidal travel.

FIG. 3 is a diagram representing the grooves of the internal lining of the sleeve.

FIGS. 4 to 6 represent the switch according to the invention, in different positions of operation.

FIGS. 7 and 8 show respectively in sectional elevation and in plan view, the forked lever of the rocker device.

FIGS. 9 and 10 show also in sectional elevation and in plan view, the second lever of the rocker device.

Finally, FIGS. 11 and 12 are views locking on the end and from above the spring overshooting the dead centre.

In the form of embodiment shown, the apparatus according to the invention comprises a shaft **1** driven in rotation by a pinion or gear **2** under the action of a controlled moving body. At the end of this rotating shaft and on the extension of its axis, is arranged a fixed screw **3** fast with a frame **4**. Between the shaft **1** and the fixed screw **3**, a rotating and sliding sleeve **5** is provided on one end **6** of its bore with a nut **7** threaded on said screw **3**, whereas the other portion **8** of the bore, turned towards the shaft, receives the movement of this latter by a member **9** projecting from the said shaft, which may be a lug or a key and slides in grooves **10** and **10***a* of the sleeve (see FIG. 1).

The member projecting from the shaft is advantageously constituted by at least one set of two balls **11** and **11***a*, which are pushed in opposite directions by a central spring **12** (FIG. 5).

The sleeve **5** is of steel with an internal lining **5***a* of plastic material permitting dry friction; this material may be a super-polyamide such as "nylon" or any other similar material which does not contain any abrasive loading (FIGS. 1 and 2).

The liner **5***a* of moulded material comprises all the working parts of the sleeve, namely the nut **7** and the longitudinal grooves **10** and **10***a*, permitting the drive

by the balls **11** and **11***a* of the projecting member **9** of the shaft. One of the edges of these grooves is flattened along a gradual slope **14** so as to calibrate the maximum stress of the de-clutching. The choice of one of the edges (**13** or **13***a*) flattened on the grooves **10** and **10***a* is reversed towards the middle of the length of the said grooves. In other words, the edges are only flattened along one half of their length and a flattened portion of an edge **13** of the groove **10**, for example, faces a non-flattened portion of the opposite edge **13** of the other groove **10***a* (FIG. 3). On the periphery of the sleeve **5** is mounted at least one cylindrical flange **15** supporting an operating arm **16**. This arm is arranged so as to encounter during its travel at least one rocker device **17** fixedly mounted on the frame of the apparatus.

The rocker device **17** is of the double-acting type comprising the combination:

(*a*) of a micro-switch **18** with a snap-action blade **18***a*, returned to one of its positions by an internal spring **19**;

(*b*) of a mechanical rocker comprising two levers **20** and **21** mounted on the same shaft **22** which is in turn parallel to the rotating shaft **1**. The levers are provided with means (**20***a* and **20***b* for the lever **20**; **21***a* for the lever **21**) constituting abutments which limit their travel, and each having a portion in the form of a blade **23** against which is applied the force of a dead-centre overshoot spring **24**.

The first lever **20** is provided at one extremity with a forked portion **25** mounted so as to be driven, rocked and then left in its stable position by the helical rotation of the arm **16**. This first lever is made in the form of a frame through which the shaft **22** passes in the bores **22***a* and containing the smaller second lever **21**, the whole being arranged like a pair of scissors with arms of unequal length (FIGS. 4 to 8).

In accordance with this arrangement, the small lever **21** is also traversed by the shaft **22**, passing through a hole or bore **22***a* formed in this lever. The hole **22***a* of the lever **21** is of course in alignment with the holes **22***a* of the frame of the lever **20**.

The small lever **21** is provided at the extremity opposite to the spring **24** with a heel **26** which transmits motion by contact with the push-rod **27** of the micro-switch **18** (FIGS. 4 to 6 and 9 and 10).

One or both of these levers may preferably be of light moulded material with high resistance to wear.

The dead-centre overshoot spring **24** is a spring blade curved in a U, with two lateral slots **29** on one arm **28**, while the other arm **30** has an axial hole **31**, permitting immediate removal from between the levers (FIGS. 11 and 12).

The arm **28** of the spring is in contact with the knife-edge **23** of the lever **20**.

The arm **30** of the spring is in contact with the knife-edge **23** of the lever **21**.

The knife-edge **23** of the lever **20** is provided at its extremities with noses **32** which engage in the slots **29** of the spring **26**.

The knife-edge **23** of the lever **21** is provided at its centre with a nose **33** engaging the hole **31** of the spring **26**.

The apparatus according to the invention operates in the following manner:

The driving device with balls **11** and **11***a* transmits the rotational movement of the shaft **1** to the sleeve **5** in one direction or the other, by reason of the housing of the balls **11** and **11***a* in the grooves **10** and **10***a* of the sleeve.

This ball driving device also acts as an effort limiter which automatically disengages if the sleeve comes at the end of its travel against the walls of the casing either on the end **6** or on the end **8**.

It may be observed that, for one direction of rotation (f_4 or f_2, FIG. 3), the effort of the balls to free themselves from the grooves of the blocked sleeve can only be applied on the flattened edge **14** of the grooves. When

the correct adjustment is re-established, the sleeve **5**—**5***a* must not remain locked and it must be positively driven in the opposite direction when at least one of the balls falls back into its groove. It is for this reason that the opposite edges of the grooves must remain sharp.

At a given moment of the travel of the sleeve **5**, and therefore of the helicoidal travel of the operating arm **16**, this latter encounters the fork **25** of the rocker device **17**.

If, for example, the arm **16** rotates in the direction f_2 (FIG. 4), it has first passed into the fork **25**, the lever **20** being at this moment in the raised position, and resting on the base by its abutment **20***b*. The arm **16** then drives the lever **20** into the position shown in FIG. 4, the knife-edge **23** of the lever **20**, the knife-edge **23** of the lever **21** and the rocking axis **22** being then located on the same straight line of dead centres. The spring **24** is compressed by one of its arms. When the arm **16** again turns through a very small angle, the limb **30** of the spring applies on the lever **21** a force having a tangential component which is still very small, while the knife-edge **23** of the lever **21** is still subjected to a tangential force of opposite direction, due to the force of the spring **19** in the direction f_1. The abrupt rocking action of the lever **21** in the direction f_2b will take place when the tangential component due to the limb **30** of the spring will have become large enough, and thus, for a certain angle of travel, after the passage of knife-edges **23** through the line of dead centres. The system then rapidly takes the position shown in FIG. 5, the push-rod **27** being depressed in the direction f_3 and the snap-blade **18***a* abruptly changes the position of the contacts of the micro-switch **18**. When starting from the position shown in FIG. 5, and the arm **16** rotates in the direction f_4 opposite to that preceding, it first drives the lever **20** in the clockwise direction up to the position shown in FIG. 6, in which the knife edges **23** of the levers **20** and **21** and the centre of rotation **22** are almost in a straight line, the knife-edge of the lever **21** being still a little behind the line of dead centres.

The tangential component of the transverse force due to the limb **30** of the spring **24** is still directed in the clockwise direction, but becomes very small while the lever **21** is subjected to a couple due to the pressure of the spring **19** and to the push-rod **27**, acting in the direction f_1. It can be seen that for a certain angle of travel before passing over the line of dead centres, the system rocks the lever **20** in the direction f_4a and the lever **21** in the direction of f_4b.

The blade **18** then returns the contacts of the micro-switch abruptly into their initial position.

In the two rocking movements, assuming the total stoppage of the arm **16** in the centre of the angle of travel of the lever **20**, the system has no possibility of remaining in equilibrium.

The main advantage of the rocker device according to the invention resides in that the pressure on the electrical contacts of the microswitch **18**, which is annulled at the moment when the contacts separate, cannot be annulled slowly while the levers **20** and **21** are in the vicinity of the position of equilibrium, for, at that moment, the push-rod **27** is still in one of its extreme positions (FIGS. 4 and 6); it should be observed that the two levers **20** and **21** of the rocker device **17** have a common shaft **22**, which simplifies the construction.

Finally it is possible that due to maladjustment, the operating arms **16** engage the fork **25** of the lever **20** of the rocker device **17** in the wrong direction, that is to say when the latter has already rocked over.

The limiter device for disengagement by balls **11** and **11***a* also plays its part in this case, and offers without any addition the same protection against breaking of the forked lever **20**.

The construction of the frictional parts of plastic material such as "nylon" gives the apparatus according to the invention a very long life, while at the same time it gives only a very small inertia to the moving parts.

In a general way, the above description has only been given by way of indication and not in any sense by way of limitation of the invention and is capable of receiving a large number of alternative forms in accordance with its scope.

I claim:

1. A screw type selector for the operation and control of a moving device having a to-and-fro movement comprising

a frame,

a fixed screw fast with said frame,

a transmission coupled to the moving device,

a rotating shaft in said transmission,

a sleeve screwing on said fixed screw and sliding on said rotating shaft,

arms mounted on said sleeve and adapted to follow a helical path which is a function of the length of travel of the moving device,

a double action rocker device in the path of said arms adapted to be actuated by said arms,

two pivoted levers of unequal lengths in said rocker device,

a micro-switch in operative relationship with said pivoted levers positioned to be actuated by one of said levers and having a snap-action blade,

and a U-spring in said rocker device adapted when actuated to cause, by its own action, the abrupt displacement of said micro-switch.

2. The screw type selector of claim 1, further characterized by

said levers being articulated as scissors and having knife-edges,

and said U-spring being supported on said knife-edges of said levers.

3. The screw type selector of claim 2, further characterized by

a push rod on said micro-switch in operative relationship with the shorter of said levers of unequal length,

the longer of said levers, of unequal length having two limbs thereon and in operative relationship with said arms,

the shorter of said levers positioned between said limbs of said longer lever and adapted to rock therebetween.

4. The screw type selector of claim 1, further characterized by

said sleeve having longitudinal grooves,

and a device with balls coupled to said rotating shaft and in driving relationship with said sleeve,

said balls located in said longitudinal grooves of said sleeve.

5. The screw type selector of claim 4, further characterized by

said levers being articulated as scissors and having knife-edges,

and said U-spring being supported on said knife-edges of said levers.

6. The screw type selector of claim 4, further characterized by

the edges of said grooves being flattened over about half of their length so that one flattened portion of an edge faces a non-flattened portion of the opposite edge of another groove and so that said device with balls is adapted to operate either as a drive for said grooved sleeve or as a de-clutching limiter device.

7. The screw type selector of claim 6, further characterized by

said levers being articulated as scissors and having knife-edges,

and said U-spring being supported on said knife-edges of said levers.

8. The screw type selector of claim 1, further characterized by

an internal liner for said sleeve made from a plastic material permitting dry friction and having longitudinal grooves therein,

and a device with balls coupled to said rotating shaft and in driving relationship with said sleeve,

said balls located in said longitudinal grooves of said sleeve.

9. The screw type selector of claim 8 further characterized by

said levers being articulated as scissors and having knife-edges

and said U-spring being supported on said knife-edges of said levers.

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