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Saumer

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[54] **CONTROL ARRANGEMENT FOR ACTUATING A SWITCHING CONTACT ON A MOVABLE MACHINE PART**

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[51] **Int. Cl.** **H01l 36/00**

[58] **Field of Search** .... 200/153 L, 153 LB, 153 LA, 200/38 C, 61.14, 61.18, 61.13; 317/DIG. 2; 340/259

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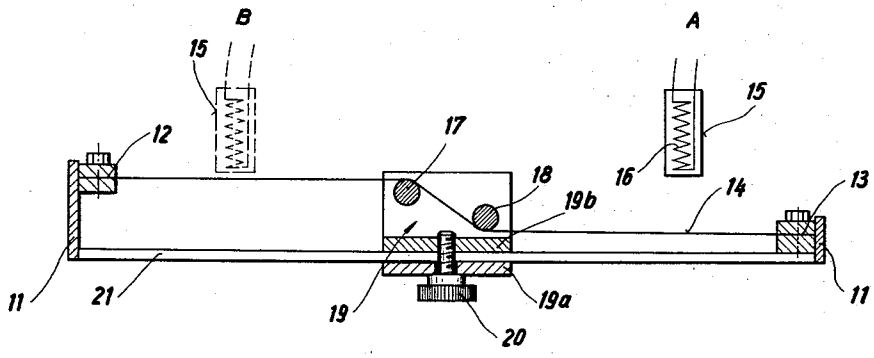
[57] **ABSTRACT**

A control arrangement for actuating switching contacts. The arrangement comprises at least one switching contact which coacts with a control surface mounted on an actuating member. The actuating member and the switching contact move relatively to each other, said movement corresponding to the movement of a machine part in a machine. The actuation of the switching contact is effected by the change in distance between the control surface and the switching contact. The control surface is mounted on one side of the actuating member and is formed by means of a flexible flat band which can be adjusted along a plane parallel to the path of the control switch relative to the actuating member.

1 Claim, 4 Drawing Figures



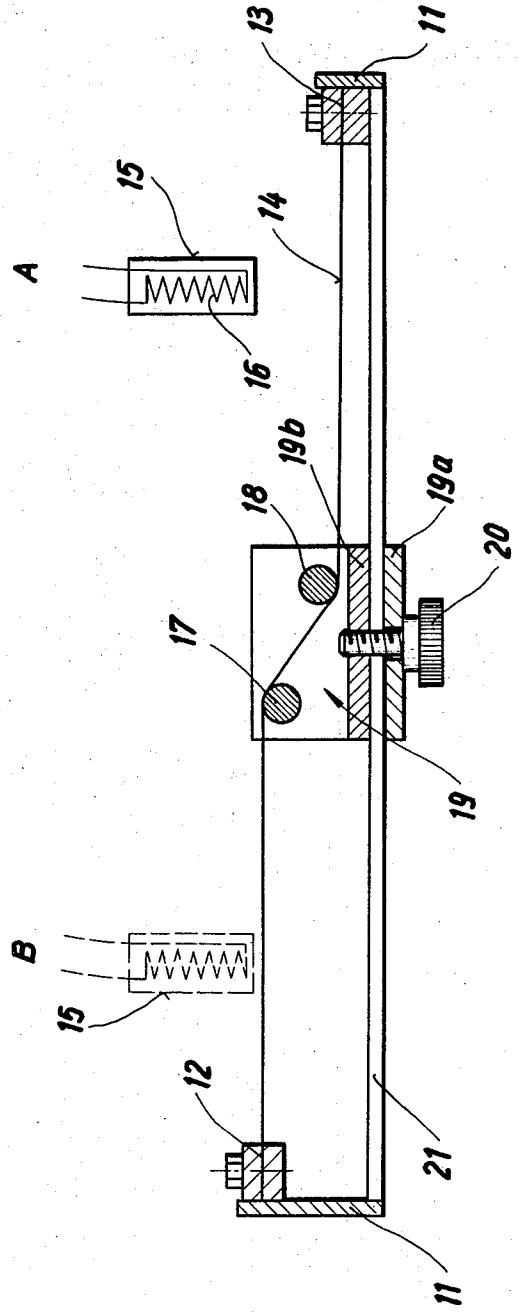


Fig.1

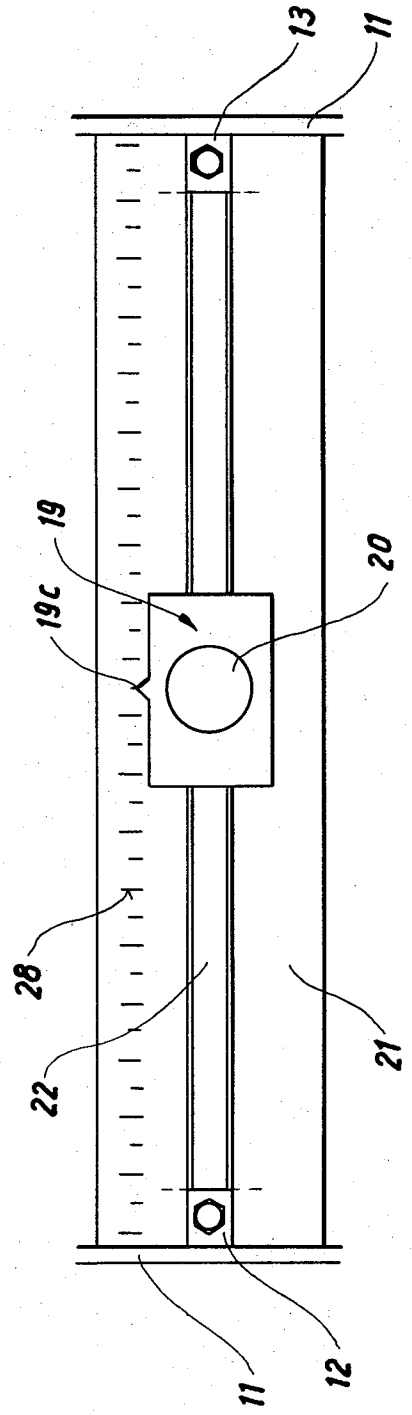


Fig. 2

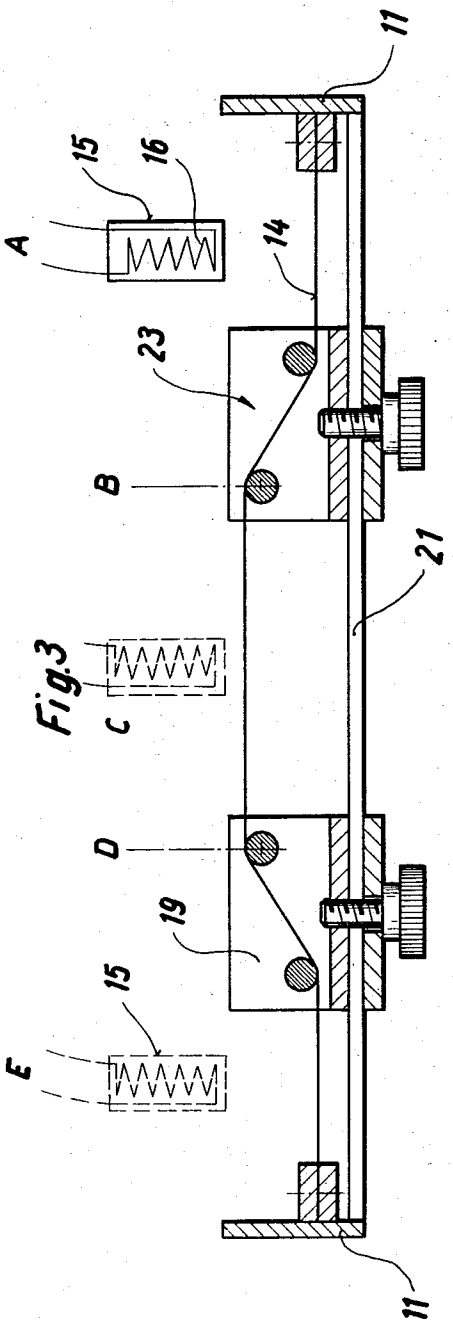


Fig.3

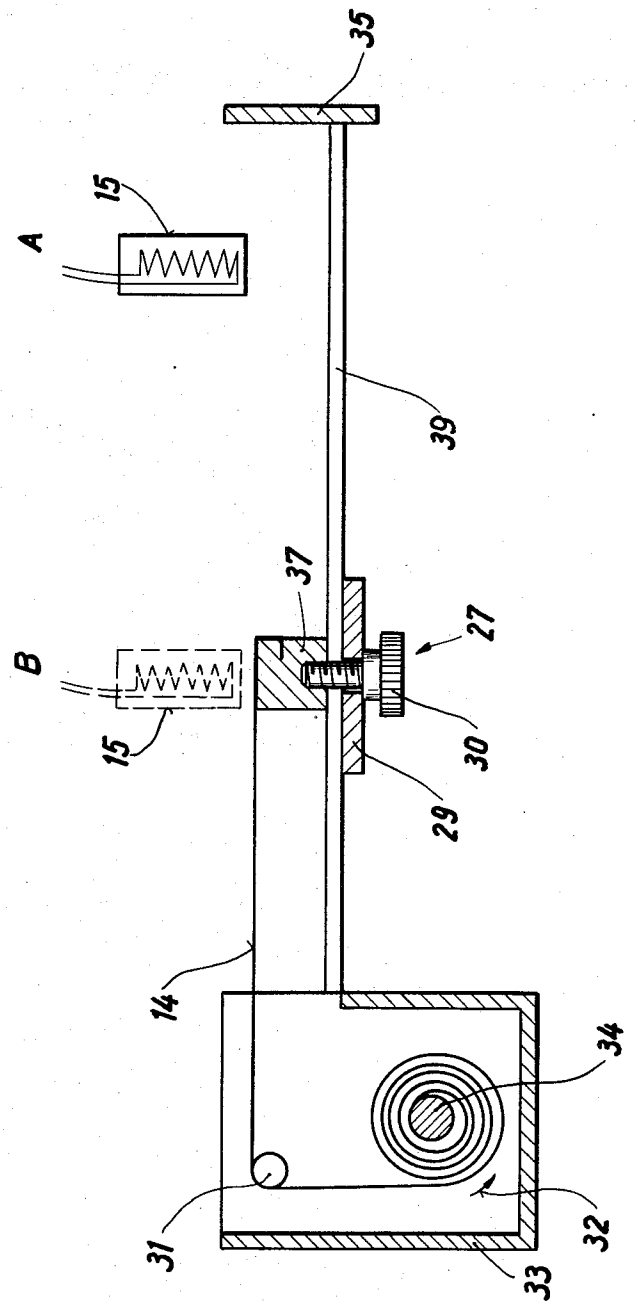


Fig. 4

CONTROL ARRANGEMENT FOR ACTUATING A SWITCHING CONTACT ON A MOVABLE MACHINE PART

BACKGROUND OF THE INVENTION

The invention relates to a control arrangement for actuating a switching contact mounted on a movable machine part. The actuating member has a control surface and the arrangement operates by a relative movement taking place between the control surface of the actuating member and switching contact. Thus the switching contact is actuated when there occurs a change in distance between the control surface and the switching contact.

In the known type of control arrangements, the switching contacts are actuated by adjustable cams. Since these cams only close the switching contacts in accordance with their effective length for a short period of time, it is necessary to provide in the electric control system of the machine a so-called "memory switch" if the machine function controlled by the switching contact is to continue. In such a known arrangement, an increased wear is placed on the switching means, in particular when the switching contact is to be actuated several times during the movement of the machine part.

It is also known to provide control bars for actuating switching contacts for extended periods of time; these control bars maintain the switching contact closed over an effective length corresponding to the extent of movement of a machine part. When, however, there is to be effected a desired change in the machine function causing a change in the length of movement of the machine part, it is necessary to provide a new control bar corresponding to this desired length which has to be exchanged with the original control bar. In such an arrangement it is not possible to effect a quick adjustment of the operation of the machine.

In general, the control bar has a length corresponding to the length of the relative movement of the machine part. If it is desired that the contact is effected only at the end of the relative movement of the machine part, then it is necessary to have the necessary length of the control bar project from the mounting arrangement. This type of known arrangement, therefore, requires a considerable amount of space which makes it difficult to install the arrangement and to mount other machine parts around it.

SUMMARY OF THE INVENTION

It is a general object of this invention to provide a control arrangement which avoids the drawbacks of the arrangements of the prior art.

It is another object of the invention to provide a control arrangement which can be easily adjusted and does not require the exchange of parts. The adjustement of the control arrangement can thus be effected without the use of so-called "memory switches."

This object of the invention is accomplished by providing a control surface mounted on one side of an actuating member and which is formed by a flat band extending parallelly to the actuating member and being provided with an adjusting mechanism which serves to adjust the effective length of the control surface formed by the flat band.

This type of an actuating member can coact with all types of switching contacts. Thus, the actuating member can coact with switching contacts that make actual physical contact with the flat band or with switching contacts that do not come into contact with the flat band. It is necessary, however, to provide a flat, metallic band in the latter case.

It is possible to fixedly mount the adjusting mechanism on the flat band or to adjustably mount it thereon. In the former case, one end of the flat band may be secured to a shaft which is rotatably mounted in the actuating member and is biased by a torsion spring so as to spool the flat band onto it. The other end of the flat band is secured to an adjusting member the position of which can be adjusted in the longitudinal direction of the flat band on the actuating member. The adjusting member determines the switching point of the switching contact.

In lieu of the aforedescribed arrangement, the flat band can also be mounted between two support members of the actuating member in an advantageous manner. At least one adjusting member is provided and can be adjustably mounted on the flat band so that its position can be adjusted in the longitudinal direction thereof. This adjusting member disposes the flat band in two different planes one of which is distanced further than the other from the switching contact. Due to the reduction of the distance between the switching contact and the control surface of the flat band, there results an actuation of the switching contact. The aforedescribed control arrangement of this invention serves to control the operation of machine parts, in particular for parts in an injection molding machine, wherein the switching contacts act as end switches for the operative path of certain parts of the injection molding machine.

BRIEF DESCRIPTION OF DRAWING

The invention is illustrated by way of examples in the accompanying drawings which form part of this application and in which: FIG. **1** is a schematic cross-sectional elevational view of a control arrangement in accordance with this invention in which the switching contacts are of the non-contacting type; p FIG. **2** is a schematic plan view of the control arrangement of FIG. **1**;

FIG. **3** is a schematic elevational cross-sectional view of a second embodiment of the control arrangement;

FIG. **4** is a cross-sectional schematic elevational view of a third embodiment of the control arrangement of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawings, the control arrangement schematically illustrated in FIG. **1** includes a frame **11** and a switching contact **15** which undergo a relative movement with respect to each other so that the switching contact A will reach the position B. The sides of the frame **11** facing each other have mounted thereon clamping means **12** and **13** which serve to support an elastic flat band **14.**

A rail **21** is also mounted between the frame **11.** An adjusting member is mounted on the rail **21.** This adjusting member **19** has a pair of clamping members **19***a* and **19***b* through which there is threadably mounted an adjusting bolt **20.** The adjusting member **19** is further provided with two idle rollers **17** and **18,** mounted at different levels, which guide the flat elastic band **14** onto two different levels. Thus, it can be noted that the

left portion of the flat band **14** which extends from the left idle roller **17** to the clamping means **12** is spaced only a short distance from the switching contact when it is in the position B while the distance between the flat band **14** and the switching contact when it is in the position A is substantially larger. Thus, by causing the switching contact **15** to come close to the flat band **14** due to the guiding of the idle roller **17**, there is brought about a switching of the switching contact **15** while when the switching contact **15** moves coextensive with the flat band **14** extending from the right idle roller **18** to the clamping means **13**, no switching of the switching contact **15** can occur. If the switching point is to be adjusted, it is only necessary to adjust the switching member **19** which is movable along the rail **21** by loosening the setting bolt **20** thereby loosening the clamping members **19***a* and **19***b* and moving the adjusting member **19** to its new position and thereafter refastening the setting bolt **20**.

The other embodiments of the control arrangement of this invention will now be described hereinbelow. Equivalent parts have been designated with the same reference numerals. As can be noted from FIG. **2**, the rail **21** has a longitudinal slit **22** along which the adjusting member **19** is slidably, movably mounted. The adjusting member **19** has an indicia marking projection **19***c* which coacts with a scale **28** arranged on the upper part of the rail **21**. In this way the adjustment of the adjusting member **19** can be repeated by observing at all times the position of the adjusting member **19** with respect to the rail **21**.

The control arrangement illustrated in FIGS. **1** and **2** can, for example, be used for controlling the movement of an injection molding machine, wherein the control contacts determine the limits of the opening movement of a molding tool. The switching contacts illustrated in FIGS. **1** and **2**, which are of the non-contacting type, may have inductive coils **16** arranged therein, which, when approaching the metallic flat band **14**, bring about a change in the inductive current in the coil. This change in current serves for actuating the switching contact.

In the embodiment illustrated in FIG. **3**, there are provided two adjusting members **19** and **23** in order to provide two switching points during the relative movement between the switching contact **15** and the frame **11**. In the illustrated position A of the contact switch **15**, the latter is open. It is closed when the switching point B is reached and remains closed during the traverse of the control paths B–D. Thus the switching contact **15** remains closed when it reaches the position C. Once the position D has been reached, the switching contact is released and remains open while reaching, for example, the position E due to the change in distance between the switching contact **15** and the metallic band **14**. Should the frame **11** move now in the opposite direction relative to the contact **15**, then when the position D is reached, the contact switch **15** is again closed. This type of control can, for example, be used to actuate in an injection mechanism of an injection molding machine wherein the switching contact **15** is closed once it reaches the position B and the ejection mechanism is moved back to the exit position when the switching contact has reached the position D.

In the embodiment illustrated in FIG. **4** that flat band **14** is not supported at opposite ends in the frame **35**. An adjusting member **27** is secured to the free end of the flat band **14**. At the other end of the flat band **14** there is mounted a shaft **34** onto which the flat band is spooled. The shaft **34** is mounted in a magazine-type housing **33** which forms an extension of the rail **39** and a unit with the frame **35**.

The shaft **34** is rotatably mounted in the housing **33** and is biased in the direction of the arrow **32** by means of a non-illustrated torsion spring, so that the flat band **14** is maintained under tension by means of the torsion spring which acts on the flat band **14** via the idle roller **31**. In the embodiment of FIG. **6**, the switching point of the non-contacting type of control switch **15** is determined by the position of the adjusting member **27**. The position of the adjusting member **27** is adjuated by means of loosening the setting bolt **30** so that the frictional engagement between the members **37** and **29** is released due to the unscrewing of the setting bolt **30** and the adjusting member **27** can be slidably moved along the rail **39**. Simultaneously with the movement of the setting member **27**, the flat band **14** is unspooled or spooled onto the shaft **34**. The non-contacting control switch **15** is closed when it reaches the position B, while it remains open in the position A.

It is of no significance in the control arrangements of this invention whether the frame, in which the flat band is supported, is moved relative to the control switch or vice-versa. It is, of course, possible to have more than one control switch coact with the frame supporting the flat band.

Although the invention is illustrated and described with reference to a plurality of preferred embodiments thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a plurality of embodiments, but is capable of numerous modifications within the scope of the appended claims.

What is claimed is:

1. In a machine having movable parts, a control arrangement for actuating at least one switching contact, comprising in combination,

an actuating member;

a switching contact, said actuating member and switching contact being adapted to move relative to each other, said movement corresponding to the movement of a part of said machine;

a flexible flat band operatively mounted in said actuating member;

said switching contact being adapted to be actuated by said flat band when said switching contact has reached a predetermined first position relative to said flexible flat band and being adapted to be deactuated when said switching contact has moved from said first position to a predetermined second portion relative to said flat band;

means operatively connected to said flat band for adjusting the position of said flat band relative to said switching contact; and

a shaft rotatably mounted in said actuating member and being biased to rotate in one direction, one end of said flexible flat band being secured to said shaft and the other end of said flat band being secured to said adjusting means, said adjusting means being adjustably movably mounted longitudinally with respect to said flat band on said actuating member.

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