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[54] **CONTROL DEVICE FOR A TEXTILE MACHINE**

[72] Inventors: **Bretislav Chvala; Jaroslav Janostik,** both of Prague; **Jindrich Mares; Jan Jerabek,** both of Trebic, all of Czechoslovakia

[73] Assignee: **Elitex, Zavody textilniho strojirenstvi generalni reditelstvi,** Liberec, Czechoslovakia

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[51] **Int. Cl.**.....**D04b 15/68**

[58] **Field of Search**.....66/57, 8, 154 A, 140 S, 41, 66/40, 1, 78; 227/9; 91/167; 92/99

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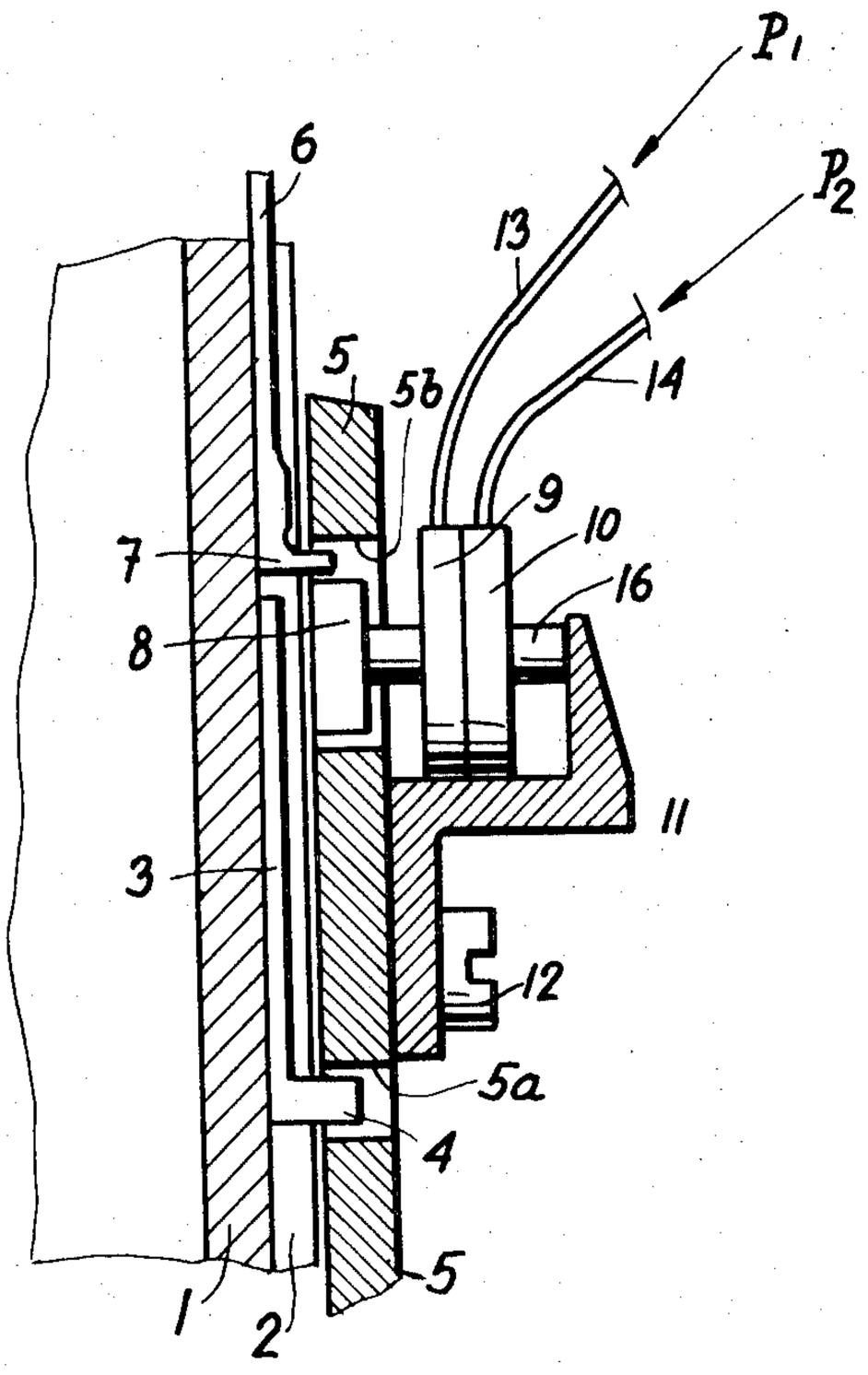
Primary Examiner—Wm. Carter Reynolds
Attorney—Richard Low and Murray Schaffer

[57] **ABSTRACT**

According to the present invention apparatus for the operation of such elements as the needle or jacks of knitting machines comprising a movable cam member adapted to be urged into and out of operative engagement with the butts of elements, the member being moved by a pneumatic activator selectively fed by a predetermined pneumatic pulse.

4 Claims, 4 Drawing Figures



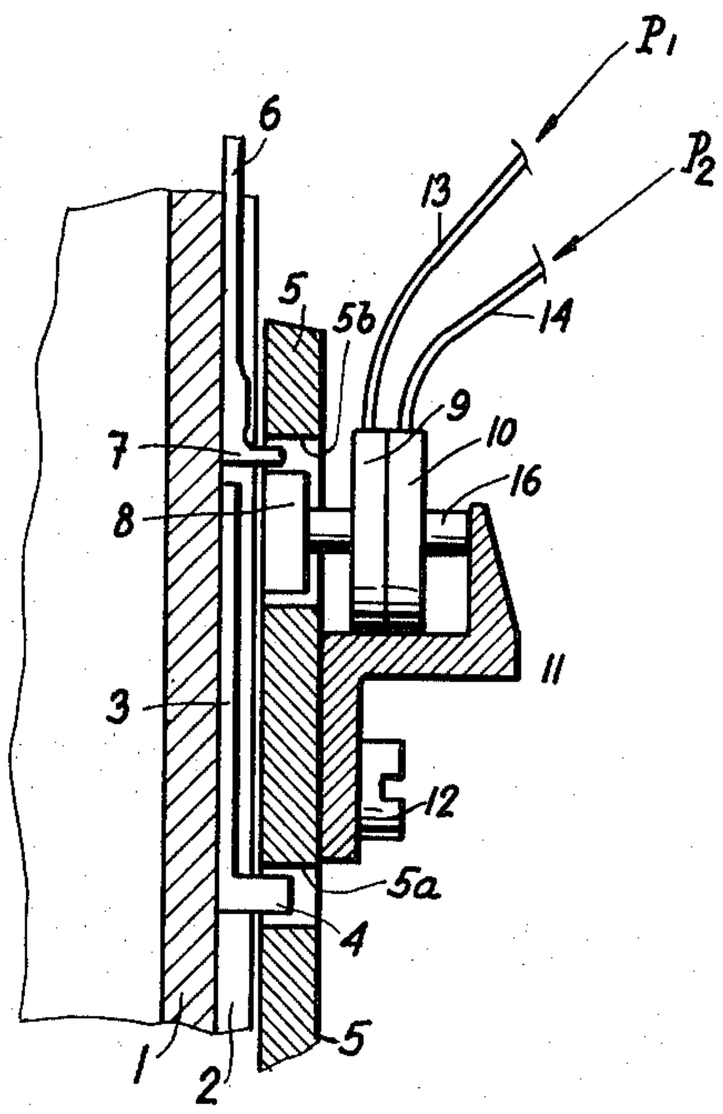


Fig. 1

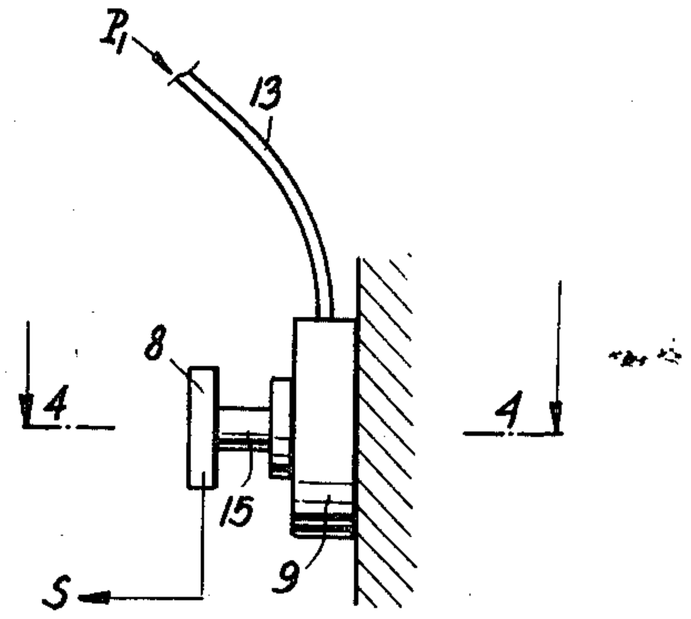


Fig. 2

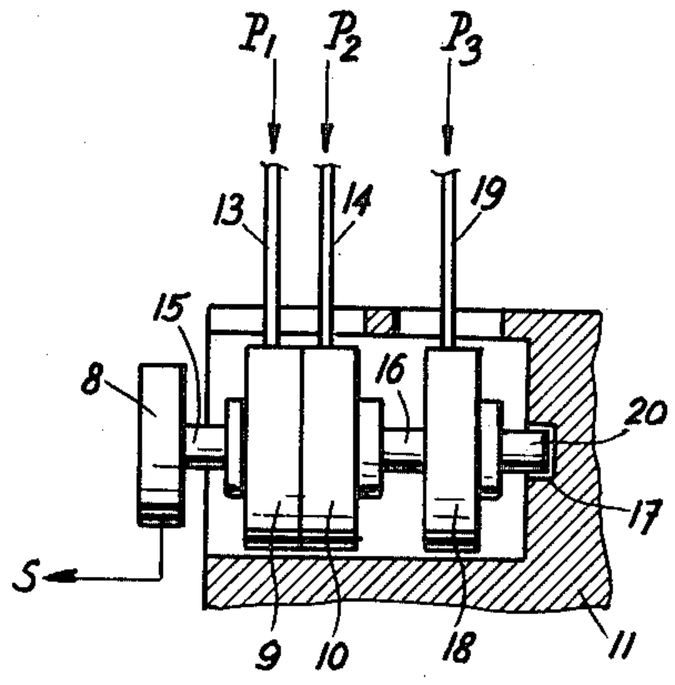


Fig. 3

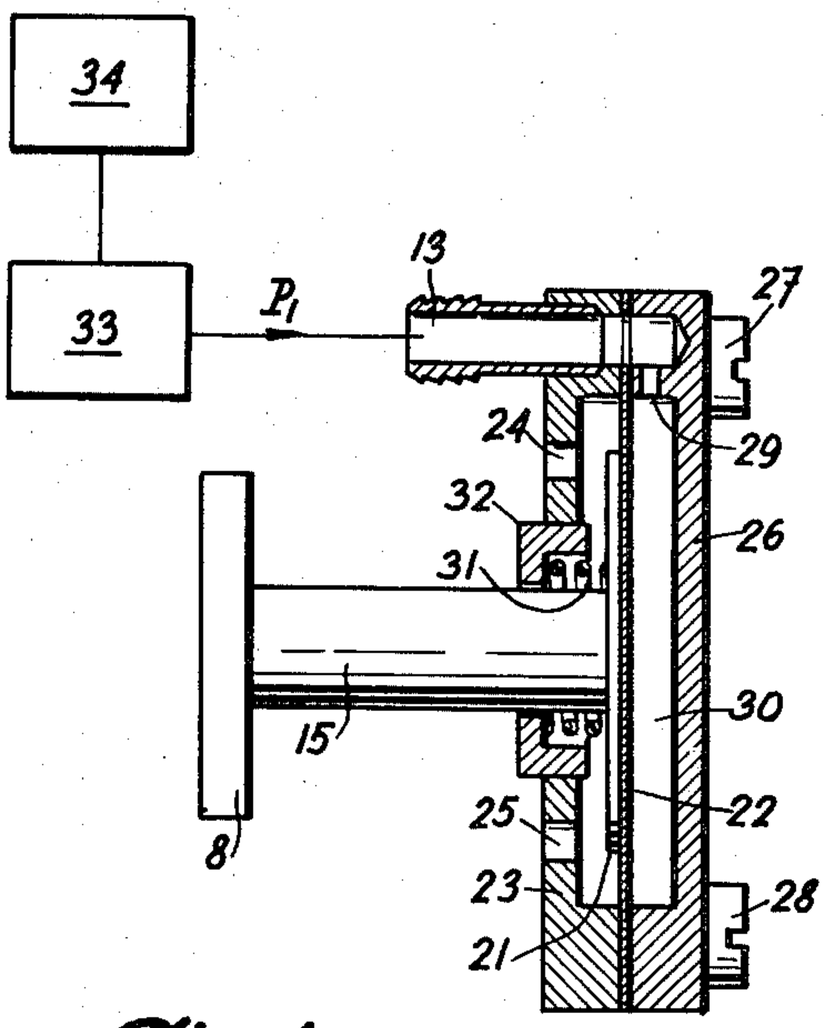


Fig. 4

BRETISLAV CHVALA
JAROSLAV JANOSTIK
JINDRICH MARES
JAN JERABEK

INVENTORS

BY Thomas Schuffer
ATTORNEY

CONTROL DEVICE FOR A TEXTILE MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for controlling the elements of knitting machines and in particular to apparatus for operating the control butts of needles, jacks and the like in circular knitting machines.

The movably mounted elements of knitting machines, such as the needles, jacks, yarn guides, etc. have been conventionally controlled by mechanical means such as levers, tie rod, lifting rods, etc. Recently, such mechanical means have been operated by a rotatable command drum remote from these elements and to which some connecting means must be provided. Obviously such a device has the disadvantage of requiring long connecting means, close tolerances, perfect adjustment, which are difficult to obtain over long operating periods. Above all such devices are complicated.

Even more recently the machine elements have been controlled by electromagnetic mechanisms activated by a pre-programed device such as a computer. Because of the high degree of precision required to build and maintain such devices, they have not been too accurate over long periods of operation. The requirement to indirectly transmit adequate power in a stepwise incremental fashion and the excessive dimensions of such elements have been further drawbacks. These factors are of significance since space, power and time are critical factors in knitting manufacture, particularly in the hosiery industry.

It is the object of the present invention to provide apparatus for the control of the movable elements of knitting machines which overcomes these drawbacks.

It is another object of the present invention to provide a small, simple, reliable, low cost, low power activator for movable knitting machine elements.

It is still another object to provide a highly sensitive, critically operative device capable of close tolerance activation of knitting machine elements.

It is yet another object of the present invention to provide apparatus suitable for use with needle, jack, yarn guide, etc.

SUMMARY OF THE PRESENT INVENTION

According to the present invention apparatus is provided for the operation of such elements as the needle or jacks, comprising a movable cam member adapted to be urged into and out of operative engagement with the butts of the elements, the member cam being moved by a pneumatic activator selectively fed by a predetermined pneumatic pulse.

In the preferred form the pneumatic activator comprises a body having a diaphragm mounted therein adapted to be flexed against the member on application of the pulse. The distance of movement of the member being determined by the flexing of the diaphragm.

Also it is possible to arrange a plurality of activators in series so that the distance of movement can be increased correspondingly.

Full details of the present invention are set forth herein, and the objects and advantages of the invention fully illustrated.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following description, reference is made to the accompanying drawings wherein:

FIG. **1** is an elevational view, partially sectioned, of a needle cylinder showing the needles and jacks of a circular knitting to which the present invention is applied;

FIG. **2** is an enlarged view of the apparatus of the present invention;

FIG. **3** is an enlarged view of a modified form of the present invention, and

FIG. **4** is an enlarged sectional view taken along lines **4—4** of FIG. **2** showing additional details.

DESCRIPTION

In the following description, reference is made to a circular knitting machine in order to illustrate the application of the present invention. Such reference is not intended to limit the use or the scope of the invention since it will be apparent that it may be generally applied to many forms of knitting machines. Further, the knitting machine portion illustrated is schematic in form, and only those parts which are required to describe the structure, function and interrelationship of the present invention are actually shown. Those skilled in this art will have a full knowledge and appreciation of the structure of knitting machines, and from the following description will be readily able to employ the present invention in any application.

Turning now to FIG. **1**, the present invention is shown as applied to a circular knitting machine having a cylinder **1** in which a plurality of longitudinal needles grooves **2** are formed. Located within each groove **2** is one or more control elements such as jacks **3**, each having a butt **4** extending radically outward to ride within a track **5** a of an annular cam housing **5**. A needle **6** is arranged in each longitudinal groove **2** above the jack **3** and is also provided with a butt **7** at its lower end engaging within a track **5***b* of the annular cam **5**.

The aforementioned structure is conventional in circular knitting machines and operates in well known manner so that as the needle cylinder **1** and the cam **5** are rotated relative to each other, the jacks and needles **6** cause axial movement of the needles effecting the looping of the yarn into a knit pattern. Conventionally, the needle butts **7** are divided into groups having differing radial length or extension so that they may be selectively engaged and operated. Separate control mechanisms such as those mentioned in the introduction hereto are employed to operate the needle butts. The predetermined programing of the relative cylinder and cam rotation, and the operation of the needle butts provides the required cyclic and repetitive operation to form a knit fabric or product of predetermined design.

The present invention is concerned with a novel needle or jack butt control mechanism and as seen in FIG. **1** comprises a cam **8** arranged to move under pneumatic impulse radially into and out of engagement with the butt **7**. In the simplest form shown in enlarged detail in FIG. **2**, the cam **8** is secured at the end of a pin member **15** extending from a pneumatic actuator **9**. The actuator, as will be described in detail later, is adapted, under the flow of pneumatic pressure to move the member **15** and the connected cam **8**, axially with respect to the cylinder **1**, a fixed distance along the

direction indicated by the arrow S. In the embodiment shown in FIG. **1**, two actuators, **9** and **10**, are arranged back to back or serially on a bracket **11** secured to the cam housing **5** by a suitable screw fastener **12**. The second actuator **10** is designed to reinforce the pulse applied to the pin **15** either separately or jointly with the pulse of actuator **9** so that the cam **8** may be moved in the direction of arrow S, in two fixed increments or steps, thus enabling it to selectively engage a short or a long needle butt **7**. The piston pin **16** of the second actuator **10** extends to the rear and is fixed against bracket **11**.

Each actuator **9** and **10** is fed by a conduit **13** and **14** respectively into which air under pressure is supplied. Suitable valve or supply mechanisms as well as programing means such as a digital computer is provided to furnish a pressure P_1 and a pressure P_2 to the conduits **13** and **14** respectively. The source of pressured air, or even an inert gas, is shown in FIG. **4** schematically, it being obvious that it, too, as well as valves, regulators, etc., are conventional and well known. The supply of pneumatic pressure, ie either or both of P_1 and P_2, is pre-programed and predetermined relative to the rotation of the needle cylinder by any of the conventional techniques, thereby establishing a predetermined knitting pattern. The cam **8** is moved in stepwise fashion either in a single or double increment to engage with the selected needle butt **7**.

Should it be desired to move the cam **8** radially along the direction S in three incremental steps, a third pneumatic actuator **18** is to be placed in tandem with actuators **9** and **10** as is seen clearly in FIG. **3**. In such an instance, the piston pin **16** of the second actuator **10** is placed in tandem with the third actuator whose own piston pin **20** extends rearwardly into a guide groove **17** formed in the bracket **11**. The third actuator is provided with its own intake conduit **19** which feeds a third pressure pulse P_3.

The arrangement of the actuators **9**, **10** and **18** and their respective piston pins **15**, **16** and **20** is dictated by the form of the actuators, themselves, which are shown in detail in FIG. **4**. This latter figure depicts the preferred form of actuator since it has been found to be simple, reliable and completely effective at low pressure inputs. The actuators can be built in very small units and to very small tolerances so as to be ganged in series about the needle cylinder.

As seen in FIG. **4**, the actuator body **9** (which is similar in structure to actuators **10** and **18**) comprises a front lid **23** and back cover **26**, each having a peripheral lip and a central recess which cooperate to form a hollow interior chamber **30**. The piston pin extends through the front face of the lid **23** through an adjustable bushing **32** and has secured at its inner end a flat plate **21** which bears against a flexible diaphragm **22** which divides the chamber **30** into front and rear sections. The diaphragm **22** is stretched and mounted between the peripheral lips of the front lid **23** and the back cover **26** and is held by suitable screw fasteners **27** and **28** which also hold the two halves of the actuator **9** together. The pressure pulse P_1 enters from a source of regulated gaseous pressure **33** through conduit **13**, into a channel **29** communicating with the chamber **30** to the rear of the diaphragm **22** where it expands and bends the diaphragm outwardly against the plate **21**. The delivery of the pulse P_1 is regulated as to time and duration by suitable programing means such as an electronic or pneumatic computer **34**.

The front lid **23** is provided with holes **24** and **25** opening to the atmosphere. The pin **15** is normally biased against the diaphragm **22** by a spring **31** held within the adjustable bushing **32**. The bushing **32** may be placed so as to limit the outward movement of the pin **15**, on actuation by the diaphragm **22**.

Operatively, in the absence of pressure pulse P_1, the chamber **30** between the diaphragm **22** and the back cover **26** is, itself, unpressurized and the diaphragm **22** assumes a neutral position, since the ambient atmosphere and the spring **31** act on the plate **21** which bears against the diaphragm. The pin **15** and the cam **8**, if attached to it, assumes a rest position. When a pressure pulse P_1 is, however, fed into conduit **13**, the rear half of the chamber **30** becomes pressurized, flexing the diaphragm and pushing the pin **15** outwardly against the spring **31**. Any air in the front half of the chamber **30** is expelled through vents **24** and **25**. Consequently, the cam **8** is moved radially into engagement with the appropriately synchronized needle butt as seen in FIG. **1**. The movement of the cam has, of course, a distance equal to a single increment.

When the actuators are arranged in tandem as seen in either FIG. **1** or FIG. **3** and only one pressure pulse P_1, P_2 or P_3 is applied, the piston **15** moves only through a single increment as described. However, should one or more pulses P_1, P_2 or P_3 be applied simultaneously, the incremental movement is double or triple, as the case may be.

The construction of the actuator **9** permits their easy arrangement in tandem or series. Two units may be placed back to back as shown in FIG. **1**. In this case, the two pistons pins **15** and **16** face each other and by setting the second piston **16** against the fixed portion of the bracket, the double pulses P_1 and P_2 actuate the piston **15** to move a double increment. When placing the third actuator, its diaphragm can act directly on the piston **16** of the second actuator as if it were the primary piston. Consequently, the simultaneous movement creates a triple movement. It will be obvious that the number of actuators may be multiplied as required to effect the exact stroke distance of the cam **8**. It will be also obvious that the cam **8** may thus be employed to operate more than one or even two sets or groups of jack butts making the present invention quite versatile.

While the present invention has been applied to the control of needle elements, it may with only minor modification be applied to control sinkers, yarn guides, latch cams and similar movable parts requiring cyclic operation. Accordingly, it is intended that this disclosure be viewed as being illustrative only and should not in any manner be limiting of the scope or application of the present invention.

What is claimed:

1. In a knitting machine, apparatus for operating a machine element such as a needle or jack having a control butt, said apparatus comprising a bracket mounted adjacent to said machine element and a plurality of pneumatic actuators serially arranged within said bracket and axially of said machine element, each of said actuators comprising a hollow body, a flexible diaphragm secured within and dividing said body into a

front and rear chamber, and a movable member extending outwardly of said chamber, means for effecting movement of said extending member over a predetermined distance on application of a pneumatic pulse thereto, means retaining the outermost actuator from movement away from said machine element, a cam mounted on the extending member adjacent said machine element adapted to be moved into and out of operative engagement with the butt of said element, said cam mounting member having a rear end bearing on said diaphragm, and resilient means for maintaining said cam normally out of engagement with the butt of said machine element, and means for selectively feeding pneumatic pulses to one or simultaneously more of said actuators to cause one or more of said diaphragms to flex and move said extending movable member against said resilient means, into engagement with said machine element, the number of pulses fed to said actuators determining the distance of movement of said extending movable member.

2. The apparatus according to claim **1**, wherein said actuators comprise a pair serially arranged back to back within said bracket to form a combined actuator,

whereby on application of a pulse to each of said pair of actuators the movable extending member adjacent said machine element is caused to travel a distance twice the predetermined distance and whereby the application of a pulse to any one of said actuators causes said movable member adjacent said machine element to move only the predetermined distance.

3. The apparatus according to claim **2** including a third pneumatic actuator arranged in series with said previously mentioned pair of actuators, the extending member of the second of said paired actuators being fixed against the back of said third actuator and the extending member of said third actuator fixed against outward movement whereby the simultaneous actuation of said third and pair of actuators causes movement of the movable member of the first of said paired actuators over a distance three times the predetermined distance.

4. The apparatus according to claim **1** including means for adjusting the distance of movement of each said extending movable member.

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