June 11, 1963 E. SOSOLIC 3,093,250

DISTRIBUTORS NOTABLY FOR FEEDING MACHINE-TOOLS AND THE LIKE

Filed Sept. 24, 1959 7 Sheets-Sheet 1

Fig. 1

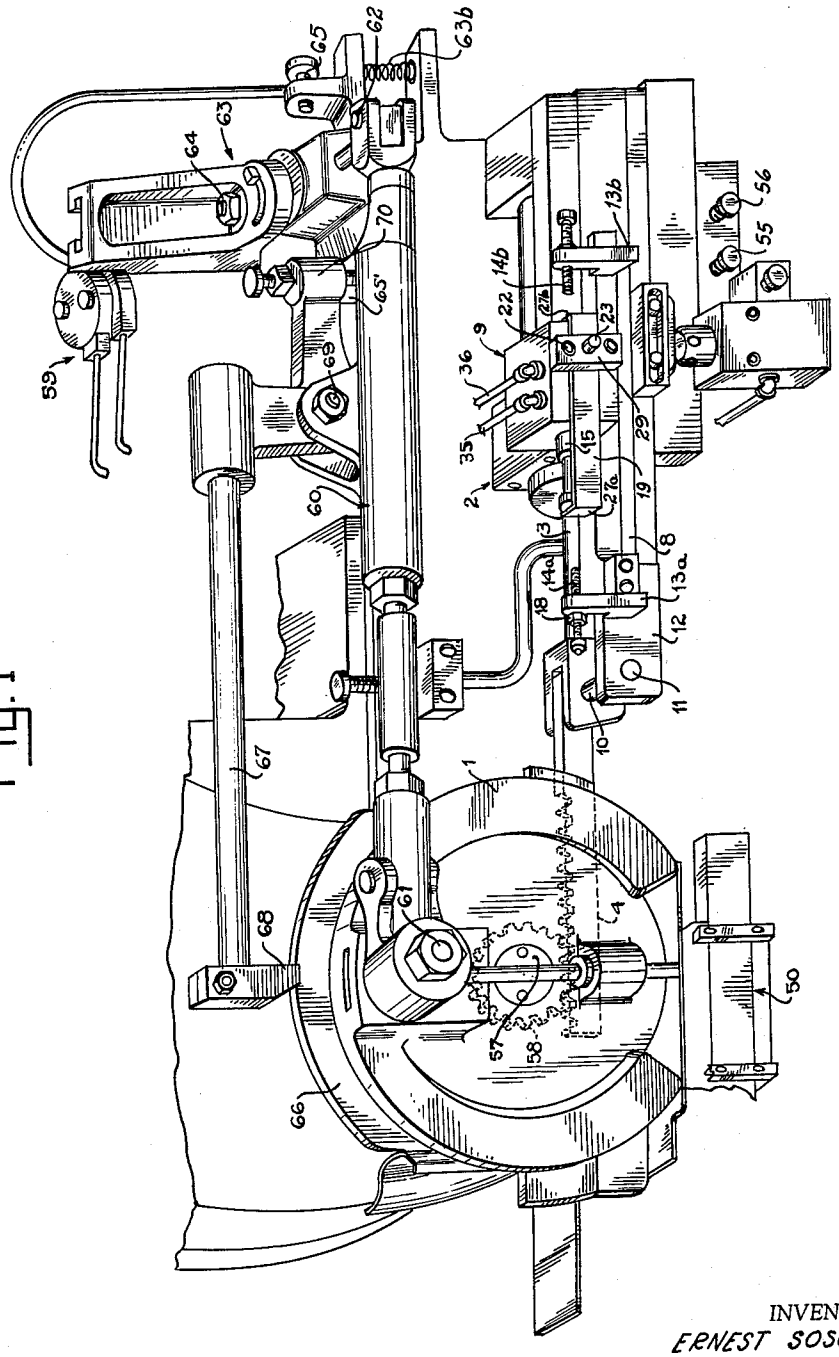


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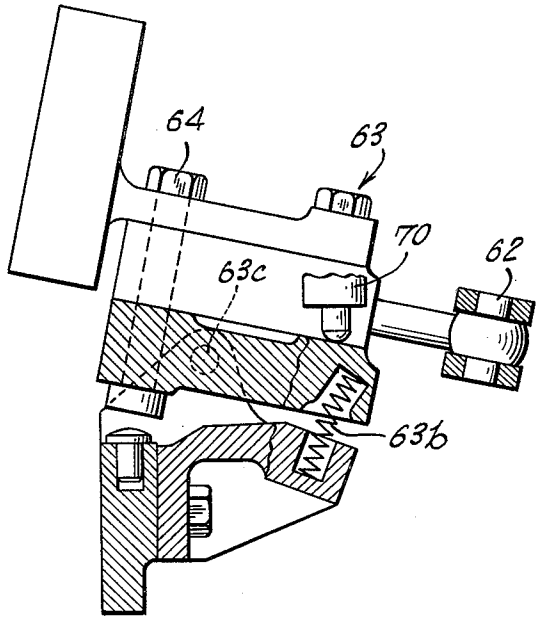
Fig. 1a.

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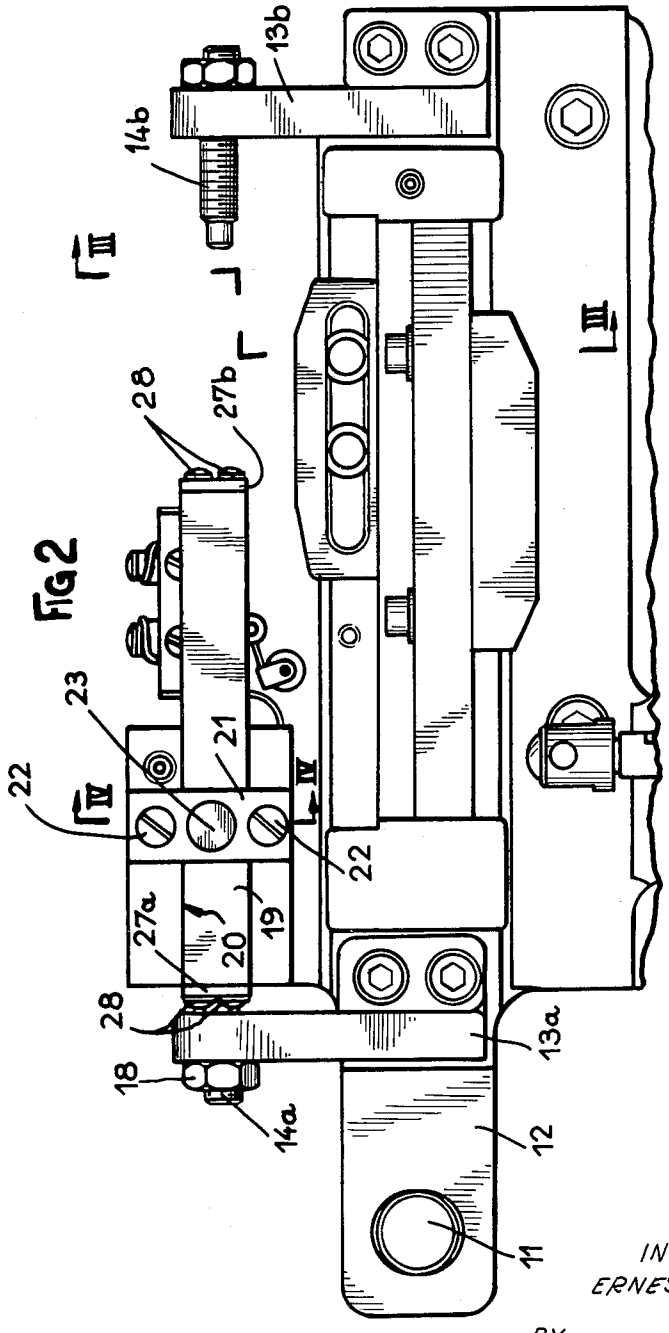


FIG 2

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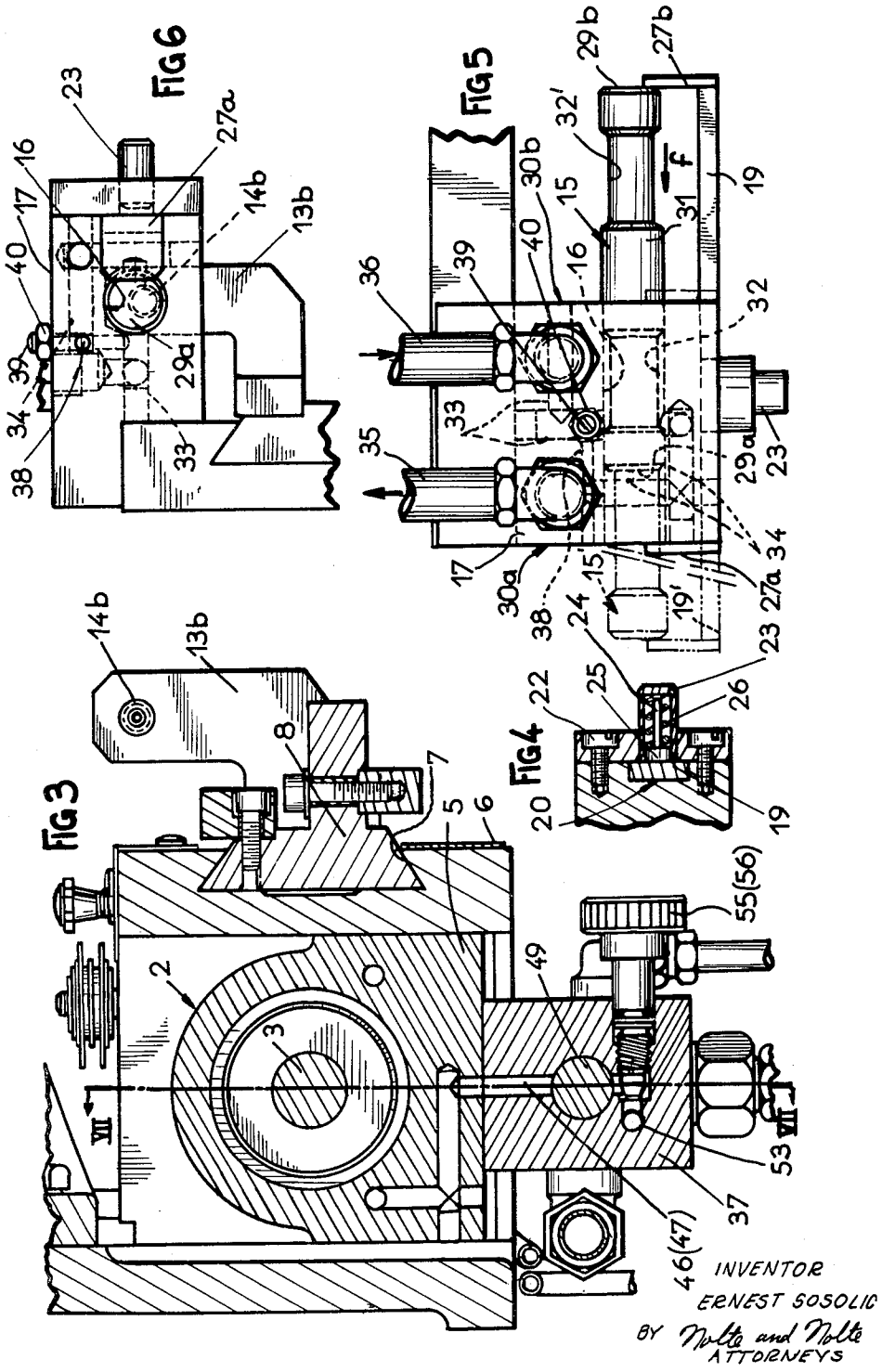

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Fig. 5a.

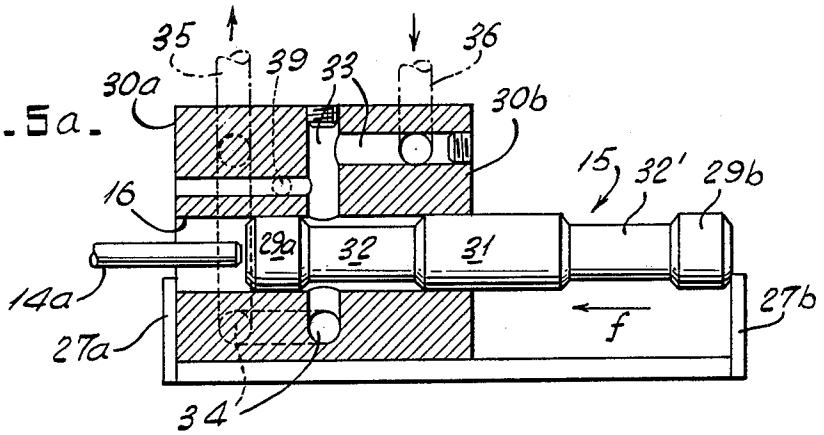



Fig. 5b.

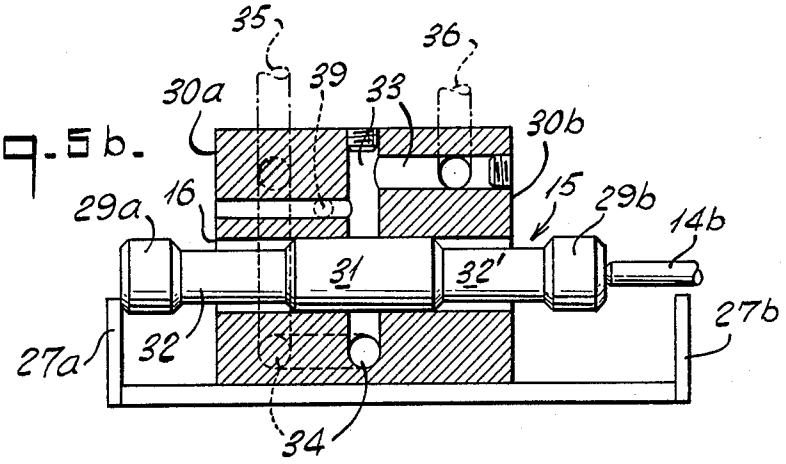
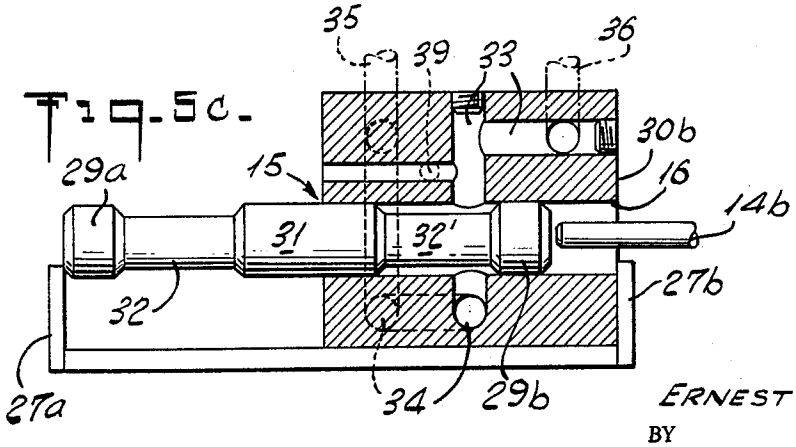



Fig. 5c.

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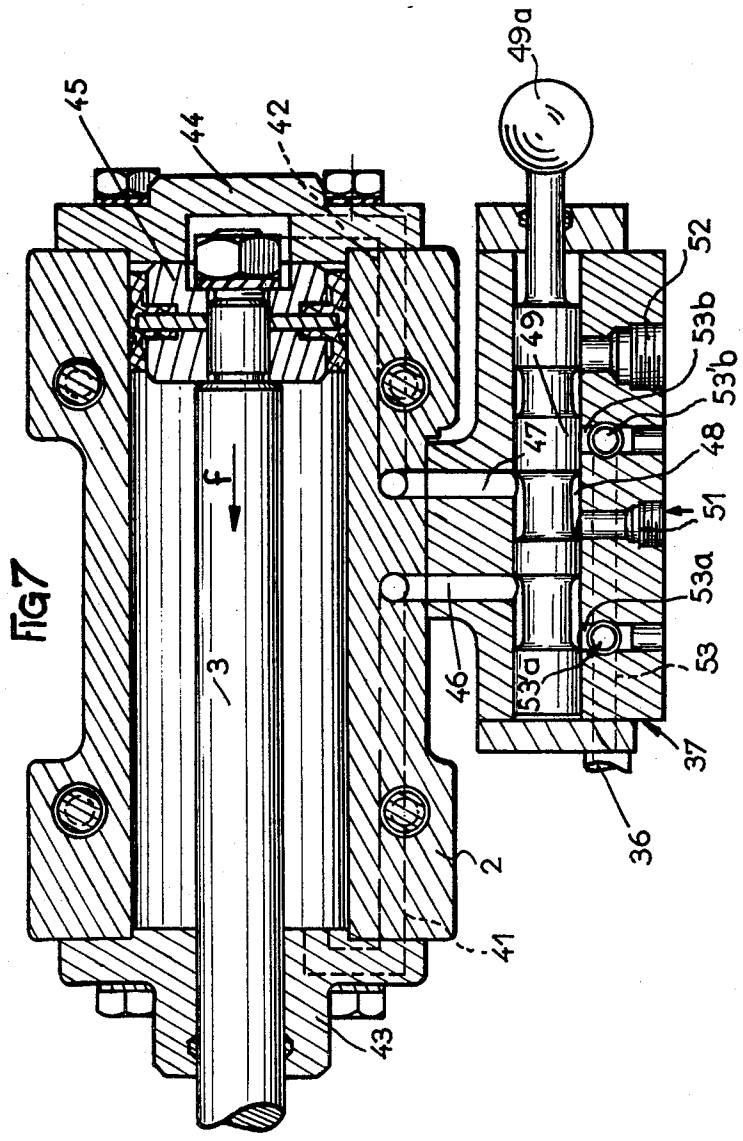


FIG7

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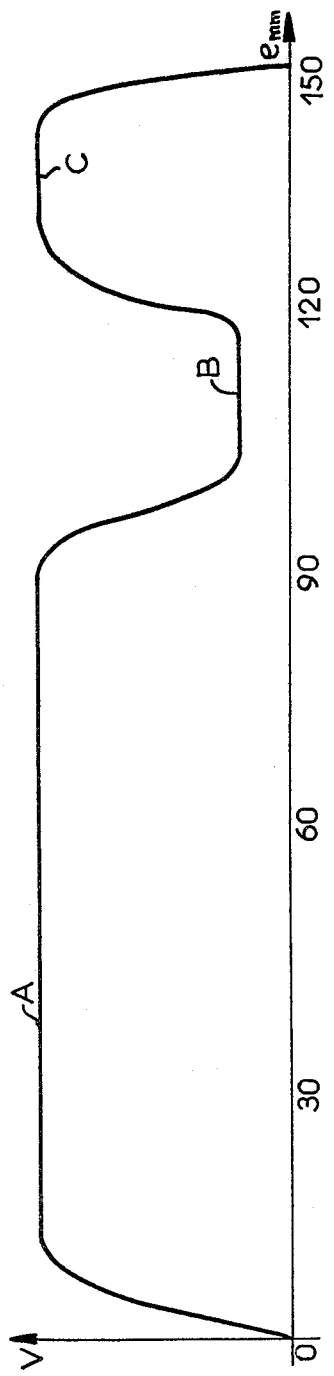
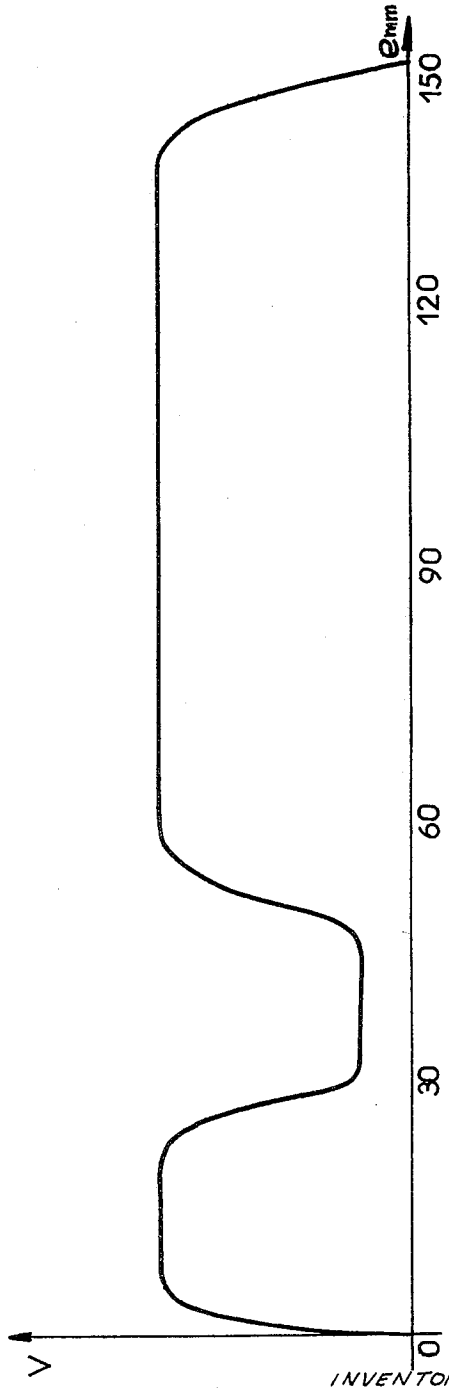



Fig 8

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United States Patent Office

3,093,250

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3,093,250

# DISTRIBUTORS NOTABLY FOR FEEDING MACHINE-TOOLS AND THE LIKE

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Claims priority, application France June 29, 1959
8 Claims. (Cl. 214—1)

The present invention is concerned chiefly with improvements in distributors constituting automatic feed means for machine-tools and miscellaneous apparatus.

This invention relates more specifically to distributors of the type comprising at least one gripping arm adapted to be reciprocated between two end positions, the movements of this arm being controlled by means of a pneumatic or like fluid-actuator.

In a distributor of this type the gripping arm travels according to a continuous cycle between a piece-containing reserve or magazine and the bed or working surface or station of the machine associated therewith, on which the pieces to be machined, shaped or otherwise worked are deposited by turns.

A typical example of a distributor of this character is described in the U.S.A. patent application Ser. No. 776,017, filed on November 24, 1958, by the same applicant and entitled "Distributor Device." The gripping arm of this prior device, which rotates about a vertical axis during its feed and return movements, travels between two extreme angular positions determined in a positive manner by a pair of stop or abutment members engaged by turns by the aforesaid arm. This angular movement is followed by a firstly downward and then upward movement (or vice versa) in order for example to lay the piece thus transported onto the bed or like position of the machine associated with the device. If the associated machine has to be fed at a relatively high rate, it is advantageous to apply some retarding force to the gripping arm at the end of the feed and return strokes, in order to damp out its shock against the aforesaid abutment means.

The improvement according to this invention is remarkable notably in that the exhaust of the actuator controlling the reciprocations of the gripping arm is directed through a braking device of the slide-valve type controlled by the piston ram of said cylinder and adapted to retard the stroke of the piston movable in said cylinder, during a predetermined time period preceding the completion of its stroke in either direction.

Practically, this braking device is designed with a view to retard the movement of the piston in said cylinder only when the gripping arm engages the corresponding end abutments, the subsequent movement of the piston controlling the vertical movement of the gripping arm which takes place at a normal speed.

The advantage arising from this improved arrangement is considerable for, as will be readily appreciated by anybody conversant with the art, it affords the maximum speeding up of the movements and therefore increases the rate of operation of the gripping arm accordingly.

According to a further feature characterizing this invention, the aforesaid braking device consists essentially of a distribution block formed with at least two inner passages for the inlet air and the exhaust air to and from the pneumatic cylinder, respectively, of an inner bore communicating with said passages and having slidably mounted therein a slide-valve member operatively connected to the piston ram of said cylinder, and, between the aforesaid pair of passages, of an inner by-pass duct of relatively reduced diameter in which the fluid is caused to flow during the braking period.

Preferably, the aforesaid by-pass duct comprises a needle valve or like throttling member for adjusting at will, from the outside, the cross-sectional area of this duct and therefore the braking time, whereby the duration of the feed and return strokes or cycles of the gripping arm can be adjusted as required.

This invention is also concerned, by way of novel industrial products, with the distributor devices for automatically feeding miscellaneous machines, of the type comprising a gripping arm effecting alternate movements or cycles under the control of a fluid-actuated cylinder or the like, these devices being provided with a braking system of the type broadly set forth hereinabove.

Other features and advantages of this invention will become apparent as the following description proceeds with reference to the accompanying drawings forming part of this specification and illustrating diagrammatically by way of example a typical form of embodiment of the braking device arrangement constituting the subject-matter of this invention. In the drawings:

FIGURE 1 is a fragmentary perspective view of the distributor, showing more particularly the braking device of this invention;

FIGURE 1*a* is a fragmentary cross-sectional view showing the tiltability of the distributor;

FIGURE 2 is an elevational view showing the braking device of FIGURE 1;

FIGURE 3 is a vertical section taken upon the line III—III of FIGURE 2;

FIGURE 4 is a fragmentary section taken upon the line IV—IV of FIGURE 2;

FIGURE 5 is a plan view from above showing the braking device;

FIGURES 5*a*—5*c* are horizontal sections showing details of the braking device of FIGURE 5;

FIGURE 6 is a side view showing the block illustrated in FIGURE 5;

FIGURE 7 is a vertical section taken upon the line VII—VII of FIGURE 3; and

FIGURE 8 is a diagram wherein the speed V is plotted against the stroke *e* during the feed and return strokes respectively of the gripping arm responsive to the braking device of this invention.

Referring first to FIGURE 1, there is shown diagrammatically therein a distributor of the type described in the aforesaid patent application, this distributor, as will be explained presently, having associated therewith a braking device constituting the improvement of this invention.

The distributor comprises essentially an oscillating disc 1 movable angularly about a fixed central shaft 57, the alternate movements or reciprocations of this disc being controlled by a cylinder 2 the piston ram 3 of which actuates a rack-forming rod 4 in meshing engagement with a pinion 58 coaxial and solid with the disc 1. This oscillating disc 1 controls in turn the alternate movements of the gripping arm 59 by means of a connecting rod 60 pivotally connected at one end to a peripheral pin 61 carried by the disc 1 and at its other end to a pin 62 carried by the support 63 of the gripping arm. This support 63 is also pivotally mounted about a fixed vertical axis consisting for example of a pin or bolt 64, and is adapted to move angularly between two end positions defined by a pair of fixed or adjustable stop or abutment members 65, 65'.

The vertical reciprocations of the gripping arm are controlled by a peripheral cam face 66 formed on or carried by the disc 1; to this end, this cam face is engaged by a follower 68 secured on one end of a bent lever 67 fulcrumed at 69 and having its other end 70 adapted to act upon the base of the aforesaid support 63 of the gripping arm. This case is also adapted to tilt vertically to a limited extent about a pivot 63*c*, and is biased in the tilting direction by a compression spring 63*b*, the

spring also maintaining the cam follower against the cam **66**. When the follower **68** rides on the elevated portion of the cam, the support **63** is tilted against the bias of the spring **63***b* due to the pressure of the fulcruming end **70** of the lever **67** (FIGURE 1*a*).

Secured on the front face of the block **5** of cylinder **2** is a mounting plate **6** in which a longitudinal dovetail-sectioned guide way **7** is formed and adapted to receive a slide **8** (FIGURE 3) which, as will be explained presently, constitutes a driving member for actuating the braking device shown in block form at **9** in FIGURE 1. This slide moves constantly in unison with the ram **3** of cylinder **2**, and is driven for example by means of the pin **10** connecting the piston ram **3** to the rack **4**, this pin also engaging a hole **11** provided in the end **12** of slide **8**.

This slide **8** carries at either end a bent lug **13***a*, **13***b* disposed in a vertical plane, each lug carrying at its upper end a driving pin or screw **14***a*, **14***b*, these two pins or screws being in axial alignment not only with each other but also with an intermediate slide-valve member **15** slidably mounted in a bore **16** formed in the block or body **17** of the braking device **9** and constituting the distribution block proper. The axis of this bore **16** and therefore the direction of movement of the slide valve member **15** as well as the direction of movement of the slide **8** are parallel to the axis of the actuator cylinder **2**.

Preferably, the driving members **14***a*, **14***b* of the slide valve **15** consist as shown of screws engaging tapped holes formed in the lugs **13***a*, **13***b*; these screws being adapted to be locked in position by nuts **18** or like members.

The displacements of the slide valve **15** in the bore **16** of braking block **17** are retarded or damped by a plate or bar **19** slidably mounted in a groove **20** formed in the front face of the braking block **17** and extending in a direction parallel to the guide way **7**. This bar **19** is held in position by a transverse piece **21** disposed straddlewise thereon and secured on the front face of the braking block **17** by a pair of screws or like fastening members **22**. In its center this transverse piece **21** is formed with a tapped hole engaged by a hollow screw-threaded stud **23** (FIGURE 4) carrying an internal braking pad **24** formed with a head **25** resiliently urged by a spring **26** against the front face of the bar **19**, the spring **26** being co-axial to the pad **24** and housed in the hollow stud **23**.

With this arrangement, the to-and-fro movements of the bar **19** in groove **20** of the braking block are constantly retarded by the friction thus set up.

At either end the bar **19** carries a small abutment plate **27***a*, **27***b* projecting rearwardly and secured on this bar by a pair of screws or like fastening members **28**. These plates **27***a*, **27***b* act firstly as retarding members as they carry along the bar **19** by being located in the path of movement of the end portions **29***a*, **29***b* of slide valve **15**. Besides, they also act as stop members with respect to this slide valve and to the plate **19** by engaging upon completion of their stroke either of the lateral faces **30***a*, **30***b* of braking block **17** (see FIGURE 5).

The slide valve **15**, on either side of a central portion **31** having an outer diameter corresponding to the inner diameter of the bore **16** is formed with two portions **32**, **32'** of reduced diameter adapted to allow the free communication, in a given position of the slide valve **15**, between two inner passages **33**, **34** provided in the braking block **17** and opening into the bore **16**. The passage **34** leads into a discharge pipe **35** emerging from the top face of this block **17**, and the other passage **33** leads into a pipe **36** also emerging from the top face of block **17** and connected through a slave valve **37** (FIGURE 7) to the exhaust side of cylinder **2**.

The braking block **17** is also provided with another inner passage **38** of smaller diameter than the passages **33**, **34** and constituting therebetween a by-pass duct the cross-sectional area of which can be adjusted at will by means of a needle-valve or like throttle member **39** projecting from the top face of the braking block (see FIGURE 6). A nut **40** is provided for locking this needle-valve **39** in the desired adjustment position.

As illustrated in FIGURE 7 the cylinder **2** of the actuator has two longitudinal passages **41**, **42** formed therein which on the one hand open at either end of the chamber of piston **45** respectively, through end plates **43**, **44** of this cylinder, and on the other hand communicate with a pair of inner passages **46**, **47** of the slave valve **37**, these passages leading in turn into the cylindrical bore **48** of this valve, in which the slide valve member **49** is slidably mounted. This slave valve **37** actuated by a master valve shown diagrammatically at **50** in FIGURE 1, which in turn is governed by the reciprocating movement of the disc **1**, is adapted to cause the inner passages **41** and **42** of cylinder **2** to communicate by turn either with the exhaust pipe **36** through the passages **53**, **53***a*, **53***b*, or with a pipe **51** connected to a source of compressed air.

Moreover, there is shown at **52** in FIGURE 7 a distributing outlet leading from the slave valve **37** to the blowing device.

The movement of piston **45** in cylinder **2** is reversed by moving the slide valve member **49** in the bore **48**. This can be either accomplished manually by means of a handle **49***a*, integral with the slide valve member **49**, or by automatic means. The automatic reversing operation can be accomplished e.g. by introducing compressed air alternately on opposite sides of the bore **48**. The alternation of the air can be governed by the master valve **50**.

A pair of tapped orifices **53'***a* and **53'***b* leading into the inner exhaust passages **53***a*, **53***b* and shown in FIGURE 7 are also adapted to receive a pair of screws **55**, **56** (FIGURE 1) formed with knurled heads whereby the cross-sectional area of the cylinder exhaust may be adjusted from the outside.

Under these conditions it is clear that by rotating the heads of these screws **55**, **56** in one or the other direction the speed of the piston in cylinder **2** can be adjusted at will independently of the braking time which, as already explained, is adjusted by means of the needle-valve **39** in the braking block.

The braking device described hereinabove operates as follows:

At the beginning of a feed stroke (the members being in the positions shown in FIGURES 2, 5 and 7) the slave valve **37** connects the compressed air inlet **51** to the inner passages **47**, **42** while the passages **41**, **46** communicate with the exhaust pipe **36** through the inner passages **53***a*, **53** of valve **37**. The slide valve **15** of the braking device occupies the end position shown in solid line in FIGURE 5 and the pipe **36** communicates freely with the discharge pipe **35** through the inner passages **33** and **34** of the braking block. The piston **45** will then move to the left (as shown by the arrow *f*, FIGURE 7) and carry along the slide **8**. As the driving screw **14***b* of this slide engages the end **29***b* of slide valve **15**, the latter is carried along in turn in the direction of the arrow *f* (FIGURE 5) and this movement continues at a relatively fast rate (portion A of the "feed" stroke in FIGURE 8) until the central portion **31** of slide valve **15** blocks the ports through which the inner passages **33** and **34** of block **17** lead into the inner bore **16**.

It will be seen (FIGURES 5–5*c*) that the distance between the two retarding plates **27***a*, **27***b* of bar **19** is substantially greater than the length of the slide valve **15**, so that this bar **19** will not be carried along immediately in the direction of the arrow *f* by the slide valve **15** when the latter commences its movements. Therefore, to prevent this slide valve **15**, during the initial portion of its travel and under the influence of the shock applied initially thereto, from moving faster than the ram and block prematurely, the positioning of the outlet ports of passages **33** and **34** in bore **16** is so calculated that the distance between them and the side face **30***a* of block **17**

be smaller than the total length of portions 29*a* and 32 of the slide valve 15, so that in case the slide valve engaged prematurely the plate 27*a* of bar 19, the inner passage 34 would still communicate with the inner passage 33.

Under these conditions, this communication is discontinued only when the slide valve 15, after engaging with its end 29*a* the abutment plate 27*a*, continues its travel (while being retarded by the bar 19) and blocks with its central portion 31 the ports corresponding to these passages 33, 34. In this case, the exhaust takes place through the by-pass duct 38 whereby the movement of the piston 45 will be retarded during a time period corresponding to the portion B of the diagram of FIGURE 8. This retarding action continues as long as the central portion 31 of slide valve 15 registers with the ports of passages 33, 34. This position of the slide valve 15 is also calculated with a view to cause this retarding action to take place immediately before the support of the gripping arm or member engages its corresponding end stop. However, in the case contemplated herein, this lagging action has a limited duration and is followed by a relatively fast end portion of the stroke during the downward movement of the gripping member on the machine bed or like working place, this fast movement being allowed by the fact that the portion 32' of reduced diameter of slide valve 15 registers in turn, at the end of the stroke (portion C of the diagram of FIGURE 8), with the ports of passages 33 and 34, thus reestablishing the free communication between the cylinder exhaust and the outlet pipe 35.

During the return stroke the movements just described take place in a similar way but their order is reversed.

During this return stroke the slide driving screw 14*a* moves the slide valve 15 to its initial position.

Then the cylinder exhaust takes place, for a reversed position of the valve member 49 of slave valve 37, through the other end passage 42 of cylinder 2.

Of course, the braking device described hereinabove may also be associated with distributors different in type and construction from the one described and illustrated herein by way of example, provided that they comprise at least and generally a gripping member or arm reciprocated under the control of a pneumatic or like fluid-actuated cylinder.

Besides, the invention should not be construed as being limited to the specific form of embodiment shown and described herein, as many modifications may be brought thereto without departing from the spirit and scope of the invention as set forth in the appended claims.

What I claim is:

1. In a distributor for automatically feeding pieces to machine-tools comprising at least one gripping arm, two end abutments for limiting the oscillation of said arm, a fluid actuator, piston means in said actuator for reciprocating said arm, a braking device on the exhaust passage of said fluid actuator, slide-valve means in said braking device controlled by the piston means in said actuator and consisting of a distributing block, an inner bore in said block, a slide-valve member slidably mounted in said inner bore and responsive to the motion of said piston means, at least two inner passages opening in said inner bore constituting the inlet and outlet passages for the actuator exhaust fluid through said distributing block, a by-pass duct of a variable cross-sectional area smaller than the one of said two inner passages connecting directly said inlet passage with said outlet passage to allow a reduced flow of fluid between said passages when their openings into said inner bore are closed by said slide valve member, said reduced flow corresponding to a breaking period which occurs, during a predetermined time prior to the completion of every stroke of said actuator in either direction.

2. Braking device as claimed in claim 1, wherein needle-valve means are provided in said by-pass duct whereby the cross-sectional area of the latter may be adjusted from the outside.

3. Braking device as claimed in claim 2 wherein a central portion having substantially the same diameter as said inner bore and two portions of a smaller diameter adjacent to the ends of said slide-valve member are provided on the latter to form a direct connection between said inlet and outlet passages when said portions of a smaller diameter register with said openings, said direct connection being prohibited when the latter are closed by said central portion.

4. In a braking device as claimed in claim 3, a slide movable in a direction parallel to said piston means motion and carried along by said piston means, a pair of pin means mounted on said slide substantially coaxial to said slide-valve member, the distance between said pin means being greater than the length of said slide-valve member so that the latter is driven only during one part of the piston means stroke by said piston means.

5. Braking device as claimed in claim 4 wherein the arrangement of said pin means in relation to said slide-valve member is executed to ensure that during any cycle the braking period takes place before the end of a stroke and before said gripping arm engages one of said end abutments and is followed by a short time period corresponding to the end of the stroke at a normal speed.

6. In a braking device as claimed in claim 5, a guide groove provided in said distributing block, a friction plate means, slidably mounted in said guide groove, small plate means extending at either end of said friction plate means and abutting on the one hand against one end of said slide-valve member to follow its motion, and on the other hand, at the end of the slide-valve member travel, against one face of said block acting as a limit stop, the reciprocating motion of said slide-valve member in said inner bore being thus limited and retarded.

7. In a braking device as claimed in claim 6, a transverse plate secured to said distributing block straddlewise on said friction plate means to hold the latter in position in said guide groove, a retaining friction pad on said transverse plate, and resilient means urging said transverse plate against said friction plate.

8. In a distributor comprising a braking device according to claim 7, a fixed guide way fastened to the body of said fluid actuator in which said slide is mounted, an orifice provided in the end portion of said slide, a pin engaging said orifice, whereby said piston means is controlling said slide and consequently said slide-valve member which controls in turn the motion of the distributor gripping means.

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