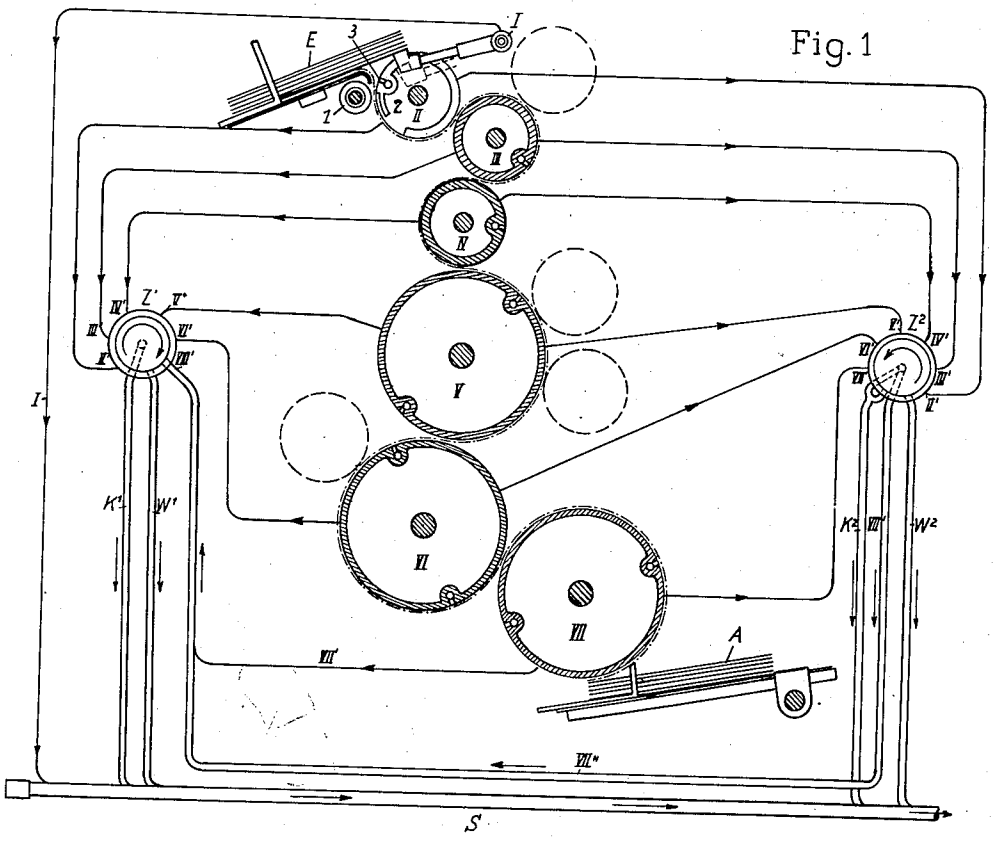
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CONTROL MEANS FOR FLUID PRESSURE SYSTEMS

Filed June 2, 1951

2 Sheets-Sheet 1

Fig. 1



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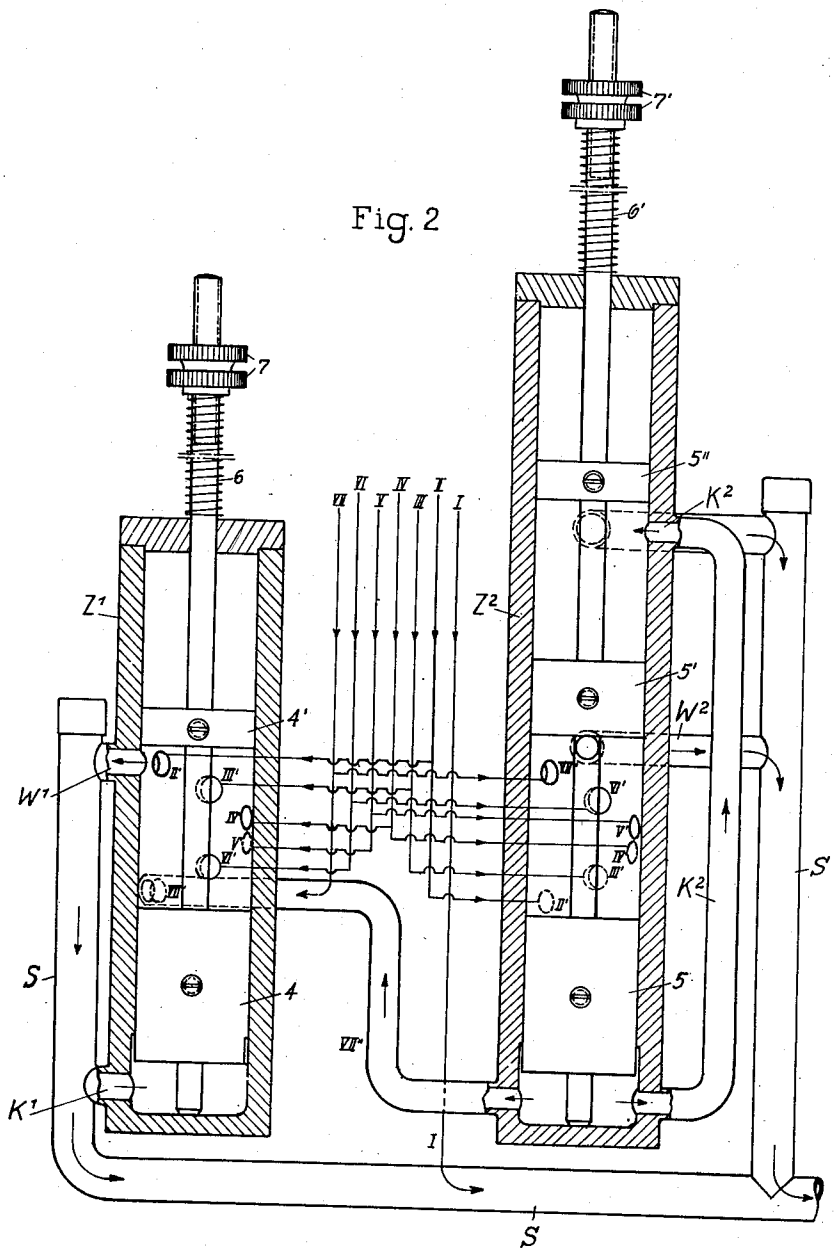
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Fig. 2



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CONTROL MEANS FOR FLUID PRESSURE SYSTEMS

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10 Claims. (Cl. 271—3)

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This invention relates to automatic valve mechanism for controlling the distribution of fluid to a series of fluid pressure devices in a predetermined sequential order, and one important practical application of the invention is in connection with control means for the suction feed mechanism of machines of the type used for the manufacture of flat paper bags and envelopes, or of other machines in which blanks or work-pieces are successively grasped by suction devices as they are conveyed progressively through the machine.

In machines of this type in which the blanks or other articles are conveyed from a feed pile, or are torn from a continuous strip, and are fed by means of a series of operating and feed rolls to a delivery table or station, the individual rolls are each provided with suction means and controls whereby the suction is applied to the blanks in accurately timed relation to the movement of such blanks through the machine during the normal operation thereof.

At the commencement of the operation and during the passage of the last blanks at the termination of the operation, however, the suction in such machines as heretofore designed may be substantially reduced due to the fact that certain of the suction devices are not engaged by blanks or other work-pieces and are consequently free to admit air sufficient to interfere with the efficient operation of the other suction devices in engagement with blanks or other work-pieces.

One object of the present invention is to provide automatic control means whereby undue loss of suction, and consequent inefficient operation, is effectively prevented during the commencement and termination of the operation of the machine and while only a limited number of the suction devices are functioning.

Another object of the invention is to provide, in addition to the well known means for controlling the suction to all the feed devices of the machine, a valve means whereby the suction is progressively applied to the different suction devices during the commencement of the operation, and another valve means whereby the suction is progressively discontinued from the individual suction devices during the termination of the operation.

Still another object is to provide valve means subjected to forces tending to move them in one direction in combination with means whereby variation in the suction causes said valve means to move automatically in the opposite direction

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and to thus progressively control the suction to the individual suction devices.

With these and other objects in view, the invention consists in the novel arrangement and construction of the suction control mechanism, as illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form and construction may be made without departing from the spirit of the invention or sacrificing any of the advantages thereof.

On the drawings, Fig. 1 is a diagrammatic view partly in cross section showing by way of example, a machine in which blanks are printed and formed with window openings and have transparent window panes pasted thereto and Fig. 2 shows in longitudinal section cylinders and pistons serving to control the suction air lines for the various parts of the machine.

Referring to Fig. 1, the roll II is divided in its longitudinal direction and the suction device I swings between the positions shown in full lines and partly shown in dotted lines and each time the said device moves downwardly it bends the edge portion of the lowermost blank in the pile E into recesses in the parts of the roll II so that the edge of the blank is positively gripped between the roll II and a counter roll I and is withdrawn from the bottom of the pile E.

The six rolls, II to VII, in turn grasp the blank by the action of suction and for this purpose each of the rolls II, III and IV is provided with a suction channel 2, while the rolls V, VI and VII are each provided with two such suction channels and each of the channels 2 communicates with an opening 3 terminating in the periphery of the roll. Each blank is delivered from one roll to the other in turn and the final roll VII delivers it to the delivery pile A, and all the blanks pass from the feed pile E to the delivery pile A through the path indicated by dot-and-dash lines on Fig. 1.

The rolls II, III and IV each feed one blank for each revolution, while the rolls V, VI and VII each feed two blanks for each revolution. The roll III may for example serve as a printing cylinder of a printing press and while the blanks are being fed by the said roll, printed matter may be impressed thereon. Roll V may be the counter-roll of two rotating stamping blades for the cutting of a window opening and the transparent window pane may be pasted over such opening while the blank is fed by roll VI. In the following description, however, all the said rolls are designated as feed rolls.

Each of the feed rolls II to VII is provided with suction control means of the type known per se and whereby each roll at the proper time takes over the blank from the preceding roll and delivers it to the next succeeding roll.

The additional device for the control of the suction air in accordance with this invention insures that when the first blanks are being fed into the machine and when the last blanks are being delivered from the machine, there is no loss of vacuum such as might interfere with the proper feeding of the sheets due to certain of the openings 3 being completely uncovered.

In operation, for the control of the suction air during the feeding of the leading blanks into the machine, a cylinder Z^1, Fig. 2, is provided, and for such control during the delivery of the final sheets from the machine, a cylinder Z^2 is employed.

The cylinder Z^1 contains two piston parts 4, 4' capable of reciprocation therein while the cylinder Z^2 contains three piston parts 5, 5', 5'' adapted to reciprocate therein. The two cylinders Z^1 and Z^2, are represented in the diagrammatic showing of Fig. 1 only by double outline circles while in Fig. 2 these cylinders are shown in longitudinal section.

The piston rod of the piston parts in the cylinder Z^1 has a compression spring 6, while the piston rod of the piston parts in the cylinder Z^2 has a compression spring 6', these springs being placed over the piston rods and resting against the cylinder covers and being capable of adjustment by means of screw and lock nuts 7, 7', so that the pistons are each acted upon by a force capable of fine adjustment.

In Fig. 2 the pistons of both cylinders are shown in their lowest positions, which are the normal positions for the operation of the machine.

When the machine is not in operation and during periods while the machine is idling, and as long as no blanks are yet present in the feed pile E or on the rolls II to VII, the pistons are located in the upper parts of their cylinders Z^1 and Z^2. In this position, the piston parts 4 and 5 cover the ports II' to VII' of the suction lines leading from the corresponding rolls II to VII, these ports being so arranged that they may be simultaneously covered by these piston parts and being distributed around the periphery of the cylinders. The cylinders Z^1 and Z^2 have suction lines W^1 and W^2 respectively connected to the main suction line S of the vacuum pump and such openings W^1, W^2 are also closed by the piston parts 4, 5. In this piston position, the piston part 5' in cylinder Z^2 closes the inlet and discharge openings of a suction line K^2 also connected to the main suction line S. In this highest position of the pistons, while the machine is idling, only the discharge opening K^1 located at the bottom of the cylinder Z^1 is open to the main suction line S, being uncovered by the piston part 4.

Since the suction device I is connected directly to the main suction line S, air is freely drawn into the system and, provided that the compression spring 6 is properly adjusted, the vacuum below the piston 4 in the cylinder Z^1 is insufficient to cause the piston part 4 to move downwardly. As soon as blanks are placed in the pile E and the operation commences, however, the suction opening 3 of the swinging arm of the suction device I is closed by engagement with a blank and, the vacuum increases in the said line and consequently in the lower part of the cylinder Z^1 so that the piston parts 4, 4' are drawn downwardly against the action of compression spring 6 from their raised position in which all of the inlet ports II' to VII' are covered, the piston part 4 being moved downwardly to such an extent that it uncovers the inlet port II' of the suction line leading to the feed roll II, but keeps all the other ports III' to VII' closed. The suction action is thus permitted through the roll II from the vacuum pump through the suction line S, the suction port W^1, the interior of the cylinder between piston parts 4 and 4', and the suction line connected to the inlet opening 3 of the roll II'.

After the first blank is grasped by the roll II the consequent increase in vacuum which then takes place, causes a further displacement of piston part 4, so that the inlet port III' of the suction line leading to the roll III is uncovered thereby permitting this roll to grasp the blank by suction from the roll II. The same process repeats itself up to the last roll VII and thus upon each roll taking over the leading blank from a preceding roll, the piston part 4 in cylinder Z^1 is drawn downwardly by the resultant increase in vacuum and uncovers the suction port for the next roll. In this manner, upon the introduction of the first blank into the machine, any loss in vacuum and any consequent failure in the operation is prevented and on the contrary, a dependable and unimpeded feed of the blanks through the machine is insured, including also the first blanks to be introduced so that proper operation can be relied upon even from the very beginning of the operation.

Upon the conclusion of the operation and when the last blanks are being delivered from the machine, the apparatus according to this invention avoids any reduction in the vacuum that might cause disturbance of the proper feeding of the blanks until the last blank has been delivered to the delivery pile. Since the roll II is the first to be released under these circumstances and the roll VII is the last, the connections of the suction lines must be interrupted in the same sequence, and any step-wise return displacement of the piston part 4, in the cylinder Z^1 upwardly would give the reverse sequence and thus would not give the desired result.

As shown in Fig. 2 the port VII' of the cylinder Z^1 communicates not only with a suction line to the last feed roll VII but also with a line VII'' leading to the bottom of the second cylinder Z^2 and as soon as the piston part 4, has reached its lowermost position as shown in Fig. 2, a vacuum is produced below the piston part 5 in cylinder Z^2 and this vacuum draws the piston parts 5, 5', 5'' downwardly with a single motion from their highest position into the lowest position as shown on the drawing. The inlet ports II' to VII' in cylinder Z^2 are then uncovered as well as the connection W^2 of cylinder Z^2 to the main suction line S. The piston parts 5, 5', 5'' in cylinder Z^2 as well as the piston parts 4, 4' in cylinder Z^1 have then reached the position shown in Fig. 2, being the position in which all these piston parts remain during the normal operation of the machine, all of the rolls being connected to the main suction line S through the two cylinders Z^1 and Z^2. The suction through cylinder Z^2 communicates fromt he main suction line S (Fig. 2, right hand side) through the cylinder part lying between the piston parts 5 and 5', the inlet ports II' to VII' located therein, and through the suction lines to the individual feed rolls.

When, at the termination of the operation, the last blanks are being delivered from the machine, the suction decreases below the pistons 4 and 5 and the springs 6, 6' cause the pistons to move upwardly in their cylinders. This upward movement of the piston part 5 successively closes the ports II' to VII' in the cylinder Z^2 as the last blank leaves the corresponding feed rolls II to VII so that there is no interruption in the efficient conveyance of blanks still in the machine due to loss of suction. The return motion of the piston 4 takes place more rapidly and first closes the port VII' in the cylinder Z^1, the spring 6 being adjusted to exert a greater pressure. The ports in cylinder Z^1 are thus closed more rapidly than those in cylinder Z^2.

The suction below piston 5 is supplied through the line VII'' from cylinder Z^1 which is connected by the line W^1 with the suction main S when the piston 4 is in its lowest position. Since the port VII' in cylinder Z^1 is again closed when the last blanks are being delivered from the machine, however, the suction line K^2 is provided to maintain a suction below the piston part 5 in the cylinder Z^2. This line K^2 leads from the bottom of the cylinder Z^2 to the upper part thereof and through the interior of the cylinder communicates with the suction line S. The inlet and outlet openings of the line K^2 are closed by the piston part 5' as long as the piston is in its upper position and they are uncovered immediately the piston moves to its lower position. As shown at Fig. 2, the portion of the cylinder Z^2 below the piston part 5 is thus connected to the suction line S by the lines K^2 and VII'' during normal operation of the machine.

Although the drawings and the above specification disclose the best mode in which we have contemplated embodying our invention, we desire to be in no way limited to the details of such disclosure for in the further practical application of our invention, many changes in form and construction may be made as circumstances require or experience suggests without departing from the spirit of the invention within the scope of the appended claims.

What we claim is:

1. Automatic valve mechanism for controlling the distribution of fluid to a series of fluid pressure devices in a predetermined sequential order, comprising a cylinder, a piston reciprocating within the cylinder, pipe lines leading to individual fluid pressure devices, ports formed in the wall of said cylinder and communicating with said lines, means tending to move the said piston in one direction in said cylinder, and means connecting the cylinder with the fluid pressure supply to move the piston in the opposite direction to successively uncover the said ports during the commencement of the operation and until the mechanism is in normal operation.

2. Automatic valve mechanism according to claim 1, in which the said means tending to move the piston in one direction comprises a piston rod, a collar on said rod, and a spring carried on said rod in compression between said collar and one end of the cylinder.

3. Automatic valve mechanism according to claim 2, in which the said collar comprises an adjustable nut mounted on said piston rod and serving to vary the compression of said spring.

4. Automatic valve mechanism for controlling the distribution of fluid to a series of fluid pressure devices in a predetermined sequential order, comprising a cylinder, a two-part piston movable within the cylinder, a spring tending to move said piston in one direction, a pipe connection between said cylinder and the fluid pressure supply, pipe lines connected with certain of said devices, ports communicating with said pipe lines and longitudinally disposed in the wall of said cylinder, and a fluid pressure line connecting the first of said fluid pressure devices with the fluid pressure supply independently of said cylinder, the decrease in fluid pressure in the main supply due to the operation of the first of said devices causing movement of said piston against the action of said spring and causing the piston to uncover the port leading to the next device in the series.

5. Automatic valve mechanism according to claim 4, comprising a second cylinder, a piston movable therein, means tending to move the latter piston in one direction, ports longitudinally disposed in the second cylinder and communicating with the said fluid pressure lines, and a fluid pressure connection from the second cylinder to the main fluid pressure supply, the first piston progressively opening the fluid pressure supply to the fluid pressure devices at the commencement of the operation and the second piston progressively closing the fluid pressure supply to the fluid pressure devices during the termination of the operation.

6. Automatic valve mechanism according to claim 4, comprising a second cylinder, a three-part piston movable therein, adjustable spring means tending to move the three-part piston in one direction, ports longitudinally disposed in the second cylinder and communicating with the said fluid pressure lines, a fluid pressure connection from the second cylinder to the main fluid pressure supply, and a fluid pressure line connecting the two cylinders with each other, one part of the two-part piston progressively opening the fluid pressure supply to the said devices at the commencement of the operation and one part of the three-part piston progressively closing the fluid pressure supply to the devices during the termination of the operation.

7. Automatic valve mechanism for controlling the distribution of fluid to a series of fluid pressure devices in a predetermined sequential order, comprising a cylinder with fluid pressure ports longitudinally disposed therein, a fluid pressure line connecting each of said ports with one of the fluid pressure devices, a piston movable within said cylinder to progressively uncover said ports and thus progressively bring such fluid pressure devices into action at the commencement of the operation, adjustable means tending to move the piston in one direction, and a fluid pressure connection to said cylinder whereby variation in the fluid pressure in the main line displaces said piston against the action of said adjustable means to bring the individual fluid pressure devices into action at the commencement of the operation.

8. Automatic valve mechanism for controlling the distribution of fluid to a series of fluid pressure devices in a predetermined sequential order, comprising a fluid pressure line leading to each fluid pressure device, a cylinder having a port communicating with each line, a piston mounted in the cylinder for the control of said ports, adjustable spring means moving the said piston into position to cover said ports, and fluid pressure means connecting the cylinder with the main fluid pressure line to displace the piston against the action of said spring to progressively uncover

said ports and progressively apply fluid pressure to said devices.

9. Automatic valve mechanism for controlling the distribution of fluid to a series of fluid pressure devices in a predetermined sequential order, comprising two cylinders, a piston movable in each cylinder, spring means tending to move each piston in one direction in its cylinder, a series of axially disposed ports in each cylinder, a fluid pressure line connecting one port in each cylinder with each individual fluid pressure device, and connections between said cylinders and the main fluid pressure line whereby the piston in one of the cylinders is moved longitudinally against the action of its spring means to progressively uncover the ports in such cylinder to operate said devices progressively as the operation commences, and whereby the piston in the other cylinder is moved to progressively cover the ports in such cylinder to progressively cut off the fluid pressure from the said devices during the termination of the operation.

10. Automatic valve mechanism for controlling the distribution of fluid to a series of fluid pressure devices in a predetermined sequential order during the commencement and the termination of the operation, comprising two cylinders, a piston movable in each cylinder, adjustable spring means tending to move each piston in one direction in its cylinder, a series of axially disposed ports in each cylinder, fluid pressure lines connecting said ports with individual fluid pressure devices, connections between said cylinders and the main fluid pressure line whereby the piston in one of the cylinders is moved longitudinally to progressively uncover the ports in such cylinder to operate said fluid pressure devices progressively as the operation commences, and whereby the piston in the other cylinder is moved to progressively cover the ports in such cylinder to progressively cut off the fluid pressure from the said devices during the termination of the operation, and a fluid pressure line leading directly to the first of said devices from the fluid pressure supply.

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