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Vollrath et al.

[11] **3,761,077**

[45] **Sept. 25, 1973**

[54] **BLAST AIR CONTROL DEVICE**

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[52] **U.S. Cl.** **271/108**, 137/613

[51] **Int. Cl.** **B65h 3/08**

[58] **Field of Search** ..... 271/26 R, 27, 30, 271/42; 137/613, 624.13

[56] **References Cited**

UNITED STATES PATENTS

3,294,396 12/1966 Staines ..... 271/26 R

Primary Examiner—Edward A. Sroka

Attorney—Ernest G. Montague

[57] **ABSTRACT**

A blast air control device for a sheet feeder with a device for the cyclic control of the blast air, which comprises a first device for the cyclic control of blast air and a second control device controlled by the feeder output as an input variable and associated with the first device. Means for regulating at least one of the pressure of the blast air and of the blast time over a wide output range of the feeder are provided in order to maintain automatically the optimum blast action.

2 Claims, 7 Drawing Figures

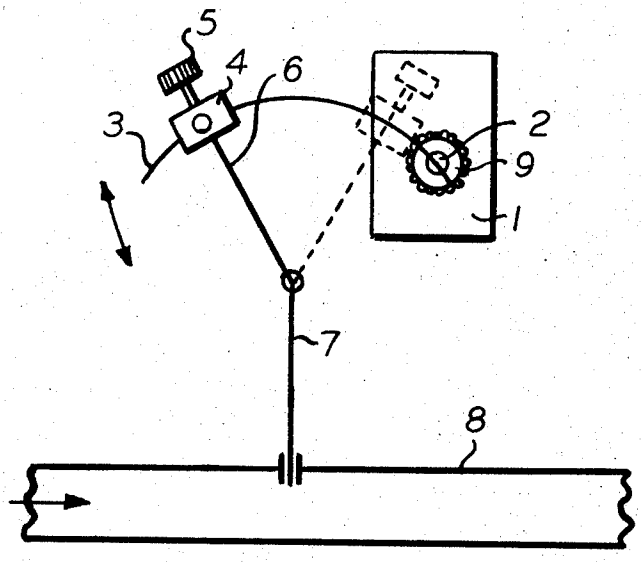


FIG. 1.

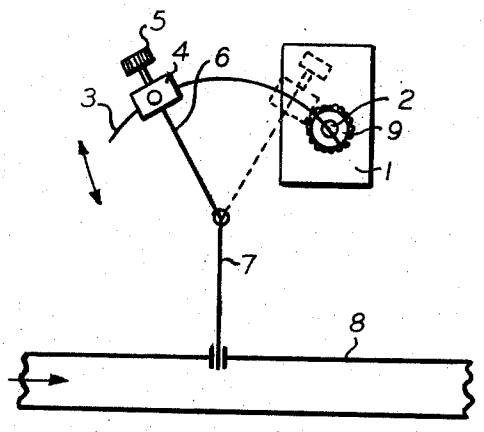
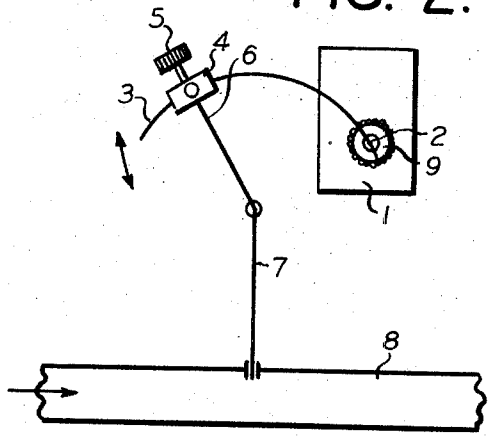


FIG. 2.



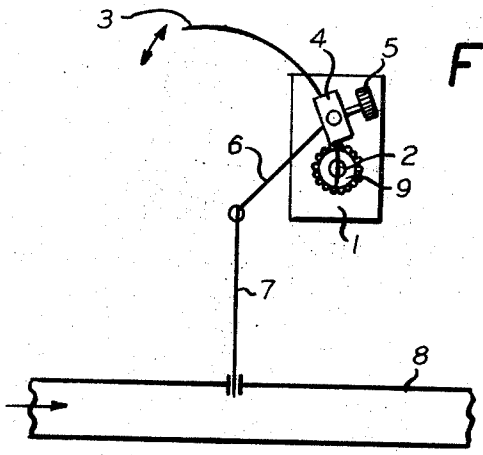


FIG. 3.

FIG. 7.

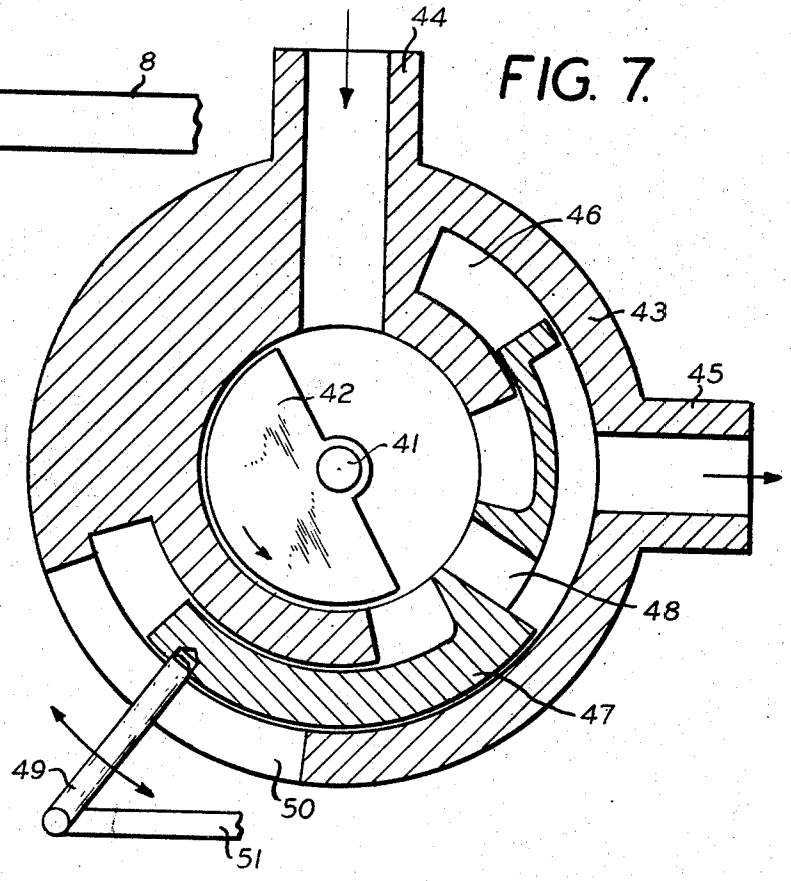


FIG. 4.

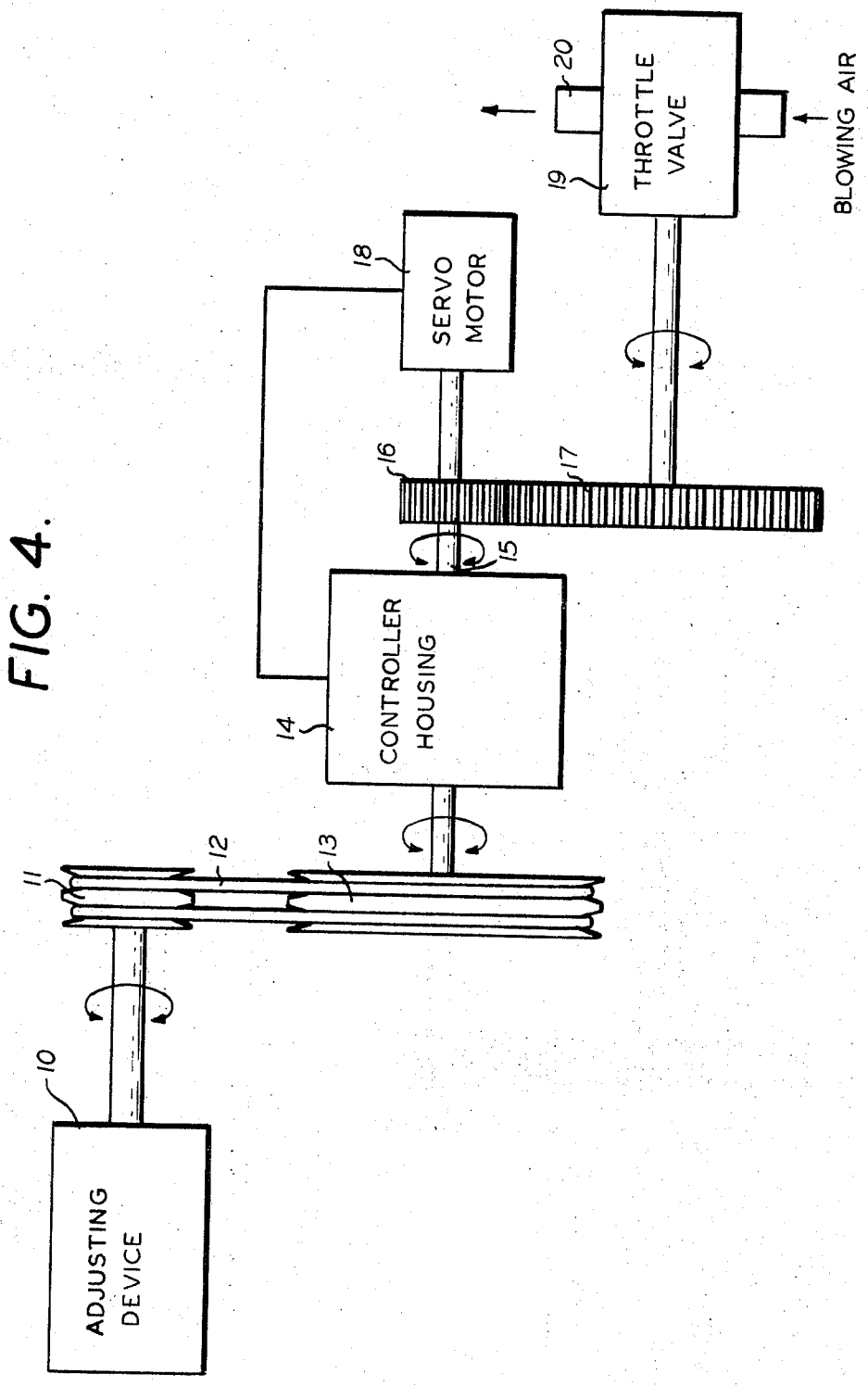
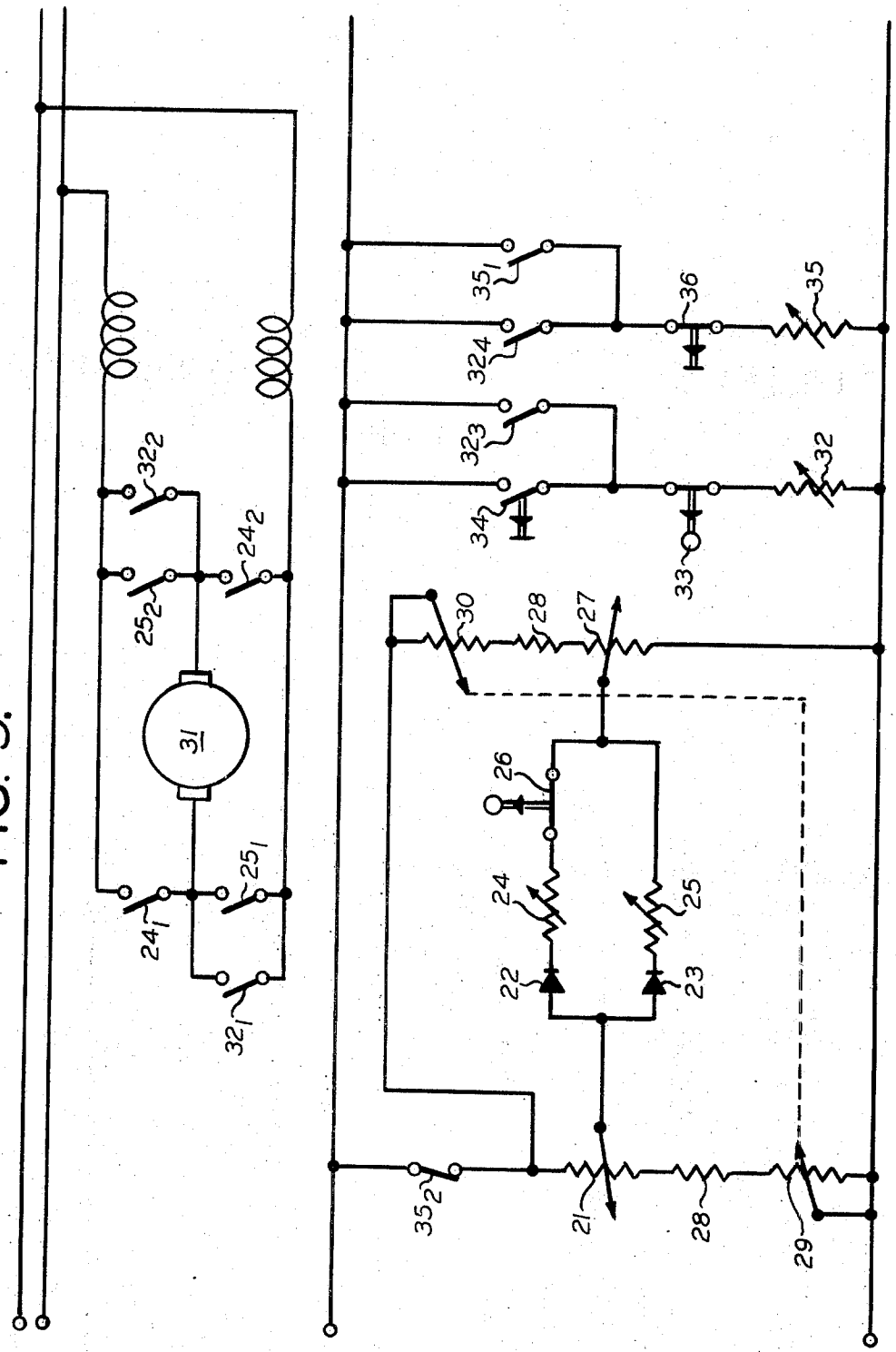

THROTTLE VALVE
BLOWING AIR
SERVO MOTOR
CONTROLLER HOUSING
ADJUSTING DEVICE
10
11
12
13
14
15
16
17
18
19
20

FIG. 5.


31
32_2
24_2
25_2
25_1
24_1
32_1
35_1
36
35
32_4
32_3
32
34_2
33
30
28
27
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24
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22
23
35_2
21
28
29

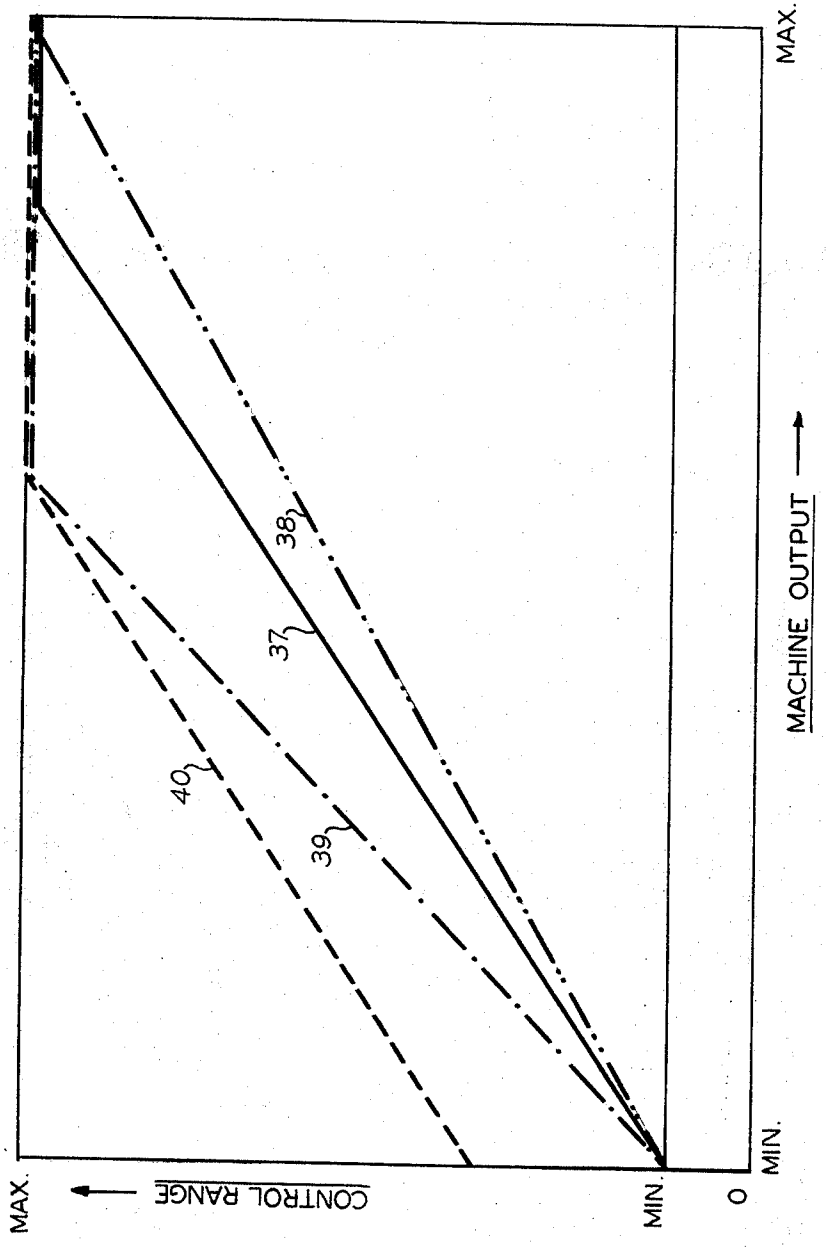


FIG. 6.

BLAST AIR CONTROL DEVICE

The present invention relates to a control device for sheet feeders for cyclic pneumatic loosening of the top sheet of a stack. In sheet feeders, as is known, the uppermost sheet is lifted by cyclic control of a stream of blast air directed against one or more upper edges of the stack, the uppermost sheet being then conveyed by conveyor means, for instance conveyor suckers or suction rollers, into a subsequent sheet-handling machine, for instance into a printing press.

The synchronous control of the stream of blast air is effected as a rule by valves, slides (German Pat. No. 670 299, East German Pat. No. 4229) or similar devices synchronously with the movement of the feeder which in its turn is driven synchronously with the sheet-handling machine, or is directly coupled with it (West German Petty Pat. No. 1 990 938). The device for the controlling of the blast air can be provided with adjustment means which make it possible to adjust in optimum fashion the time of commencement and the duration of the action of the blast air as a function of the properties of the sheets to be worked (West German Pat. No. 1 172 280); the same purpose is served in other sheet-feeder constructions by means for establishing an optimum pressure of the blast air (West German Pat. No. 1 056 151).

The means for the synchronous control and for the manual connecting and disconnecting of the suction and blast air and for adjusting the pressure of the blast air are arranged mostly at different places in the feeder. The position of the devices which are not adapted for manual control is unimportant for the operation of the feeder. The connecting and disconnecting of the suction air and of the blast air is effected from the operating stand of the feeder, from which generally the operating members for the subsequent machine are also accessible, while the adjusting of the pressure of the blast air is generally effected by an operating member which is arranged on the suction lock which is present above the rear edge of the pile. In order to save the worker frequent travel to the suction lock from the operating stand of the feeder, from which the speed of operation of the machine and of the feeder are also adjusted, it is known to combine the devices for the manual control of the suction and blast air and of the pressure of the blast air in a single operating element and to arrange same centrally on the operating stand of the feeder or of the machine (U.S. Pat. No. 3,294,396 = British Pat. No. 1,065,136).

For the exact feeding of the sheets it is of decisive importance that the uppermost sheet of the pile which is to be fed is properly separated from the sheet below same and is grasped by separating suckers, nevertheless not displaced in the horizontal, in any direction with respect to the edges of the pile, when it is taken over by the conveyor devices, for instance conveyors suckers, and fed by them to the following machine. The satisfying of this condition presupposes that the loosening of the sheet is adjustable as a function of the properties of the sheets to be worked and the speed of operation of the feeder within wide limits.

While the properties of the sheets to be fed remain constant for a long period of time, the operating speed of the feeder is dependent on the workability of the sheets in the following machine, for instance the printability of the sheets in a subsequent printing press. The

workability of the sheets can be changed by changing the parameters of the following machine, so that the speed of feeding also changes upon optimizing of the machine output. Upon the starting and stopping of the feeder unit of the machine, different feeding speeds also occur which lead to inaccurate feeding of the sheets. Modern high-capacity printing presses are operated, depending on the printability of the sheets, with outputs in the range of between 3,000 and 15,000 sheets/hour; the time of action of the blast air on the sheet to be delivered can accordingly, in the case of the lowest machine output, amount to five times the time of action for the highest machine output. With lower output, the sheets are bottom-blown too strongly, so that they carry out undesired horizontal movements; if the action of the blast air is reduced until there is obtained a dependable feeding of the sheets with lower output, then the uppermost sheet will no longer be dependably separated from the underlying sheet, in case of higher outputs.

In order to prevent an inaccurate defective feeding of the sheets, the printer, for the reasons indicated, must shut off both the conveyance of the sheet and the pressure of the machine upon the starting and stopping of the machine behind the feeder, for instance a printing press; during this time, therefore, no printing is effected. With the contemplated speed of operation of the machine, the conveyance of the sheets is started while the printing is still stopped, and the blast action is adjusted in such a manner that the sheets are fed in dependable fashion; only then can the printing be started. The sheets which have been delivered unprinted during the stopping of the blasting action of the feeder must subsequently be removed again from the pile of printed sheets. A change in the speed of operation of the machine, in order to optimize the printing output, can be effected only slowly and in small steps and requires continuous manual readjustment of the blast action of the feeder by the printer. On occasion it is attempted, when the machine is starting or stopping, to maintain by manual continuous variation of the blast action within a larger output range, suitable feed conditions, so that more sheets can be printed. This, however, is possible only in the exceptional case, under very favorable conditions, and in case of long experience on the part of the printer. Since as a rule, rejects result from improper feeding (and these rejects must be removed again from the stack of printed sheets), one generally refrains from proceeding in this manner and prefers to turn off the feeding of the sheets and the printing upon substantial changes in the operating speed.

It is one object of the present invention to eliminate the aforementioned disadvantages and to make possible a more effective utilization of the machine-feeder apparatus. In order to achieve this, a sheet feed control is to be developed in such a manner that within a large range of outputs it optimizes the output in connection with all qualities of sheets which occur without the necessity of manually varying the blast effect, so that the output of the printing machine and of the feeder can be utilized to the maximum.

It is another object of the present invention to obtain with a blast-air control device, in which there is associated with the known device for the synchronous control of the blast air, in accordance with the present invention, a control device which is regulated as an input

variable by the feeder output and which automatically maintains the optimum blast effect by varying the pressure of the blast air or the blast time, or both, over a wide range of feeder outputs.

In this way the printer has the possibility, without manual control of the feeder or without readjustment of the blast air, at any time to increase the output of the machine to an optimum, or possibly reduce it, and in case of interruptions in operation upon the stopping of the machine to disconnect the feeder and the printing only at low output of the machine, and upon the restarting of the machine, to connect the feeder and the printing again upon only low machine output without the danger of the occurrence of waste, so that the output of the machine-feeder unit can be far better utilized.

A further development of the invention is possible in the manner, that the control device is provided with means for establishing different control characteristics by which the control can be adapted to the different properties of the sheets.

The control device can be developed both as mechanical control of the blast air pressure or the blast time, or both, and also as electrical control.

With these and other objects in view which will become apparent in the following detailed description, the present invention, which is shown by example only, will be clearly understood, in connection with the accompanying drawings, in which:

FIG. 1 is a schematic diagram of a mechanically acting control device in the position, in which it is disposed when the feeder is stopped;

FIG. 2 is a schematic diagram of the device shown in FIG. 1, in the position in which it is in medium feeder output;

FIG. 3 is a schematic diagram shown in FIG. 1, in the position in which it is with high feeder output, with a differently set control characteristic;

FIG. 4 is a diagrammatic elevation of the construction of an electrically acting control device;

FIG. 5 is a circuit diagram of the electric control device of FIG. 4;

FIG. 6 is a diagram depicting other control characteristics, which can be obtained with the control device in accordance with FIGS. 4 and 5; and

FIG. 7 is a section in a plane perpendicular to the axis of a device for changing the blast time by means of a control device.

Referring now to the drawings, and in particular to FIGS. 1 to 3, the control device, which is actuated mechanically by the speed of rotation, has a controller housing 1 from which there extends a pin 2, which is swingable a few degrees as a function of the speed of rotation. On the pin 2 there is fastened a link 3, on which a slide 4 is displaceable and can be locked by means of a clamp screw 5. To the slide 4 there is pivoted a connecting rod 6 by which a throttle slide valve 7 is moved in a blast air conduit 8. By means of a knurled nut 9, the link 3 can be clamped fast to the pin 2 in any position of the slide valve 4, so that when the machine-feeder unit is stopped, a desired minimum opening of the slide valve is set, as shown in FIG. 1. With a slow start of the machine-feeder unit, the throttle slide valve 7 is moved slowly in the blast air line 8 in the direction of reduction of the throttling of the blast air, as shown in FIG. 2. The throttling is reduced more, the shorter the time during which the blast air underblows the uppermost sheet of the stack, so that the volume of air available for the under-blowing of the sheet remains approximately the same. In case of maximum speed, the cross-section of the blast air line 8 is then approximately fully opened, as shown in FIG. 3. The link 3 can bear a marking (not shown) which refers to the properties of the sheet and makes it possible to select the desired control characteristic by corresponding adjustment of the slide valve 4. If as a result of the working of sheets with constant sheet properties, a change in the control characteristic is not necessary, then the link 3 can be formed as a simple lever, to which the connecting rod is articulated. The actual blast air control by means of which the blast air is connected and disconnected in synchronism can be of any desired known nature; it is since it is not part of the present invention, and not shown for this reason.

The mechanical control device is adjusted as follows: after adjustment of the control characteristic corresponding to the sheet properties, by clamping the slide 4 on the link 3 at the corresponding place, the machine-feeder unit is run up to the desired output. A fine adjustment of the blast air action can now be effected by swinging the link 3 with respect to the pin 2 and then again clamping it fast by means of the knurled nut 9, if necessary.

In the region between the minimum and maximum operating speeds of the machine-feeder unit, no further readjustment of the blast air control is necessary, as long as the same quality sheet is present. The fine adjustment of the blast air action at the desired output of the machine-feeder unit is also necessary in the case of known sheet-feed controls by adjustment of the blast air pressure, as has already been described above. The synchronous control of the blast air, which is represented by the prior art, can be effected with any desired known means and they can be arranged both in front of and behind the throttle slide valve 7 in the blast air line 8. Since they do not form a part of the present invention, they will not be described.

Referring now again to the drawings, and in particular to FIG. 4, it shows schematically the construction of an electrically acting control arrangement.

From the device (not shown) for adjusting the speed of rotation for the drive motor for the machine-feeder unit, there is controlled an adjusting device 10, which acts via a V-pulley 11, V-belt 12 and another V-pulley 13 on a speed-proportional angle-of-rotation adjusting of a variable potentiometer 21 present in a controller housing 14 (FIG. 5). A shaft 15 rotated by a servo motor 18 bears an adjustment pinion 16 which meshes with an adjustment gear 17 by means of which a throttle valve 19 in a blast air line 20 can be adjusted. The servo motor 18 is electrically connected with the devices in the controller housing 14 in a manner, which will be described below; its shaft 15 adjusts the wiper of a repeater potentiometer 27 (FIG. 5) in the controller housing 14.

The construction and electric operation of the control device will be described on basis of the wiring diagram of FIG. 5. In principle, by a variable potentiometer 21 the value of which is dependent on the speed of rotation of the machine-feeder unit, and a repeater potentiometer 27 the value of which is dependent on the position of a setting motor 31 (18 in FIG. 4), there is formed a bridge circuit the diagonal voltage of which is zero when the bridge is balanced. In the bridge diago-

nal a series connection of a rectifier **22**, a relay **24** and a limit switch **26** is in parallel to a series connection of a rectifier **23** with a relay **25**. When the adjusted resistance values of the variable potentiometer **21** and the repeater potentiometer **27** do not agree with each other, the balance of the bridge is disturbed and there occurs on the bridge diagonal, a voltage which, depending on its polarity, causes the attraction of the relay **24** or of the relay **25**.

By the contacts **24**/1 and **24**/2 of the relay **24**, the setting motor **31** is turned in one direction, or by the contacts **25**/1 and **25**/2 of the relay **25**, it is turned in the other direction. The rotation of the adjusting motor **31** effects on the one hand the adjustment of the repeater potentiometer **27** in a direction towards the reduction of the voltage of the bridge diagonal (so-called tracking circuit) until it has become zero, and the relay **24** or **25** which has been attracted again drops out, and effects on the other hand an adjustment of the throttle valve **19** in the blast air line **20** (FIG. **4**), so that the blast air is adjusted in the desired way. By means of two characteristic preselector potentiometers **29** and **30**, the control characteristic can be selected as desired. If instead of two characteristic preselection potentiometers **29** and **30** which are mechanically independent of each other and with which any desired characteristics, including nonlinear characteristics or the characteristics **37**,**38** and **39** of FIG. **6**, can be adjusted, two potentiometers mechanically coupled with each other are used, namely a so-called tandem potentiometer, then a family of characteristics parallel to each other can be adjusted similar to the characteristic **40** of FIG. **6**.

With the electrical circuit shown, one can also electrically introduce switching operations, which can be carried out by hand in the case of known sheet feed controls.

Thus it is frequently necessary to shut off the feed when the machine is operating. For this purpose, blast air or suction air or both are shut off in connection with known controls by manual actuation of valves, slide valves and the like. In the case of the control in accordance with the invention, there is actuated a key **34** which brings about the attraction of a relay **32** which holds itself over its contact **32**/3 and via a contact **32**/4 brings about the attraction of a relay **35**, which holds itself over the working contact **35**/1 and disconnects the bridge feed circuit via the rest contact **35**/2. By the working contacts **32**/1 and **32**/2, the adjusting motor **31** is connected in the direction of rotation, in which the blast air is shut off by the throttle valve **19** (FIG. **4**). When this position of the throttle valve is reached, the limit switch **33** is automatically actuated and causes the relay **32** to drop out again, so that the contacts **32**/1 to **32**/4 also open again. The adjusting motor **31** is now without current, and the relay **35** continues to hold itself over the working contact **35**/1 until the blast air is again connected by depressing the On button **36**. In this way, the feed of the current to the relay **35** is interrupted, the working contact **35**/1 opens and the rest contact **35**/2 closes, so that the bridge circuit is again under voltage. Since the repeater potentiometer **27** is in the position corresponding to the smallest throttle opening and the variable potentiometer **21** is in a position corresponding to a high output of the machine, there occurs in the diagonal branch of the bridge, a voltage, which causes the attraction of the relay **24**. In this way the contacts **24**/1 and **24**/2 are closed, the adjusting motor **31** starts up and the throttle valve **19** (FIG. **4**) is opened until the diagonal branch of the bridge again has no voltage and thereby the relay **24** drops out again. By means of a limit switch **26**, the relay **24** is positively caused to drop out, when the throttle valve **19** (FIG. **4**) is opened to a maximum.

In both branches of the bridge there are arranged adjustment resistors **28** by which a minimum opening of the throttle valve **19** (FIG. **4**) can be adjusted, which is still sufficient for the loosening of the sheet at the lowest work output when the blast air is regulated. By means of these adjustment resistors **28**, an optimizing of the action of the blast air with optimum working speed of the machine-feed unit is possible by a fine adjustment of the throttle valve **19** (FIG. **4**) in a manner similar to that, which has already been described in connection with FIG. **3**. In that case the link **3** is finely adjusted with respect to the pin **2** and clamped fast by means of the knurled nut **9**, so that the throttle cross-section can be changed by minimum values. Actual practice has shown that an optimizing of the blast air action is possible also by minimum changes or displacements of the control characteristic.

As shown in FIG. **7** it is possible by means of a suitable control device, for instance, that described with reference to FIGS. **4** to **6**, also to change the blast time with constant pressure, so that the condition is fulfilled of optimally underblowing the sheet with all feeding speeds. Absolute constancy of the blast. air volume is neither necessary nor desired; rather, depending on the control characteristic selected as a function of the properties of the sheet, the blast air volume which is sufficient for optimum loosening of the sheet, is blown below the sheet depending on the control characteristic selected in accordance with the sheet properties with all feeding speeds of feed.

On a single-revolution shaft **41** of the feeder (not shown) there is fastened a rotary slide valve **42** which turns in a stationary rotary slide-valve housing **43** once per cycle of the feeder. In the rotary slide-valve housing **43** there are provided an inlet connection **44** and an outlet connection **45** for the blast air, the inlet and outlet connections being connected with each other over a given angle of rotation of the rotary slide valve **42**. Rotary slide-valve controls of the type described up to now and having the elements **41** to **45** are per se part of the prior art and are frequently used on sheet feeders in the same and similar structural embodiment. In an annular groove **46** of the rotary slide-valve housing **43** there is guided a control segment **47** which has an air channel **48** through which the blast air can pass into an annular groove **36** and thus into the outlet connection **45**. On the control segment **47** there is fastened a lever **49** which is extended through a slot **50** out of the rotary slide valve housing **43** and pivotally fastened to a setting member **51**. The setting member **51** is moved by a control device, for instance one like that of FIGS. **4** to **6**, via known elements, not shown. Upon a movement of the setting member **51** in the direction of the double arrow, the control segment **47** is displaced in the annular groove **46** in a counter-clockwise direction, and the rotary slide valve **42** must continue to rotate by an angle corresponding to the adjustment of the control segment **47** until it has again closed the air channel **48**, and the blast time will accordingly become longer. Upon movement of the setting member **51** in the direction indicated by the arrow, the control segment **47** is

displaced in a clockwise direction and the air channel **48** is accordingly closed earlier by the rotary slide valve **42** and the blast time becomes shorter. The blast action takes place always at the same time when the edge of the rotary slide valve **42** releases the righthand edge of the opening in the air inlet connection **44.**

It is evident that the control devices can be substantially modified in construction and manner of operation from the embodiments described by way of example without abandoning the basic concept of the present invention. It is merely essential, that the input value of the regulator be dependent on the output (number of cycles per unit of time) of the machine-feeder unit and that the output valve affect the blast air for the loosening of the sheet in quality and quantity or else in its time of action on the sheet. It is furthermore self-evident that one can combine a control means **8***a* (FIGS. **1–3**) of the blast air pressure as desired with a control of the time of action of the blast air on the sheet.

While we have disclosed several embodiments of the present invention, it is to be understood, that these embodiments are given by example only and not in a limiting sense.

We claim:

1. A blast air control device for a sheet feeder with a device for the cyclic control of the blast air, comprising

a first device for the cyclic control of blast air,

a second control device controlled by the feeder output as an input variable and associated with said first device,

means for regulating at least one of the pressure of the blast air and of the blast time over a wide output range of the feeder, in order to maintain automatically the optimum blast action.

2. The blast air control device, as set forth in claim **1,** which includes

means for adjusting different control characteristics.

* * * * *