

Oct. 29, 1963

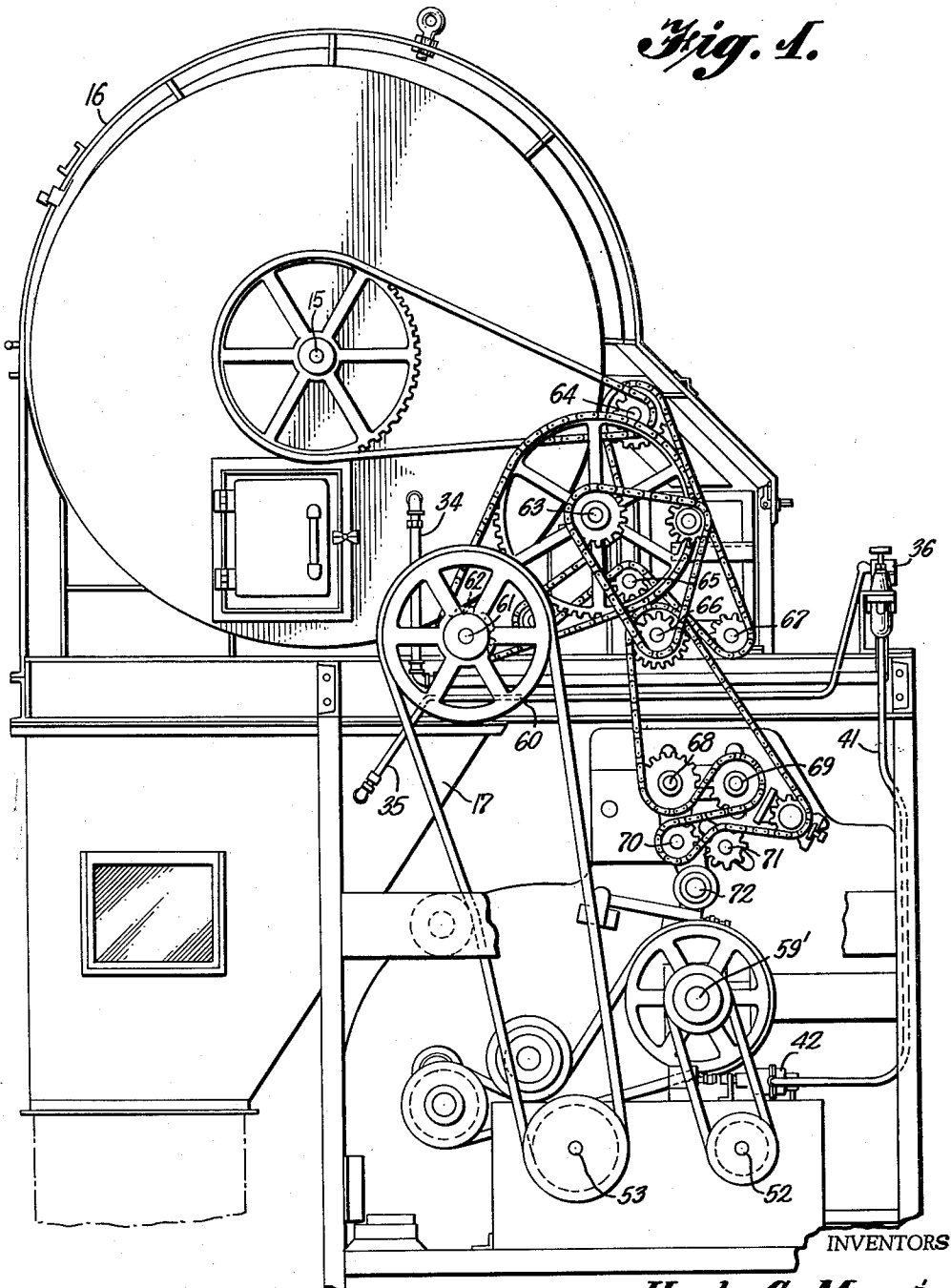
H. G. MOSS ET AL
AUTOMATIC CONTROL SYSTEM FOR PRODUCING A BAT
OF UNIFORM THICKNESS IN LINT CLEANERS

3,108,332

Filed May 23, 1961

4 Sheets-Sheet 1

Fig. 1.



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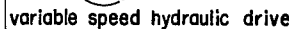
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Fig. 3.



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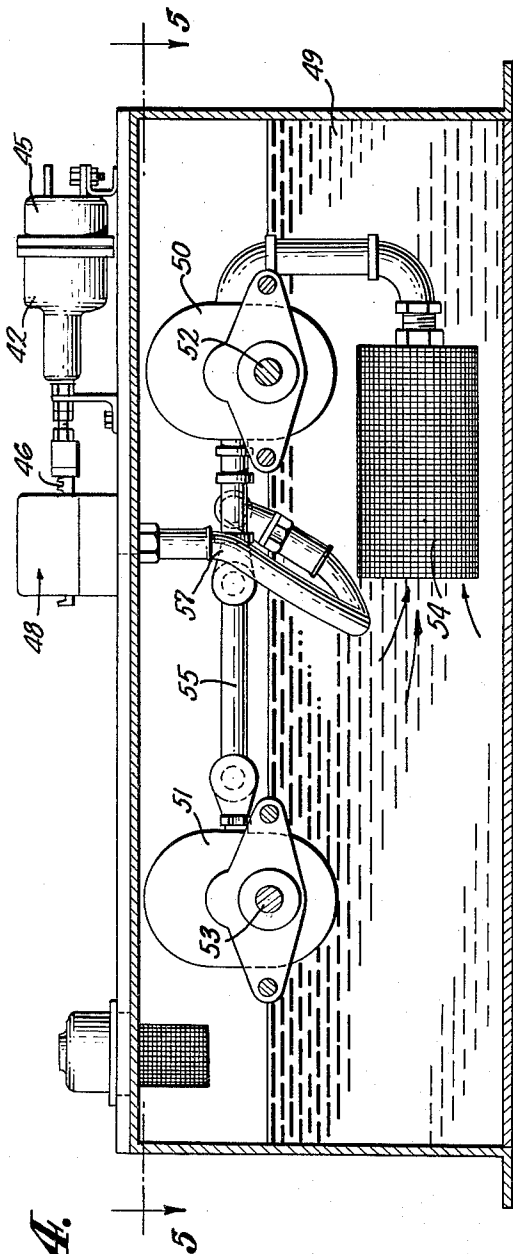
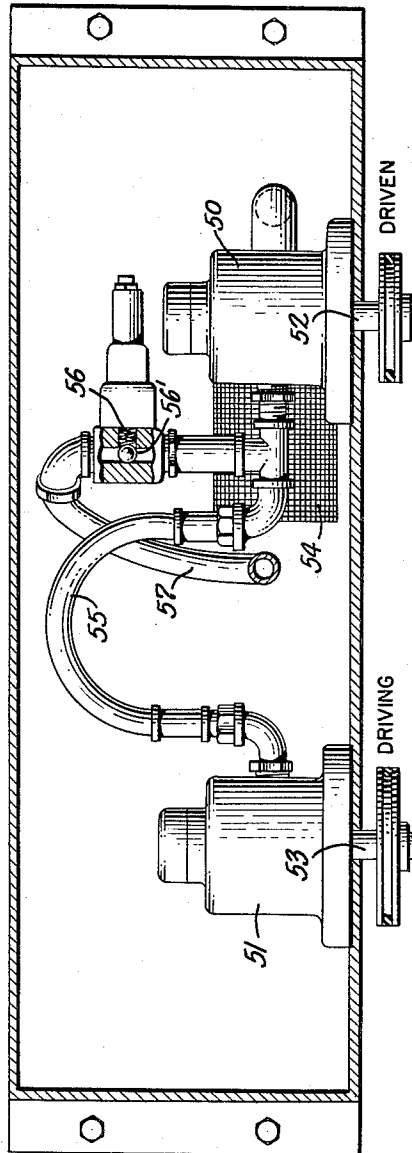


Fig. 4.

Fig. 5.



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Fig. 6.

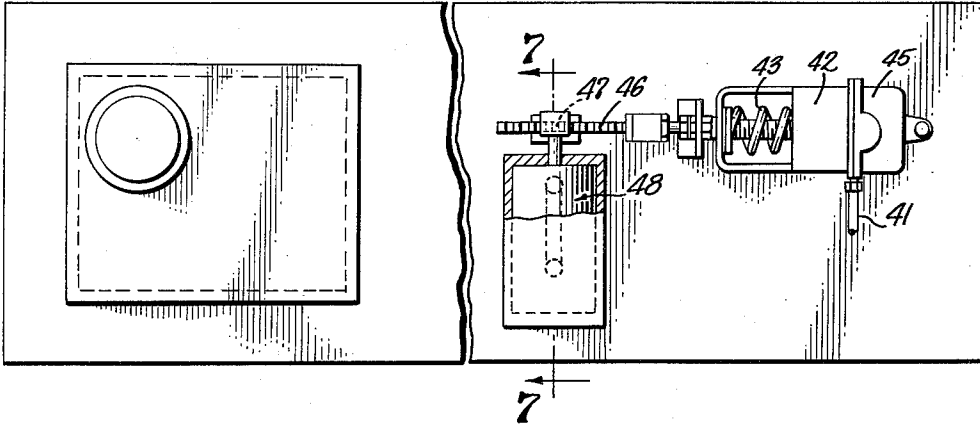
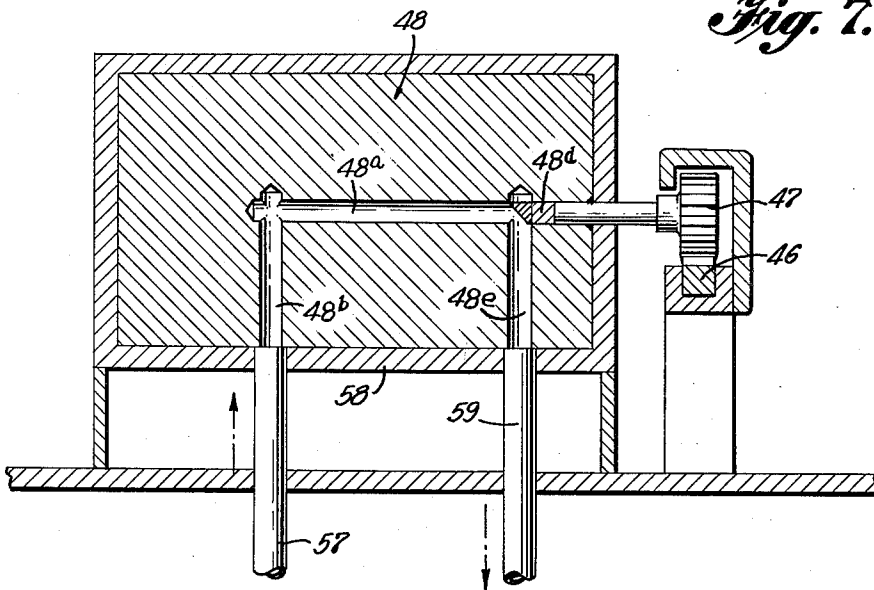


Fig. 7.



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AUTOMATIC CONTROL SYSTEM FOR PRODUCING A BAT OF UNIFORM THICKNESS IN LINT CLEANERS

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Filed May 23, 1961, Ser. No. 119,011
8 Claims. (Cl. 19—202)

This invention relates to lint cleaners of the type designed to serve a battery of gins, such lint cleaners comprising essentially a rotatable screen to the outer face of which cotton is conducted air borne in a column of vehicle air through a lint flue common to the gins, and deposited upon said outer face in the form of a bat which is continuously formed and continuously peeled from the screen and transferred to "feed works." By the latter it is drawn progressively into thinner texture and at the same time combed so as to be in optimum condition for uniformly covering and attaching to the teeth of a saw cylinder by means of which the lint, still in bat form, is brought into coaction with lint cleaning instrumentalities.

If the bat is not of uniform thickness and density when fed to the saw cylinder, the latter will not be properly clothed with the lint. Either there will be areas of the toothed surface capable of holding more lint, or in the case of excess thickness of the bat, there will be a layer of lint free-riding on the attached lint which will be dislodged by the cleaning instrumentalities and discharged with the motes.

The provision of uniform thickness and density of the bat at the point of presentation to the saw cylinder demands that the lint be accumulated at a uniform rate upon the surface of the condenser screen as the latter rotates. This would be no problem if the rate of feed from the gins were constant. However, this ideal condition is seldom realized in practice. It is not possible for all the gins of a battery to be started or stopped simultaneously. First one is started, then a second, and so on. It may take some little time to ready the second gin for starting after the first one has been put into operation. It may be necessary also while all the gins are running, to cut one out for a number of reasons, for instance, to clear the debris of a spent roll from the roll box, or to relieve congestion between saws and ribs. When only the first gin is operating, the rate of deposit of lint upon the surface of the condenser screen in the area exposed to the lint flue is low, and the bat formed is quite thin. On the contrary, when all the gins are operating, the accumulation of lint is relatively thick for the same duration of exposure to the oncoming lint. When a single gin is cut out, the rate of accumulation is accordingly diminished, resulting in a relatively thin portion of the continuously produced bat. Obviously variations in the thickness of the bat could be compensated and the bat made substantially uniform in thickness by varying the speed of rotation of the condenser screen, making it move more slowly across the mouth of the lint flue when the feed is light, accumulating a greater thickness of cotton and speeding up its rate of transit when the feed is heavy, proportionately diminishing the accumulation.

One of the objects of the present invention is to produce a continuous bat, in a lint cleaner of the type specified, of substantially uniform thickness and density throughout, by varying the speed of rotation of the condenser screen compensatingly with respect to variations in the thickness of the accumulation on the condenser screen, through means responsive to a function of that portion of the bat which at any time covers the con-

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denser screen in its area of exposure to the lint supplying flue.

An object of the invention, more specifically stated, is to control the speed of rotation of the condenser screen in the manner set forth, responsive to the variable differential pressure on opposite sides of the screen created by the variable air permeability of the incipient bat formed on the screen.

Another object of the invention is the provision of an automatic control system for producing a continuous bat of uniform thickness and density throughout, by varying the speed of rotation of the condenser screen and of the rotatable feed works, responsive to variable differential pressure on opposite sides of the condenser screen, including sensing means in the flow path of the vehicle air at opposite sides of the screen which transmit the pressures to the respective sides of a diaphragm, the latter being the operative element for a valve controlling the admission of air under pressure from a suitable source to a pneumatic motor, the latter being operatively related to connections for varying the speed of rotation of the screen and correlative feed works.

Still another object of the invention is the provision of a control system as above described in which the pneumatic motor operates a valve in the pressure line of a hydraulic circuit between a positively driven pump and a motor driven thereby for varying the output of said pump to said motor, the latter being operatively connected with driving means for the screen and said works.

Other objects of the invention will appear as the following description of a practical embodiment thereof proceeds.

In the drawings which accompany and form a part of the following specification and throughout the figures of which the same reference characters have been employed to designate identical parts:

FIGURE 1 is an end view in elevation of the upper part of a lint cleaner incorporating the control system of the present invention;

FIGURE 2 is an intermediate vertical section taken in a plane parallel to the plane of the end view illustrating diagrammatically the pneumatic sensing system including the diaphragm regulator which responds to the differential pressures sensed by the sensing means and which in turn actuates the pneumatic motor that controls the driving rate of the condenser screen and feed works;

FIGURE 3 is a sectional view taken along the line 3—3 of FIGURE 2;

FIGURE 4 is a side sectional view of the hydraulic reservoir and the instrumentalities contained therein and on the cover plate thereof;

FIGURE 5 is a horizontal sectional view taken along the line 5—5 of FIGURE 4;

FIGURE 6 is a top plan view of the closed reservoir illustrating diagrammatically the hydraulic bypass valve directly controlled by the pneumatic motor;

FIGURE 7 is a vertical longitudinal cross-sectional view on an enlarged scale through the bypass valve.

Referring now in detail to the drawings, the lint cleaner as a whole is designated by the numeral 10 and comprises a rotatable cylindrical condenser drum 11 open at the ends, the peripheral face of the drum being a perforated condenser screen 12 preferably of reticulated structure. The condenser screen is supported at the ends of the drum by headers 14 of open construction fixedly mounted on a driven shaft 15.

A housing or hood 16 encloses the condenser drum and extends downwardly therefrom to form the end portion of a lint flue 17, the mouth of which extends the full axial length of the condenser screen and exposes the same through an arc of almost 180° to the accumulation there-

upon of lint air borne in a flow of air from the gins, which air discharges through the screen thus separating from the lint which remains on the screen. The flow of vehicular air carrying the lint to the lint flue 17 is furnished in the usual manner by the cotton gin or gins served by the herein described lint cleaner, or by another lint cotton cleaner in the system. The housing 16 includes the suction duct 18 which communicates with the interior of the drum 11 and receives the vehicle air therefrom which is discharged externally of the lint cleaner 10, the suction duct 18 having a conventional suction fan (not shown) therein in the usual installation.

As viewed in FIGURE 2, the condenser drum rotates in a counterclockwise direction, the screen 12 in its lower arc of rotation moving from left to right, the lint progressively accumulating upon it as it traverses the mouth of the lint flue. This accumulation constitutes the incipient bat which is continuously formed and may acquire a thickness up to one-half inch or so at the righthand limit of the area of exposure to the lint flue. At this point a fluted driven roll 21 is located, coaxial with the condenser drum and close enough to the condenser screen to compress the bat somewhat, increasing the coherence of the mass so that it will not break into discrete tufts when engaged by the flexible flaps of the adjacent wiper roll 22 which removes the bat from the screen and guides it in a downward direction into the region of activity of the feed works. The latter need not be described herein in great detail for they as well as the rest of the cleaner as described so far constitute in substance a single version of the double screen cleaner disclosed in the patent to Ennis E. Moss, No. 2,704,862, granted March 29, 1955, and reissued as Patent No. 24,624 on March 31, 1959.

It is sufficient to explain that the feed works comprise pairs of spaced rolls 23, 24 and 25 arranged one pair beneath another with the spaces between the rolls of each pair in substantially vertical alignment, the bat passing downward through said spaces, the latter being sufficiently close for the rolls to frictionally grip the bat, and each lower pair being driven faster than the pair immediately above it whereby the bat is drawn progressively thinner. The compression and thinning of the bat loosens and exposes the motes, improves the cohesiveness of the fibers and reduces the bat to the thickness of one-eighth inch which is optimum for the cleaning process.

Below the lowermost set of drawing rolls is the resiliently mounted roll 26 and the cooperating feed plate 27. The roll 26 presses the thinned bat against the side of the feed plate. A saw cylinder 28 rotates at quite a fast peripheral speed adjacent the lower face of said feed plate. The plate has a nose 29 defined by the junction of the side and lower faces of the feed plate. This point marks the end of the bat at which it is fed to the saw cylinder, its end being fringed by the attrition of the saw teeth which whisk the lint into and through the narrow space between the saw teeth and the lower face of the feed plate where, being crowded it becomes firmly attached to the teeth. At the high speed of the saw cylinder the locks of lint on the saw teeth stand out by centrifugal force and brush impactively against the grid bars 30, the motes being thrown off by inertia. The cleaned lint is removed from the saw cylinder by the doffer 31 and discharged into the lint duct 32 from which it is withdrawn by suction.

In the prefatory paragraphs of this specification it has been mentioned that the lint flue 17 is designed to serve a battery of several gins and that in practice there is great variation in the rate at which the lint is fed to the cleaner, resulting in variation in the thickness of the bat in the direction of its length. Assuming that the speed of the condenser screen and of the feed works is uniform, it is obvious that the thinner portions of the bat would not be properly processed in the feed works, being too thin to be held between the rolls 23 so that it would slip between them under the pull of the rolls 24 and

there would be no drawing of the bat between the sets of rolls 23 and 24. Thus, the drawing stages would be reduced to two, between the rolls 24 and 25 and between the roll 26 and the side face of the feed plate 27. Since drawing improves the cohesion of the fibers and the tensile strength of the bat, omission of one drawing stage would make it more likely that the bat would be torn between the roll 26 and the adjacent side of the feed plate under stress of the attack of the saw teeth upon the fringe end of the bat. Portions of a bat that are too thick to pass through the feed works with normal frictional pressure against the rolls would necessarily be unduly compressed in passing between them and would recover to a thickness greater than the optimum one-eighth of an inch when released to the saw teeth. This would result in more lint being fed to the saw cylinder than could become properly attached to the teeth and this excess would ride free on the attached layer, much of which would be brushed off by contact with the grid bars or fly off centrifugally.

The desirability of so controlling the rate of accumulation of the lint on the condenser screen that the bat will be continuously of uniform thickness from the point of its presentation to the feed works is apparent from the above recitation of only some of the drawbacks attending the working of bats of variable thickness. The present invention proposes to control the thickness of the bat by means responsive to the thickness of the lint accumulating on the area of the condenser screen exposed to the mouth of the lint flue from the time said screen area begins to enter the area of exposure until it becomes congruent with said area. It will be noted in FIGURE 2 that the partition 33 within the hood 16 blocks the access of lint to the part of the hood which overlies the condenser drum so this may be considered the lefthand boundary of said area of exposure. The figure shows that the accumulation of lint begins upon that part of the screen which has been emerged from beyond the partition, and that it is thickest adjacent the roll 21 which delineates the opposite boundary of the area. It is, therefore, the average thickness of the accumulation over the exposed area of the condenser screen which is employed as the control factor. If there were no accumulation on the screen the flow of air therethrough would be free and there would be no difference in the air pressure at opposite sides of the screen. The lint accumulation on the screen obstructs the flow of air through the screen and builds up the relative pressure on the upstream side of the screen compared to the pressure on the downstream side. Thus, a pressure differential is created at opposite sides of the screen which is a function of the average thickness of the accumulation of lint upon the screen and which is in direct ratio to its thickness.

It can be readily understood that if the speed of rotation of the condenser drum were reduced it would take longer for a given area of the screen to traverse the width of the mouth of the lint flue, giving more time for lint to accumulate on the screen, and vice versa, if the rotation of the screen is speeded up. A similar adjustment must be simultaneously applied to the speed of the rotatable elements of the feed works, for the slowing of the condenser drum retards the movement of the bat to the feed works and if the speed of the latter were not reduced there would be excessive drawing of the bat between the sets of drawing rolls.

Referring now in particular to FIGURE 2, the pressure on opposite sides of the condenser screen is sensed by the open tubes 34 and 35, the former tapping the hood 16 at a point sensing the pressure downstream with respect to the condenser screen and the latter communicating with the lint flue near its mouth, sensing the pressure on the upstream side. The differential pressure is employed as a control means by connecting the tubes 34 and 35 to a diaphragm chamber 36 at opposite sides of a diaphragm

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37 which divides the chamber. A valve 38 is connected to the center of the diaphragm by a stem 39 and is moved by the diaphragm responsive to differential pressure to control a bleed passage 40 in an air supply conduit 41 to a pneumatic single acting piston type motor 42 in which the piston is returned by a spring 43.

Since the upstream pressure in the lint flue always exceeds the downstream pressure when any cotton is being fed to the condenser screen, the range of deflection of the diaphragm will always be below its repose plane, as viewed in the drawing. In the planiform state of the diaphragm shown in the drawings, the valve is in its limit position in an open direction, this being its position when the lint layer on the screen is of the thinnest texture. In this position the bleed valve is wide open and the operative pressure upon the piston of the motor 42 is at a minimum. The piston of the motor, therefore, moves outwardly a relatively small distance before being counterbalanced by the increasing tension of the spring 43. As the thickness of the bat on the screen increases the differential pressure rises and the valve 38 moves in a closing direction, restricting the escape of air through the bleed passage and permitting a higher fluid pressure to be imposed upon the piston. Under these conditions the piston will move outward a relatively greater distance before being counterbalanced by the spring.

Supply air pressure of twenty pounds p.s.i. supplied through the conduit 41 is considerably reduced through loss at the bleed passage 40, especially when the valve 38 is close to its wide open position so that the air pressure on the motor may be inadequate due to the return pressure of the spring to move the piston proportionately to the differential pressure, in view of which weakness a pneumatic relay 45 may be interposed in the pressure line between the bleed passage and the pneumatic motor to develop a pressure in the motor cylinder sufficient to permit the piston to move out proportionately to the differential pressure to which it responds. The relay shown diagrammatically in the drawing is a purchased item known as the "Powers Stay-put."

The pneumatic motor reciprocates a rack bar 46 in mesh with the gear 47 at the end of a shaft which operates a speed control device for varying the speeds of rotation of the condenser screen and rotatable elements of the feed works. In the present illustrative embodiment of the invention the speed control device is a hydraulic valve 48 of conventional, commercially available construction, diagrammatically shown in FIGURES 6 and 7 as having a fluid passage 48a extending between an inlet 48b and an outlet 48c and a rotatable valve member or cam 48d connected to and driven by the gear 47, which controls a hydraulic system now to be described which effects the speed variation of the condenser drum and feed works.

Referring to FIGURES 4, 5, 6 and 7, the numeral 49 represents a rectangular tank containing a body of oil that fills the tank to an intermediate level. In the tank are a pump 50 and a motor 51, both of which elements may be of similar construction. They are shown having shafts 52 and 53, respectively, that carry their respective rotors journaled in bearings secured to the sides of the tank. The pump 50 draws in oil through the submerged strainer 54 and delivers it under variable pressure to the motor 51 through the conduit 55. The conduit 55 is provided with a relief passage 56 controlled by a spring loaded relief valve 56' set to open at a pressure in excess of the maximum load that the motor is designed to carry. This allows the pump 50 to run continuously without stalling when the motor 51 encounters an excessive load and does not differ in this respect from conventional hydraulic systems. The conduit 55 is provided with a bypass pipe 57 leading to the casing 58 that houses the hydraulic valve 48. The flow through the pipe 57 is variably controlled by the valve 48 by angular adjustment of the valve member 48d responsive to adjustment of the gear 47 upon movement of the rack bar 46. The oil that passes through the valve discharges back into the tank through the outlet pipe 59.

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The controlled bleed of oil through the valve 48 determines the pressure of the oil pumped to the motor which determines the speed of the motor.

FIGURE 1 shows that the pump is belt driven from the shaft 59' of the saw cylinder 28 and that the motor 51 is belt connected to the pulley 60 keyed to a lay shaft 61. The latter carries a sprocket 62 from which a system of chains and sprockets connect, which can readily be traced, that transmit driving torque to the shaft 15 of the condenser drum and to the several shafts 63, 64, 65, 66, 67, 68, 69, 70, 71 and 72 which drive the rotary elements of the feed works, the shaft 72 being driven from shaft 66 by a chain (not shown) located on the opposite side of the lint cleaner from that illustrated in FIGURE 1.

It will be readily appreciated that the hydraulic system, including the pump that introduces the variable speed factor into the driving train between the main drive of the lint cleaner and the condenser drum and feed works may be substituted by any type of converter of constant speed to variable speed capable of being actuated by means movable responsive to variations of the differential pressure in the lint flue at opposite of that area of the condenser screen at the moment dividing said flue, through which the vehicle air carrying lint to said screen, must pass.

While we have in the above description disclosed a practical embodiment of the invention, it will be understood by those skilled in the art that the instrumentalities as specifically described and the arrangement thereof, are by way of example, and not to be construed as necessarily limiting the scope of protection accorded this invention.

What we claim is:

1. In a lint cleaner of the bat type having a lint flue through which a stream of air borne lint is conveyed from a gin and a rotatably driven condenser screen arranged in said lint flue to progressively expose areas of the screen to the stream of air borne lint for accumulating a bat of lint on the upstream surface of the exposed screen areas and discharging vehicle air therethrough, in which the rate of feed of lint to the rotatably driven condenser screen may be non-uniform and wherein a pressure differential exists across the exposed screen areas during operation of the lint cleaner produced by the bat of lint formed thereon which pressure differential varies with variation in the thickness of the bat, a control system for keeping uniform the thickness of the bat throughout its length comprising means for sensing the pressures in the zone of the lint flue at opposite sides of said exposed screen areas adjacent the upstream and downstream surfaces thereof, and means for employing the pressure differential measured by the sensing means for compensatingly varying the speed of rotation of the condenser screen.

2. In a lint cleaner of the bat type as claimed in claim 1, said lint cleaner having a shaft that rotates at uniform speed and driving connections from said shaft to said condenser screen, said connections including means responsive to said pressure differential for converting the uniform input speed of said converting means into variable output speed proportional to the variations in said differential pressure.

3. In a lint cleaner of the bat type as claimed in claim 1, said lint cleaner having a shaft that rotates at uniform speed and driving connections from said shaft to said condenser screen, said connections including a hydraulic pump driven from said shaft and a hydraulic motor drivingly connected to said condenser drum, a conduit connecting said pump and motor, said motor being driven by liquid under pressure delivered by said pump through said conduit, the latter being provided with a relief passage, a valve controlling said passage, and operating means for said valve movable responsive to said pressure differential and proportional thereto.

4. In a lint cleaner of the bat type having a lint flue through which a stream of air borne lint is conveyed

from a gin and a rotatably driven condenser screen arranged in said lint flue to progressively expose areas of the screen to the stream of air borne lint for accumulating a bat of lint on the upstream surface of the exposed screen areas and discharging vehicle air therethrough, in which the rate of feed of lint to the rotatably driven condenser screen may be non-uniform and wherein a pressure differential is produced across the exposed screen areas during operation of the lint cleaner by the bat of lint formed thereon which pressure differential varies with variation in the thickness of the bat, a control system for keeping uniform the thickness of the bat throughout its length comprising means for sensing pressures in the lint flue at opposite sides of the condenser exposed screen areas, said lint cleaner including feed works having rotatable elements for feeding the bat to a location from the condenser screen, and means for employing the pressure differential measured by the sensing means for compensatingly varying the speed of rotation of the condenser screen and the rotatable elements of the feed works, including a shaft that rotates at uniform speed, driving connections from said shaft to said condenser screen and said rotatable elements, said connections including a hydraulic pump, driven from said shaft and a hydraulic motor drivingly connected to said condenser screen and said rotatable elements, a conduit connecting said pump and motor, said motor being driven by liquid under pressure delivered by said pump through said conduit, the latter being provided with a relief passage, a valve controlling said passage, a pneumatic motor having a reciprocable element operatively connected to said control valve, a conduit for supplying air under pressure to said pneumatic motor, said conduit being provided with a bleed passage, and a valve controlling said bleed passage, movable responsive to variations in said pressure differential.

5. In a lint cleaner of the bat type having a lint flue through which a stream of air borne lint is conveyed from a gin and a rotatably driven condenser screen arranged in said lint flue to progressively expose areas of the screen to the stream of air borne lint for accumulating a bat of lint on the upstream surface of the exposed screen areas and discharging vehicle air therethrough, in which the rate of feed to the rotatably driven condenser screen may be non-uniform and wherein a pressure differential exists across the exposed screen areas during operation of the lint cleaner produced by the bat of lint formed thereon which pressure differential varies with variation in the thickness of the bat, a control system for keeping uniform the thickness of the bat throughout its length, comprising sensing means open to the lint flue at opposite sides of said exposed screen areas for sensing the pressure of vehicle air at said opposite sides, a pneumatic motor, means operated thereby for varying the rate of rotation of said condenser screen, a conduit conducting air under pressure to said motor for operating it, said conduit being provided with a bleed orifice, a valve controlling said orifice, and operating means for said valve to which said sensing means are connected in opposed-pressure relation whereby said valve operating means responds to the pressure differential in said lint flue at opposite sides of said exposed screen areas.

6. In a lint cleaner of the bat type having a lint flue through which a stream of air borne lint is conveyed from a gin and a rotatably driven condenser screen arranged in said lint flue to progressively expose areas of the screen to the stream of air borne lint for accumulating a bat of lint on the upstream surface of the exposed screen

areas and discharging vehicle air therethrough, in which the rate of feed to the rotatably driven condenser screen may be non-uniform and wherein a pressure differential exists across the exposed screen areas during operation of the lint cleaner produced by the bat of lint formed thereon which pressure differential varies with variation in the thickness of the bat, a control system for keeping uniform the thickness of the bat throughout its length, comprising sensing means open to the lint flue at opposite sides of said exposed screen areas for sensing the pressure of vehicle air at said opposite sides, a pneumatic motor, means operated thereby for varying the rate of rotation of said condenser screen, a conduit conducting air under pressure to said motor for operating it, said conduit being provided with a bleed orifice, a valve controlling said orifice, and operating means for said valve comprising a diaphragm chamber, a diaphragm dividing said chamber, said sensing means being respectively connected to said chamber at opposite sides of said diaphragm whereby the latter is deflected responsive to the pressure differential between the pressure sensed by said sensing means, said valve being movable with said diaphragm.

7. In a device of the type having a duct through which air borne fibrous material is conveyed in a stream and a rotatably driven condenser screen arranged therein to progressively expose areas of the screen to the stream for accumulating a bat of the fibrous material thereon and discharging vehicle air therethrough, in which the rate of feed of the fibrous material to the exposed screen areas may be non-uniform and a pressure difference is produced between the pressures at opposite sides of the exposed screen areas which pressure difference varies in relation to variations in the thickness of the bat, a control system for keeping uniform the thickness of the bat throughout its length comprising sensing means for sensing the pressures in the zones of the duct adjacent and at opposite sides of said exposed screen areas, and means responsive to variation in the pressure difference between the pressure sensed by said sensing means for compensatingly varying the speed of rotation of the condenser screen.

8. In a lint cleaner of the bat type having a lint flue through which a stream of air borne lint is conveyed from a gin and a rotatably driven condenser screen arranged in said lint flue to progressively expose areas of the screen to the stream of air borne lint for accumulating a bat of lint on the upstream surface of the exposed screen areas and discharging vehicle air therethrough, in which the rate of feed of lint to the exposed screen areas may be non-uniform and variations in the thickness of the bat on said exposed screen areas produces variations in the difference between pressures at opposite sides of the exposed screen areas adjacent the upstream and downstream surfaces thereof, a control system for keeping uniform the thickness of a continuously produced bat on said exposed screen areas comprising pressure actuatable means activated by variable opposing unequal pressures to move proportionately to the difference between said unequal pressures, pressure sensing means exposed in said lint flue respectively at opposite sides of said exposed screen areas to the pressures in the zones adjacent the upstream and downstream surfaces of said exposed screen areas, so connected to said pressure actuatable means as to transmit the sensed pressures thereto in opposed relation, and means for transmitting variable driving torque to said condenser screen from said pressure actuatable means proportionately to the movement of said last named means.

No references cited.