April 17, 1962 G. B. M. STIDWILL 3,030,107

LEVEL CONTROL FOR THE DELIVERY OF CUT SHEETS

Filed April 18, 1960 3 Sheets-Sheet 1

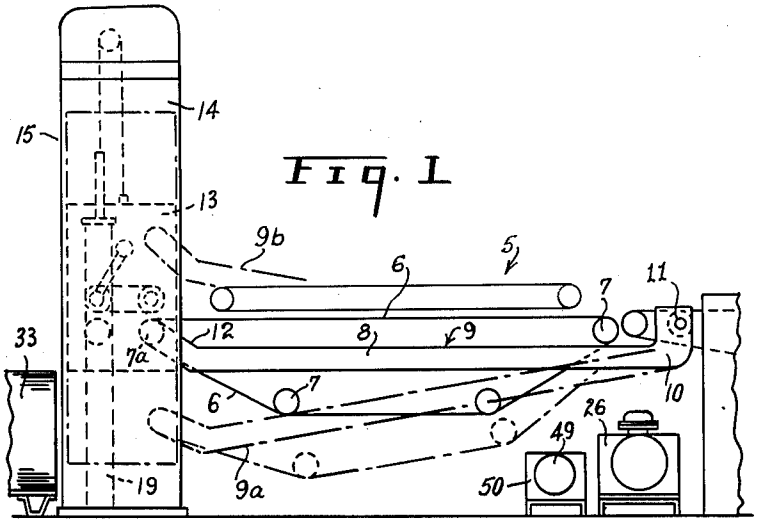

Fig. 1

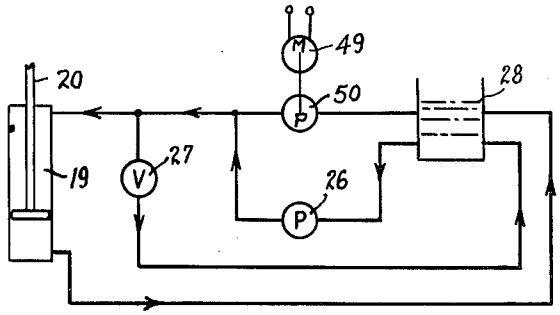

Fig. 7

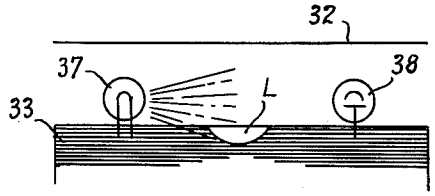

Fig. 8

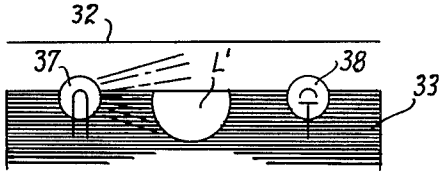

Fig. 9

INVENTOR
G.B.M. STIDWILL
BY Featherstonhaugh & Co.
ATTORNEYS

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LEVEL CONTROL FOR THE DELIVERY OF CUT SHEETS

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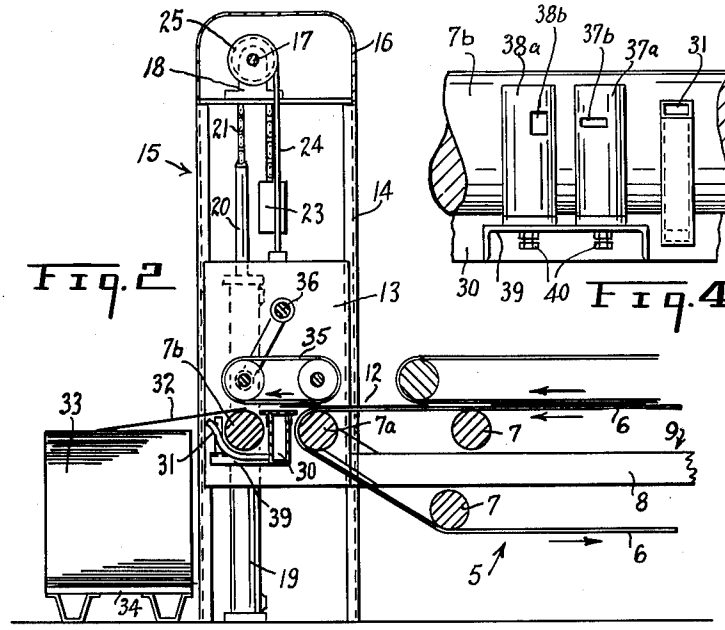

Fig. 2

Fig. 4

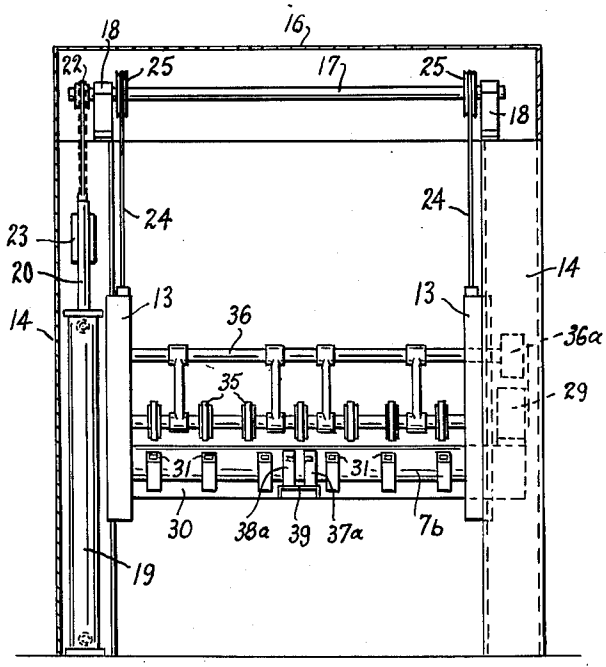

Fig. 3

INVENTOR
G. B. M. STIDWILL
BY Fetherstonhaugh & Co.
ATTORNEYS

April 17, 1962 G. B. M. STIDWILL 3,030,107

LEVEL CONTROL FOR THE DELIVERY OF CUT SHEETS

Filed April 18, 1960 3 Sheets-Sheet 3

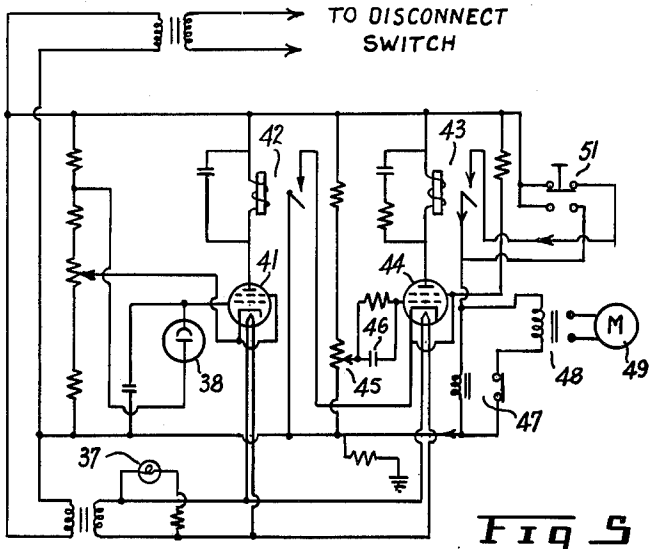

FIG 5

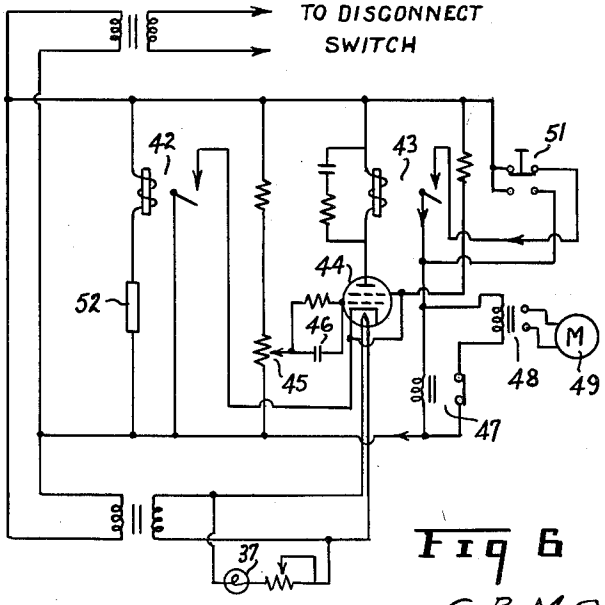

FIG 6

INVENTOR
G. B. M. STIDWILL
By Fetherstonhaugh & Co.
ATTORNEYS

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3,030,107

LEVEL CONTROL FOR THE DELIVERY OF CUT SHEETS

George Benson Munroe Stidwill, Cornwall, Ontario, Canada, assignor to Howard Smith Paper Mills Limited, Montreal, Quebec, Canada

Filed Apr. 18, 1960, Ser. No. 23,025
6 Claims. (Cl. 271—68)

This invention relates to the piling of sheet material and more particularly to the piling of cut sheets of paper on a platform or pallet as the sheets are discharged from the delivery end of a paper cutter or similar machine.

This invention is particularly applicable to high speed paper cutting machines in which the delivery end of the machine is moved upwards at a constant speed about a fixed pivot point and the platform on to which the paper sheets are loaded, remains stationary. In this type of paper cutting machine it is intended that the rate of rise of the delivery end of the machine should be such that a fixed relative level between the delivery end of the machine and the level of the top of the pile of sheets on the platform should be maintained during the piling operation. It has been found that maintaining a fixed relative level between the delivery end of the machine and the top of the pile of sheets cannot easily be accomplished within the limits which will allow the cut sheets to pile on the platform evenly and without the separate sheets interfering with each other during their transfer from the machine to the platform. In practice, it has been found that there may be a gap in the feeding of the cut sheets from the machine to the platform due to various causes such as a decrease in the number of rolls of paper being cut or a decrease in the thickness of the paper. This will have the effect of increasing vertically the relative level between the top of the pile and the delivery end of the machine. Conversely there may be a tendency for the pile of sheets on the platform to increase in height faster than the rise of the delivery end of the machine. This condition will reduce the relative level of the top of the pile and the delivery end of the machine and cause the sheets to foul each other.

The present invention consists essentially in means to correct any tendency at disturbing the relative level of the delivery end of the machine and the top of the pile of sheets on the platform and includes means for giving a boost to the rising delivery end of the machine when the value of the accumulated area of light reflection on the vertical face of the pile of sheets adjacent the delivery end of the machine and on the edges of the sheets being delivered to the pile, reaches a specified degree, and cutting off the boost to the rising delivery end of the machine when the value of light reflection from the edges of the sheets is reduced to a specified degree, or when a predetermined interval of time has elapsed, whichever occurs first. The invention consists in mounting on the movable delivery end of the cutting machine a source of light and light pick-up means which will operate to pass a signal when the accumulated value of light reflected from the adjacent face of the pile of sheets on the platform and from the edges of the sheets being delivered to the platform reaches a predetermined value. The signal passed by the light pick-up means will initiate a boost in the rate of rise of the delivery end of the machine which will continue until the value of light reflection picked up by the light pick-up means is reduced to a predetermined value or when a predetermined time interval has elapsed, whichever is first. In the apparatus hereinafter described the delivery end of the machine is raised hydraulically at a constant rate by means of a cylinder and piston device and a pump feeding fluid to the

cylinder and piston device. The signal passed by the light pick-up device causes a boost pump to feed an additional supply of fluid to the cylinder and piston device during the period of the signal. The boost given to the cylinder and piston device has the effect of raising the delivery end of the machine relative to the pile of sheets on the platform and reducing the value of light reflection on the sheets and allowing a time interval to elapse so as to cut off the signal to the boost pump and so return the rise of the delivery end of the machine to its normal increment.

The object of the invention is to provide means whereby the relative level between the delivery end of a sheet cutting machine and the top of a load of piled sheets is maintained relatively constant.

A further object of the invention is to provide means whereby the rising of the delivery end of a sheet cutting machine is boosted when the relative level between the delivery end of the machine and rising pile of sheets is reduced.

A further object of the invention is to provide boost means for raising the delivery end of a sheet cutting machine in which the area of light reflection from a light source is picked up by a photo-electric tube or photo-conductive cell which in turn passes a signal to effect the boost for raising the delivery end of the machine.

A further object of the invention is to provide means whereby the boost control of the raising of the delivery end of the machine can be readily adjusted to suit various working conditions and which can be changed from automatic to manual control when required.

A further object of the invention is to provide means whereby the amount of the boost can be limited to a very small increment controlled by an adjustable time delay.

These and other objects of the invention will be apparent from the following specification and the accompanying drawings in which:

FIG. 1 is a vertical side elevation in diagrammatic form of the delivery end of a paper cutting machine having a pivoted delivery table and in which is incorporated the present invention.

FIG. 2 is a vertical side elevation, partly in section, of the delivery end of the machine shown in FIG. 1 and showing the means for raising the delivery end.

FIG. 3 is a vertical end view, partly in section, of the delivery end of the machine shown in FIG. 2.

FIG. 4 is an enlarged detail of the light source and the light pick-up device for controlling the boost of the raising of the delivery end of the machine.

FIG. 5 is a schematic wiring diagram of the circuit controlling the boost mechanism in which a light source and a photo-electric tube are employed to initiate the signal to the boost mechanism.

FIG. 6 is a schematic wiring diagram similar to FIG. 5 in which a photo-inductive cell takes the place of the photo-electric tube in FIG. 5.

FIG. 7 is a schematic diagram showing the hydraulic circuit controlling the raising of the delivery end of the machine.

FIG. 8 is a diagram showing the paper load in its normal position relative to the sheet delivery level of the delivery end of the machine in which the area of reflective light on the face of the load is insufficient to initiate a signal through the light sensitive device.

FIG. 9 is a diagram similar to FIG. 8 but showing the levels of the delivery end of the machine and the top of the load reduced relative to each other with a consequent increase in the area of reflective light on the load sufficient to initiate a signal through the light sensitive device.

Referring to the drawings, the paper cutting machine 5 includes means for cutting paper from feed rolls not shown, into sheets of a predetermined size and delivering

the cut sheets on to the delivery tapes 6. These delivery tapes 6 are supported on a series of rolls 7 mounted in brackets on the side frame members 8 of the delivery table 9. The end 10 of the delivery table 9 adjacent the cutting mechanism is pivoted to the machine 5 at 11 while the opposite end 12 is secured to mechanism for vertical movement to enable the delivery table 9 to be pivoted in a vertical plane from the lower position 9*a* to the upper position 9*b* as shown in FIG. 1. The roller 7*a* at the delivery end 12 of the table 9 is journalled in the side plates 13 which are arranged for vertical sliding movement in the side frame members 14 of the end frame 15. The end frame 15 is in the form of an arch with the cross frame member 16 being supported on the top of the side frame members 14. A counter shaft 17 is located within the cross frame member 16 and is journalled in the bearing brackets 18.

A cylinder and piston device 19 is located in one of the side frame members 14 and its piston rod 20 is connected to one end of a roller chain 21 which is trained over the sprocket wheel 22 on the counter shaft 17. A balance weight 23 is carried on the opposite end of the roller chain 21. The side plates 13 are connected by means of the cables 24 to separate pulleys 25 each secured to the counter shaft 17 for rotation therewith to give vertical lift to the side plates 13 and the end 12 of the table 9 when the piston rod 20 is withdrawn downwards by the cylinder and piston device 19.

The cylinder and piston device 19 is activated by fluid supplied by the pump 26 to lower the piston rod 20 and through the counter shaft 17 raise the side plates 13. The pump 26 is adjusted to effect the raising of the delivery end 12 of the machine at a constant rate depending on the size, weight and speed of delivery of the cut sheets being delivered by the cutter. A valve 27 in the hydraulic system, as seen in FIG. 7, is opened at the end of the rising cycle of the delivery end 12 of the machine and permits the fluid from the pump 26 to short circuit the cylinder and piston device 19, allowing the delivery end of the machine to be lowered by its own weight. The pump 26 draws its fluid supply from the fluid reservoir 28 and the return flow of fluid from the cylinder and piston device 19 is directed back to the reservoir 28.

The above described machine also includes air blowing means, including a fan 29, an air distribution duct 30 connected with the fan 29, and a series of air outlets 31 from the duct 30 directs jets of air under the sheets 32 as they are discharged from the delivery end 12 of the machine over the guide roll 7*b* to assist in floating the sheets evenly on to the top of the load 33 as it is built up on the pallet 34. Jogger belts 35 are mounted at intervals across the machine on the rocking shaft 36 to move the sheets of paper 32 from the tapes 6 forward on to the top of the load 33. The air distribution duct 30, fan 29 and air outlets 31 are supported by the side plates 13 and move vertically therewith, and the drive for the fan 29 and the rocker shaft 36 is supplied by a moter 36*a*.

The above described mechanism is generally common to the type of high speed paper cutting machines. The invention hereinafter described in detail covers means whereby variations in the relative levels of the top of the load 33 with respect to the delivery of the sheets 32 from the delivery end 12 of the machine, particularly where the level of the top of the load 33 tends to creep up on the level of sheet delivery, can be corrected automatically in order to maintain a level of the top of the load 33 at a fixed distance below the level of the sheet delivery from the machine during the upward travel of the delivery end of the machine.

The invention comprises the installations of a light source 37 and a photo-electric tube 38 on a bracket 39, here shown as extending from the air distribution duct 30 which is movable along with the vertically movable delivery end 12 of the machine. The light source 37 and the photo-electric tube 38 can be adjusted vertically relative to the bracket 39 by means of the adjustment screws 40. The light source 37 and the photo-electric tube 38 are suitably protected in the casings 37*a* and 38*a*.

The casing 37*a* is slotted at 37*b* to project a beam of light of limited area against the adjacent edges of the sheets 32 falling on to the load 33 and against the vertical face of the load. The height of the slot 37*b* is coordinated with the slot 38*b* in the casing 38*a* so that the photo-electric tube therein will pick up the reflected light from the edges of the paper over a fixed range of reflectivity in a vertical direction. The slots 37*b* and 38*b* are set at an angle on a horizontal plane so that their axis will be focalized on the adjacent vertical face of the load and at an adjusted horizontal level between the desired relative levels of the delivery of the paper sheets and the top of the rising load. This condition is illustrated in FIG. 8 of the drawings.

The area of light reflection L on the vertical face of the load 33 will remain constant so long as the load increases in height at the same rate as the upward movement of the delivery end of the machine and, should the area of light reflection L on the vertical face of the load remain at or below the intensity at which the photo-electric tube 38 will not pick up sufficient light to cause it to operate, the cylinder and piston device 19 will continue to lift the delivery end 12 of the machine at a constant speed. However, should for some reason, the sheets 32 be delivered to the top of the load 33 at a rate which will cause the load to increase in height at a faster rate than the rate of rise of the delivery end of the machine the area of light reflection on the vertical face of the load will also increase, as illustrated at L' in FIG. 9, until it reaches a value which will cause the photo-electric tube 38 to operate. Energizing of the photo-electric tube 38 makes the tube 41 conductive and effects closing of the magnetic relay 42. The load magnetic relay 43 is normally open and is closed when the tube 44 is made conductive. This latter tube 44 is operated by a time delay circuit regulated by the variable resistance 45. It is the adjustment or setting of this variable resistance 45 which determines the value of the bias charge given to the condenser 46 in the time delay circuit associated with the tube 44. When the relay 42 is closed, the tube 44 will remain inoperative or non-conductive until such time as the bias charge in the condenser 46 is bled off, and the predetermined time delay in the apparatus is that required to bleed off the bias charge in the condenser before the tube 44 can be triggered to pass a current from the switch 42 to close the magnetic relay 43. When contactor 43 operates and closes its contacts, current is passed through the coil of timer relay 47. The contacts of timer relay 47 are normally closed. When the coil of timer relay 47 is energized the contacts of this relay remain closed for a predetermined time. At the end of this predetermined time the contacts of timer relay 47 open.

The contacts of timer relay 47 are in series with the coil of motor starting relay 48. This coil is energized from the same source as coil 47. When contacts of relay 43 close, coils 47 and 48 are energized and motor 49 will operate. At the predetermined time setting of timer relay 47 the contacts of this relay will open and shut down relay 48 thereby stopping the motor 49. The intention of this operation is to prevent motor 49 for over shooting and coasting too far.

The load motor 49 drives the boost pump 50 in the hydraulic system shown in FIG. 7, which in turn implements the flow of fluid to the cylinder and piston device 19 to effect a boost or speed up in the rate of rise of the delivery end 12 of the machine. A push button 51 is inserted in the circuit to enable the operator to start up the motor 49 and pump 50 manually instead of automatically through the activation of hte photo-electric tube 38.

As the delivery end 12 of the machine speeds up, the light source 37 and the photo-electric cell 38 rise with it,

with the result that the area of light reflection L' on the face of the load **30** is reduced. As this area of reflection is reduced to below the value at which the photo-electric cell will no longer be activated, i.e. to the position shown in FIG. 8, the circuit to the motor **49** is opened and the boost pump **50** will cease to pass additional fluid to the cylinder and piston device **19**, and will remain inactive until such time as there is a change in the relative levels of the top of the load **33** and the delivery end of the machine which would cause the photo-electric tube **38** to be reactivated.

FIG. 6 shows a modification of the schematic wiring diagram shown in FIG. 5. In this diagram a photo-conductive cell **52** replaces the tube **38**.

In the operation of loading cut sheets **32** from the machine **5** the delivery end **12** of the machine is lowered and the level of the delivery is adjusted in relation to the top surface of the pallet **34** and the level of the slots **37***b* and **38***b* respectively of the casing of the light source **37** and photo-electric tube **38** are correspondingly adjusted so that the photo-electric tube will remain inactive generally at the designated rate of rise of the delivery end of the machine and of the load.

When the machine is set in motion and cut sheets **32** are fed to the delivery end and on to the pallet **34**, the pump **26** is also started up, it first having been adjusted to pass the necessary volume of fluid to the cylinder and piston device **19** to give the desired rate of rise of the delivery end **12** of the machine. So long as the relative levels of the delivery end of the machine and the top of the load of cut sheets remains constant only the pump **26** will be in operation. However, should the top of the load **33** rise faster than the upward rise of the delivery end of the machine, the area of light reflection on the face of the pile will increase and, when this area of light reflection reaches a value which will cause the photo-electric tube to become activated, the pump **50** will start up after the time delay allowed by the electrical circuit. Operation of the pump **50** effects an increase in the rate of rise of the delivery end of the machine and will continue until the area of light reflection on the face of the pile is reduced sufficient to deactivate the photo-electric tube **38**.

In the course of rise of the delivery end of the machine to its top position, the pump **50** may not be brought into operation, and again it may be brought into operation a number of times, all depending on the relative levels of the top of the load and the delivery end of the machine.

The sensitivity of the photo-electric tube **38** or the amount of illumination provided by the light **37** can be adjusted to suit the varying degree of light reflectance provided by the paper being piled on the pallet **34**. Such adjustment is required when changing over from white to coloured paper or from light to dark coloured papers.

Satisfactory operation of the device is obtained despite the fact that there may be anywhere from one to twenty or thirty sheets falling through the air from the delivery end of the machine to the solid part of the load and going past the light source and photo-electric tube, the air gradually squeezes out of the space between the sheets of paper as they land on the top of the load and the sheets gradually pack into a tighter and tighter pile. In the meantime, the light from the light source is being reflected back from the edge of the individual sheets of paper. It is the accumulation of these multitudinous edge reflections which operate the photo-electric tube and not a sharp edge of a solid material. The time during which the tube **44** is conductive is the time during which the pump **50** will be active and a boost be given to the cylinder and piston device **19**, unless the preset time interval has first elapsed.

By combining a light source of given intensity and a photo-electric tube or photo-conductive cell of known sensitivity and knowing the reflective value of the sheets being cut and piled and by varying the preset time interval, the added lift to the delivery end of the machine can be controlled within fine limits.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a paper cutting machine in which the delivery end of the machine is caused to rise continuously at a pre-determined rate and the cut sheets of paper are delivered on to a pallet one on top of the other, a cylinder and piston device operatively connected to the delivery end of said machine, a constantly driven pump, a fluid connection between said pump and said piston and cylinder device, said pump effecting through said cylinder and piston device the raising of the delivery end of the machine at a pre-determined speed, a source of light directed on to the edges of the sheets being delivered and on to the vertical face of the height increasing load of sheets at a predetermined level below the level of delivery of the sheets from the machine, a light sensitive device activated by an increasing degree of light reflection on the edges of the sheets being delivered and on the face of the height increasing load, the said source of light and said light sensitive device being mounted on a common support on the delivery end of said machine, a boost pump, a fluid connection between said boost pump and said cylinder and piston device, said boost pump being activated by said light sensitive device to increase the rate of rise of the delivery end of the machine during the period the said light sensitive device is activated.

2. In a paper cutting machine as set forth in claim 1 in which a timer device is associated with the said light sensitive device, the said timer device limiting the time during which the said boost pump is activated.

3. In a paper cutting machine in which the delivery end of the machine is caused to rise continuously at a pre-determined rate and the cut sheets of paper are delivered on to a pallet one on top of the other, a hydraulic device effecting the rise of the delivery end of the machine, a source of light directed on to the edges of the sheets being delivered and on to the vertical face of the height increasing load of sheets at a pre-determined level below the level of delivery of the sheets from the machine, a light sensitive device activated by an increasing degree of light reflection off the edge of the sheets being delivered and off the face of the height increasing load, the said source of light and said light sensitive device being mounted on a common support on the delivery end of said machine, and means activated by said light sensitive device, the said means applying a boost to said hydraulic device to increase the rate of rise of the delivery end of the machine when the said light sensitive device is activated.

4. In a paper cutting machine in which the delivery end of the machine is caused to rise continuously at a pre-determined rate and the cut sheets of paper are delivered on to a pallet one on top of the other, a hydraulic device effecting the rise of the delivery end of the machine, a source of light directed onto the edges of the sheets being delivered and on to the vertical face of the height increasing load of sheets at a pre-determined level below the level of the delivery of the sheets from the machine, a light sensitive device activated by an increasing degree of light reflection off the edge of the sheets being delivered and off the face of the height increasing load, the said source of light and said light sensitive device being mounted on a common support on the delivery end of the machine, and a hydraulic pump operatively connected with said hydraulic device, the said hydraulic pump being activated by the said light sensitive device to apply a hydraulic boost to the said hydraulic device to increase the rate of rise of the delivery end of the machine when the said light sensitive device is activated.

5. In a paper cutting machine in which the delivery end of the machine is caused to rise continuously at a predetermined rate and the cut sheets of paper are de-

livered on to a pallet one on top of the other, a hydraulic device effecting the rise of the delivery end of the machine, a source of light directed on to the edges of the sheets being delivered on to the vertical face of the height increasing load of sheets at a pre-determined level below the level of the delivery of the sheets from the machine, a light sensitive device activated by an increasing degree of light reflection off the edge of the sheets being delivered and off the face of the height increasing load, the said source of light and said light sensitive device being mounted on a common support on the delivery end of the machine, a hydraulic pump operatively connected with said hydraulic device, the said hydraulic pump being activated by the said light sensitive device to apply a hydraulic boost to the said hydraulic device to increase the rate of rise of the delivery end of the machine when the said light sensitive device is activated, and a timer device associated with said light sensitive device, the said timer device limiting the time during which the said pump is activated.

6. In a paper cutting machine in which the delivery end of the machine is caused to rise continuously at a predetermined rate and the cut sheets of paper are delivered on to a pallet one on top of the other, a hydraulic device effecting the rise of the delivery end of

the machine, a source of light directed on to the edges of the sheets being delivered and on to the vertical face of the height increasing load of sheets at a pre-determined level below the level of the delivery of the sheets from the machine, a light sensitive device activated by an increasing degree of light reflection off the edge of the sheets being delivered and off the face of the height increasing load, the said source of light and said light sensitive device being mounted on a common support on the delivery end of the machine, a hydraulic pump operatively connected with said hydraulic device, the said hydraulic pump being activated by the said light sensitive device to apply a hydraulic boost to the said hydraulic device to increase the rate of rise of the delivery end of the machine when the said light sensitive device is activated, a timer device associated with the said light sensitive device, the said timer device limiting the time during which the said pump is activated and means to adjust the time setting of the said timer.

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