March 2, 1954 J. W. BACH 2,670,954

SHEET FEED CONTROL DEVICE

Filed March 9, 1951 2 Sheets-Sheet 1

FIG. 1.

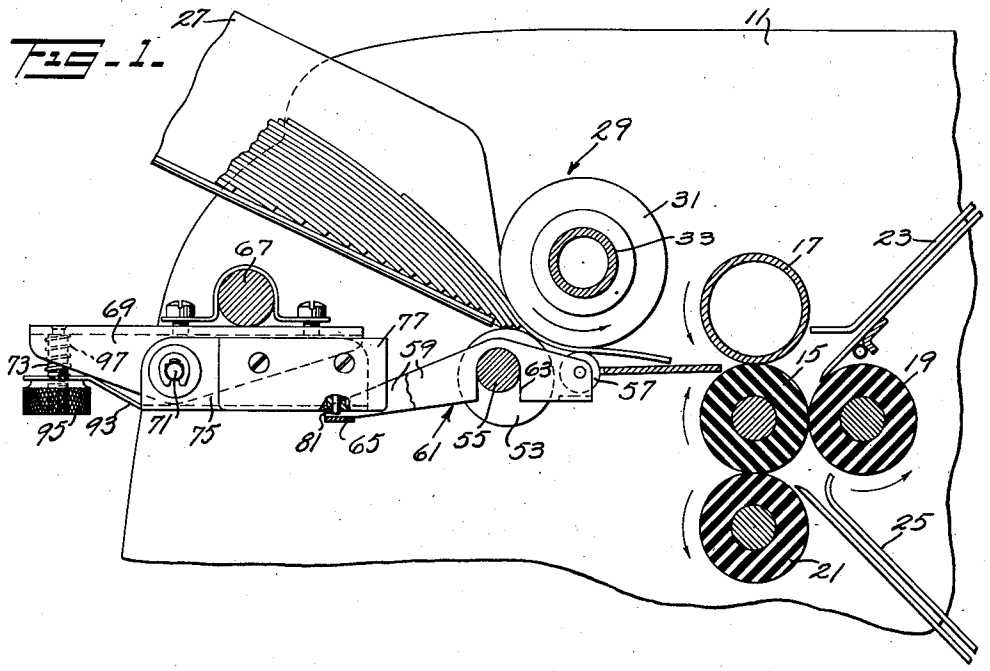


FIG. 2.

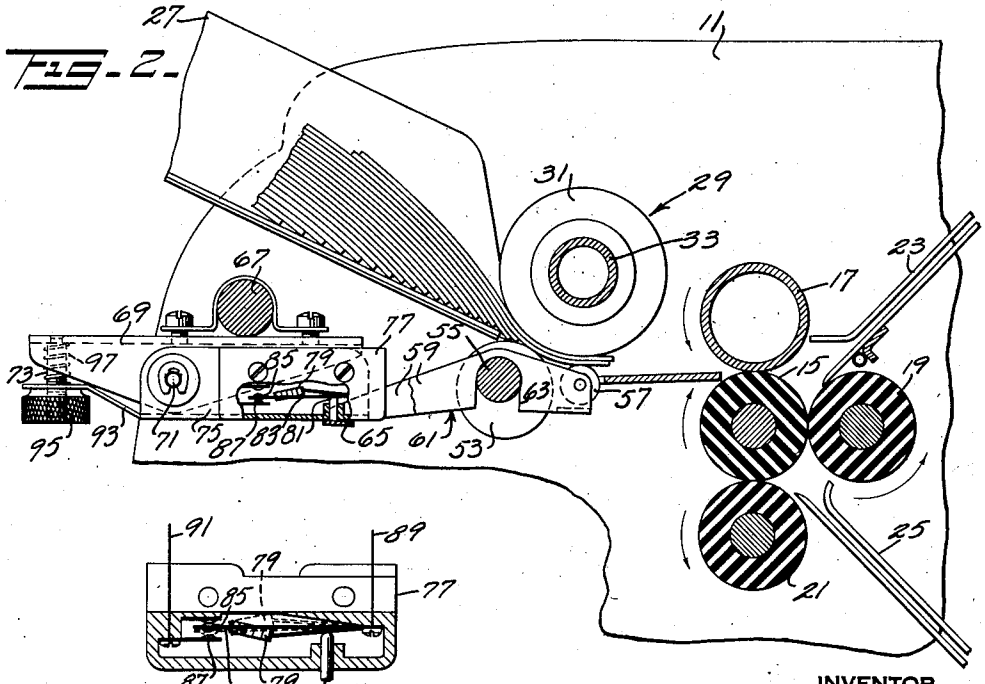


FIG. 6.

INVENTOR
John William Bach
BY
Edwin H. Oliver
ATTORNEY

March 2, 1954 J. W. BACH 2,670,954

SHEET FEED CONTROL DEVICE

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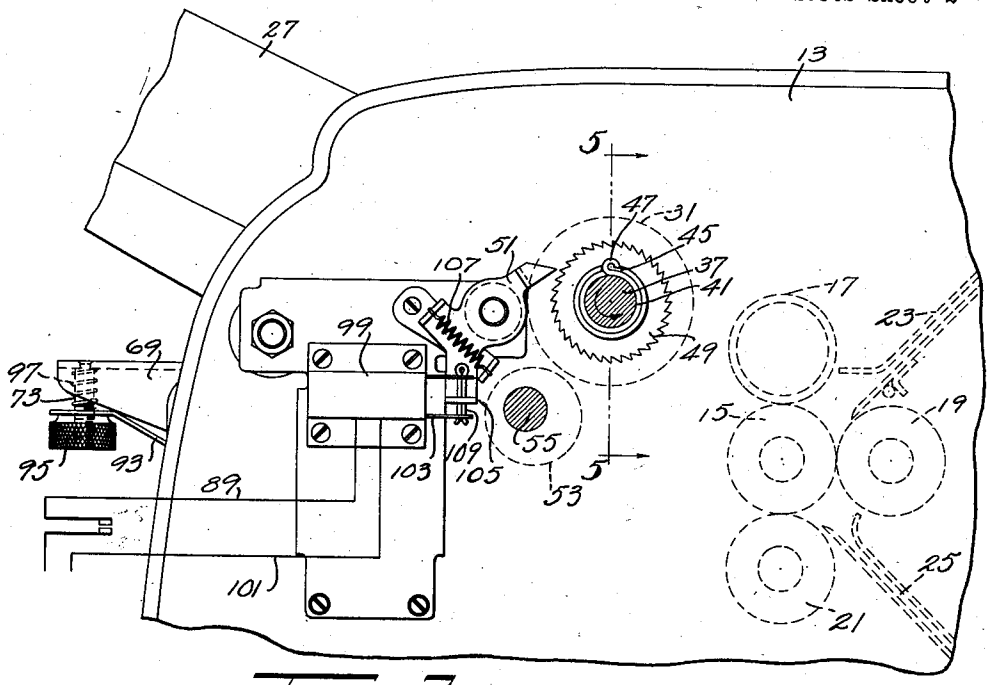


FIG. 3.

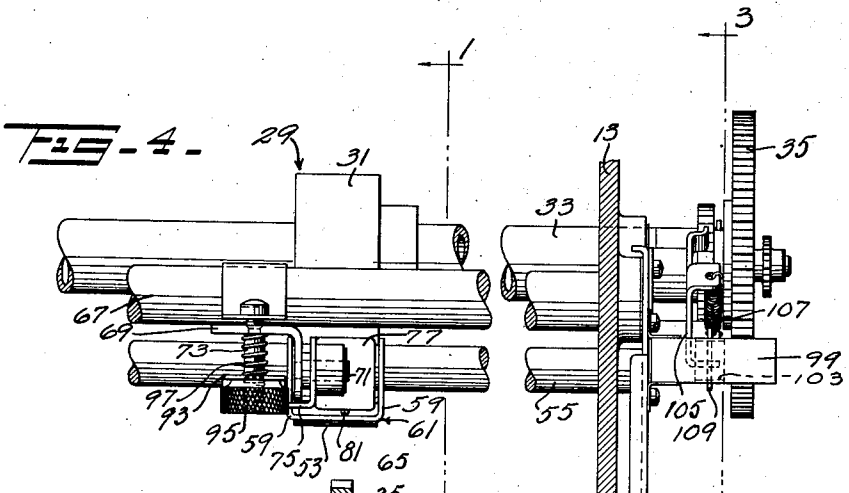


FIG. 4.

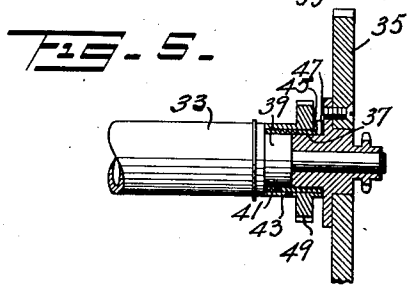


FIG. 5.

INVENTOR
John William Bach
BY
Edwin H. Oliver
ATTORNEY

Patented Mar. 2, 1954

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UNITED STATES PATENT OFFICE

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SHEET FEED CONTROL DEVICE

John William Bach, Port Chester, N. Y., assignor to Pitney-Bowes, Inc., Stamford, Conn., a corporation of Delaware

Application March 9, 1951, Serial No. 214,778

14 Claims. (Cl. 271—57)

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This invention relates to sheet handling devices and particularly to sheet separating and feeding devices of the type having a sheet separator roller driven through an overrunning clutch.

In the sheet handling art it has been known to provide a friction roller working in cooperation with a closely spaced, relatively fixed, hard, smooth abutment for separating workpieces, usually in the form of sheets, from a shingled stack and forwarding them one at a time to be worked upon. Usually the abutment is adjustable to provide for the proper handling of sheets of different thicknesses. It sometimes happens due to improper abutment adjustment, variation in sheet thickness, or more often a combination of both, that the sheets will not be accurately fed and that two will be forwarded instead of one from time to time. Such operation is normally undesirable since it may, for example, impair the efficiency of the following work step or provide, without warning, unacceptable duplicates or extra weight in mailed matter.

The present invention has for its object the provision of means for detecting the forwarding of more than one sheet, and for calling the operator's attention to this fact.

It is a feature of the present invention that the detecting means immediately prevents the feeding of the sheets whereby the operator has his attention called to the condition, and the production of faulty work is simultaneously prevented.

Another feature of the invention is the employment of the same overrunning clutch that is normally present in separator roller drives (to permit taking the work away from the separator roller at higher speed by a subsequent feed) for the purpose of stopping the roller drive in response to the operation of the sensing means. This permits an important saving in the cost of the device and provides at the same time a prompt, sensitive response to the action of the sensing means.

Still another feature of the invention is the provision of sensing means which can be adjusted to accommodate sheets of differing thicknesses.

A further feature of the invention is the provision of a separate power means controlled by the sensing means, for performing the actual work of interrupting the feed, which makes possible the removal of any substantial sheet compressive loads from the sensing means and permits sensitive and accurate detection of undistorted sheet measurements.

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For purposes of illustration and explanation the invention is shown in detail in its preferred form in the accompanying drawings, wherein:

Fig. 1 is a longitudinal section of the machine of the invention taken substantially on line 1—1 of Fig. 4, with parts broken away, and illustrating the normal operation;

Fig. 2 is a section similar to Fig. 1, but showing the operation of the device when a plurality of sheets is forwarded;

Fig. 3 is a longitudinal section of the machine of the invention taken substantially on line 3—3 of Fig. 4, and also includes an electrical diagram of the solenoid circuit;

Fig. 4 is an end view of the device with parts broken away, taken from the left and looking towards the right in Figs. 1 to 3;

Fig. 5 is a detail section showing the overrunning clutch mechanism and taken substantially on line 5—5 of Fig. 3; and

Fig. 6 is a detail section to a larger scale of the switch mechanism shown in Figs. 1 and 2, a secondary position of the switch parts being illustrated in dotted lines.

The present invention deals with sheet separators and forwarders employing a friction roll which cooperates with a fixed abutment, and is illustrated for convenience in connection with a four roll buckle type sheet folder. The machine comprises a frame including end frame members 11 and 13, appearing in Figs. 1 and 3 respectively, and includes the usual cooperating folder rollers 15, 17, 19 and 21 extending between and mounted for rotation on said frames. The rollers cooperate in a known manner with upper and lower buckle chutes 23 and 25 to produce one or more creases in a worksheet as the same is fed through the machine.

Sheets S are held in the form of a stack in the supply holder and guide 27. The separator and forwarding means, indicated generally by reference character 29, is provided for the purpose of separating one sheet S from the stack and projecting the same forward to a position where it can be engaged by the first pair of folder rollers 15, 17. The separator and forwarding means 29 includes a short starter roller 31 which has a high friction coefficient surface. The roller 31 is mounted on and driven by a shaft 33 which is rotatably mounted within the frame of the machine. A gear 35 which forms a part of the driving train connecting the shaft 33 with a suitable motor drive (not shown) is arranged adjacent one end of shaft 33 and has a cylindrical hub 37, the outer surface of which

coincides with the cylindrical extension of the surface of a hub portion 39 on shaft 33, as best seen in Fig. 5. These two hubs form parts of an overrunning clutch which is completed by a helical spring 41 long enough to embrace both hubs. Said spring is so configured as to exert a light radially inward force on the hub 37 to maintain the inner portions of its convolutions in frictional contact with the hub surface. The spring, as viewed in Fig. 3, is wound in a direction which will effect a tight driving contact with the hubs 37 and 39 when the same is turning in the normal counterclockwise direction (Fig. 3), the roller 31 being driven thereby. Since rollers 15, 17 travel at higher speed than roller 31, they will tend to drive the latter by means of the forwarded sheet when its leading edge reaches their nip between said rollers. Such driving action will be permitted, for when the hub 39 turns more rapidly than the hub 37 in the direction of the arrow of Fig. 3, the grip of the spring 41 on hub 37 is loosened, and overrunning of its drive by shaft 33 is permitted.

The clutch also has a disabling operator in the form of a sleeve 43 freely mounted on the outside of the spring 41 and provided with a notch 45 for receiving a radially extending ear 47 integral with the end of the spring. The sleeve has an integral toothed brake wheel 49, for engagement by stop pawl 51, for a purpose to be described hereinafter.

Arranged at one side of the roller 31 is a fixed separator abutment for cooperation with the roller. In the form of the invention shown this consists of a disk 53 preferably having a high friction or abrasive surface and mounted eccentrically and rigidly on a shaft 55, which shaft is adjustably carried by the frame. By turning the shaft 55 slightly, the spacing between the surfaces of abutment 53 and roller 31 can be adjusted to provide a separation suited to the particular sheets being handled and to limit the feed to only one sheet at a time.

The adjustment described above is tested by the machine operator by feeling the frictional pull on a sheet which the roller 31 exerts when the machine is running. Since it is rather difficult to get the setting exactly accurate, and since the operation of the device is such that even though accurately set for an average sheet, slight changes in conditions or in the sheet thickness will sometimes permit the compressing and starting of two sheets instead of one between the roller 31 and separator abutment 53, the present invention provides means hereinafter described for accurately determining when such a misfunctioning occurs and for stopping the machine before the plural sheets have been fully forwarded to be worked upon.

According to the present invention, a feeler is arranged to engage the lower side of roller 31 to the right of the separator abutment 53 as seen in Fig. 1. In the preferred form illustrated in the drawings, the feeler includes a roller 57 rotatably mounted between side walls 59 of a lever 61 which is preferably partly U-shaped in cross section. Notches 63 formed in the side walls 59, are arranged to pivotally mount the lever 61 on the shaft 55 while the walls 59—59 straddle the separator abutment 53. The notches 63 are also placed so as to provide a magnifying ratio, shown for convenience as being about one to two, between the distance from the feeler roller axis to the axis of shaft 55, and the distance from the latter axis to a switch operating pad 65 bridging walls of the lever at the end opposite from the feeler roller 57.

Clamped to a portion of the machine frame, for example a transversely extending rod 67, is a bracket 69 which carries a laterally extending stud 71 and a depending screw 73. The stud 71 pivotally mounts a switch bracket 75 which carries a switch 77. The latter is preferably of the type known as a microswitch having a spring toggle means 79 engaged by an operating plunger 81 and arranged so that the toggle is always slightly biased to hold the plunger 81 out and the switch contacts separated, and operates to snap the contact arm 83 one way or the other whenever the toggle 79 lines up with the same. The switch contact 85 carried by arm 83, and the contact 87 are connected electrically to conductors 89 and 91 respectively.

The bracket 69 is clamped on rod 67 in such position that the switch 77 is embraced by the side walls 59 of the lever 61 and the plunger 81 overlies the operating pad 65. The switch bracket 75 is also provided with an arm 93 which is turned to one side so as to embrace the screw 73, and a nut 95 is threaded on the screw for adjusting the position of the arm 93 and consequently that of the switch 77 through small angles about the axis of stud 71. A spring 97 holds the arm 93 firmly against the nut 95 and provides tension to resist any inadvertent derangement of an adjustment once arrived at. By adjusting the nut 95 the spacing between the end of plunger 81 and operating pad 65 can be very accurately set to the desired value.

The switch 77 is also shown diagrammatically in Fig. 3, the conductors 89 and 91 forming one side of the power line supplying a solenoid 99, the other terminal of which is served by the conductor 101. The solenoid 99 is mounted on the end member 13 adjacent the pawl 51, and is preferably so arranged that the retraction of the plunger 103 of the solenoid, when the circuit is closed through switch 77, will project the pawl 51 into engagement with the teeth of wheel 49. In the form of the invention shown the pawl is pivoted to the end member 13 and has an integral operating lever 105 which is urged by a spring 107 in a direction to withdraw the pawl from the wheel. A pin 109 connects the end of lever 105 with the solenoid plunger 103.

It has been found that, apparently due to the multiplying ratio of the lever 61 and possibly the lack of any high degree of sheet compressive force urging the feeler roller 57 towards the roller 31, the feeler mechanism is capable of being adjusted to such a position that a single sheet S between feeler roller 57 and starter roller 31 will have no tendency whatever to close the switch 77, while two sheets S between the said rollers will consistently close the switch 77 regardless of slight variations in sheet thickness.

The operation of the device may best be visualized in connection with Figs. 1, 2 and 3. When the sheet separator and forwarding means 29 is operating in the desired fashion, i. e. withdrawing a single sheet S from the shingled supply, the parts assume the position of Fig. 1, and the thickness between rollers 31 and 57 is insufficient to close switch 77. The solenoid 99 consequently remains at rest position as seen in Fig. 3 and the feeding of the sheet continues in the normal fashion. When, however, some variation from normal condition causes the separator to withdraw two sheets S from the supply, the parts assume the position of Fig. 2. At this time the

added thickness between rollers 31 and 57 causes the lever 61 to swing slightly farther than before. This added movement is multiplied by the factor of the lever, in this case two, and firmly closes the switch 77. By turning to Fig. 3, it can be seen that the solenoid 99 will be actuated, thus retracting its plunger 103 and projecting the pawl into braking relation with the wheel 49. The wheel 49 is normally turning with the shaft 33 in the direction of the arrow, but when it is arrested by contact with the pawl 51, its rotation stops instantly, thereby stopping the rotation of the ear 47 at the end of spring 41. A further minute fraction of a turn of the drive hub 37 is sufficient to loosen the grip of the spring 41 thereon, so that the hub 37 turns idly within the clutch spring 41 and the rotation of shaft 33 ceases at once, although the drive gear continues to rotate.

The cessation of sheet feeding above described calls the operator's attention to the fact that more than one sheet has been started. He thereupon merely stops the machine, withdraws the offending sheets from between starter roller 31 and abutment 53, possibly rechecks the abutment spacing adjustment if stoppage has occurred rather frequently, and restarts the machine. In this way, no searching for double sheets at subsequent stations is needed, and the situation is corrected at the instant it occurs.

While in order to comply with the statute the invention is described in language which is rather specific as to structural features and arrangements, it is to be understood that the invention is not limited to the specific details shown, but that the means herein disclosed comprises the preferred of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the scope of the language employed in the appended claims.

Having described the invention, what is claimed is:

1. In a device of the character described, continuously rotating feed rollers, means designed to take one sheet of paper at a time from a shingled stack of sheets and advance the same to the feed rollers; means located between said feed rollers and said sheet advancing means for sensing the number of sheets advanced by said advancing means; and means responsive to the sensing of more than one sheet by said sensing means for stopping said advancing means before the plural sheets being advanced reach the feed rollers and without affecting the continued rotation of said feed rollers.

2. In a separating and advancing means designed to take one workpiece at a time from a stack of sheet-like workpieces which comprises a starting roller, a drive therefor, and an abutment having a surface spaced from the surface of the roller to retard all but the one workpiece to be advanced by the starting roller, the improvement which comprises: means for sensing the thickness of the material issuing from between said roller and said abutment and for assuming one position in response to the issuance of a single workpiece, said means being moved to another and detectably different position when a plurality of superposed workpieces issue; and means operated by the sensing means when in the second position for interrupting said drive to stop the movement of the workpieces.

3. In a separating and advancing means designed to take one workpiece at a time from a stack of sheet-like workpieces which comprises a starting roller, a drive therefor, a clutch normally connecting said drive and said roller, and an abutment having a surface spaced from the surface of the roller to retard all but the one workpiece to be advanced by the starting roller, the improvement which comprises: means for sensing the thickness of the material issuing from between said roller and said abutment and for assuming one position in response to the issuance of a single workpiece, said means being moved to another and detectably different position when a plurality of superposed workpieces issue; and means operated by the sensing means when moved to the second position for releasing said clutch and stopping the movement of said workpieces.

4. In a separating and advancing means for sheet-like workpieces which comprises a starting roller, a drive therefor, an overrunning clutch normally connecting said drive with said roller for forward driving of the roller in a workpiece advancing direction, but permitting overrunning of the drive by the roller when a workpiece is taken away from the roller at higher speed by a subsequent feed, and an abutment having a surface spaced from the surface of the roller to retard all but the one workpiece to be advanced by the starting roller, the improvement which comprises: means for sensing and moving to positions indicating whether one workpiece or more than one workpiece is issuing from between said roller and said abutment; and means for disconnecting said clutch to stop the advancement of the workpieces in response to movement by said sensing means to a position indicating issuance of a plurality of workpieces.

5. In a separating and advancing means for sheet-like workpieces which comprises a starting roller, a drive therefor, and an abutment having a surface spaced from the surface of said roller to retard all but the one workpiece to be advanced by the starting roller, the improvement which comprises: a lever having a feeler surface adjacent to and biased towards said roller at a location where workpieces issuing from between said roller and said abutment will pass between said feeler surface and said roller, said lever being moved from normal position when a plurality of workpieces passes simultaneously between said roller and said feeler surface; and power means actuated by said feeler when so moved for interrupting said drive.

6. In a separating and advancing means for sheet-like workpieces, which comprises a starting roller, a drive therefor, and an abutment having a surface spaced from the surface of said roller to retard all but the one workpiece to be advanced by the starting roller, the improvement which comprises: a lever having a feeler surface adjacent to and biased towards said roller at a location where workpieces issuing from between said roller and said abutment will pass between said feeler surface and said roller, said lever being moved from normal position when a plurality of workpieces passes simultaneously between said roller and said feeler surface; means operated by said lever to move in response to the movement of said feeler but through a greater distance; and means actuated by said lever operated means when the lever is so moved for interrupting said drive.

7. In a separating and advancing means for sheet-like workpieces which comprises a starting roller, a drive therefor, and an abutment having a surface spaced from the surface of said

roller to retard all but the one workpiece to be advanced by the starting roller, the improvement which comprises: a lever having a feeler surface adjacent to and biased towards said roller at a location where workpieces issuing from between said roller and said abutment will pass between said feeler surface and said roller, said lever being moved from normal position when a plurality of workpieces passes simultaneously between said roller and said feeler surface; an electric switch operated by said lever; and means including a solenoid controlled by said switch for interrupting the drive in response to switch actuation.

8. In a separating and advancing means for sheet-like workpieces which comprises a starting roller, a drive therefor, and an abutment having a surface spaced from the surface of said roller to retard all but the one workpiece to be advanced by the starting roller, the improvement which comprises: a lever having a feeler surface adjacent to and biased towards said roller at a location where workpieces issuing from between said roller and said abutment will pass between said feeler surface and said roller, said lever being moved from normal position when a plurality of workpieces passes simultaneously between said roller and said feeler surface; means operated by said lever to move in response to the movement of said feeler but through a greater distance; an electric switch operated by said lever operated means; and means including a solenoid controlled by said switch for interrupting the drive in response to switch actuation.

9. In a separating and advancing means for sheet-like workpieces which comprises a starting roller, a drive therefor, an overrunning clutch normally connecting said drive with said roller for forward driving of the roller in a workpiece advancing direction, but permitting overrunning of the drive by the roller when a workpiece is taken away from the roller at higher speed by a subsequent feed, and an abutment having a surface spaced from the surface of the roller to retard all but the one workpiece to be advanced by the starting roller, the improvement which comprises: a lever pivotally mounted with one end adjacent said roller at a location where workpieces issuing from between said roller and said abutment will pass between the lever end and said roller, said end of said lever being lightly biased towards said roller; an arm on said lever having an end arranged to move in response to the movement of said one end but through a greater distance; and means actuated by the end of said arm for disconnecting said clutch.

10. In a separating and advancing means for sheet-like workpieces which comprises a starting roller, a drive therefor, an overrunning clutch normally connecting said drive with said roller for forward driving of the roller in a workpiece advancing direction, but permitting overrunning of the drive by the roller when a workpiece is taken away from the roller at higher speed by a subsequent feed, and an abutment having a surface spaced from the surface of the roller to retard all but the one workpiece to be advanced by the starting roller, the improvement which comprises: the construction of said overrunning clutch as a helical spring clutch normally rotating with said drive and roller and including a disconnecting ear extending from the free end of the spring forming said clutch; a brake wheel engaging said ear and normally rotated by the same; means for sensing and moving to a position indicating whether one workpiece or a plurality of superposed workpieces is issuing from between said roller and said abutment; and means for engaging and arresting said brake wheel in response to movement by said sensing means to a position indicating issuance of a plurality of workpieces.

11. In a separating and advancing means for sheet-like workpieces which comprises a starting roller, a drive therefor, an overrunning clutch normally connecting said drive with said roller for forward driving of the roller in a workpiece advancing direction, but permitting overrunning of the drive by the roller when a workpiece is taken away from the roller at higher speed by a subsequent feed, and an abutment having a surface spaced from the surface of the roller to retard all but the one workpiece to be advanced by the starting roller, the improvement which comprises: the construction of said overrunning clutch as a helical spring clutch normally rotating with said drive and roller and including a disconnecting ear extending from the free end of the spring forming said clutch; a brake wheel engaging said ear and normally rotated by the same; a lever pivotally mounted with one end adjacent said roller at a location where workpieces issuing from between said roller and said abutment will pass between the lever end and said roller, said end of said lever being lightly biased towards said roller; an arm on said lever having an end arranged to move in response to the movement of said one end, but through a greater distance; an electric switch positioned in the path of movement of said lever arm end; a solenoid controlled by said switch; and brake means operated by said solenoid and positioned for engagement with said brake wheel for arresting the same in response to solenoid movement resulting from switch actuation by the end of said lever arm.

12. In a separating and advancing means for sheet-like workpieces which comprises a starting roller, a drive therefor, an overrunning clutch normally connecting said drive with said roller for forward driving of the roller in a workpiece advancing direction, but permitting overrunning of the drive by the roller when a workpiece is taken away from the roller at higher speed by a subsequent feed, and an abutment having a surface spaced from the surface of the roller to retard all but the one workpiece to be advanced by the starting roller, the improvement which comprises: the construction of said overrunning clutch as a helical spring clutch normally rotating with said drive and roller and including a disconnecting ear extending from the free end of the spring forming said clutch; a brake wheel engaging said ear and normally rotated by the same; a lever pivotally mounted with one end adjacent said roller at a location where workpieces issuing from between said roller and said abutment will pass between the lever end and said roller, said end of said lever being lightly biased towards said roller; an arm on said lever having an end arranged to move in response to the movement of said one end, but through a greater distance; an electric switch positioned in the path of movement of said lever arm end; a solenoid controlled by said switch; brake means operated by said solenoid and positioned for engagement with said brake wheel for arresting the same in response to solenoid movement resulting from switch actuation by the end of said

lever arm; and means for adjusting the position of said switch relative to the end of said lever arm.

13. In a machine for feeding and working on sheet-like workpieces, a machine drive; a separating and advancing means which comprises a starting roller, an operating connection for the starting roller from the machine drive, and an abutment having a surface spaced from the surface of said roller to retard all of a supply of workpieces except the one to be advanced by the starting roller; means cooperating with the starting roller surface for sensing the thickness of the material issuing from between the roller and the abutment and for assuming one position in response to the issuance of a single workpiece, and another and detectably different position when a plurality of superposed workpieces issue; and means for breaking said operating connection in response to movement of said sensing means to a position indicating issuance of a plurality of workpieces to prevent advancing of said workpieces by said starting roller without affecting the normal operation of the rest of the machine parts.

14. A folding machine comprising continuously operating folding mechanism; a sheet supply holder; starting means designed for taking

one sheet at a time from the supply and advancing the same to the folding mechanism including a starting roller closely adjacent the folding mechanism, and an abutment spaced from the starting roller to retard all but the one workpiece to be advanced by the starting roller; sensing means between the starting means and the folding mechanism for detecting the inadvertent advancement of more than one sheet by the starting means; and means, responsive to the sensing by said sensing means of more than one sheet being advanced by said starting means, for stopping said sheet starting means before the plurality of sheets being advanced reach the folding mechanism, and without interfering with the continued folding operation of the folding mechanism on a preceding sheet.

JOHN WILLIAM BACH.

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