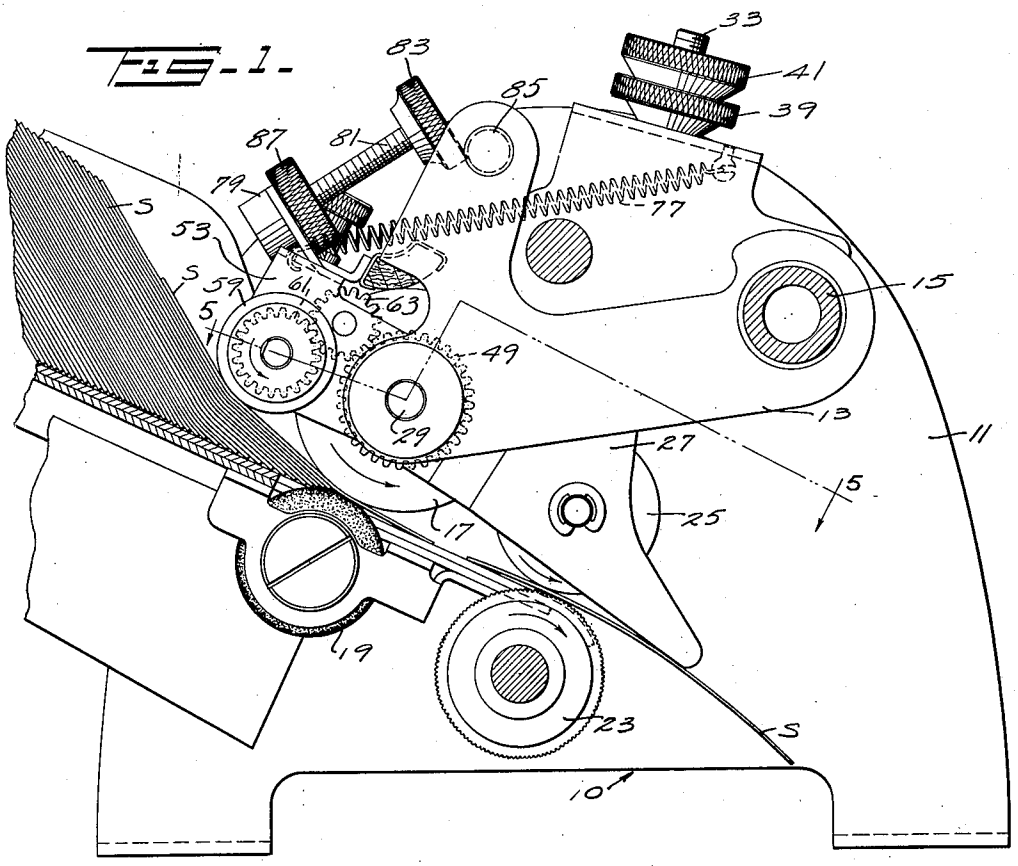
Sept. 11, 1956 F. W. UTHENWOLDT ET AL 2,762,623

SHEET FEEDING DEVICE

Filed May 10, 1952 3 Sheets-Sheet 1

FIG. 1.



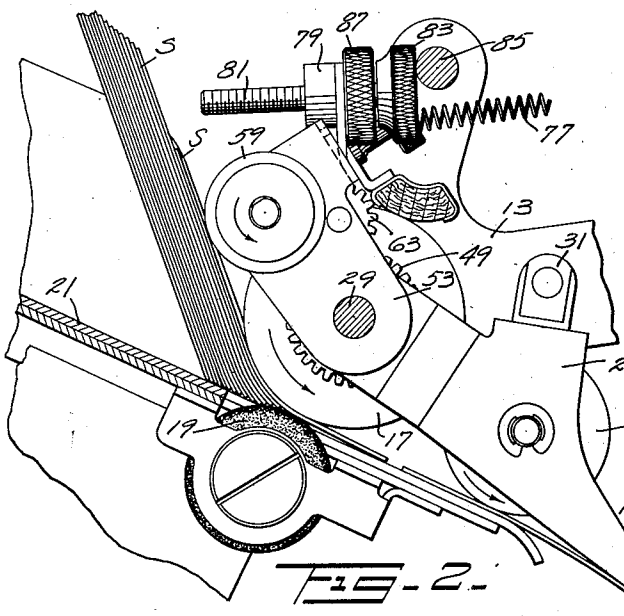


FIG. 2.

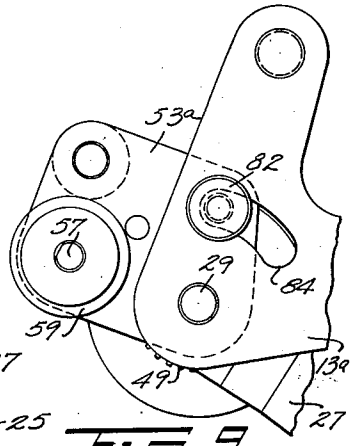


FIG. 3.

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SHEET FEEDING DEVICE

Filed May 10, 1952 3 Sheets-Sheet 2

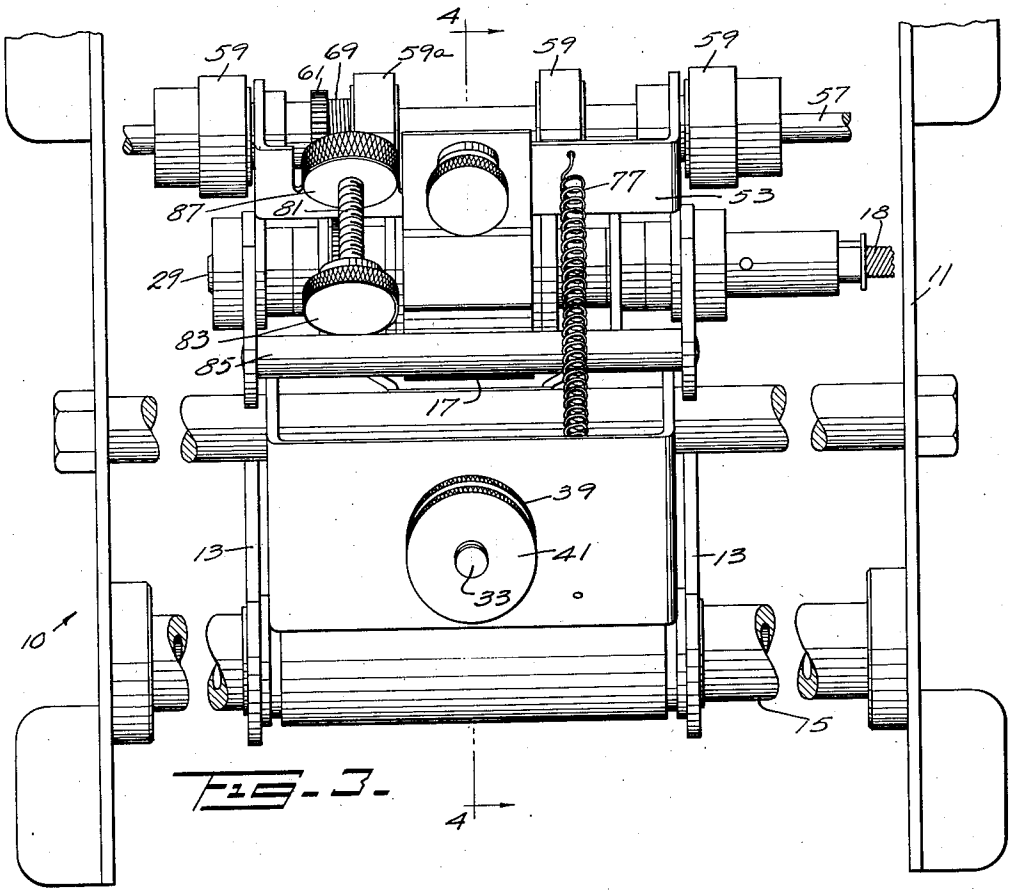


FIG. 3.

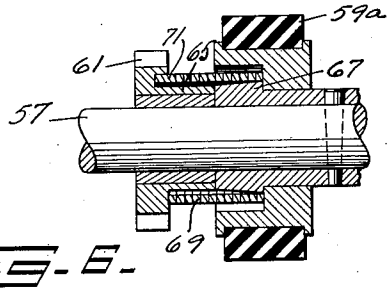


FIG. 6.

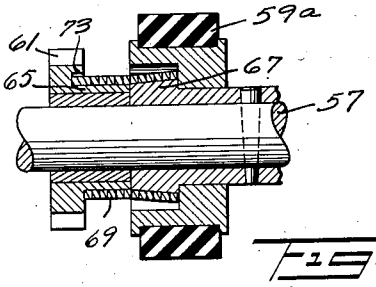


FIG. 7.

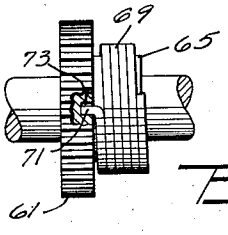


FIG. 8.

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SHEET FEEDING DEVICE

Filed May 10, 1952 3 Sheets-Sheet 3

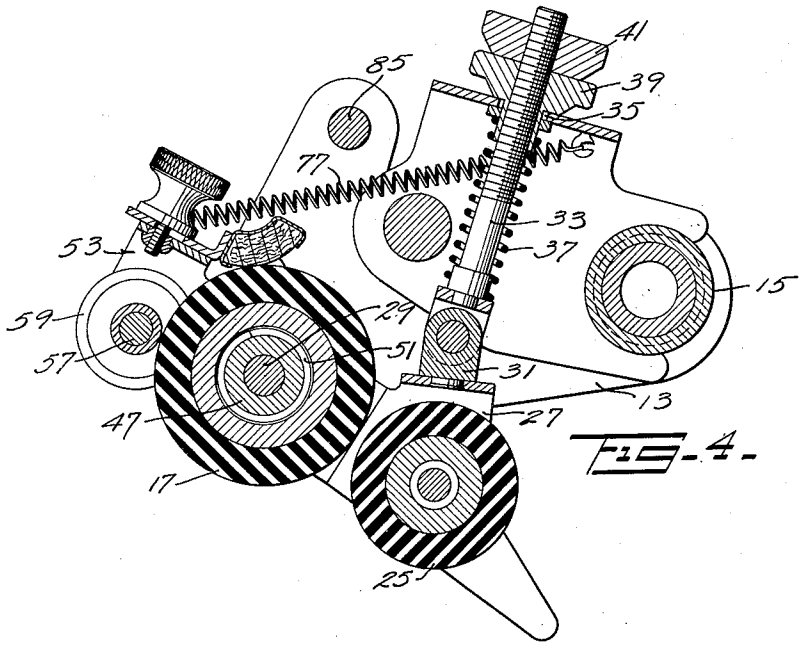


FIG-4-

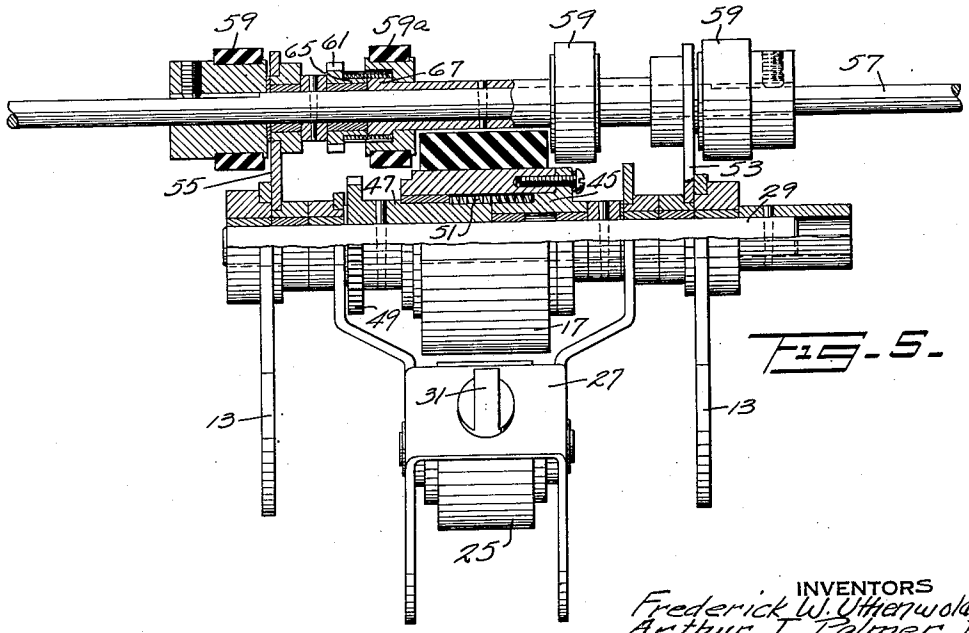


FIG-5-

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United States Patent Office 2,762,623 Patented Sept. 11, 1956

2,762,623

SHEET FEEDING DEVICE

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Application May 10, 1952, Serial No. 287,139

10 Claims. (Cl. 271—36)

This invention relates to the feeding and handling of sheetform workpieces and especially to the repeated separating and feeding forward of the foremost workpiece in a supply stack of such workpieces.

An object of the present invention is to provide for the boosting or urging forward of each workpiece into separating and feeding position just prior to the instant that its feeding motion commences in order to insure that proper feeding will occur at the intended time.

It is the feature of the present invention that the urging or boosting of the next workpiece to be fed is accomplished by means of a friction roller driven from the primary separating and feeding roller.

In accordance with the present invention means is provided for adjusting the position of the booster roller to accommodate its booster effect to the flexibility and stacking characteristics of different workpieces without affecting the booster drive.

Inasmuch as a speed of the booster roller in excess of that intended might be detrimental to the feeding operation, it is an object of the invention to so arrange the booster drive with respect to the primary separating and feeding roller that any increased speed of the latter which may occur during the taking away of a workpiece by a subsequent high speed feed will not be transmitted to the booster roller.

Another object of the invention is to provide a booster roller adjacent and driven from the primary separating and feeding roller, in which overrunning clutch means is provided between the booster roller and its drive to permit the booster roller to rotate rapidly without affecting its drive in the case where a workpiece in contact with the booster roller is of sufficient length to come into contact with a high speed subsequent feed.

Still another object of the invention is the provision of an arrangement in accordance with the immediately foregoing object, but such that reengagement of the overrunning booster clutch after an overrunning operation is momentarily delayed. The effect of such delay is to postpone the boosting effect on a subsequent sheet. This avoids the possibility of premature boosting action under special circumstances and hence removes the danger of feeding two workpieces at one time.

A further object of the invention is the provision of a novel overrunning clutch structure which is capable of delaying its engaging action for a short interval equal to a predetermined angle of rotation of the driving member.

It is a feature of the invention that the immediately foregoing object can be obtained without increasing the complexity, expense or number of parts required as compared with clutches which do not provide this operation. It is another feature of the invention that the amount of delay desired in clutch engagement can be very accurately determined and can be built into the novel clutch structure by an extremely simple operation.

With the above and other objects in view, which will appear as the description proceeds, the invention resides

in the combination of parts and in the details of construction hereinafter described and claimed, it being understood that various changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

A preferred embodiment of the invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a side elevation, partly in section, of a sheet feeding device according to the present invention and showing the same adjusted to accommodate relatively flexible workpieces;

Fig. 2 is a fragmentary elevation similar to portions of Fig. 1 but illustrating a different adjustment of the device for cooperation with workpieces of stiffer characteristics;

Fig. 3 is a condensed top plan of the device shown in Fig. 1 with the supply table omitted;

Fig. 4 is a detailed section taken substantially on line 4—4 of Fig. 3;

Fig. 5 is a plan of the device of Figs. 3 and 4, but with the main frame parts and roller adjusting means omitted, and with the shafts, rollers and driving connections illustrated in partial section;

Fig. 6 is an enlarged detailed section illustrating the overrunning clutch connection between the auxiliary or booster roller shaft and its drive gear, and showing the same in declutched condition;

Fig. 7 is a view similar to Fig. 6 but illustrating the clutched condition;

Fig. 8 is a fragmentary plan of Fig. 6 with the booster roller removed and illustrating the helical spring connection to the drive gear; and

Fig. 9 is a fragmentary elevation illustrating an alternate form of the position adjusting means for the booster mechanism.

The present invention deals with sheet separators and forwarders employing a frictional roller which cooperates with a fixed abutment and is illustrated for convenience in the accompanying drawings as comprising a main support frame **10** having end plates **11** carrying an auxiliary feed frame **13** swingably mounted at one end on a cross shaft **15** on the main frame. The free end of the frame **13** carries a primary feed or starting roller **17** which is rotatably mounted in the feed frame and suitably driven, for example, by a flexible shaft **18** (Fig. 3), from a source of power (not shown). A hard abrasive cylinder or abutment **19** is carried by supporting structure secured to the support **10** in a position to cooperate with the roller **17** for separating workpieces in the form of sheets one by one from a supply stack held in a hopper or guide chute **21**. Suitable means (not shown) is provided for holding the frame **13** in desired adjusted position to provide the correct spacing between the surface of roller **17** and abutment **19**.

A secondary or main feed roller **23** is rotatably mounted on the main frame **10** in a position to receive each sheet S as it is fed forward from the separating means **17, 19**, and cooperating therewith is a presser roller **25**. The feed roller **23** is driven by suitable power means (not shown) at a surface speed substantially in excess of the speed of the primary feed roller **17** so that the sheets when once engaged by the feed roller **23** are quickly removed from the primary feed.

In the form of the invention illustrated in the drawing, the mounting for the presser roller **25** is arranged to serve at the same time as a resilient urging means for the roller and as a convenient adjustment for the separation gap at the secondary feed so that adjustment for workpieces of different thickness can be readily made. As seen in Figs. 1, 2, 4 and 5, the presser roller **25** is rotatable in a presser

frame 27 swingably mounted at one end on a shaft 29 which preferably also serves as the support for the primary feed and separating roller 17. An eye 31 formed on the upper portion of the frame 27 at its free end is pivotally connected to a screw shaft 33 which passes through an opening 35 formed in a fixed portion of the main frame 10. A spring 37 surrounding the screw 33 tends to urge the frame 27 downwardly, while a nut 39 threaded on the screw shaft 33 may be used to raise the same against the spring 37. A lock nut 41 is used to fix the setting once determined.

From the relationship of the parts as described above, it can be seen that turning the nut 39 to raise the screw 13 swings the presser frame 27 away from the feed roller 23 to increase the spacing between rollers 23 and 25. On the other hand, turning the screw 39 in the opposite direction permits the spring 37 to move the frame 27 downwardly so that the presser roller 25 approaches the feed roller 23. In this fashion an accurate adjustment of the space between the main or secondary feed rollers 23 and 25 is effected, while the presser roller is permitted to yield when necessary regardless of its adjustment.

In separating and feeding device of the type with which this invention is concerned, the separating and primary feeding roller is normally provided with overrunning clutch means for connection to its drive in order that the sheet which is still engaged in the primary feed may be drawn freely away from the same by the secondary or main feed means which normally moves at a higher speed. In the form of the device illustrated in the drawing, a drive to the separating or primary feed is effected through the flexible shaft 18 which connects with the shaft 29 to drive the same. As seen in Fig. 5, the primary feed roller 17 is rotatably mounted on the shaft 29 by means of a bushing 45 at one end, and at the other end rotates on hub 47 of a gear 49 which is pinned to the shaft 29. The one-way helical spring clutch 51 frictionally surrounds a portion of the gear hub 47 and a portion of the roller connected bushing 45, and drivingly connects the two as the driven gear hub 47 effects a winding action of the clutch spring to thus drive the roller 17 forwardly or counterclockwise as seen in Fig. 4. However, when the roller 17 is rotated more rapidly by the force of the sheet which is being drawn through rollers 23—25, the bushing 45 runs free within the clutch spring consequently allowing the roller 17 to run free until the trailing end of the sheet passes beyond the bite of the roller 17.

In certain applications for feeding mechanisms of the above character, for example in collating devices, it is important to feed a sheet each time the feeding device operates in order to prevent the possibility of defective work in the form of missing sheets. To this end the present invention provides means for insuring the presence of a new sheet precisely at the primary feed position at all times so that whenever the primary feed roller 17 attempts to separate and feed forward a sheet, it will be certain to do so. Mechanism for bringing this about is referred to hereinafter as a booster mechanism and includes a booster frame 53 having arms 55 pivotally supported at one end on the shaft 29 and rotatably receiving and supporting at their other ends the booster roller shaft 57 which carries a series of friction booster rollers 59 and 59*a* non-rotatably secured thereto. Rotatable on the shaft 57 is a drive gear 61 which is driven from the gear 49 by an idler 63 mounted on the booster frame 53. The gear 61 has an axially extended hub portion 65 which is positioned adjacent a similar hub portion 67 within the roller 59*a*. Both of these hub portions are surrounded by a one-way helical clutch spring 69 which provides an overrunning drive connection between the gear 61 and the shaft 57 to which the rollers 59 and 59*a* are drivingly connected. It will be seen that the gearing 49, 63, 61 has a ratio such that the rollers 59, 59*a* are driven at a surface speed substantially the same as or possibly just slightly less than the primary feed roller 17.

In Figs. 6, 7, and 8, the one-way clutch connection driving the booster shaft is illustrated in detail. It can be seen, particularly in Figs. 6 and 7, that the hub 65 of gear 61 has a slightly smaller diameter than the normal inner measurement of the spring 69. The hub 67 of roller 49 on the other hand has a slight taper, and is adapted to maintain frictional contact with the interior of the spring at one end. The hub 67 tapers from this large end to a diameter substantially equal to that of the hub 65. In lieu of a frictional engagement with the surface of hub 65 the spring 69 also includes a positive driving connection with the gear 61. In the form shown this connection consists of a tongue 71 formed by bending one end of the spring and lodging the same with freedom of radial movement within a suitable recess 73 formed in the adjacent face of the gear 61.

The spring 69 is wound in such direction that when the gear 61 rotates in a forwardly direction (counterclockwise in Fig. 1) it will tend to decrease the diameter of the spring and cause the same to grip the hubs 65 and 67 to thereby drive the hub 67 and its connected shaft 57 together with the booster rollers 59, 59*a*. It will be noted, however, that by reason of the reduced diameter of the hub 65 and the taper of hub 67, a driving connection to the rollers 59 will not be instantaneously effected in that a short interval will be required for winding the spring to its reduced, hub-gripping diameter. By reason of this novel clutch structure, it is possible to introduce a time delay factor into the drive in a very simple fashion purely by assigning appropriate values to the hub and clutch spring diameters and the desired delay angle of rotation for gear 61 may be built in with extreme accuracy merely by turning the hub diameter and taper to predetermined values. It will also be appreciated that inasmuch as the tongue 71 provides a driving connection between the spring 69 and gear 61, the function of the hub portion 65 is primarily for delay and only incidentally for driving. The purpose and utility for this delay will appear more fully in the description of the operation hereinafter set forth. As is the case with the usual helical spring, one-way clutch, when the roller 59 rotates more rapidly than the shaft 57 in a forward direction (counterclockwise in Fig. 1) the frictional grip on the convolutions of spring 69 will be relaxed and the latter will assume their normal configuration as seen in Fig. 6.

As illustrated in Figs. 1 and 2, the frame 53 which carries the booster mechanism is arranged to swing about the axis of the shaft 29 so that the rollers 59 can assume any desired adjusted position, and this adjustment can be made without affecting the booster drive. A tension spring 77 is connected at one end with the outer end of the frame 53 and at its other end to a fixed point on the frame 10. The spring 77 tends to swing the frame 53 upwardly or clockwise as seen in Fig. 1. The outer end of the frame 53 carries a nut 79 into which is threaded an adjusting screw 81, the head 83 of which is arranged for contact with an abutment 85 on the frame 10. When the screw 81 is threaded out of the nut as shown in Fig. 1, the rollers 59 are adjusted to their lower positions for cooperation with the relatively flexible workpieces. By threading the screw 81 into the nut, the rollers 59 are permitted to raise under the influence of spring 77, as seen in Fig. 2, to a position where they are adapted to cooperate properly with sheets of stiffer characteristics. In any case, it will be found that the characteristics of the workpieces being fed will determine the nature of the supply pile formed and the shape of the front face thereof, and when the workpieces have been allowed to dispose themselves in their natural condition the screw 81 may be manipulated by the head 83 to bring the rollers 59, 59*a* into proper frictional contact with the first workpiece of the stack. When the adjustment is correctly made its permanence can be assured

by turning down a lock nut 87 also threaded on the screw 81.

In place of adjustment of the frame 53 by the operation of screw 81 and spring 77, alternative embodiments may be employed, one of which is illustrated in Fig. 9. In this form of the invention the booster frame 53 is replaced by a booster frame 53*a* which carries a clamping screw 82 movable back and forth in a slot 84 formed in one arm of a feed frame 13*a* corresponding to frame 13 of the other views. With this construction the frame 53*a* may be swung until booster rollers 59, 59*a* are in proper position, and fixed in the desired location by tightening the clamping screw 82.

In the operation of the device of this invention the supply of sheets is stacked in the chute 21 with the foremost sheet S having its leading edge against the primary feed roller 17 and the abutment 19. The position of the booster rollers 59, 59*a* is then adjusted as previously described using screw 81 (or clamp screw 82 in the Fig. 9 form) to provide the proper light frictional contact between the surface of rollers 59, 59*a* and the surface of the foremost workpiece S. When the feed is begun, the drive through the flexible shaft 18 and shaft 29 rotates the hub 47 and causes drive actuation of the helical clutch 51 to rotate the primary feed roller 17 thus separating and forwarding the foremost of the sheets S. During the early portion of the feed, the primary feed roller and the booster rollers 59 act in substantial concert since the latter are driven by the former at substantially the same sheet-starting surface speed. When the leading edge of the first sheet S finally reaches the nip of the secondary or main feed provided by rollers 23, 25, its travel is substantially speeded up, the main feed roller 17 being permitted to follow the sheet at the higher speed by reason of its one-way clutch connection with the shaft 29. Furthermore, if the sheets S are of sufficient length to be in contact with both the secondary feed 23, 25 and the booster rollers 59 at the same time, the booster rollers 59, 59*a* are also permitted to be rotated rapidly by the sheet S by virtue of their one-way clutch connection 65, 67, 69 with the gear 61. As soon as the first sheet S which is being fed by the secondary feed rollers 23, 25 has left the primary feed position, the roller 17 again assumes its normal speed under the influence of shaft 29 and the clutch 45, 47, 51 and proceeds to separate and feed forward the next sheet S. Similarly, whenever the trailing edge of a workpiece which is being fed by the secondary feed 23, 25 leaves the booster rollers 59, 59*a* they revert to their normal speed as determined by the drive gear 61 and clutch 65, 67, 69.

The primary function of the booster mechanism of this invention is to urge the sheet subsequent to the one being fed, firmly into a ready position where its feeding can take up instantaneously when the trailing edge of the sheet being fed leaves the primary feed 17, 19. This function commences to be performed, therefore, at the time the trailing edge of the sheet being fed passes the booster rollers 59, 59*a*, for these rollers then come into contact with the surface of the subsequent sheet and their rotation tends to urge the latter towards the abutment 19. The pressure of the stack of sheets S against the surface of the booster rollers 59, 59*a* is sufficient to provide a frictional urging contact therewith but not enough to cause an actual feeding or buckling of the sheet when movement is prevented at the abutment 19.

It has been found in experimenting with booster mechanisms that there is a tendency, greater or less depending upon the uniformity of the sheets and other factors, for the subsequent or boosted sheet sometimes to be caught up by the primary feed roller 17 and the sheet presently being fed, whereby two sheets are fed at once, which of course is undesirable. The reduction or elimination of this tendency has been one important object of the present invention, and the same has been achieved to a marked degree by the arrangement about to be described.

Under normal conditions it has been determined that if booster rollers 59, 59*a* move at a surface speed substantially equal to or slightly less than that of the primary feed roller 17, the booster action or frictional urging force applied to the subsequent sheet will have the most suitable value to insure feeding engagement at the proper time with a minimum of chance for a premature or double feed. However, the conditions do not stay constant throughout all feeding cycles, and an abnormal condition appears to occur momentarily while the secondary feed 23, 25 is withdrawing the fed sheet rapidly from the control of the primary feed, or from the combined control of the primary feed and the booster mechanism, depending upon the length of the sheets being handled. Under these circumstances (and the condition seems to be especially aggravated when the sheets S are long enough to reach from the secondary feed 23, 25 to beyond booster rollers 59, 59*a*) there seems to be a supernormal pull on the subsequent sheet, due to the high speed of the sheet being withdrawn, to which the addition of the booster effect has proved inadvisable. In order to abate the booster action temporarily under these conditions, the delay in incidence of booster activity brought about by the novel clutch structure of Figs. 6 to 8 was devised. By reason of the delay in reengagement of the booster clutch as previously described, the trailing edge of the sheet S being fed is permitted to pass far enough beyond the booster rollers 59, 59*a* to permit the temporary supernormal drag on the subsequent sheet to dissipate itself before the booster rollers resume their boosting action, and, as a result, the control of the feed is found to assume a degree of regularity and accuracy not heretofore achieved, for a sheet is always kept in readiness for feeding by the action of the booster, thus avoiding skips, while the action of the booster is modified in such a way that the danger of feeding doubles is removed.

Although the provision of a one-way clutch for allowing the primary feed roller to overrun its drive whenever the main or secondary feed 23, 25 takes control is a conventional expedient, the present invention provides a novel organization in which this overrunning drive takes on an added significance. Since the booster mechanism operates at speeds closely related to that of the primary feed, and since the best booster action can be obtained by a close physical association between the booster rollers and the primary feed roller, it is convenient and economical to drive the booster mechanism by a mechanical connection with the primary feed roller. If this drive provided a continuous connection, however, there would be times when an improper operation might result and double feeds occur. This condition could arise, for example, when the main or secondary feed takes control to withdraw a fed sheet from the primary feed or separator roller 17. The roller 17 is speeded up under these circumstances and would, of course, correspondingly speed up the connected booster mechanism to increase the booster on the subsequent sheet at a time when the sheet being fed was still engaging the roller 17, thus seriously increasing the hazard of feeding two sheets at one time. By arranging the one-way clutch 45, 57, 51 between the roller 17 and its drive 49, 63, 61 to the booster rollers 59, 59*a* however, this communication of the speed-up to the booster mechanism is avoided and the booster rollers 59, 59*a* are driven at their normal speed regardless of the speed of the roller 17.

From the foregoing description it can be seen that the present invention provides a separating and feeding mechanism which is capable of coping with the various conditions which arise during the feeding of workpieces of different sizes and characteristics, and which can be made to feed individual workpieces consistently and ac-

curately with no chance for feed omissions or for double feeds.

Having described the invention, what is claimed is:

1. In a separating and forwarding mechanism for sheet-form workpieces, a feed roll; means to drive the feed roll; separating abutment means opposite said feed roll for cooperating therewith to restrict the feeding to single workpieces between the feed roll and abutment means from a supply stack of workpieces; a frictional booster roller positioned relative to the feed roll to engage the supply stack of said workpieces at a location to contact the surface of the foremost workpiece at the beginning of its feed and the surface of the subsequent workpiece while the foremost workpiece is being fed out; means for driving said booster roller from said feed roll; a one way clutch including a delayed drive control connecting the booster roller with said latter means and means for adjusting the position of said boster roller towards and away from the face of the supply stack without affecting its drive from the feed roll in order to provide proper frictional contact with the workpieces being fed.

2. In a separating and forwarding mechanism for sheet-form workpieces, a feed roll; means to drive the feed roll; separating abutment means opposite said feed roll for cooperating therewith to restrict the feeding to single workpieces between the feed roll and abutment means from a supply stack of workpieces; a frictional booster roller positioned relative to the feed roll to engage the supply stack of said workpieces at a location to contact the surface of the foremost workpiece at the beginning of its feed and the surface of the subsequent workpiece while the foremost workpiece is being fed out; means for driving said booster roller from said feed roll; a one way clutch including a delayed drive control connecting the booster roller with said latter means and means for adjusting the position of said booster roller towards and away from the face of the supply stack without affecting its drive from the feed roll in order to provide proper frictional contact with the workpieces being fed, said means comprising a spring urging the booster roller away from the face of the supply stack, and threaded means for adjusting the roller towards the face of the supply stack in opposition to the spring.

3. In a separating and forwarding mechanism for sheet-form workpieces, a feed roll; means to drive the feed roll; separating abutment means opposite said feed roll for cooperating therewith to restrict the feeding to single workpieces between the feed roll and abutment means from a supply stack of workpieces; an arm mounted at one end to swing about the axis of said feed roll; and a frictional booster roller rotatably carried by the other end of said arm adjacent said feed roll and driven from said feed roll, said booster roller engaging the face of the supply stack of workpieces.

4. In a separating and forwarding mechanism for sheet-form workpieces, a feed roll; means to drive the feed roll; separating abutment means opposite said feed roll for cooperating therewith to restrict the feeding to single workpieces between the feed roll and abutment means from a supply stack of workpieces; an arm mounted at one end to swing about the axis of said feed roll; a frictional booster roller rotatably carried by the other end of said arm adjacent said feed roll and driven from said feed roll, said booster roller engaging the face of the supply stack of workpieces; and means to adjustably fix the angular position of said arm about the feed roll axis to accommodate workpieces of different stacking characteristics.

5. In a separating and forwarding mechanism for sheet-form workpieces, a primary feed roll; means to drive the feed roll; separating abutment means opposite said feed roll for cooperating therewith to restrict the feeding to single workpieces between the feed roll and abutment means from a supply stack of workpieces; a frictional booster roller engaging the surface of the foremost workpiece; high speed secondary feed means following said primary feed roll to take the workpieces away from the primary feed roll as they are advanced one by one; and means for driving the booster roller from said primary feed roll to urge each subsequent workpiece toward the primary feed roll, said booster roller including a one-way clutch with delayed drive control permitting the booster roller to be rotated at high speed by contact with a workpiece being advanced by the secondary feed means without thereby increasing the speed of said booster roller and preventing the feed of a subsequent workpiece momentarily upon contact by the booster roller with the surface of said subsequent workpiece.

6. In a separating and forwarding mechanism for sheet-form workpieces, a primary feed roll; means to drive the feed roll; separating abutment means opposite said feed roll for cooperating therewith to restrict the feeding to single workpieces between the feed roll and abutment means from a supply stack of workpieces; a frictional booster roller engaging the surface of the foremost workpiece; high speed secondary feed means following said primary feed roll to take the workpieces away from the primary feed roll as they are advanced one by one; and means for driving the booster roller from said primary feed roll to urge the next workpiece toward the primary feed roll, said booster drive means including a one-way clutch permitting the primary feed roll to be rotated at high speed by contact with a workpiece being advanced by the secondary feed means without thereby increasing the speed of said booster roller, said booster drive means also including another one-way clutch with delayed drive control permitting the booster roller to be rotated at increased speed by contact with a workpiece being advanced by the secondary feed means and preventing the feed of a subsequent workpiece momentarily upon contact by the booster roller with the surface of said subsequent workpiece.

7. In a separating and forwarding mechanism for sheet-form workpieces, a primary feed roll; means to drive the feed roll; separating abutment means opposite said feed roll for cooperating therewith to restrict the feeding to single workpieces between the feed roll and abutment means from a supply stack of workpieces; a frictional booster roller engaging the surface of the foremost workpiece; high speed secondary feed means following said primary feed roll to take the workpieces away from the primary feed roll as they are advanced one by one; and means for driving said booster roller from said primary feed roll including a one-way clutch associated with said booster roller and permitting the same to overrun its drive when rotated by a workpiece being advanced by the secondary feed means, said one-way clutch including means for causing a momentary delay in re-engagement of the clutch after a workpiece being advanced at high speed by the secondary feed means has passed from contact with the booster roller in order to prevent excessive boosting action on the subsequent workpiece.

8. In a separating and forwarding mechanism for sheet-form workpieces, a primary feed roll; means to drive the feed roll; separating abutment means opposite said feed roll for cooperating therewith to restrict the feeding to single workpieces between the feed roll and abutment means from a supply stack of workpieces; a frictional booster roller engaging the surface of the foremost workpiece, high speed secondary feed means following said primary feed roll to take the workpieces away from the primary feed roll as they are advanced one by one; and means for driving said booster roller from said primary feed roll including a one-way coiled spring clutch associated with said booster roller and permitting the same to overrun its drive when rotated by a workpiece being advanced by the secondary feed means, said clutch comprising coaxial driving and driven hubs and a coiled spring having side-by-side convolutions surrounding said hubs, said driv-

ing hub being smaller that the normal relaxed inner diameter of adjacent portions of the spring, means to drivingly connect one end of said spring to said driving hub, said driven hub having at least a portion which has a diameter large enough to frictionally engage the interior of the spring adjacent its other end.

9. In a separating and forwarding mechanism for sheet-form workpieces, a primary feed roller; separating abutment means opposite said feed roller for cooperating therewith to restrict the feeding to single workpieces between the feed roll and abutment means from a supply stack of workpieces; a frictional booster roller engaging the surface of the foremost workpiece; drive means including a shaft for driving said primary feed roller and booster roller at workpiece starting speeds; and high speed secondary feed means following said primary feed roller to take the workpieces away from the primary feed roller as they are advanced one by one, said drive means including two one-way clutches, one between said shaft and said primary feed roller and the other between said shaft and said booster roller, and each arranged to drive its associated roller in a workpiece advancing direction and to permit overrunning of the shaft by the associated roller when the roller rotates more rapidly than its drive, said booster roller being arranged to frictionally engage the surface of the next workpiece to urge the same into feeding position for feeding when the trailing edge of the workpiece being fed has advanced to or beyond the primary feed roller, said one-way clutches permitting said booster roller and primary feed roller to follow at high speed a workpiece with which they are in contact when the workpiece has reached and is being fed by the secondary feed means, the one-way clutch associated with the booster roller also causing the booster roller to be driven at workpiece starting speed to urge the subsequent workpiece into feeding position while a fed workpiece, which has cleared the booster roller and which is in contact with the secondary feed means is still rotating the primary feed roller at high speed, the one-way clutch associated with said primary feed roller permitting the same to be rotated by a workpiece moving at high speed without affecting its drive or the workpiece starting speed drive of the booster roller when the latter is in urging contact with the next workpiece, and causing the primary feed roller to be driven at starting speed to begin advancing the next workpiece when the workpiece advancing at high speed has been taken away.

10. In a separating and forwarding mechanism for sheet-form workpieces, a primary feed roller; separating abutment means opposite said feed roller for cooperating therewith to restrict the feeding to single workpieces between the feed roll and abutment means from a supply stack of workpieces; a frictional booster roller engaging the surface of the foremost workpiece; drive means including a shaft for driving said primary feed roller and booster roller at workpiece starting speeds; high speed secondary feed means following said primary feed roller to take the workpieces away from the primary feed roller as they are advanced one by one, said drive means including two one-way clutches, one between said shaft and said primary feed roller and the other between said shaft and said booster roller, and each arranged to drive its associated roller in a workpiece advancing direction and to permit overrunning of the shaft by the associated roller when the roller rotates more rapidly than its drive, said booster roller being arranged to frictionally engage the surface of the next workpiece to urge the same into feeding position for feeding when the trailing edge of the workpiece being fed has advanced to or beyond the primary feed roller, said one-way clutches permitting said booster roller and primary feeder roller to follow at high speed a workpiece with which they are in contact when the workpiece has reached and is being fed by the secondary feed means, the one-way clutch associated with the booster roller also causing the booster roller to be driven at workpiece starting speed to urge the subsequent workpiece into feeding position while a fed workpiece, which has cleared the booster roller and which is in contact with the secondary feed means is still rotating the primary feed roller at high speed, the one-way clutch associated with said primary feed roller permitting the same to be rotated by a workpiece moving at high speed without affecting its drive or the workpiece starting speed drive of the booster roller when the latter is in urging contact with the next workpiece, and causing the primary feed roller to be driven at starting speed to begin advancing the next workpiece when the workpiece advancing at high speed has been taken away; and means connected with the one-way clutch associated with said booster roller for delaying reengagement of said booster roller clutch momentarily after the booster roller has been cleared by a workpiece rotating it at high speed to avoid excessive urging of the next workpiece and the chance of feeding the same before the workpiece advancing at high speed has cleared the primary feed roller.

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