Sept. 15, 1931. J. T. WRIGHT 1,823,182

SHEET FEEDING MACHINE

Filed April 17, 1929 3 Sheets-Sheet 1

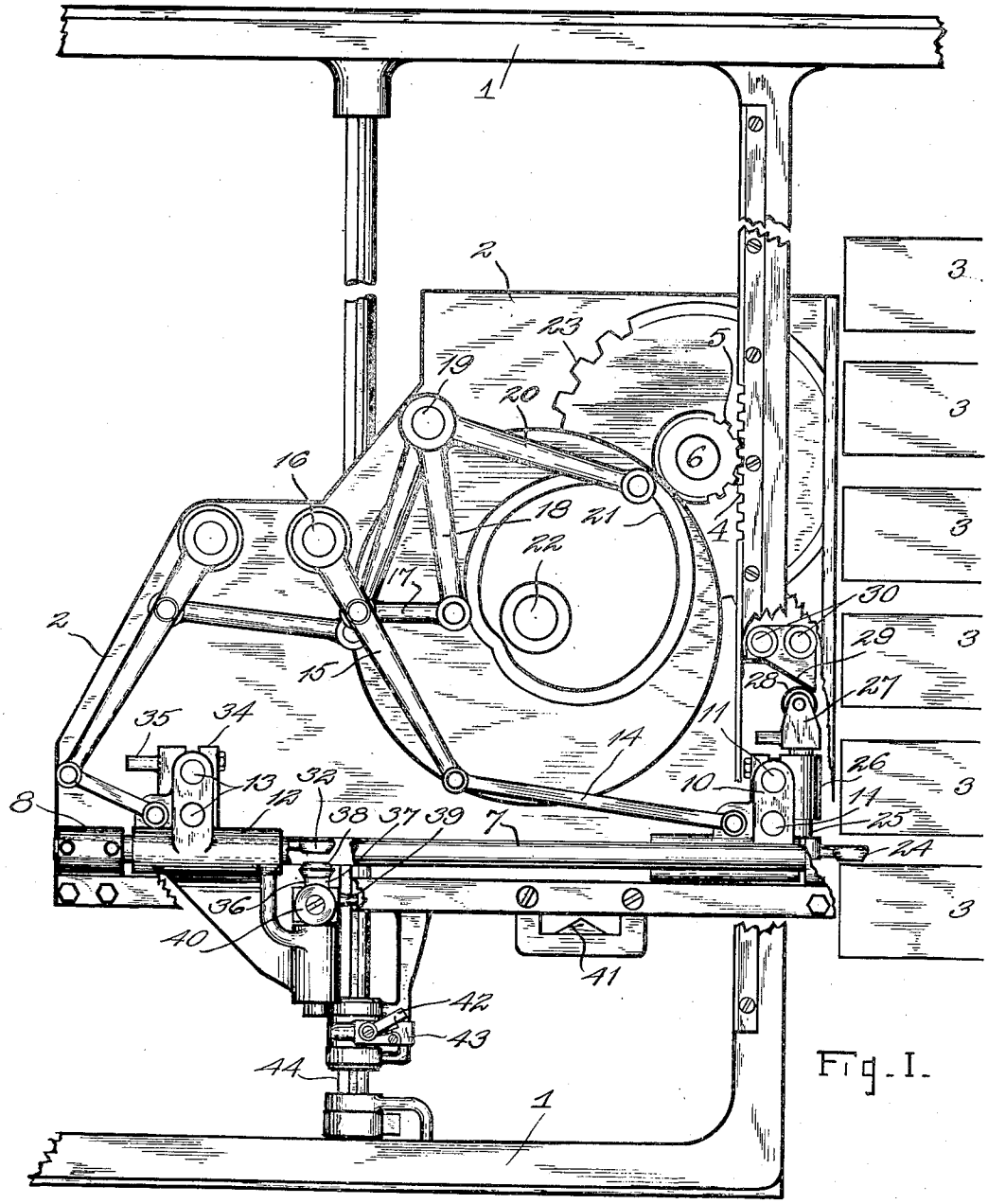


Fig. I.

Inventor

Joseph T. Wright

By Wood & Wood

Attorneys

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SHEET FEEDING MACHINE

Filed April 17, 1929 3 Sheets-Sheet 2

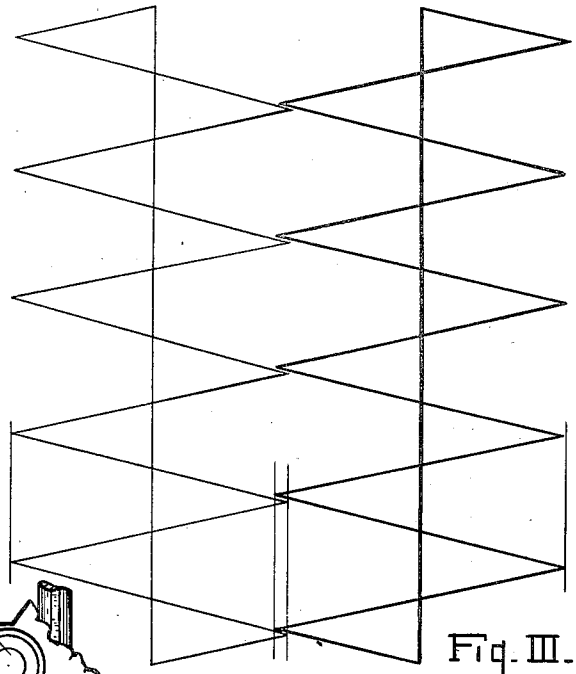


Fig. III.

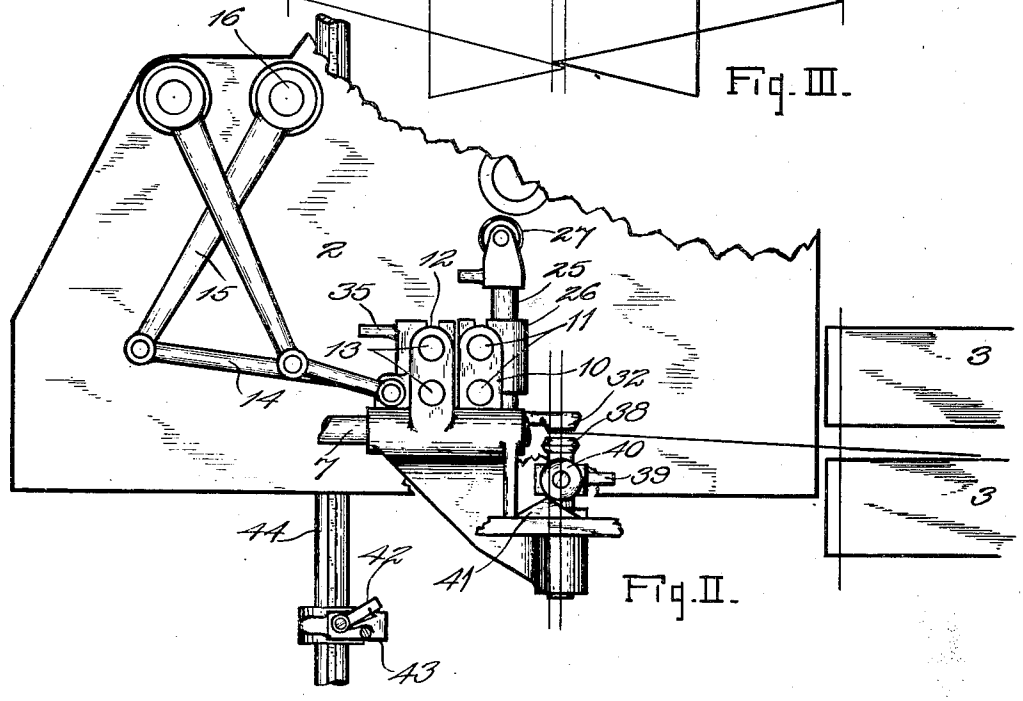


Fig. II.

Inventor

Joseph T. Wright

By Wood & Wood

Attorneys

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SHEET FEEDING MACHINE

Filed April 17, 1929 3 Sheets-Sheet 3

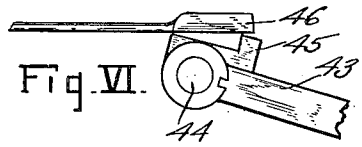


Fig. VI.

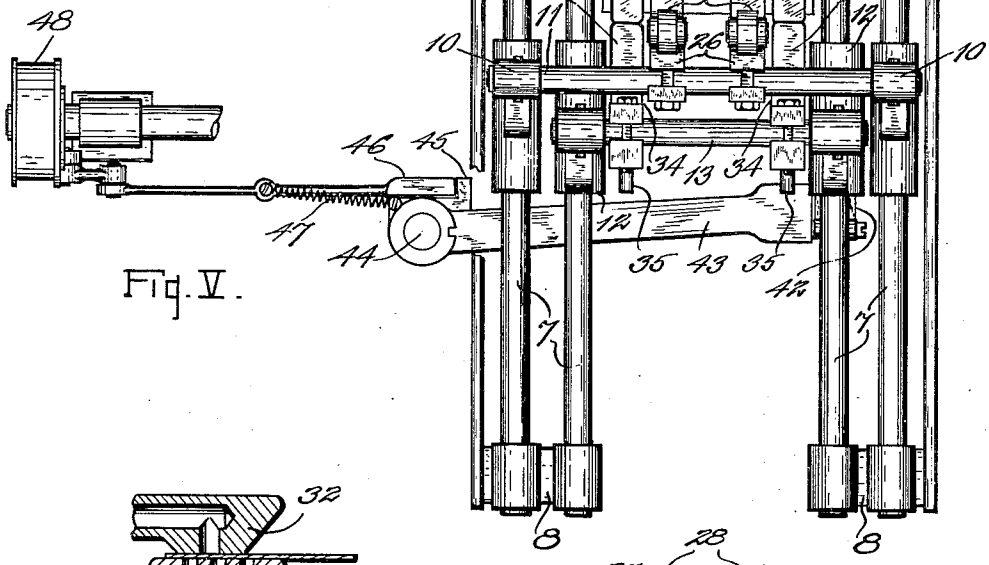


Fig. V.

Fig. VII.

Fig. IV.

Inventor

Joseph T. Wright

By Wood & Wood

Attorneys

Patented Sept. 15, 1931

1,823,182

UNITED STATES PATENT OFFICE

JOSEPH T. WRIGHT, OF CINCINNATI, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE HARRIS-SEYBOLD-POTTER COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF DELAWARE

SHEET FEEDING MACHINE

Application filed April 17, 1929. Serial No. 355,927.

This invention relates to a sheet delivery or feeding device, the sheets taken successively from a stack or consecutively from a plurality of stacks, and particularly to the sheet detector mechanism for the automatic power or feeding control of the machine in the event of sheet feeding failure or the withdrawal of more than one sheet at a time from the pile or stack.

The present invention is susceptible for use in conjunction with various kinds of machines, as printing or collating, operating upon sheets of paper successively fed therein, the sheets primarily mechanically taken or withdrawn consecutively from a supply pile or stack, or in collating, from several stacks.

The detector mechanism operates in motions of reciprocation and constitutes sheet feeding members movable simultaneously in opposite directions, whereby the members pass into juxtaposition at an intermediate point or station in the feeding traverse of the sheet and at which point or station the sheet is transferred from one feeding member to the other, with the transmission control being effective practically at the meeting point or station of the feeding members.

The feeding members are designated as primary and secondary, the primary representing a suction finger or gripper adapted for engaging upon or over the uppermost sheet of the stack or pile and to attractively contact therewith to withdraw and advance the uppermost sheet in a forward feeding stroke of the suction finger and to a distance to bring the advancing sheet to and between a secondary feeding member, comprising a pair of opposing suction fingers or grippers for engaging the opposite sides of the sheet, the secondary feeding members continuing the advance of the sheet when released or relieved by the primary.

The secondary feeding members are capable of moving relatively in a direction transverse to the feeding motion, adapting one thereof, in the event of sheet feeding failure of the primary member, to move independently of its feeding motion for tripping or actuating transmission controlling mechanism cutting off the power, stopping the machine, and similarly function in the event of the transfer of a plurality of sheets, breaking the cooperative relation between the two secondary feeding members for transmission control.

The primary feeding member is arranged to reach over or upon the power while the secondary feeding members are in a superposed relation and opposed to one another for cooperation upon the sheet at opposite sides thereof, permitting one of the members to be moved laterally or transversely to the plane of the sheet or feeding direction of the members immediately upon leaving the transferring station or primary and secondary members, and serving as a trip while moving in its feeding stroke by cutting off or stopping the transmission or power. With the interposition of a single sheet between the opposing secondary suction members, both cooperate to grip the sheet and are held in their cooperative position under the suction influence for the full feeding stroke of the companion members as a unit.

In the event of sheet feeding failure by the primary member, no cooperating influence of the secondary members is or can be established, resulting in an independent motion of one of the secondary members immediately upon leaving the starting or transfer station for machine transmission control. Likewise, with the interposition of two or more sheets, the secondary feeding members become ineffective for conjoint or cooperative action, whereupon the secondary members immediately upon leaving the starting or transfer station recede from one another for effecting the transmission control.

It is, therefore, an object of the invention to provide efficient and reliable sheet feeding mechanism for taking sheets successively and consecutively from a stack or pile of sheets, and in which the feeding grip upon the sheet controls the operation of the feeding mechanism.

Another object of the invention is to provide a pair of relatively opposing and cooperating sheet gripping devices for gripping and advancing therewith a sheet interposed

therebetween, with failure of sheet interposition or the interposition of several adhering sheets effecting the cooperation of the gripping devices for administering transmission control and arresting feeding advance.

Another object of the invention is to provide sheet feeding devices in which a single fed sheet controls the feeding grip of cooperating grippers through the interposition therebetween, and whereby failure of sheet interposition or the interposition of several adhering sheets automatically cuts out the feeding transmission.

Another object of the invention is to provide sheet feeding and sheet feed detector mechanism capable of rapid operation for increased capacity and for organization in either printing, sheet collating, or other machines, operating upon sheets, the sheets taken either from the single supply stack or pile or successively from the plurality of stacks or piles, the sheet feed detector mechanism effective for feeding a single sheet at a time and inoperative for sheet advance in the event of sheet feed failure or the pick-up of several adhering sheets.

Other features and advantages of the invention will be more fully set forth in the description of the accompanying drawings, in which:

Figure 1 is a side elevation of a portion of a collating machine with the improved sheet feeding and sheet feed detector mechanism incorporated therewith, the sheet feeding mechanism adapted for opening upon a plurality of stacks or piles of paper in relative superposed relation.

Figure 2 is a view of the sheet feeding and sheet feed detector mechanism in an intermediate position for transferring the sheet from one sheet feeding gripper to a second brought into juxtaposition.

Figure 3 is a diagrammatic view showing the feeding paths of several sheets taken from a plurality of piles.

Figure 4 is an end view of the sheet feeding mechanism shown in Figure 1.

Figure 5 is a top plan view thereof.

Figure 6 is a detailed view of the tripping mechanism for throwing out the clutch of the main driving pulley of the machine.

Figure 7 is a detail sectional view of the cooperating secondary suction gripper or grippers receiving the sheet in transfer, shown as disposed upon relatively opposite sides of the sheet and in suction grip therewith.

The sheet feeding detector mechanism in the machine organization as shown herein is embraced in a sheet collating machine wherein the sheet feeding and detector mechanism after each sheet feeding cycle for withdrawing and delivering a sheet from one stack of sheets is elevated to a second stack in a superposed relation for taking a sheet therefrom or next stack in order, adapting the sheets from the several stacks to be consecutively withdrawn, compiled and restacked. In the drawings, Figure 1, six stacks of paper are shown in a superposed relation or tier.

The collating characteristics and details of construction of the elevating mechanism for moving the feeding mechanism in step degrees or otherwise to the various elevations of the plurality of stacks does not form a part of the present invention. Therefore, detail description thereof will be herein omitted. Likewise, a plurality of sets of detector and subsidiary feeding mechanism may be employed for increased capacity, and in the arrangement, the sheet feeding mechanism as suction fingers is arranged to engage the sheets at a plurality of points across its width for a more uniform feed or traverse of the sheet, to which no description as to detail is made, and is principally disclosed to show the comprehensiveness of sheet feeding systems with which the detector mechanism can be employed.

Referring to the drawings, 1 indicates the frame structure of a collating machine having vertical supports or posts for slidably supporting a carriage 2 carrying the sheet feeding and sheet feed detector mechanisms.

The carriage is elevated in either predetermined step degrees or rates of feed to bring the feeding mechanism into operative relation with the topmost sheet of a stack, or consecutively with the topmost sheet of a plurality of stacks 3 suitably sustained in a superposed relation, as in a rack located at one end of the collating machine, a sheet being taken from each stack in a consecutive order or from a single stack, irrespective of the height of the stack or variations in the height of stack or stacks.

The stacks and the feed of the sheets generally are in a horizontal plane, with the sheet supply taken from one end of the machine and delivered to an opposite end. The elevating feed or traverse of the carriage is thus commensurate to the height of a single pile or stack and variation thereof as the sheets are removed, and to the relative elevation of a plurality of stacks and their capacity heights.

The elevating mechanism for the carriage and sheet feeding mechanism being distinct from the present invention, only general detailed reference thereto is herein made, merely to include elevating capacity, and in so far as illustrated the elevating means comprises a vertical rack 4 fixed to one of the frame posts; a gear 5 in mesh with the rack 4 and fixed upon a shaft 6 suitably journalled in bearings mounted or carried by the carriage. The shaft 6 is in connection with suitable transmission mechanism (not shown) for rotating the shaft and rack gear for the appropriate rate and degree of car-

riage elevating feed necessary to bring the feeding mechanism at an elevation or cooperation with the topmost sheet of the stack.

A plurality of sets of feeding devices are illustrated, approximately of duplicate construction, each set characteristically having feeding members movable simultaneously in opposite directions whereby the members pass into juxtaposition at an intermediate point or station in the feeding movement of the sheet for transferring the sheet from one feeding member to the other. This alternate action of the feeding members of a set materially reduces their feeding stroke length for the given feeding traverse of the sheet, facilitates in the handling of the sheets, and rates of feed relative to the feeding stroke of the feeding member.

The sheet feeding and sheet feed detector mechanism in the present instance are organized into two sets, the duplicate of one another, each set operating simultaneously upon a sheet either intermediate of the width of the sheet or at opposite ends for uniformly feeding the sheet. The detailed description, however, need only be made in the singular, excepting in so far as the elements are combined and move as a unit.

Parallel horizontal guide rods 7 arranged in pairs at relatively opposite sides of the carriage are horizontally mounted upon the carriage. Each pair at its opposite ends is supported upon brackets 8—8 fixed to the carriage. Each rod has a carrier sleeve thereon, the carriers upon respective rods connected in pairs by cross rods. The carriers 10—10 slide upon the outer guide rods 7 and are connected as a unit by a pair of superposed cross rods 11—11, the carriers serving for the foremost or primary paper sheet gripping and feeding members, and the carriers 12—12 slide upon the inner guide rods and are connected as a unit by a pair of superposed cross rods 13—13 serving to support the rear or secondary sheet feeding and sheet feed detector members which in transfer receive the sheet from the primary sheet feeding members at a point or station wherein the primary and secondary feeding members come into juxtaposition, normally being at the end of the feeding or forward stroke of the primary and at the end of the return stroke of the secondary.

The carriers 10—10 as a unit and 12—12 as a unit are actuated by cam and lever devices of duplicate construction, and for the carriers 10—10 comprise a link 14, one end pivotally connected to one of the carriers 10, and its opposite end to a lever 15. The lever 15 is pivotally mounted upon a carriage as at 16 and connects with a link 17, the link 17 being pivotally connected to the end of one arm of a bell crank lever 18, the bell crank lever being suitably pivoted as at 19 upon the carriage. A second arm 20 of the lever 18 engages with a heart-shaped cam 21 fixed upon a shaft 22 journalled in the carriage, the shaft being in gear connection with a gear 23 fixed upon the shaft 6. The actuating mechanism for the carriers 12—12 is likewise actuated through actuating mechanism and a heart-shaped cam (not shown), excepting that the relative arrangement of the actuating mechanism is such as to operate the carrier units in relative opposite motions of reciprocation for each revolution of the shaft or cams for the purpose of moving the feed members into juxtaposition for sheet transfer.

The primary feeding devices mounted upon the carrier 10—10 as a unit or the cross rods thereof comprise a suction finger 24 extending from the lower end of a vertically movable tubular plunger 25 slidably mounted within a bracket 26 bolted to the cross rods 11—11. The head end 27 of the plunger 25 is forked for journalling a roller 28 engaging with a stationary cam 29 fixed to a pair of cross rods 30 mounted upon the carriage.

The cam 29 is positioned at the end of the retreat stroke of the primary feeding member to depress the feeding or suction finger upon the stack of sheets from which the uppermost sheet is to be withdrawn. The suction finger when depressed upon the uppermost sheet of the stack grips the sheet so as to carry the same therewith in its forward or feed stroke to transfer the same to the secondary feeding members.

The suction finger at its lower side is cupped to provide a suction chamber in conduit connection with the bore of the tubular plunger and in communication with the hose (not shown) connecting a nipple 31 projecting transversely from the head end of the plunger.

The suction principle for picking up or gripping the sheets of paper is well-known in the art, and any suitable method may be employed for making the suction connections with the various suction grippers herein employed, and to control the suction the timed moments or periods for gripping and releasing the paper may be variously embodied, and as the same does not form a part of the present invention detailed disclosure and the description thereof is not included herewith, it being understood that when the suction cup or gripper 24 is in contact with the uppermost sheet of the stack the suction will be applied and continues until the gripper has moved to the end of its feeding stroke or at any point therebetween at which it may be desired to release the sheet.

This likewise applies to the secondary or transfer grippers, taking the sheet from the primary to continue its advance from the pile to an objective point.

The secondary sheet feeding and sheet feed detector grippers are mounted to move with

the carriers 12 and constitute a suction gripper finger 32 having an inverted cup terminal 33 extending horizontally and rigidly fixed to a support 34 clamped to the cross rods 13—13 joining the carriers 12—12, the finger and its support having a passage therethrough from the cup or gripper 33 to a nipple extension 35 extending laterally from the support 34 for making the necessary suction connections.

One of the carriers 12 is provided with a depending arm 36 as a support for a vertically movable plunger suction gripper 37 having a cupped head 38 in alignment and registry with the suction cup or finger 32 to cooperate therewith and grip the underside of the sheet interposed between said upper and lower grippers, the interposed sheet serving to maintain the suction and thus sustain the lower gripper in its elevated position for the feeding or advancing stroke of the secondary grippers.

Failure to transfer a sheet from the primary to the secondary allows the lower suction gripper to drop immediately after starting in its forward or feeding stroke for controlling the power of the machine to stop the machine. This also results if two sheets are transferred as there is no suction influence from the upper suction gripper on the lower of the two or more sheets transferred, causing the lower gripper to drop, and when moved in its lowermost or descent position serves as a trip.

The plunger 37 is of hollow or conduit formation and provided with a nipple 39 extending laterally therefrom for making the suction connections. The plunger 37 is also provided with a roller 40 adapted to engage with a stationary cam 41 depending from the elevator carriage at the end of the forward stroke of the secondary feeding grippers for positively elevating the plunger to bring its suction gripper into contact with the lower side of the transferred sheet and into cooperation with the upper suction gripper 33.

The suction chambers of the cups are so arranged that the suction is broken if no sheet is interposed therebetween, so that the upper will not hold the lower thereto in the event of sheet transfer failure.

Allowing the suction gripper plunger 37 to drop, brings the lower end of the plunger in a position or path to intercept and engage a spring actuated trip pawl 42 pivoted upon the end of a lever 43, the lever 43 horizontally disposed beneath the carriage, moving therewith and splined to a vertical rock shaft 44.

The lever 43 and its pawl being mounted upon the carriage move therewith to accommodate for the carriage adjustments governed by the variations in stack height or elevations of several superposed stacks, so that the trip lever is always in position to be engaged by the plunger irrespective of the vertical traverse of the carriage.

When the plunger 37 engages the trip paw 42 it will swing the lever 43 therewith, rocking the shaft 44, which in turn actuates a dog 45 fixed to the rock shaft 44, disconnecting a spring pawl rod 46 therefrom or breaking the latch or locking connection between the members 45 and 46, allowing the rod 46 to be moved under the pressure of the spring 47 in an appropriate direction for actuating a clutch of the main driving pulley 48, cutting out the power to bring the feeding mechanism to immediate rest.

The power or clutch controlling mechanism may be of any conventional structure most suitably adapted for the particular type of clutch or transmission control employed and capable of being tripped or actuated by the suction gripper plunger 37 within its descent or non-sheet conveying position.

In Figure 3, a diagrammatic chart is illustrated showing the travel of the carriage for collecting and feeding the sheets from a plurality of superposed stacks and the reciprocating strokes made by the primary and secondary grippers for consecutively conveying the sheets, the primary and secondary grippers coming into juxtaposition at an intermediate point in the feeding movement of the sheets for sheet transfer from one gripper, or sets of grippers, to another, and maintaining the gripper control.

The carriage travel may be continuous from one stack height to a second so as to position the primary suction gripper over the uppermost sheet of a stack next in order for sheet removal therefrom to increase the feeding capacity. The carriage, however, may be otherwise operated, as in stepped degrees, remaining idle during the feeding or transfer of a sheet or either one or both of the sets of grippers, primary and secondary.

The primary suction gripper need not necessarily move approximately the same distance as the secondary, although in the capacity shown and described increasing rates of feed are possible under an extended length of feed traversed by the two sets of feeding grippers. The primary may only be used to withdraw the uppermost sheet from the stack sufficiently for transfer to the secondary suction grippers, so as to operate upon opposite sides of a single sheet or a plurality of sheets adhering together for transmission control in the event of sheet feeding failure or transferring more than one sheet at a time.

Likewise, the primary and secondary sheet feeding members need not be moved simultaneously in opposite directions but merely moved relatively, so that the two are in cooperative position at the transfer point, adapting the sheet to be released from one while taken up by the second for continuous movement of the sheet, and their lengths of

stroke may be differential instead of approximately equal as herein illustrated.

In Figure 7, the upper suction gripper 32 is shown as in cooperation with the sheet and lower suction gripper 38. The suction chambers or passages are relatively arranged so that if the sheet is not interposed it is impossible for the two grippers to adhere together, the passages in the lower suction gripper being open to the atmosphere and in connection with the central passage of the upper gripper so as to open it also to the atmosphere, breaking the suction, allowing the lower suction gripper to descend or drop.

In an operation of the feeding mechanism, the primary suction gripper initially engages with the uppermost sheet of a stack, and when thus contacted or engaged the suction is cut in and the gripper moved to withdraw the sheet from the stack and present the same between the opposing pair of secondary suction grippers for continuing the feed of the sheet. In this capacity, the primary suction gripper may commence to move toward the stack for a subsequent feed immediately upon its release of the delivered sheet, while the secondary grippers are continuing the advance of the sheet, so that the relative timed movements of the reciprocating grippers may be variously modified to meet specific conditions.

In the transfer of the sheet from the primary to the secondary, the lower or suction gripper plunger at the transfer point is moved upwardly into contact with the sheet and against the upper secondary or transfer suction gripper, so that the sheet is gripped by the two grippers at opposite sides thereof, combining to hold the gripper plunger in an elevated position and continuously for the full feeding stroke of said secondary grippers, the plunger gripper being positively elevated by the stationary cam member.

In the event of sheet feeding or transfer failure or transferring two sheets at a time, the lower plunger gripper is incapable of maintaining its cooperation with the upper to either a break in the suction holding the two members together or allowing the lower gripper to descend with a second sheet, in which event the lower plunger is in position to actuate the transmission control, cutting out and stopping the machine, requiring a manual correction and restarting.

Having described my invention, I claim:

1. In a sheet feeding mechanism, the combination of a plurality of sheet feeding members movable simultaneously in opposite directions to withdraw a sheet from a stack and deliver the same to an objective point, the members movable in juxtaposition for sheet transfer from one to the other, one member gripping the sheet at one side for withdrawal of the topmost sheet of the stack, and the second in cooperation with and at opposite sides of the sheet for detecting sheet transfer failure or the transfer of several adhering sheets.

2. In a sheet feeding mechanism, opposing sheet suction grippers movable as a unit for receiving a sheet in transfer in its delivery from a source to an objective point, the grippers in cooperation when a sheet is interposed therebetween for continuing sheet delivery and detecting sheet transfer failure or the transfer of several adhering sheets.

3. In a sheet feeding mechanism, the combination of a plurality of sheet feeding suction grippers movable simultaneously in opposite directions to withdraw a sheet from a stack and deliver the same to an objective point, the grippers movable in juxtaposition for sheet transfer from one to the other, one gripper arranged to engage upon and withdraw the topmost sheet of the stack, and the second constituting opposing gripper members cooperating by the interposition of a sheet for continuing sheet delivery and detecting sheet transfer failure or the transfer of several adhering sheets.

4. In a sheet feeding mechanism, the combination of a plurality of sheet feeding suction grippers movable simultaneously in opposite directions to withdraw a sheet from a stack and deliver the same to an objective point, the grippers movable in juxtaposition for sheet transfer from one to the other, the gripper receiving the sheet in transfer constituting opposing suction gripper members cooperating by the interposition of a sheet and movable relatively transversely to direction of sheet delivery for detecting sheet transfer failure or the transfer of several adhering sheets.

5. In a sheet feeding mechanism, the combination of a plurality of sheet feeding suction grippers movable simultaneously in opposite directions to withdraw a sheet from a stack and deliver the same to an objective point, the grippers movable in juxtaposition for sheet transfer from one to the other, the gripper receiving the sheet in transfer constituting opposing suction gripper members cooperating by the interposition of a sheet and movable relatively transversely to direction of sheet delivery for detecting sheet transfer failure or the transfer of several adhering sheets, and means for positively bringing said members into cooperative position at the transfer station, whereby the same can be cooperatively sustained under suction only by the interposition of a sheet when leaving the transfer station.

6. In a sheet feeding mechanism, the combination of an elevating carriage, a plurality of sheet feeding members mounted on said carriage movable simultaneously in opposite directions to withdraw a sheet from either one of a plurality of stacks in superposed relation and deliver the sheet to an objective point,

the members movable in juxtaposition for sheet transfer from one to the other, one member gripping the sheet at one side for withdrawal of the topmost sheet of the stack, and the second in cooperation with and at opposite sides of the sheet for detecting sheet transfer failure or the transfer of several adhering sheets.

7. In a sheet feeding mechanism, the combination of an elevating carriage, a plurality of sheet feeding members mounted on said carriage movable simultaneously in opposite directions to withdraw a sheet from either one of a plurality of stacks in superposed relation and deliver the sheet to an objective point, the members movable in juxtaposition for sheet transfer from one to the other, one member gripping the sheet at one side for withdrawal of the topmost sheet of the stack, and the second in cooperation with and at opposite sides of the sheet for detecting sheet transfer failure or the transfer of several adhering sheets, power control in the sheet delivery motion of said second member, and transmission control devices adapted to be actuated by said second member.

8. In a sheet feeding mechanism, the combination of a plurality of sheet feeding suction grippers movable simultaneously in opposite directions to withdraw a sheet from a stack and deliver the same to an objective point, the grippers movable in juxtaposition for sheet transfer from one to the other, the gripper receiving the sheet in transfer constituting opposing suction gripper members cooperating by the interposition of a sheet and movable relatively transversely to direction of sheet delivery for detecting sheet transfer failure or the transfer of several adhering sheets, and to intercept transmission control devices for stopping gripper motion, and transmission control devices adapted to be actuated by one of said gripper members.

9. In a sheet feeding mechanism, opposing suction grippers movable as a unit for receiving a sheet in transfer in sheet delivery from a source to an objective point, the grippers cooperating through the interposition of a sheet for sheet grip and continued delivery thereof, said grippers upon leaving the sheet receiving point non-cooperating through non-interposition of a sheet, causing gripper separation relatively transverse to the direction of sheet delivery for intercepting transmission control devices for stopping.

10. In a sheet feeding mechanism, opposing suction grippers for simultaneously engaging upon relative opposite sides of a sheet interposed therebetween, and movable as a unit for conveying an engaged sheet, one of said grippers movable independently away from the opposing gripper upon the failure of sheet insertion between the grippers or the interposition of several adhering sheets for disrupting the sheet conveying motion of said grippers.

11. In a sheet feeding mechanism, a suction gripper for engaging one side of a sheet and reciprocable for conveying the sheet when engaged therewith, a second suction gripper, for cooperation with said first gripper and be sustained thereby when said grippers are cooperating upon the relative opposite sides of a single sheet interposed between the grippers, said second gripper movable from cooperation with said first gripper for sheet conveying control of said grippers upon failure of sheet insertion or the interposition of several adhering sheets.

12. In a device of the nature disclosed, oppositely disposed suction grippers for engaging upon relatively opposite sides of a sheet interposed therebetween, one of said grippers movable away from the other upon the failure of sheet insertion between the grippers or the interposition of several adhering sheets, the suction influence of the grippers upon an interposed sheet causing one of the grippers to sustain the other through the intermediary of a single sheet.

In witness whereof, I hereunto subscribe my name.

JOSEPH T. WRIGHT.