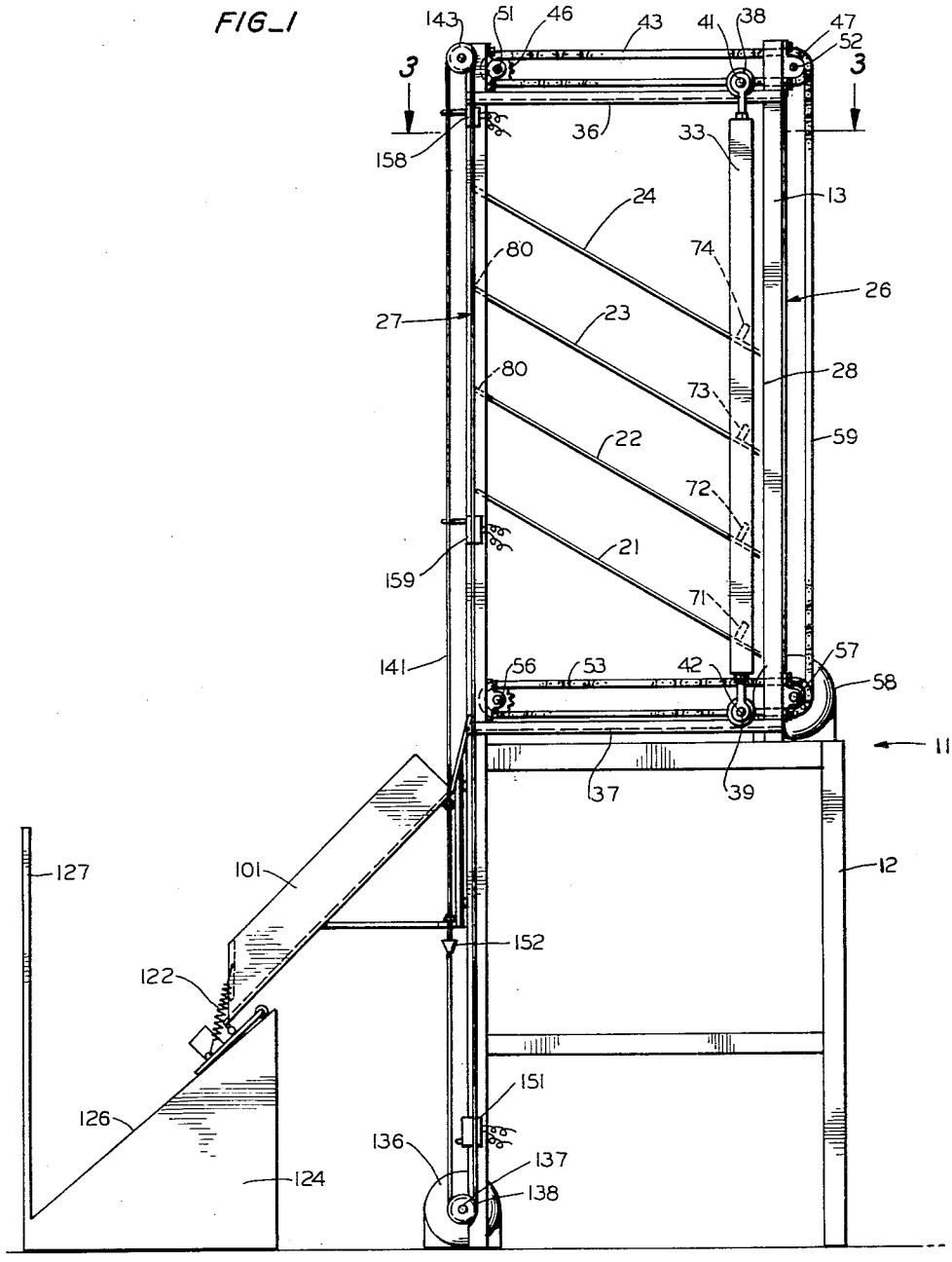
May 22, 1962 E. D. BASSETT 3,035,832

COLLATING MACHINE

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FIG_1



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COLLATING MACHINE

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FIG_2

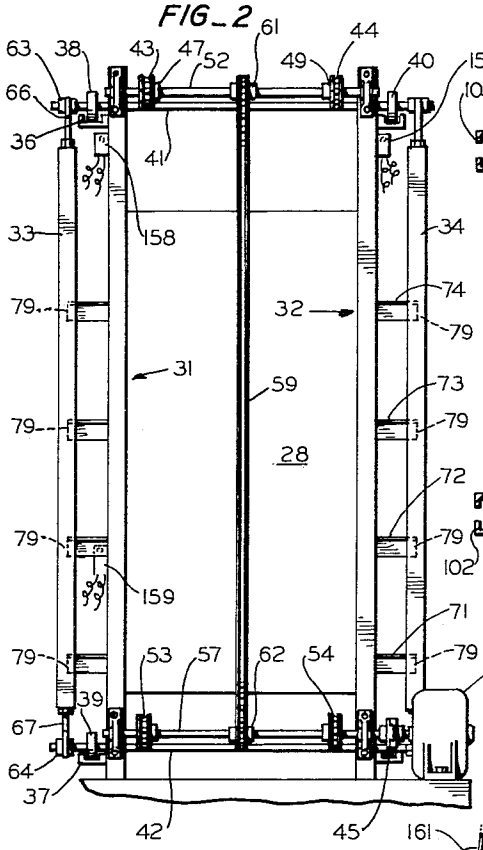


FIG_3

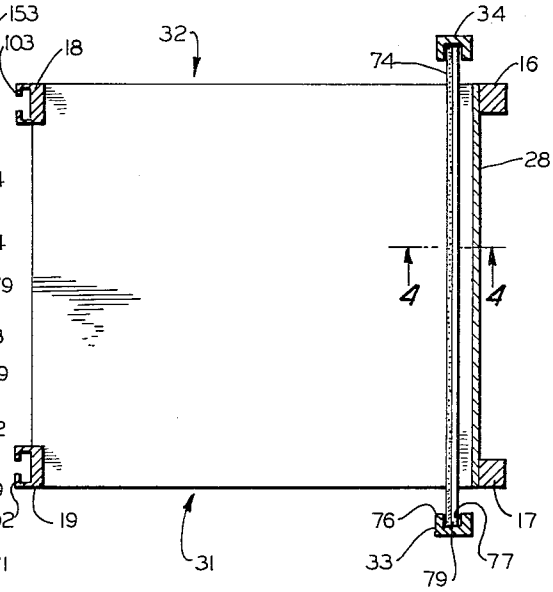


FIG_4

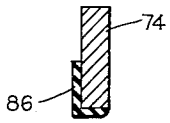


FIG_5

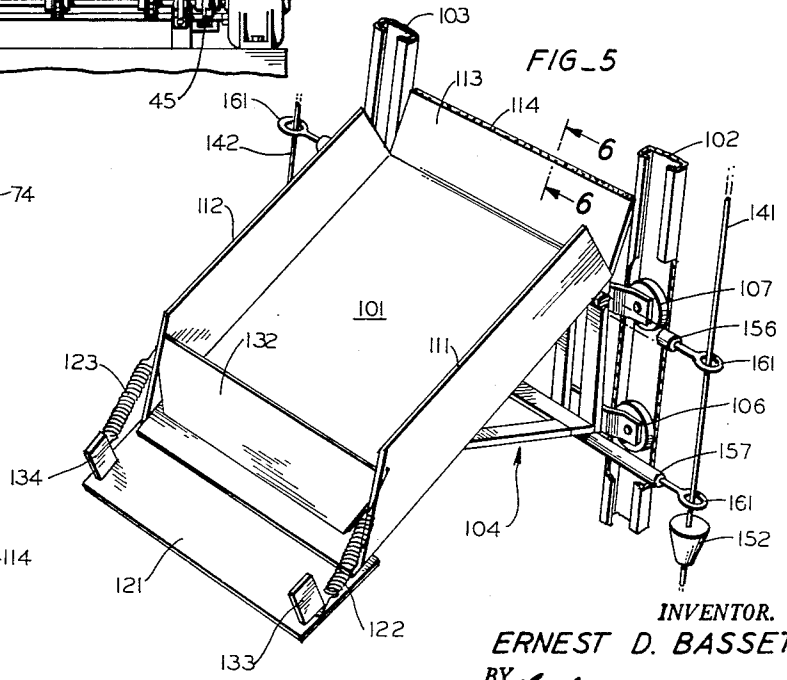
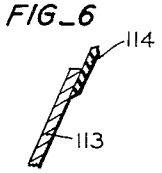


FIG_6



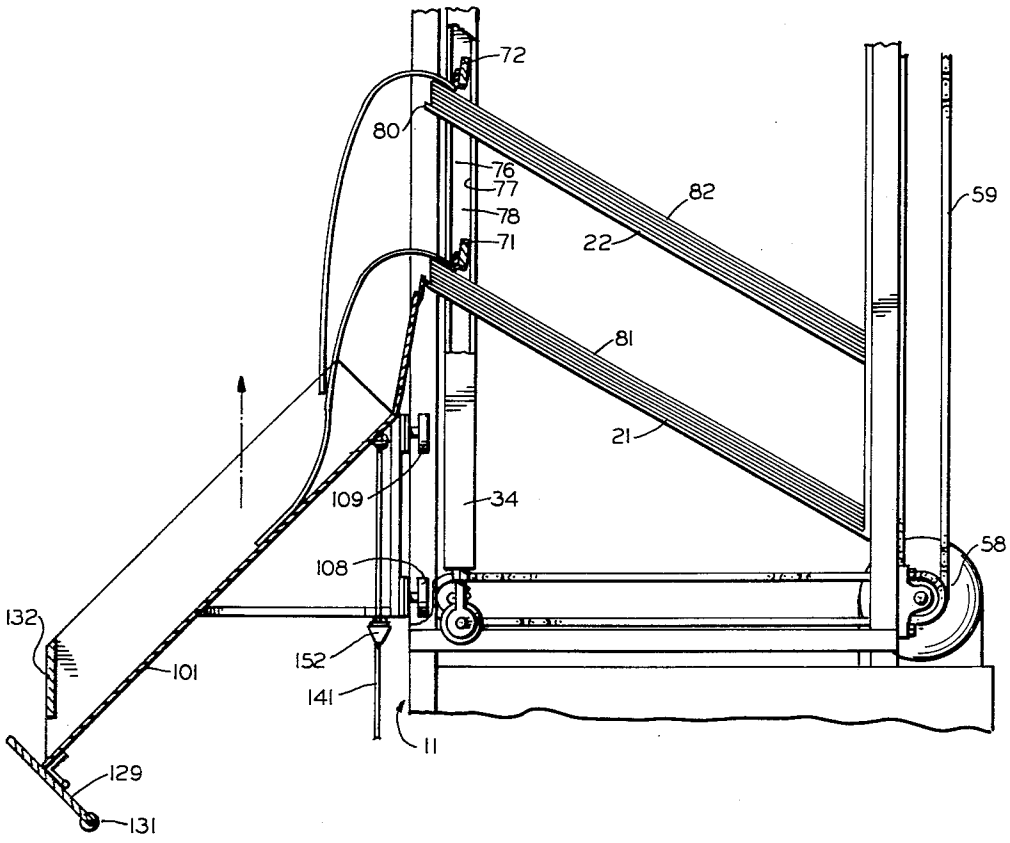
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COLLATING MACHINE

Filed Oct. 20, 1960 4 Sheets-Sheet 3

FIG_7



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May 22, 1962 E. D. BASSETT 3,035,832

COLLATING MACHINE

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FIG_8

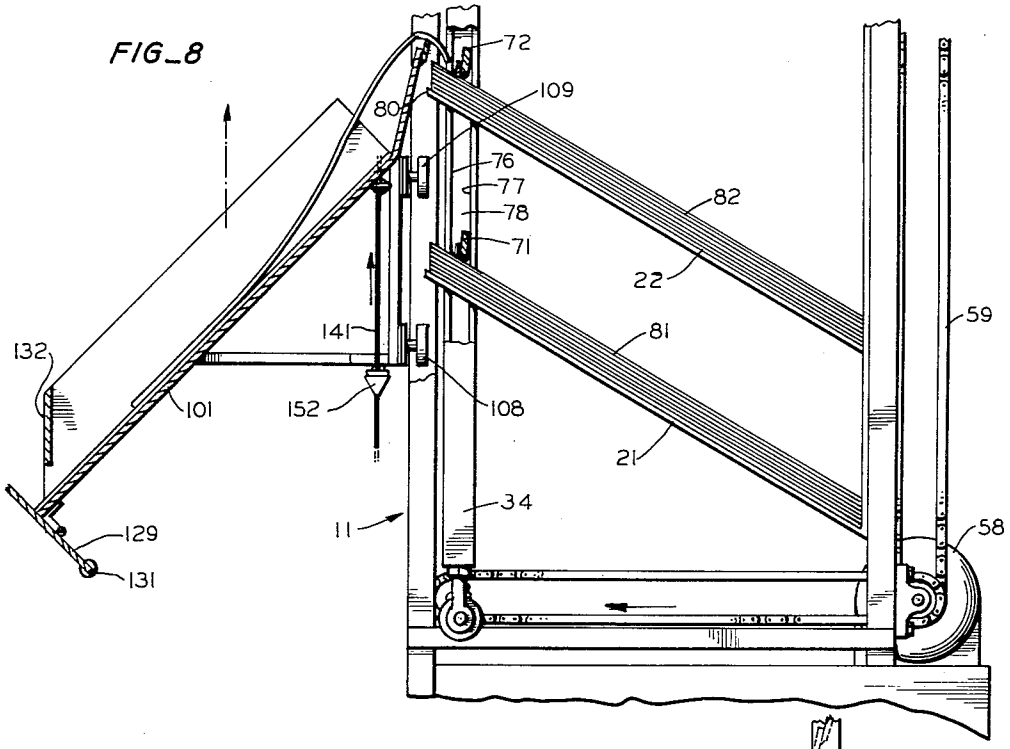
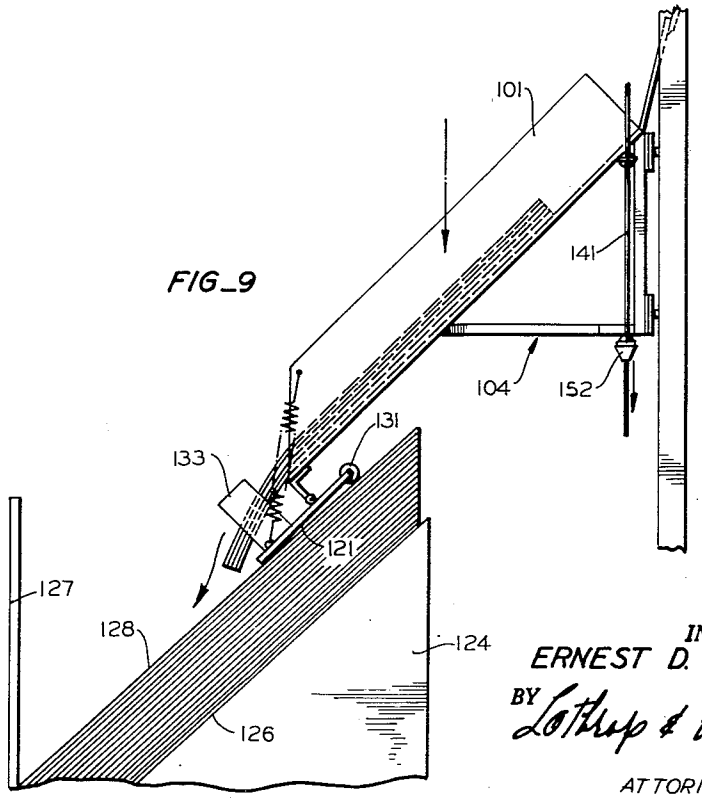


FIG_9



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United States Patent Office 3,035,832 Patented May 22, 1962

3,035,832

COLLATING MACHINE

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Filed Oct. 20, 1960, Ser. No. 63,753
11 Claims. (Cl. 270—58)

This invention relates to collating machines, and, more particularly, to such machines adapted for continuous automatic operation.

Collating machines previously known in the art have generally not been fully automatic in operation, and when they are fully automatic they are generally constructed for unnecessarily positive and forced engagement with and manipulation of the papers to be collated from the start to the finish of the collating operation, with the result that the mechanisms have been extremely complex, with difficult and easily disturbed timing adjustments, and have been bulky and space consuming in over-all assembly.

It is accordingly an object of this invention to provide a fully automatic collating machine adapted for operation in a reduced space.

It is another object of this invention to provide a fully automatic collating machine having a reduced number of parts, such parts being quite simple in interarrangement and co-functioning action, and adapted for uncomplicated and positive timing adjustment.

It is still another object of this invention to provide a fully automatic collating machine adapted for simplified gravity operation of various parts thereof and arranged to provide a high degree of gravity manipulation of the papers to be collated from the start to the finish of the collating operation.

It is a further object of this invention to provide a fully automatic collating machine which is adapted for self-adjusting operation of the paper-engaging parts and which accommodates to the varying thicknesses of the uncollated and collated stacks of paper in the machine.

It is yet a further object of the invention to provide a fully automatic collating machine embodying within a rigid frame a plurality of paper-supporting shelves capable of being located in a variety of selected spaced relationships.

It is another object of the invention to provide a collating machine which is extremely reliable and rapid, yet which is relatively economical, both with respect to original cost and upkeep.

It is still a further object of the invention to provide a generally improved collating machine.

Other objects, together with the foregoing, are attained in the embodiment described in the following description and shown in the accompanying drawings in which:

FIGURE 1 is a side elevational view of the collating machine of the invention;

FIGURE 2 is a rear elevational view of the upper portion of the collating machine of FIGURE 1;

FIGURE 3 is a cross sectional plan view of the upper portion of the machine of FIGURE 1, the plane of the section being taken substantially along the lines 3—3 of FIGURE 1;

FIGURE 4 is a cross sectional elevational view, on an enlarged scale, of a portion of the machine, the plane of the section being taken substantially along the line 4—4 of FIGURE 3;

FIGURE 5 is a perspective view on an enlarged scale of a portion of the machine shown in FIGURE 1;

FIGURE 6 is a cross sectional view on an enlarged scale of a portion of the apparatus shown in FIGURE 5, the plane of the section being taken substantially along the line 6—6 of FIGURE 5;

FIGURE 7 is a cut-away side elevational view, on an enlarged scale, of a portion of the machine shown in FIGURE 1;

FIGURE 8 is a cut-away side elevational view on an enlarged scale of a portion of the machine of FIGURE 1; and

FIGURE 9 is a side elevation of a portion of the machine shown in FIGURE 8 and to the same scale.

While the machine of the invention is susceptible of numerous physical embodiments, depending on the environment and requirements of use, substantial numbers of the herein shown and described embodiment have been made and used and have performed in an eminently satisfactory fashion.

The collating machine of the invention includes a frame, generally designated by the reference numeral **11**, including a four-legged lower stand **12** and an upper frame **13**, the latter including four rectangularly related parallel upright corner members **16**, **17**, **18** and **19**, together with suitable cross supports to form a rigid construction.

A plurality of parallel paper-supporting racks **21**, **22**, **23** and **24** is mounted with the racks in vertically spaced relation on the frame **11** (particularly on the upper frame **13**) and are inclined upwardly from a rear side **26** to a front side **27** of the frame. Each rack or shelf has a back wall, here shown as a common back wall **28**, and each rack serves to support a different stack of the papers to be collated, the papers in each stack being similar to one another. The number of racks may be varied to accommodate different numbers of uncollated stacks, provision being made, as by a plurality of slots (not shown) in the front and rear vertical members adapted to receive and support a plurality of shelves.

As an important feature of the invention, the machine includes mechanism mounted at lateral sides **31** and **32** of the frame for forward-rearward reciprocation along these lateral sides, i.e., in a direction horizontally across the paper in the view of FIGURE 1. As here shown, this mechanism includes a pair of vertical members **33** and **34** (see FIGURES 2 and 3) each mounted on the corresponding one of the lateral sides **31** and **32** for coordinated reciprocation. The structure and mounting of each of the two members is substantially identical and for this reason only that of the vertical member **33** will be described in detail.

At the top and at the bottom of the frame side **31** is mounted a pair of horizontal forward-rearward extending tracks **36** and **37**, respectively. In these tracks there is mounted a pair of anti-friction bearing wheels or rollers **38** and **39**, respectively, each roller being rotatably mounted on respective transverse axle shafts **41** and **42**. The shafts extend from the lateral side **31** to the opposite lateral side **32** of the frame where a corresponding upper roller **40** and lower roller **45** are installed.

The shaft **41** is secured to the bottom runs of a pair of upper transversely spaced endless sprocket chains **43** and **44** moving generally horizontally and forwardly-rearwardly. The chain **43** is reaved over toothed gears **46** and **47** and the chain **44** is afforded comparable structure on the opposite side. The gear **46** and its opposite counterpart are axially mounted on a rotatable horizontal transversely extending shaft **51** mounted in bearing brackets at the front end of the frame. The gears **47** and **49** are similarly mounted on a shaft **52** at the rear end of the frame. Consequently, rotation of the transverse shafts **51** and **52** effects translation of the shaft **41** and of the upper roller **38**.

The lower shaft **42** is similarly secured to similar sprocket chains **53** and **54** running on similar toothed gears mounted on a pair of transverse shafts **56** and **57** (see FIGURES 1 and 2). The lower shaft **57** is driven by drive mechanism including a first reversible motor **58**, and the upper shaft **52** is driven in unison with the shaft **57** by an endless vertical chain **59** running over suitable

toothed gears **61** and **62** mounted respectively on the shafts **52** and **57**.

The shafts **41** and **42** are aligned in the same vertical plane (see FIGURE 1) and it will be understood that these shafts are, by the arrangement described, constrained to be always conjointly moved in the same vertical plane from front to rear and from rear to front of the frame when the motor **58** is operated.

At the ends of the shafts **41** and **42** extending from the side **31** of the frame are mounted respective collars **63** and **64**, and over these collars are press-fitted eye-bolts **66** and **67**, which extend from the upper and lower ends, respectively, of the vertical member **33**. Comparable structure is provided on the opposite side.

By this arrangement it will be seen that the vertical members **33** and **34** are maintained in vertical attitude and in the same transverse plane of the frame while being moved by the chains and motor **58** in a reciprocating action forwardly and rearwardly along the lateral sides **31** and **32** of the frame.

The reciprocating mechanism also includes a plurality of paper-engaging elements, here shown as cross members **71, 72, 73** and **74**, mounted one above each of the corresponding racks **21—24** and connected to the vertical members **33—34** for impelled forward-rearward reciprocation therewith, and for relatively free vertical sliding motion with respect to the vertical members. The connection between each of the vertical members and the cross members is preferably made by providing a pair of generally forwardly-rearwardly spaced bearing portions **76** and **77** (see FIGURES 3 and 7) on one of the members of the combination. In the example illustrated, these bearing or track portions **76—77** are provided on the vertical members **33—34** as by forming the vertical members with facing vertical grooves **78** with the bearing portions **76—77** defining the forward and rearward walls of the grooves as shown in FIGURE 7. Disposed within the tracks are the ends **79** of the other member of the combination, in the illustrated example this other member being one of the cross members **71—74**. The portions **79** are relatively loosely disposed between the bearing portions **76—77** of the vertical member. Thus, whenever the vertical members **33** and **34** are moved forwardly they impell the cross members **71—74** along in a forward direction, as by engagement of at least the rearward bearing portions **77** of the track against the portions **79** of the cross members. Owing to the weight of the cross members and the frictional resistance between the bearing portions **77** and the cross members, the latter are urged into frictional engagement with the topmost sheets of the stacks of papers **81, 82**, etc. (see FIGURES 7 and 8), on the racks **21—24** and urge these sheets upwardly and forwardly to drape over the forward edges **80** of the racks (as appears most clearly in FIGURE 7).

As explained above, the number and the spacing of the racks can be adjusted to accomplish the particular collating job being worked on. Since the cross-members are freely removed and introduced from the top of their tracks **33** and **34**, any suitable number of cross members can be placed in the machine, with one cross member for each shelf, the cross member being disposed above its corresponding shelf.

As the cross members progress forwardly in engagement with the respective top sheets of paper, the vertically (upwardly) directed component of the counterforce exerted by the papers supported on the upwardly pitched racks on the member overcomes the downwardly directed forces exerted by the weight of the member and by the frictional resistance between the member and the bearing portion **77**, and the cross member moves relatively freely upwardly in the loosely fitting grooves **78**. Thus, in forward movement, the weight and frictional resistance of the cross member combine to urge the cross member into constant "floating" frictional engagement with the topmost sheet of paper and yet because of the loose fitting of the cross member in the groove **78**, the cross member is relatively free to move upward in the grooves.

Conversely, in rearward movement, the cross members are constrained by their frictional resistances against the impelling bearing portions **76** of the track and the downward pitch of the rack to remain generally out of frictional engagement with the topmost sheets of paper, while yet being relatively free to descend in the grooves **78**. Thus, the cross members are returned to starting position at the lower rear sides of the respective racks without crumpling up the papers against the rear wall **28**. As shown in FIGURES 7 and 8, the cross members may be made generally rectangular in cross sectional form so that in tilting they may come into frictional engagement with both of the bearing portions **76—77** at the same time, and the rotation of the cross members is also effective in providing the described action. As shown most clearly in FIGURE 4, the cross members are also provided with a downwardly extending lip **86** on the forward face of the members, and recurved around the bottoms thereof, the lip **86** being made of high frictional resistance material such as rubber or plastic, for better engagement with the topmost sheets of paper.

As another important feature of the above-described arrangement, the cross members **71—74** operate to move the topmost sheets of paper into positions overhanging the forward edges of the racks **21—24**, so that the sheets are substantially draped and curved downwardly and forwardly from the racks, as shown in FIGURE 7, and in a favorable position for subsequent collection into a collated stack. In this disposition, the paper sheets have only their extreme rear portions still held under the cross members **71—74** and held slightly above the paper stacks. Generally, these rearward portions of the sheets are constrained, by the stiffness of the paper, to arc upwardly and rearwardly and downwardly, with the cross members somewhat elevated and supported by the arc of the sheets, as appears most clearly in FIGURE 7, the cross members having sufficiently free vertical movement to permit such arcing and yet securely to retain the papers against downward and forward slipping out of the racks before they are collected. At the same time, the cross members provide relatively little resistance to upward and forward movement of the sheets when they are withdrawn in a forward direction during the collecting process, as will be later seen. In effect, the structure as described provides a self- adjusting "suspension control" of the sheets in overhanging position more effectively to retain the sheets before collection and more effectively to release the sheets at the moment of collection.

As will also be understood, the "floating" construction of the vertical and cross member assembly has the advantage of providing with a relatively small number of parts a simple yet reliable self-adjusting operation of the structure to accommodate to different stack thicknesses and conditions of operation. The arrangement, furthermore, of the driving apparatus, including the reciprocating vertical members **33—34** at the lateral sides of the frame, enables the machine to be operated in a restricted space, since none of the moving parts of the machine need extend rearwardly of the frame at any portions of their movement paths.

The machine of the invention also comprises a collection mechanism, here shown as including a tray **101**, or carrier, mounted on the frame and co-functioning with the reciprocating members **33—34** and **71—74** to collect the overhanging sheets to a collated stack after each forward cycle of the reciprocating members.

The carrier **101** is mounted for vertical reciprocation on the front of the frame **11** so that upon upward motion it sequentially engages the overhanging sheets from beneath (FIGURE 8) and upwardly withdraws and collects the sheets. The frame **11** has guide means, here shown as including a pair of vertical parallel tracks **102**

and 103 (see FIGURE 5) mounted on the front of the frame, and the carrier has a bracket 104 on which are mounted two pairs of vertically spaced rollers 106 and 107, and 108 and 109, engaged in and retained by the tracks so that the carrier is held in a forwardly extending position and is retained for vertical sliding motion only.

Besides extending forwardly, the carrier 101 also extends downwardly, and has a pair of flared sides 111 and 112 and an upwardly-rearwardly extending lip 113, from the rear edge of which extends a strip 114 of frictional material, such as plastic or rubber for engaging the overhanging sheets upon upward movement and withdrawing them from the members 71—74 and into the carrier. At the forward edge of the carrier 101 is formed a selectively operable paper stop means, here shown as including a hinged flap or gate 121, hinged for forwardly and downwardly swinging opening movement to discharge the collected papers, but spring-loaded as by springs 122 and 123 to remain normally in closed position at approximately right angles to the plane of the carrier and to thus retain the collected papers in the carrier.

The machine also includes a paper-receiving bin 124, comprising a downwardly and forwardly inclined paper-receiving rack 126 and a vertical paper-aligning wall 127 extending upwardly from the forward and lower side of the rack 126 for receiving and aligning the collected papers in an upwardly-building stack 128 (FIGURE 9). The bin 124 is selectively positionable with the stack 128 partly underlying the forward portion of the carrier 101, so as to engage and stop the carrier in each downward journey at the level of the top of the stack 128 and at the correct level for discharging the collected papers from the carrier onto the top of the stack. The gate 121 has an operating element, here shown as a lower portion 129 (see FIGURE 8) extending downwardly and rearwardly at a substantial angle to the vertical. Paper-engaging rollers 131 are mounted at the lower edge of the portion 129. Thus as the tray or carrier moves vertically downwardly (FIGURES 8 and 9), the rollers 131 engage the top of the stack 128 and are constrained to move upwardly and rearwardly along the top of the stack, thus opening the gate 121 against the resistance of the strings 122—123; the papers are thereupon discharged by gravity onto the top of the stack. The bin 124 is particularly set so that upon subsequent upward movement of the tray 101, the discharged papers are left remaining on the top of the stack and the gate 121 is closed by the springs. It will be noted that the forward part of the tray is provided with a cross partition 132, or drift-control panel, spaced substantially from the bottom of the tray and inclined thereto, so as to stop the floating tendency of sheets in motion and provide a funneling action on the collected papers as they are received from the racks. The gate 121 is provided with spaced lateral guide lips 133 and 134 to guide the flow of papers into the bin.

The drive mechanism for the machine, including the reversible motor 58, also includes a second reversible motor 136 for driving the tray 101. These motors are arranged to drive the vertical members 33—34, the cross members 71—74 and the tray 101, in repeated cycles of operation, including sequentially timed forward movement of the vertical and the cross members, upward collecting movement of the tray past the racks 21—24, and downward and rearward movement, respectively, of the tray and the members.

Particularly, the motor 58 is arranged to drive the members 33—34 forwardly in a first mode (forward rotation) of operation of the motor and rearwardly in the reverse mode (reversely rotating); and the motor 136 is connected to drive the tray upwardly in the first operating mode of this motor and downwardly in the reverse mode.

The motor 136 drives a shaft 137 mounted at the bottom of the frame and on which is mounted a pair of pulley wheels 138. Reaved on the pulley wheels 138, for driven rotation thereby, is a pair of endless belts 141 and 142, or cords. The cords are arranged for vertical rotation over a pair of pulley wheels 143 mounted at the top of the frame; and the tray bracket 104 is connected to the belts 141—142 for vertical movement therewith.

It is to be noted that the lowermost paper-holding rack 21 is spaced substantially above the bottom of the frame 11, so that when the tray 101 and the members 33—34 start downwardly and rearwardly, respectively, from their positions at the upper and the front portion of the frame, the tray moves farther and the members 33—34 have time to move to the rear of the frame and back again to the front with the overhanging papers before the tray traverses its circuit to the bottom of the frame and back up again to the level of the rack 21. Thus, the overhanging papers are disposed ready for collection before the tray begins collecting them on its upward sweep.

Automatic timing mechanism is provided to operate the motors 58 and 136 substantially concurrently in the same modes of operation, and cyclically to reverse the modes when the tray and the reciprocating members are respectively and simultaneously at the top and front of the frame 11, and again when the tray 101 is at the lower portion of the frame 11 and when the members are at the rear of the frame. The timing apparatus includes an electric motor-reversing switch 151 (preferably a micro-switch) mounted on the frame 11 at the lower portion of the stand 12 and connected to reverse the motor 136 from second to first mode of operation; and the switch 151 is engaged for operation by one of a pair of blocks 152 mounted on and extending from the cords 141 and 142, so that each time the block descends and operates the switch, the motor reverses and the block is stopped and returned upwardly again on the cord.

At the top of the frame is mounted a second switch 153, capable of being tripped by the upper rod 156 of a pair of laterally extending rods 156 and 157 forming part of the tray-supporting bracket 104, the rods terminating in eyes 161 encircling the cords 141 and 142. The switch 153 is connected so as to reverse the motor 136 from first to second mode each time the upwardly moving rod 156 operates the switch. Also at the top of the frame is mounted a switch 158 likewise operated by the rod 156 and connected to reverse the motor 58 from first to second mode each time the rod 156 reaches the top of the frame, the members 33—34 being at the same time at the front of the frame. The members 33—34 are thus headed in a rearward direction to starting location, preparatory to starting forwardly to gather a new set of sheets ready for collation.

On the front of the frame is also mounted a switch 159 operated by one of the blocks 152 in downward motion and connected so as to reverse the motor 58 from the second to the first mode upon each operation, the motor being in the second mode. The switch 159 is spaced from the top of the frame at a distance to allow the tray assembly, in downward motion, to clear all paper shelves before any forward action of the cross members 33—34 is commenced, and the sheets of paper are pushed into a frontal position. The motor 58 reverses when the members 33 and 34 arrive at the rear of the frame. The switch 159 is of the kind which is actuated only by downward movement of its extending pin; in other words, the upward tilting of the pin as the block 152 moves upwardly is inoperative to actuate the switch 159.

For use with the bin 124, the tray 101 is given a lost motion connection to the belts 141 and 142, owing to the provision of the eye members 161 extending from the ends of the bracket rods 156 and 157 and loosely encircling the cords, the blocks 152 being of sufficient size and being mounted below the eye members so as to engage those eye members extending from the lower rod

157 upon upward motion and to lift the tray to the top of the frame and to lower the tray so far as it is permitted to descend by the paper stack 128 on the bin 124. Upon engaging the stack 128, the tray 101 is stopped and the blocks 152 continue their downward motion until one of the blocks contacts and operates the switch 151, reversing the operation of the motor 136, and starting the blocks upward again. When the blocks 152 again reach the tray, they engage and lift it upwardly in a new cycle. The blocks 152 thus constitute lifting elements driven by the motor 136 for engaging and lifting and lowering the tray.

The operation of the machine is as follows. The paper holding racks 21—24, or shelves, are loaded with the appropriate stacks of paper. The vertical reciprocating drive members 33 and 34 are thereupon moved to the rear end of the frame and over each stack of paper on each shelf, a corresponding one of the cross members 71—74 is disposed in the tracks of the drive members 33 and 34.

Next, the carrier 101, or tray, located well up on the frame, is urged downwardly and into tripping contact with the switch 159, thus starting the motor 58 which urges the vertical members forwardly. As the vertical drive members move toward the front of the machine, the cross bars cause the topmost sheet on each stack to move toward the front. When the vertical drive members come into abutment with the rear edges of the front frame members and are thereby stopped, the individual sheets of paper are disposed with a great portion of their length in a forwardly and downwardly arched and draped fashion, but with the last fraction of an inch or so restrained by the respective cross members. The sheets, in other words, are held in suspension in a position of being arched over the edge of the stacks and the front edge of the paper-holding shelves.

In the meantime, the carrier belt motor 136 having been turned on and running in a direction such that the carrier belt moves downwardly, the block 152, or stop, trips the switch 151 and causes the motor 136 to reverse its direction. This action urges the belt upwardly, the block 152 coming into supporting engagement with the adjacent one of the eyes 161 (see FIGURE 5) and lifting the carrier.

As the carrier rises the edge 114 of the carrier lip 113 pushes upwardly against the arched portion of each of the sheets of paper (see FIGURE 8) and dislodges the paper from the restraining cross member, the paper thereupon falling by gravity downwardly into the bed of the carrier. The sheets are sequentially dislodged as the carrier moves upwardly and the various guides and panels on the carrier cause the collected papers to come to rest in substantially perfect register.

At the top of its run, the carrier contacts both the switch 153 and the switch 158, causing both the motors to reverse. Thus, the carrier belt starts to descend and the vertical drive members are returned to the rear of the frame.

As the carrier moves downwardly it trips the switch 159 and starts the next cycle for the vertical members, causing the drive members to move toward the front of the frame and thus urging the cross members and the corresponding sheets forwardly.

The carrier continues to move downwardly until it abuts the bin, at which juncture the front panel of the carrier is swung open and allows the collected sheets to move down onto the subjacent previously gathered stacks.

The lost motion action of the carrier belt enables the carrier belt and the block 152 to continue to descend and to move into contact with the switch 151 which reverses the motor 136 and raises the carrier belt, thus concluding the cycle of the carrier and of the machine.

What is claimed is:

1. A collating machine comprising: a frame; a plurality of parallel laterally open paper-supporting racks mounted in spaced relation on said frame and inclined upwardly from a rear side to a front side of said frame; a plurality of transverse paper-engaging elements located above each of said racks and adapted for movement with respect thereto; fixed means on said elements for engaging the topmost sheets of paper supported on said racks and for moving said topmost sheets in inclined motion upwardly and forwardly over the front edges of said racks; and vertically movable means mounted on said frame for collecting said topmost sheets into a collated stack upon arrival of said paper-engaging elements at said front side of said frame.

2. A collating machine comprising: a frame; a plurality of parallel open-sided paper-supporting racks mounted in spaced relation on said frame and inclined upwardly from the rear to the front thereof; a plurality of vertical members mounted on said frame for coordinated forward-rearward reciprocation along the inclined lateral edges of said racks; a plurality of substantially linear transverse paper-engaging cross members mounted one above each rack and connected to said vertical members for forward-rearward reciprocation therewith and for relatively free vertical sliding motion with respect thereto; automatic drive means connected to said vertical members for urging said members forwardly after the arrival of said members at said rear of said frame and rearwardly after the arrival of said members at said front of said frame to define repeated reciprocation cycles of said members, whereby said paper-engaging members are caused upon forward movement gravitationally to engage the topmost sheets of paper on said racks and to move said sheets to positions overhanging the front edges of said racks, with said paper-engaging elements being subsequently returned to the rear of said frame to begin a new cycle; and vertically movable means mounted on said frame and co-functioning with said members and drive means to collect said overhanging sheets into a collated stack after each forward cycle of said paper-engaging members.

3. A collating machine comprising: a frame; a plurality of parallel paper-supporting racks mounted in vertically spaced relation on said frame and inclined upwardly from the rear to the front thereof; a pair of vertical members mounted one at each lateral side of said frame for coordinated forward-rearward reciprocation along said lateral sides; a plurality of paper-engaging cross members mounted one above each rack and connected to said vertical members, the connections between the members of each vertical and cross member combination being formed by a pair of generally forwardly-rearwardly spaced bearing portions formed on a first one of said members of said combination and by a portion extending from a second one of said members of said combination and relatively loosely fitting between said bearing portions of said first member, whereby each of said cross members of said combination is moved forwardly and rearwardly in substantially conjoint reciprocation with the corresponding vertical member, said cross member being relatively light in weight free for vertical movement with respect to said vertical member and being vertically movable whenever the vertically-directed component of force on said cross member is greater than the frictional resistance between said bearing portion and said extending portion of the respective members; automatic drive means connected to said vertical members for moving said members in cyclical reciprocation between forward and rearward positions on said frame whereby said cross members are effective to move the topmost sheets of paper on said racks to positions overhanging the front edges of said racks; and means mounted on said frame and co-functioning with said members and drive means to collect said overhanging sheets into a collated stack after each forward cycle of said members.

4. The device of claim 3, wherein said vertical members are formed with facing vertical grooves with said bearing portions being defined by the forward and rear-

ward walls of said grooves, and wherein each of said cross members is an elongated element with the ends thereof constituting said extended portions and fitting relatively loosely in said grooves of the respective vertical members.

5. A collating machine comprising: a frame; a plurality of parallel paper-supporting racks mounted in vertically spaced relation on said frame and inclined upwardly from the rear to the front thereof; a pair of vertical members mounted one at each lateral side of said frame for coordinated forward-rearward reciprocation along said lateral sides; a plurality of paper-engaging cross members mounted one above each rack and connected to said vertical members for impelled forward-rearward reciprocation therewith and for relatively free vertical sliding motion with respect thereto, and for thereby upon forward motion gravitationally engaging and moving the topmost sheets of paper on said racks to positions overhanging the front edges thereof; a paper-collecting tray mounted for vertical reciprocation on the front side of said frame and for sequentially engaging and collecting said overhanging sheets from beneath; and automatic drive means connected to said vertical members and said tray for moving said members and tray in repeated cycles of operation including sequentially timed forward movement of said members, upward collecting movement of said tray past said racks, and downward and rearward movement respectively of said tray and said members.

6. The device of claim 5 wherein said drive means includes a first reversible motor connected to drive said vertical members forwardly in a first mode of operation of said motor and rearwardly in the second and reverse mode of operation thereof; a second reversible motor connected to drive said tray upwardly in a first mode of operation thereof and downwardly in the second and reverse mode; and automatic timing means connected to operate said motors substantially concurrently in the same modes and cyclically to reverse the operating modes of said motors when said tray and members are respectively and simultaneously at the top and front of said frame and again when said tray and members are respectively at the lower portion and rear of said frame, the lowermost one of said paper-supporting racks being spaced above the bottom of said frame for timed movement of said members to the front of said frame before said tray in upward motion reaches said lowermost rack.

7. The device of claim 6, wherein said frame has guide means formed on the front thereof and engaging and restraining said tray for vertical sliding motion only, and wherein said frame also has a lifting element driven by said second motor and mounted on the front of said frame for vertical reciprocation corresponding with the two operating modes of said motor, said lifting element being particularly formed and disposed for engaging the underside of and supporting said tray for lifting and lowering said tray in lost motion reciprocating action thereof.

8. The device of claim 7, wherein said tray is formed with a downward and forward slope and has selectively operable paper stop means at the forward edge of said tray for holding and discharging said collected papers, and wherein there is also provided a bin comprising a downwardly and forwardly inclined paper-receiving rack and a vertical paper-aligning wall extending upwardly from the forward and lower side of said rack for receiving said collected papers in an upwardly-building stack, said bin being selectively positionable with said stack partly underlying the forward portion of said tray for stopping said tray in each downward journey at the level of the top of said stack, and said paper stop means of said tray having an operating element extending downwardly to engage said stack top in downward movement, said operating element being connected to operate said stop means to discharge said collected papers onto said stack top when so engaged.

9. A collating machine comprising a frame; a plurality of parallel open-sided paper-supporting racks on said frame extending from the rear side to the front side thereof; a plurality of vertically movable transverse paper-engaging elements each disposed above a corresponding one of said racks and being located in a common vertical transverse plane; means for urging said paper-engaging elements in a forward direction from said rear side toward said front side of said frame whereby the top-most sheet of paper in each of said racks is moved toward said front side of said frame; means for halting the forward movement of said paper-engaging elements in a location such that only the extreme rear portion of each of said sheets is held by the corresponding one of said paper-engaging elements; and vertically movable means on said frame adapted successively to dislodge said sheets from said paper-engaging elements.

10. The device of claim 9 wherein each of said vertically movable paper-engaging elements is of a weight sufficient only to counter-balance by a slight amount the upward resilient force exerted by said extreme rear portion of said sheets.

11. The device of claim 9 wherein said paper-engaging elements extend laterally beyond the edges of said racks.

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