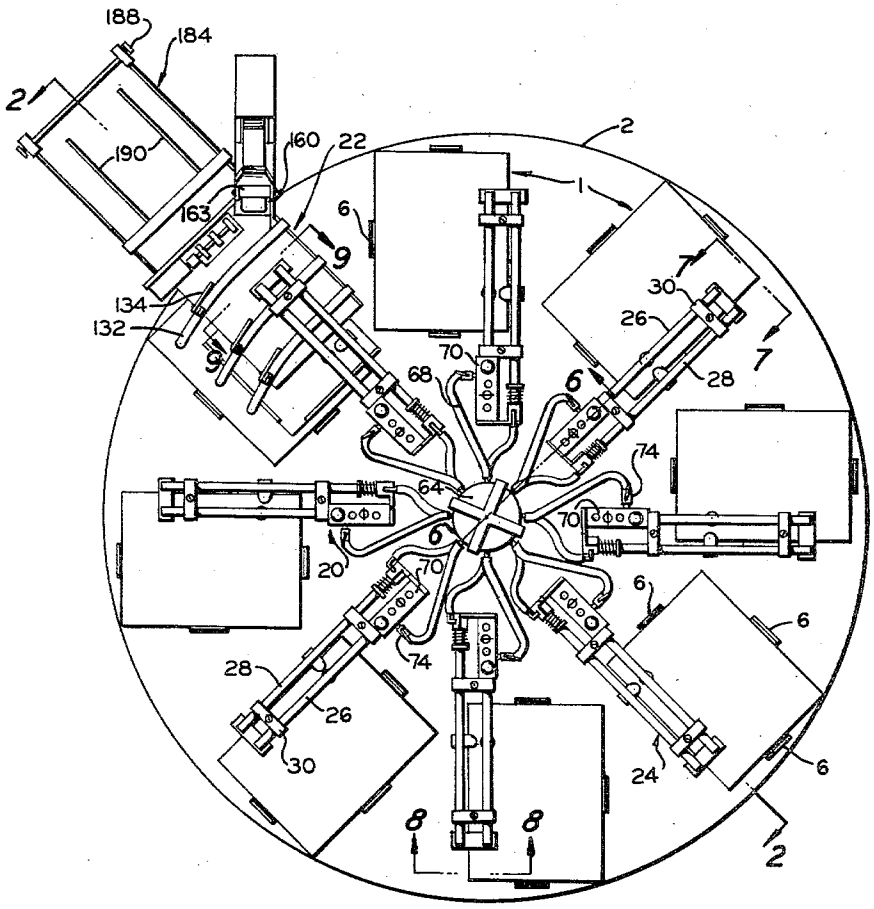
July 6, 1965 C. H. KRETZ, JR 3,193,284

COLLATING MACHINE WITH JOGGER AND EJECTOR

Original Filed Dec. 5, 1956 7 Sheets-Sheet 1

FIG_1



INVENTOR.
CHARLES H. KRETZ, JR.
BY Paul M. Klein Jr.

ATTORNEYS

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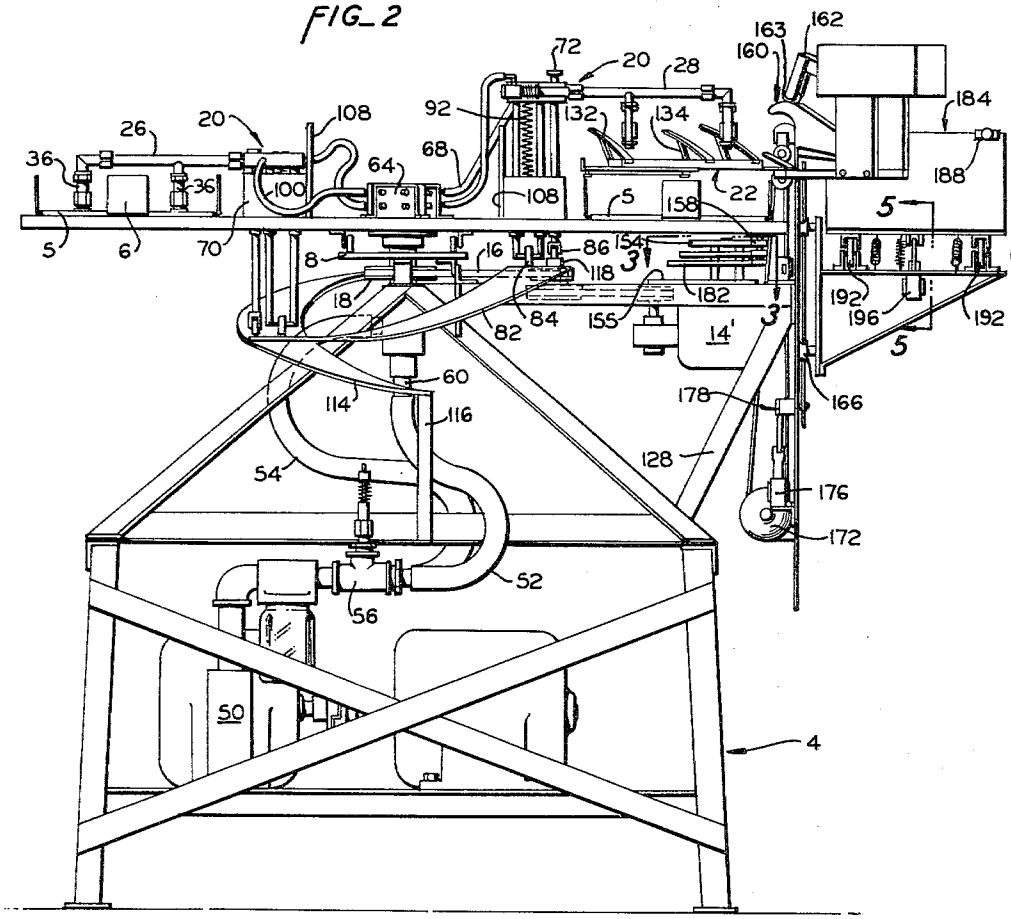
COLLATING MACHINE WITH JOGGER AND EJECTOR

Original Filed Dec. 5, 1956 7 Sheets-Sheet 2

FIG_2



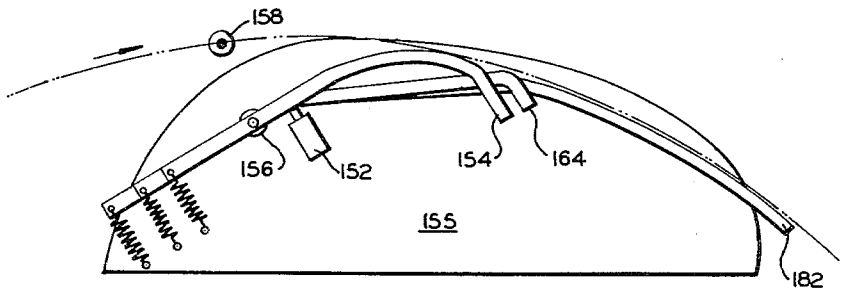


FIG_3

INVENTOR.
CHARLES H. KRETZ, JR.
BY Paul M. Klein Jr.

ATTORNEYS

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COLLATING MACHINE WITH JOGGER AND EJECTOR

Original Filed Dec. 5, 1956 7 Sheets-Sheet 3

FIG_4

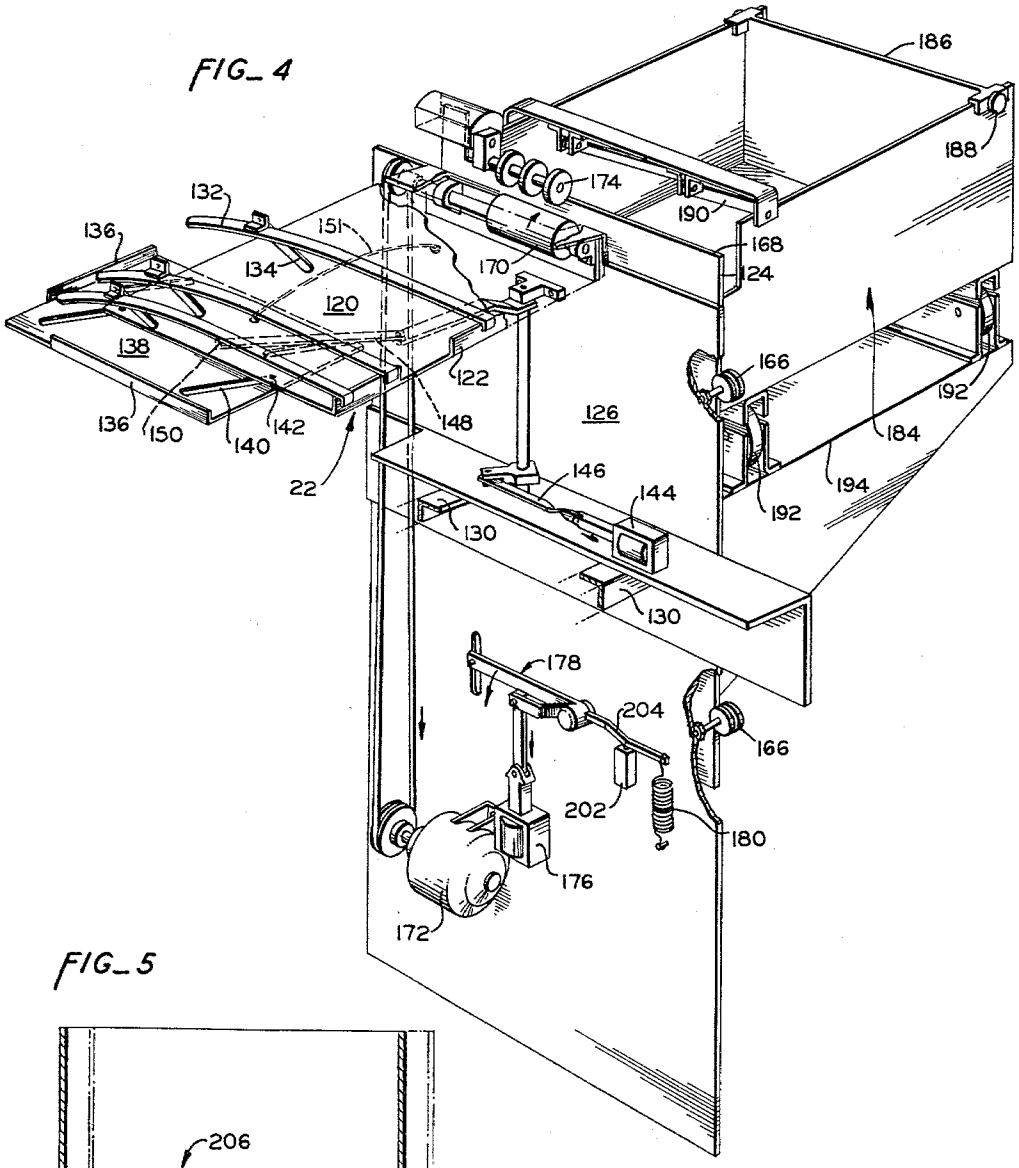
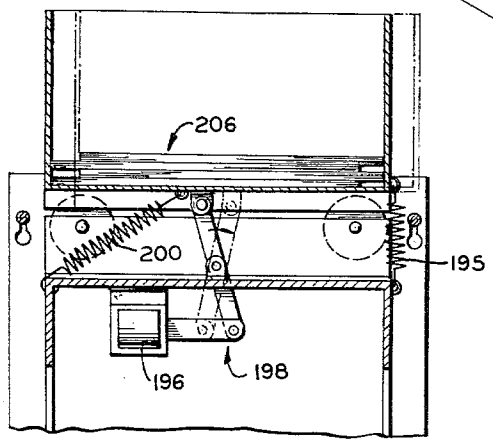


FIG_5



INVENTOR.
CHARLES H. KRETZ, JR.
BY Paul M. Klein Jr.

ATTORNEYS

July 6, 1965 C. H. KRETZ, JR 3,193,284

COLLATING MACHINE WITH JOGGER AND EJECTOR

Original Filed Dec. 5, 1956 7 Sheets-Sheet 4

FIG_6

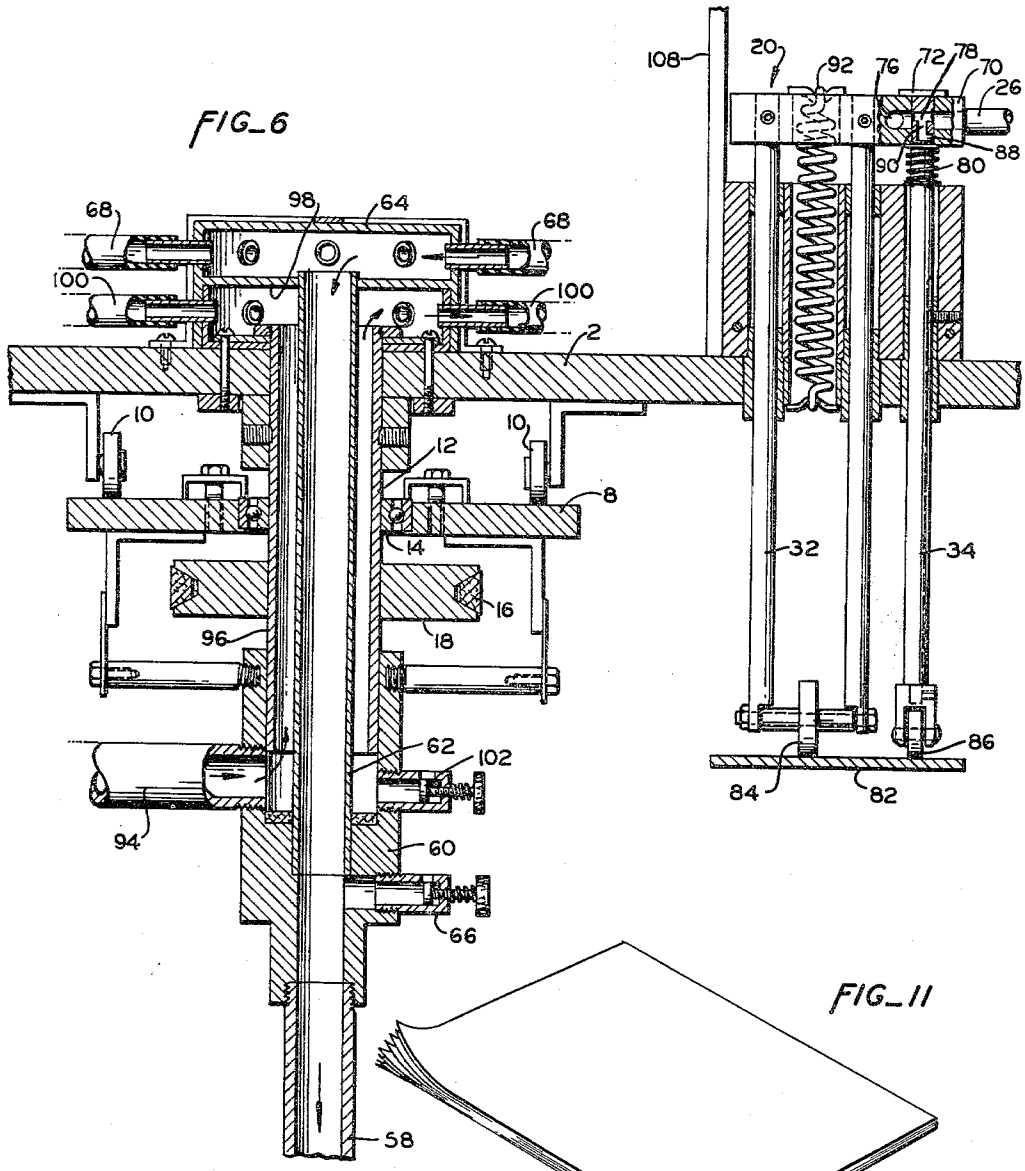
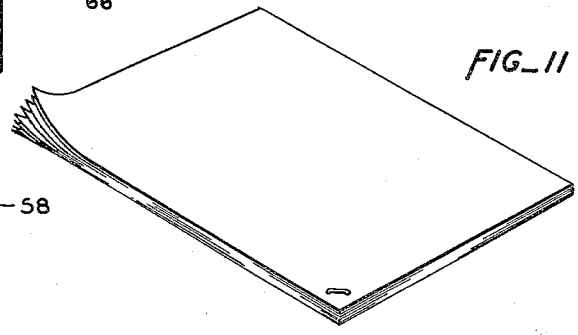


FIG_11



INVENTOR.
CHARLES H. KRETZ, JR.
BY Paul M. Klein Jr.

ATTORNEYS

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COLLATING MACHINE WITH JOGGER AND EJECTOR

Original Filed Dec. 5, 1956 7 Sheets-Sheet 5

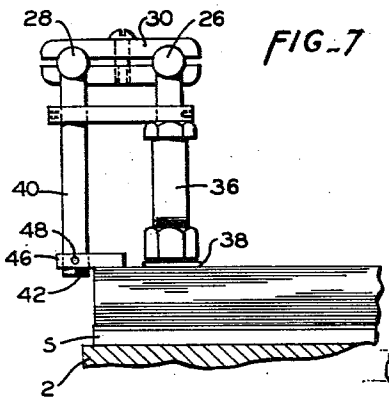

FIG_7

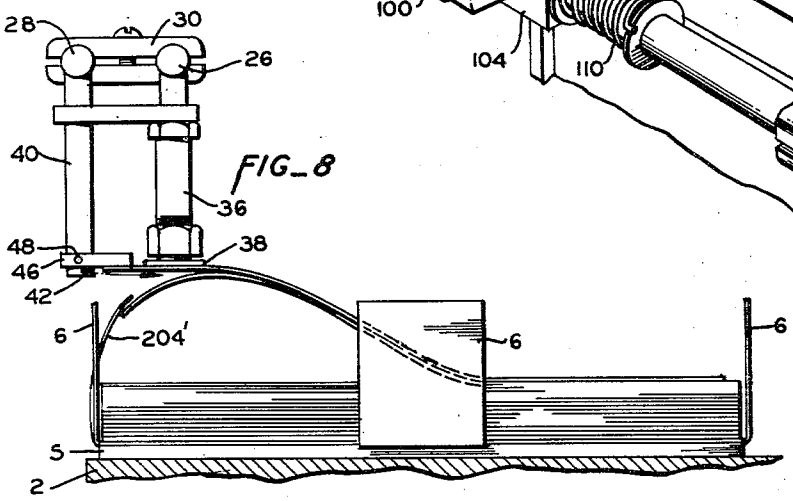

FIG_8

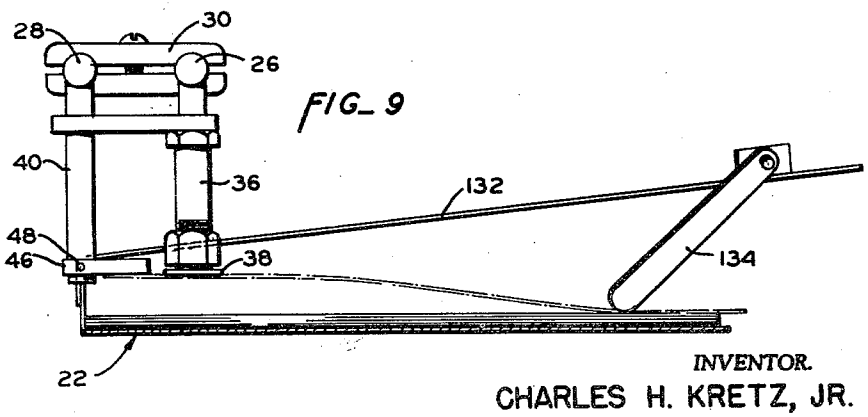

FIG_9

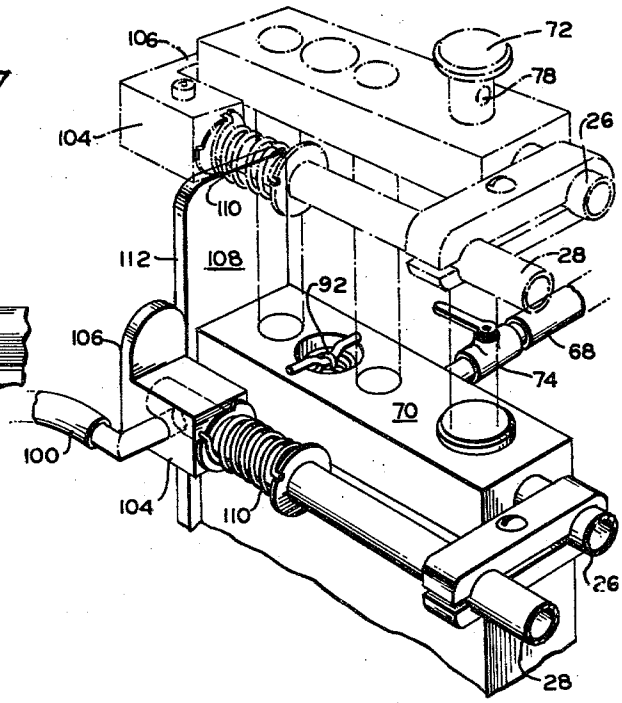

FIG_10

INVENTOR.
CHARLES H. KRETZ, JR.
BY Paul M. Klein Jr.
ATTORNEYS

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COLLATING MACHINE WITH JOGGER AND EJECTOR

Original Filed Dec. 5, 1956 7 Sheets-Sheet 6

FIG_12

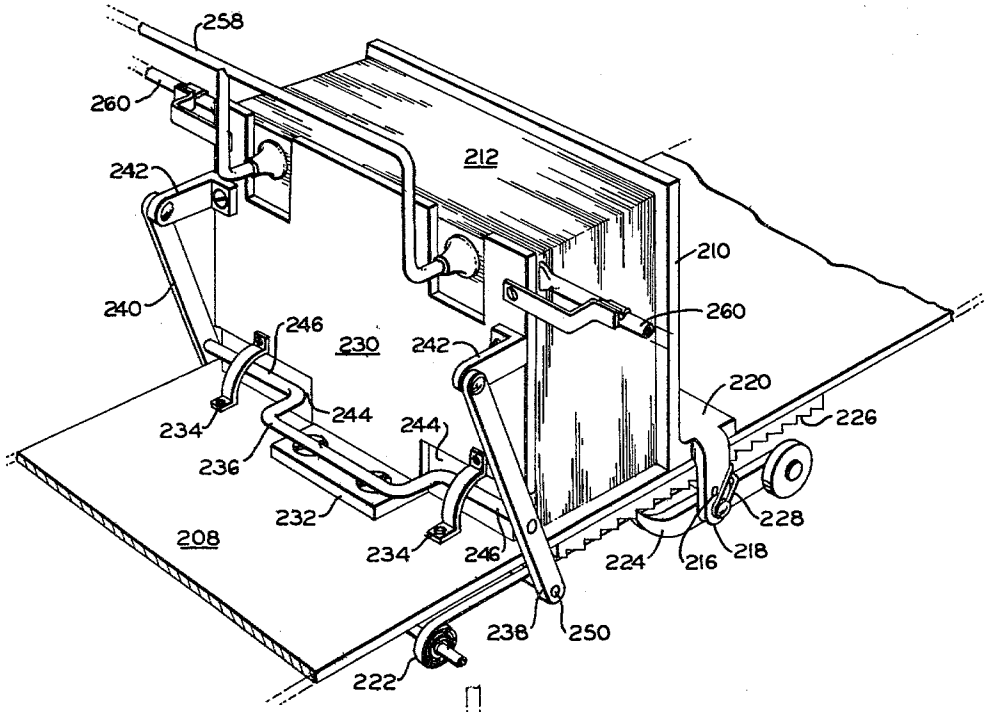
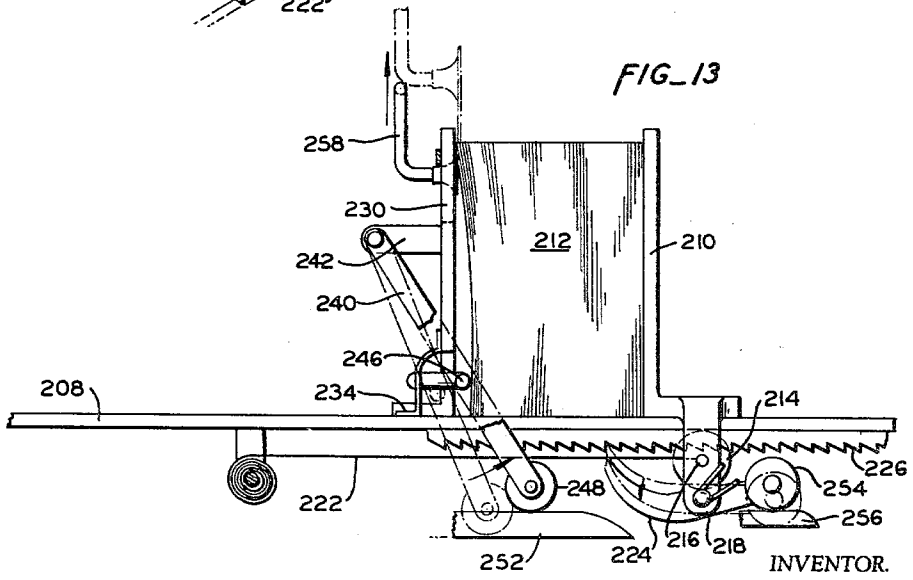


FIG_13



INVENTOR.

CHARLES H. KRETZ, JR.

BY

Paul M. Klein Jr.

ATTORNEYS

July 6, 1965 C. H. KRETZ, JR 3,193,284

COLLATING MACHINE WITH JOGGER AND EJECTOR

Original Filed Dec. 5, 1956 7 Sheets-Sheet 7

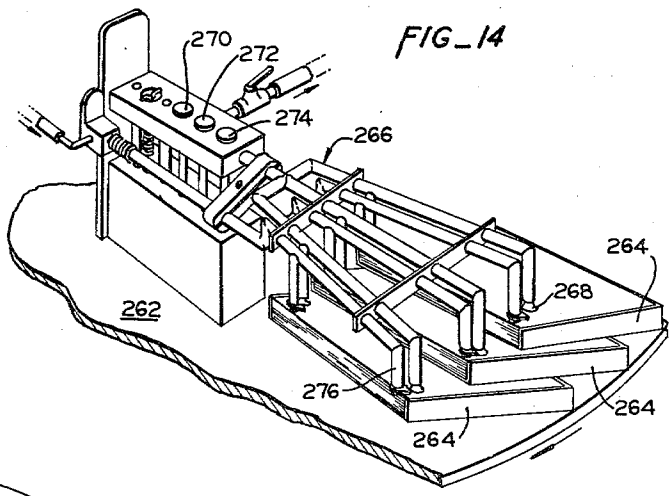


FIG_14

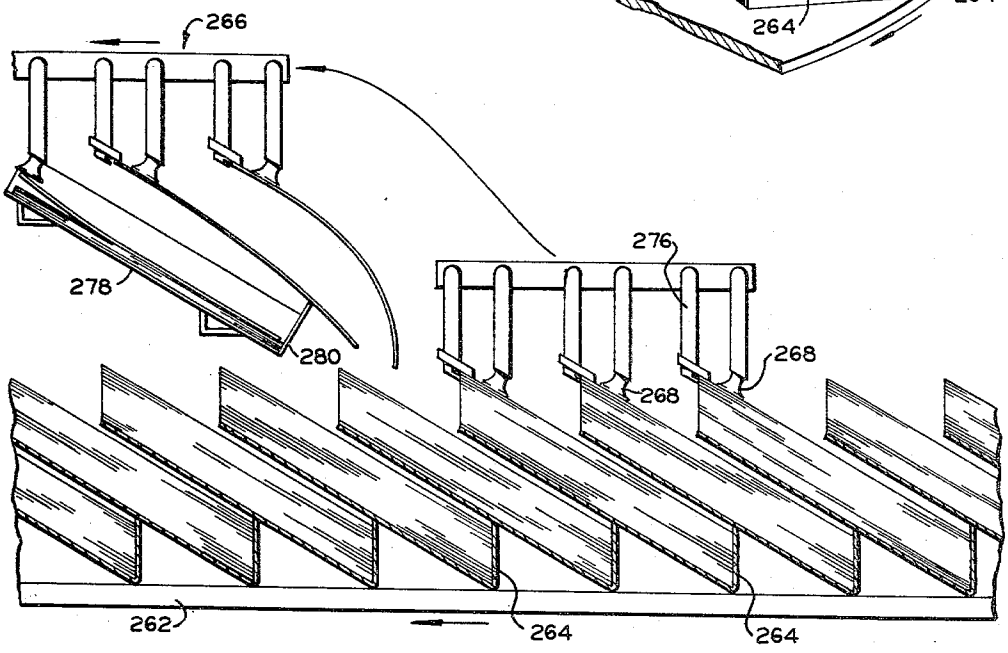


FIG_15

INVENTOR.
CHARLES H. KRETZ, JR.
BY Paul M. Klein Jr.
ATTORNEYS

United States Patent Office

3,193,284

Patented July 6, 1965

3,193,284

COLLATING MACHINE WITH JOGGER AND EJECTOR

Charles H. Kretz, Jr., U.S. Navy, assignor to Kretz Collator Co., San Francisco, Calif., a corporation of California

Original application Dec. 5, 1956, Ser. No. 626,553, now Patent No. 3,041,065, dated June 26, 1962. Divided and this application Apr. 30, 1962, Ser. No. 207,833

3 Claims. (Cl. 271—89)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by and for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This is a division of application Serial No. 626,553, filed December 5, 1956, now Patent No. 3,041,065.

This invention relates to a collating machine with a jogger and ejector and more particularly to a collating machine in which stacks of sheet material to be collated move as a unit relative to a collector station while pickup means, moving with the unitary motion, gradually pick up a sheet from each stack and deposit it at the collector station as that stack passes adjacent the collector station.

Prior art collators usually maintain the stacks of sheet material stationary relative to a collector station and suffer from the defect of having the pickup means move the sheet material a considerable distance from the stacks to deposit it at the collector station instead of having the pickup means move in unison with the stacks relative to the collector station.

An object of the present invention is to provide a collating machine including the following especially adapted for coaction with the particular collating mechanism of this collating machine: means for jogging collated sheets into alignment, selectively operable means for fastening the aligned sheets together and selectively operable means for ejecting the aligned sheets from the jogging mechanism.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a top view of a preferred embodiment of the present invention;

FIG. 2 is an elevation view of the embodiment of FIG. 1 taken along the line 2—2 in FIG. 1 with only two stack supports and associated pickup assemblies shown for clarity;

FIG. 3 is a detail view of part of the embodiment of FIG. 1 taken along the line 3—3 in FIG. 2 and showing cam lever means for controlling actuation of the jogger and associated equipment;

FIG. 4 is an isometric view of the jogger mechanism and associated equipment of the embodiment of FIG. 1;

FIG. 5 is a detail view in cross-section taken along the line 5—5 in FIG. 2 of the receiving bin associated with the jogger mechansim;

FIG. 6 is a partial view in elevational cross-section taken along the line 6—6 in FIG. 1;

FIG. 7 is a detail elevation view showing part of the pickup mechanism about to remove the top sheet from a stack of sheet material;

FIG. 8 is a detail elevation view similar to FIG. 7 but showing the pickup mechanism having almost removed the sheet from the stack;

FIG. 9 is a detail elevation view showing the pickup mechanism of FIG. 7 delivering a sheet at a collector station;

FIG. 10 is a detail isometric view of a part of the pickup framework and valve mechanism with the pickup position being shown in solid line and the delivery position being shown in phantom;

FIG. 11 is an isometric view of a group of sheets assembled by the collating machine of FIG. 1;

FIG. 12 is an isometric detail view of a support for sheet material stacked on edge with the planes of the sheets perpendicular to the direction of motion of the support;

FIG. 13 is an elevation view of a stack support of FIG. 12;

FIG. 14 is an isometric view of part of a collator having supports for stacks of sheet material carried with the planes of the sheets oblique to the plane of motion of the supports and having a single pickup assembly provided with multiple groups of sucker arms; and

FIG. 15 is an elevation view of the collator of FIG. 14, partially in cross section, showing sheets about to be deposited in a collector.

Generally the collating machine of the present invention comprises an assembly of supports for sheet material mounted to move as a unit relative to a base so that each sheet material support in turn passes adjacent a collector station. The machine further comprises pickup means for picking up a sheet of material from each support, which pickup means is mounted to move with the assembly of supports relative to the base and also to undergo additional motion toward and away from a stack of paper in its respective support so that as the assembly of supports moves relative to the base the pickup means gradually picks up a sheet of paper from its support and deposits it at the collector station as it passes adjacent the collector station. The machine also includes mechanism at the collector station for jogging either a single sheet or a group of sheets into alignment, for fastening the sheets together and for ejecting the sheets from the jogger mechanism into a receiver. Additionally, the invention contemplates mechanism for shifting the relative position of the jogging mechanism and receiver so that alternate groups of aligned sheets can be deposited at different relative positions in the receiver.

The invention comprehends the assembly of supports for sheet material moving as a unit relative to the base in any of numerous ways such as, for example, having the supports mounted in the manner of a Ferris wheel, or mounted like a train traveling on a closed loop of track, mounted on an endless belt, mounted for reciprocation on tracks or other guides, or mounted for rotation about an axis through the base.

One preferred embodiment illustrated in the drawings is shown in FIGS. 1 through 10 as being an assembly of supports mounted for rotary motion relative to a base. The supports, indicated generally by numeral 1, are generally located circumjacent the axis of rotation and can be held in position in any convenient manner such as being mounted on separate arms like the spokes of a wheel but preferably they are located on a rotatable disc 2 mounted for rotation about an axis passing through a base generally designated as 4 (FIG. 2). The supports in this case are constituted by spacer blocks 5 attached to the upper surface of the disc 2 plus a plurality of members 6 shown conveniently as being made of sheet metal extending generally transverse to the plane of the disc for constraining sheet material in or on the support. The members 6 can be made of sheet metal angles fastened with a screw and slot arrangement, if desired, to the disc 2 to allow for adjusting the members 6 to retain different sizes and shapes of sheet material. The disc 2, including the assembly of sheet material supports, is mounted for rotation about a central axis, being supported on an extended portion of the base forming a platform 8 on which supporting rollers 10 (FIG. 6) fixed to the underside of the disc 2 can roll. A tubular shaft 12 in bearing relation at 14 with the platform 8 serves to

maintain the disc 2 and its assembly in proper relation to the base.

The support assembly is rotated relative to the base by means of any suitable motor 14' (FIG. 2) through a speed reduction belt and pulley arrangement terminating with a belt 16 engaging pulley 18 (FIGS. 2, 6) which in turn is fixed to the shaft 12. A pickup means indicated generally at 20 is provided to pick up a single sheet of sheet material, such as paper, from the stack carried by each support. As the assembly rotates under the action of belt 16, the pickup means 20 gradually picks up the top sheet from its particular stack of material and deposits it in a collector generally indicated at 22 supported by the base high enough above the disc 2 in order to clear the top of the support members 6.

The pickup assembly

Each support for a stack of sheet material has its own pickup assembly generally indicated at 20 comprising a suction means for lifting off the top sheet of paper from the stack in the support and for releasing it into the collector 22 at the proper time. The pickup assembly 20 includes a frame generally designated as 24 (FIG. 1) mounted so as to partake of the general unitary motion of the disc 2 and its associated assembly of supports, and also mounted for vertical movement relative to the plane of the disc toward and away from the material in the stack support. The frame 24 comprises a tube 26 (FIGS. 1, 6, 7, 10) for conducting vacuum, a tube 28 for conducting pressure, clamping members 30 for spacing the tubes 26 and 28 and holding them in a rigid framework relationship, and guide rods 32 and 34 which serve not only to guide the motion of the framework and maintain it in its proper location but also serve certain other purposes to be hereinafter discussed. The pickup assembly further includes a pair of tubes 36 (FIGS. 2, 7) depending from the tube 26 and each terminating in a sucker 38 adjustably mounted at the end of each tube 36 by threads or otherwise. Connected to and depending from the pressure conducting tube 28 is a pair of tubes 40, each provided adjacent its end with one or more holes or a slot 42 constituting a pressure blast nozzle for directing fluid pressure, usually air, against the underside of the top sheet of material in each stack to facilitate separating the top sheet from the others. A foot 46 is carried by each tube 40 and adjustable along its length, being held in adjusted position as by a set screw 48. The foot serves four purposes: (*a*) to flatten and maintain flat the edges of the sheets of paper or other material in the stack so as to facilitate removing only the top sheet, (*b*) to space the blast opening 42 a distance equal to about the thickness of one sheet of material from the top surface of the top sheet of material, (*c*) to allow the pickup assembly to automatically find the level of the top sheet of material regardless of the number of sheets of material in the stack, and (*d*) to provide means in conjunction with the adjustable sucker tips 38 for adjusting the sucker tips 38 in the transverse plane relative to the top sheet of material in the stack in order to properly pick up various types and weights of sheet material.

A motor driven pump 50 (FIG. 2) supplies both the suction necessary for the vacuum pickup and the pressure necessary for the blast separator through hoses 52 and 54, respectively, the flow through each hose being monitored by safety valves such as 56. Vacuum from the hose 52 is supplied through a nipple 58 (FIG. 6), through a rotary seal bearing block 60 carried by the base frame, and thence through central tube 62 to a vacuum manifold 64. The vacuum is controlled by a main vacuum control valve 66 and passes from the manifold 64 through individual hoses 68 to a block 70 constituting part of the framework of the pickup assembly and serving as the chamber or valve block for the cyclically operating individual vacuum control valves 72. If desired, a separate petcock 74 can be provided for each pickup assembly to control its own vacuum supply. The valve 72 serves to cyclically connect the tube 26 alternately with vacuum and atmospheric pressure, the vacuum being supplied through the channel 76 (FIG. 6) in the block 70 and thence through the bore 78 in the valve 72 when it is in the position shown in FIG. 6 and in solid line in FIG. 10. The valve 72 is urged into this position by the coil spring 80 and will remain there as long as permitted to do so by the relative positions of the pickup assembly frame and the valve 72 which are governed (in a manner hereinafter explained) by the coaction of the cam 82 with the cam follower rollers 84 and 86 (FIG. 6) which are attached to guide rods 32 and 34, respectively. In the alternate position of the valve 72 shown in phantom line in FIG. 10 the tube 26 is connected to the atmosphere through port 88, the connecting chamber 90, and the bore 78 while the vacuum passage 76 is blocked off by the surface of the valve 72 opposite the port 88. The pickup assembly is urged downward toward the support for sheet material by a coil spring 92 (FIGS. 2 and 6).

Pressure to the blast nozzles is supplied from the hose 54 through the nipple 94, the hollow shaft 96, the pressure manifold 98 and individual hoses 100 leading to each tube 28. The main pressure supply is controlled by a main control valve 102 and the supply of pressure to each blast nozzle is controlled by a rotary cam-operated valve 104. The valve 104 is operated by the lever 106 which constitutes a cam follower coacting with the cam 108 (FIGS. 6 and 10) fixed to and extending upward from the disc 2. The coil spring 110 (FIG. 10) urges rotation of the valve and lever 106 in a clock-wise direction as viewed in FIG. 10 so that the follower lever 106 bears against vertical surface 112 of the cam 108 in the situation shown in solid line in FIG. 10 where the valve 104 is admitting pressure from the hose 100 to the tube 28. In the phantom line position shown in FIG. 10 the follower lever 106 has rotated clock-wise through 90° and has cut off the pressure supply to the tube 28.

Cam means for causing the supplementary motion of the pickup assemblies toward and away from their respective sheet material supports and cam means for causing operation of the suction control valves 72 can conveniently be incorporated more or less in the single continuous cam 82 circumscribing the axis of rotation of the disc 2 as shown particularly in FIG. 2. For structural convenience in supporting the cam 82 a portion 114 of it, not generally used for camming, is anchored on a support column 116 carried by the framework of the base 4. Each pickup assembly 20 descends under the action of gravity aided by the spring 92 as its follower roller 84 descends along the lower portion of the cam 82 and is forced upward as the roller 84 rises along the rising surface of the cam 82. Since the desired motion of the valve 72, for a large part of the time, is similar to that of the assembly 20, the same cam 82, merely being made wide enough to accommodate roller 84 and roller 86, can be used. However, at the collector station, as shown in reference to the right hand pickup assembly in FIG. 2, it is required that the valve 72 be elevated relative to the assembly 20 and to accomplish this it suffices to add a small protuberance to the high side of the cam surface 82 in the form of a block 118 screwed or otherwise fastened to cam 82. The rising of the roller follower 86 upon the block 118 raises the rod 34 to displace the valve 72 into a position where it blocks off the vacuum supply to the suckers 38 and simultaneously admits atmospheric pressure to them through tubes 26 thus causing the suckers to drop the sheet of sheet material (until then carried by them) into a collector which, with its associated mechanism, will now be described.

The collector and associated mechanism

The collector into or onto which the pickup assemblies sequentially deposit their respective sheets of material is indicated generally at 22. It can be of any convenient construction such as a platform, a moving belt or the like or a chute. In the preferred embodiment illustrated, it

comprises what might be designated as a collector tray made up of a base plate 120 (FIG. 4) having a guide wall 122 on one side and what amounts to a second guide wall 124 oriented to engage an edge of sheet material deposited in the collector tray which is non-parallel to the edge engaged by the guide 122. The members 122 and 124 combine to retain sheet material in the tray. The collector and its associated equipment are supported by the base 4, being carried by a plate 126 fastened to part of the base structure such as angle iron braces 128 and 130.

To assist in guiding a sheet of material released by the suckers of a pickup assembly onto the collector 120, curved spring fingers 132 are provided, each having a pivoted arm 134 which, under the action of gravity and/or a light spring, engage each sheet of material and retain it against the upper surface of the tray 120.

For aligning a group of sheets deposited in the collector 120 a jogger mechanism is provided comprising a pair of pusher elements 136 adapted to engage a pair of non-parallel sides of sheet material deposited in the collector to urge the sheet material against the pair of guides 122, 124. The pusher elements 136 could be mounted independently but conveniently are mounted as part of a unit including a base plate 138 which, in effect, forms an extension of the base plate 120 of the collector tray. The pusher member 138 is carried by the plate 120 and mounted for movement relative thereto by virtue of the slot and pin connections 140, 142. The slots 140 are cut on the bias relative to the plate 120 so that as the pusher 138 is moved, sliding along the pins 142, it engages any sheets of material extending beyond the borders of the plate 120 and urges them simultaneously against the constraining walls 122 and 124. Any convenient mechanism can be used to operate the pusher member 138. Such a mechanism is shown as including a solenoid 144 connected through link 146 and associated crank, shaft, and lever mechanism to the link 148 pivotally pinned at 150 to the pusher 138. After the disc 2 has rotated sufficiently to deposit a predetermined desired number of sheets such, for example, as one from each stack of material, on the collector 120, the solenoid 144 is energized to move the pusher member 138 toward the plate 120 so that the pusher elements 136 urge the group of sheets on the collector into alignment. If desired, when assembling a large number of sheets, each sheet may be aligned independently just after it has been deposited in the tray and before the following sheet is deposited in the tray. A spring return 151 returns the pusher member 138 to the position shown in FIG. 4. The means for energizing the solenoid conveniently comprises a switch 152 (FIG. 3) operated by a cam follower arm 154 (FIGS. 2 and 3) pivoted on a plate 155 forming part of the base framework 156 and actuated by a roller type cam 158 (FIGS. 2 and 3) depending from the bottom of disc 2.

Under some circumstances it may be desirable to fasten together, as by stapling or otherwise, groups of sheets of material in the collector after they have been jogged into alignment. To accomplish this function the preferred embodiment shows a more or less conventional stapler adapted for automatic operation. One or more staplers can be used and placed in any desired location such as along one edge of the sheets of material. However, the illustrated embodiment shows a single stapler 160 adapted to staple the corner region. The stapler is supported on a bracket extending from the plate 120 and is operated by a solenoid-actuated lever 162. The lever 162 carries a roller 163 which acts on the head of the stapler 160 with a gentle, rotating camming action that prevents damage to the stapler head and extends its life materially. This action is a marked improvement over the destructive hammer action that slams the life out of conventional low-cost solenoid actuated staplers wherein the solenoid acts essentially only downward on the stapler head. This solenoid, which actuates the lever 162 and is provided with a manually operated selector switch to disable it at will, is controlled conveniently by a switch identical to switch 152 which in turn is operated by a pivoted cam follower 164, similar to arm 154, actuated by a roller cam similar to 158 and carried on the same shaft therewith. The operation of the stapler follows the jogging step.

To facilitate ejection of the group of sheets from the collector 120 after the sheets have been jogged and, if desired, stapled, the guide 124 is preferably made movable. It is slidably mounted on the plate 126 and its motion relative to the plate 126 is facilitated by rollers 166. When it is desired to eject a group of jogged sheets from the collector 120 the plate 124 is lowered, conveniently by means of a solenoid mechanism, until the upper surface 168 of the plate 124 is below the level of the sheets in the collector 120. The group of sheets is then ejected from the plate 120 by any convenient means such as the continuously driven power roller, of rubber or the like, 170 driven by motor 172, coacting with the idler rollers 174 carried by the plate 124. The power roller 170 is arranged so that its upper surface is approximately tangent to the upper surface of the plate 120 so as to engage the lower side of sheet material in the tray 120. The plate 124 is moved by a solenoid 176 through a linkage generally indicated at 178 and returned by a spring 180. The actuation of the solenoid 176 is accomplished in sequence with the jogging step and, if operative, the stapling step, by means of a third arm 182 (FIG. 3) similar to the arms 154 and 164, actuated by a roller similar to roller 158. In addition, the solenoid for the gate 124 has in its circuit a manually operable selector switch which can disable the solenoid at will.

Bundles or groups of sheets of sheet material ejected from the collector are conveniently deposited in or on a receiver. The receiver can be in any shape or form such as a table, a platform, a box, a moving belt, etc. However in the preferred embodiment it is shown as a sort of bin generally indicated at 184. The receiving bin 184 is more or less in the form of an open box adjustable in size by means of a movable rear wall 186 held in place by thumb screws 188. The bin has one or more loosely pivoted arms 190 acting in a manner similar to arms 134 to guide bundles of sheets into the bin and retain them in place. For reasons to be discussed in connection with the operation of the equipment, the bin 184 is shown as being mounted for adjustment into at least two different positions relative to the collector tray. As seen in FIGS. 4 and 5 the bin 184 is carried on rollers 192 which are mounted to turn on axles carried by the supporting bracket 194 which supports the bin assembly. The bin is held against rollers 192 by retaining spring 195 but can be shifted sideways, in the modification shown, into one of two positions, by any convenient means. This means is illustrated as including a solenoid 196 together with a linkage arrangement generally designated as 198 and return springs 200. The bin shifting mechanism has a separate manually controlled selector switch for disabling it, but when this switch is in the "on" position, the mechanism is actuated by a switch 202 (FIG. 4) which itself is operated by a lever 204 forming part of the ejector gate mechanism. This causes the bin shifting mechanism to operate in proper sequence relative to the ejector mechanism so that upon the ejection of one group of sheets, the bin is shifted into its alternate position and remains there until the next group of sheets has been ejected after which it returns to its original first position.

Operation

In using the embodiment of the invention shown in FIGS. 1 through 10, the supports 1 are each loaded with a stack of sheet material such as paper which it is desired to collate. In the embodiment shown in FIG. 1, there are eight supports for sheet material which means that, with this embodiment, a pamphlet having a maximum of eight sheets can be assembled with each revolution of the disc 2. Embodiments capable of handling a

greater number of sheets per revolution can obviously be made by using a disc 2 of larger diameter or by making a multi-deck arrangement of two or more discs 2 or two or more sets of supports carried by the same disc.

After the sheet material supports have ben loaded with the stacks of paper, for example, the switch controlling the motor 14 is thrown starting rotation of the stack support assembly. Next, assuming that it is desired to jog, staple, and eject groups of eight sheets, the separate manual control switches for each of these operations is thrown into the "on" position. Considering each of the supports 1 as being designated in sequence by the letters A through H, it will be observed that the rollers 158 actuating the arms 154, 164 and 182 to initiate the jogging, stapling and ejecting steps, are located adjacent support H so that these steps will occur only after all eight sheets have been deposited in the collector 22. With this in mind, the operator watches the rotation of the disc 2 until the suckers 38 of the pickup assembly 20 associated with support A are approaching the surface of the stack in support A and at that same instant throws the switch energizing the pump 50 to apply suction to the suction manifold 64 and pressure to the pressure manifold 98. Thus the first sheet to be picked up will be from support A and the others will follow in proper sequence insuring that the first jogging and stapling action will take place only after a full group of eight sheets has been deposited in collector 22.

With the pump 50 in operation the top sheet from each stack is gradually picked up and deposited in the collector 22 as the disc 2 rotates clock-wise as viewed from the top in FIG. 1. The pickup assembly 20 for each stack descends towards the top of the stack as its roller 84 descends to the lower portion of the cam 82. This descent of the assembly 20 is accomplished by gravity acting on the mass of the assembly plus the spring 92. When the foot 46 reaches the top of the top sheet in the stack, the assembly 20 comes to rest and the sucker 38 is so adjusted on its threads that it is close to or resting against the upper surface of the top sheet as seen in FIG. 7. Under the action of suction through the tube 36 combined with an air blast emitted from the opening 42 the sucker 38 picks up the top sheet only from the stack of material. This function is assured by the air blast from 42 keeping the uppermost several sheets of the stack separated from one another. In addition, as seen in FIG. 8, where the assembly 20 has started to rise away from the stack lifting with it the top sheet, the separation of the top sheet from the others is insured by one or more curved spring wires 204' fastened to and extending upward from the stack supports 1. Occasionally, despite the air blast from 42, two sheets may tend to stick together because of electrostatic attraction or otherwise but invariably the combination of the air blast from 42 with the wires 204' will separate the top sheet. Often the sheets are separated without ever touching the wires 204.

As the support assembly continues to rotate, the roller 84 rides up along the ascending surface of the cam 82 lifting up the pickup assembly 20 with its single sheet of paper held by the sucker 38. As the pickup assembly 20 rises, the cam follower 106 rides up along the vertical surface 112 of the cam 108 (FIG. 10) and as the motion is continued, the surface 112 no longer obstructs the motion of lever 106 so that this lever can turn under the action of spring 110 and close the valve 104 cutting off the air blast supply to the nozzle 42. This is desirable at this time since the air blast is no longer needed to separate sheets of paper and its continuance would be undesirable since it might tend to blow the selected sheet of paper off the sucker 38. The pickup assembly 20 rises until it is high enough to be above the top surface of the collector 22 as shown in FIG. 2. As it reaches the position directly above the collector 22 the sheet of paper has been pulled under the spring fingers 132 and has been engaged by the arms 134 which tend to strip it off the suckers 38. When the paper is in position directly over the collector 22, the roller 86 has ridden up on the block 118 (FIG. 2) and raised the valve 72 to the position shown in FIG. 2 and also in phantom line in FIG. 10 thus cutting off the vacuum supply to the suckers 38 and subjecting them to atmospheric pressure so that they release the sheet of paper which then falls to rest on the collector 22. This event is just about to occur in the configuration shown in FIG. 9 where the arms 134 have already started to strip the sheet of paper shown in phantom line from the suckers 38.

After the last of the sheets from the eight supports has been deposited in the collector 22, continued rotation of the disc 2 brings the roller cam 153 into engagement with the cam follower arm 154 to actuate the switch 152 (FIG. 3) which energizes the solenoid 144 (FIG. 4) to cause the pusher member 138 to jog the eight sheets in the collector 22 into alignment against the plate 124 and the guide 122. Very soon thereafter continued rotation of the disc 2 causes motion of the lever arm 164 (FIG. 3) to energize the solenoid acting on the stapler lever 162 (FIG. 2) to cause the stapler 160 to staple the corner, in this instance, of the group of sheets as shown in FIG. 11. Promptly thereafter the continued rotation of the disc 2 causes motion of the lever arm 182 (FIG. 3) to energize the solenoid 176 (FIG. 4) to depress the gate 124 which slides easily along the rollers 166. The power driven roller 170 engages the lower surface of the group of stapled sheets in the collector 22 and, coacting with the idler rollers 174, transports the pamphlet over the top of gate 124 above the surface 168 and deposits it in the receiver bin 184. The cycle is then repeated.

Sometimes it may be desired to deliver the groups of sheets or pamphlets into the receiver bin in the form of a staggered stack where periodically, for example on alternate cycles, a pamphlet or group of sheets is displaced from the preceding one so that it is easy to separate from the pile. This situation may be desired when a machine having, for example, only eight stacks is to be used to assemble pamphlets of, say, twelve sheets. In this case a first run would be made with the first eight sheets being assembled, without stapling, into groups which are piled into the receiver bin in a staggered stack wherein each group of eight sheets is displaced, say, laterally from the adjacent groups. The next run of the machine would be used to assemble the additional four sheets for each pamphlet, also into a staggered pile. Then the two staggered piles can be manually paired so that a group of eight sheets removed from the first pile is manually attached to a group of four sheets from the second pile and then the complete twelve sheets are manually stapled. This function of staggered piling into the receiver bin 184 is accomplished by throwing into the "on" position the manual switch for the bin-shifting mechanism. Thereafter the motion of the lever 204 (FIG. 4) occasioned by the occurrence of the ejection step causes alternate operation of the push-on, push-off switch 202 which controls the solenoid 196 (FIG. 5) thus producing a pile of staggered groups of sheets as shown at 206 in FIG. 5. The sequence of events would be as follows. As the solenoid 176 (FIG. 4) is energized, it starts motion of the linkage 178 which lowers the gate 124 and causes ejection of the group of sheets from the collector 22 into the bin 184 by the coaction of roller 170 with roller 174. After this has occurred the solenoid 176 is deenergized and the spring 180 returns the gate 124 into blocking position and simultaneously causes the lever 204 to actuate the swtich 202 supplying power to the solenoid 196. Solenoid 196 thereupon, through linkage 198, shifts the bin 184 into the phantom line position shown in FIG. 5 where it remains because power is continuously supplied to solenoid 196 until the switch 202 is given another push. Upon the next rotation of the disc 2 another group of sheets is deposited in the bin 184 in staggered relation to

the first mentioned group and at the end of this cycle the switch 202 is given another push by the lever 204 de-energizing the solenoid 196 and permitting the bin 184 to be shifted into the solid line position in FIG. 5 by the spring 200.

The staggered piling in the receiver bin can also be used to advantage where two pamphlets are to be assembled simultaneously when the total number of sheets in the two pamphlets does not exceed the number of supports on the disc 2. For example, if one pamphlet of five sheets and another pamphlet of three sheets have to be assembled, this can be done simultaneously with the use of the shifting receiver bin. In such a case an additional set of roller cams similar to 158 would be attached beneath the disc 2 to actuate the jogging, stapling, ejector, and bin-shifting mechanisms during the interval between the passage of support E by the collector 22 and the passage of support F past the collector 22.

Although the operation of the embodiment of FIG. 1 described in relation to a single collector, there can, of course, be a plurality of collector stations used both with this embodiment and with other embodiments of the invention. In the case of the rotating disc type of assembly, a plurality of collector stations could be installed around the periphery of the disc, each with its own set of cam-actuated switches similar to 152 and the cam 82 would be modified to cause cycling of the pickup assemblies more frequently than once per revolution of the disc—namely, once for each collector station. Also by using a separate cam similar to 82 for each pickup assembly, certain of the pickups can be made to deliver to only one collector station and other pickups can be made to deliver to only another collector station. The operation of these modified forms is in all other respects generally similar to the operation of the embodiment of FIG. 1.

Support structure for on-edge stacks of sheet material

Although the embodiment of FIG. 1 shows the supports for the stacks of sheet material carrying the sheet material with the surfaces of the sheets parallel to the surface of the disc or table supporting the assembly of supports so that the motion of the sheets, as the assembly of supports moves as a unit, is in a direction parallel to the planes of the sheets, the stacks of material can equally well be supported on edge. This type of support is applicable to the rotary disc type of assembly such as shown in FIG. 1 or to the other types of support assemblies described hereinbefore: for example, the traveling train type, the endless belt type, and the reciprocation type. The stacking of the material in the supports on edge, that is, with the planes of the material generally oblique to or perpendicular to the plane of motion of the assembly of supports allows for including more stacks of material in the same linear or circumferential distance along the assembly of supports. For example, as applied to the embodiment of FIG. 1, on-edge stacking of the sheets with their planes perpendicular to the plane of the disc 2 would permit of stacking perhaps three or four times as many stacks of material on the same size disc, i.e., instead of eight, perhaps twenty-four or thirty-two.

A suitable support for on-edge stacking of sheet material perpendicular to the plane of motion of the support is shown in detail with part of the associated pickup mechanism in FIGS. 12 and 13, FIG. 12 being an isometric elevation view and FIG. 13 being a side elevation view. A suitable support for on-edge stacking of sheet material with the planes of the sheets oblique to the plane of motion of the supports is shown in FIGS. 14 and 15.

Although FIGS. 12 and 13 show the supports so arranged that the sheets of material are oriented with their planes perpendicular to the plane of motion of the support and also perpendicular to the direction of motion of the support, the invention nevertheless comprehends arranging the support so that the planes of the sheets of material are oriented perpendicular to the plane of motion of the support but parallel to the direction of motion of the support. That is, for example, if the support of FIGS. 12 and 13 be regarded as applied to a disc, then the thickness of the stack of sheets of material would be regarded as extending circumferentially or tangentially but it could be arranged, within the scope of the invention, that the thickness of the stacks would extend radially with the planes of the sheets thus perpendicular to the radius of the disc. Furthermore, the capacity of a given size disc, assuming it is sufficiently large, can be increased by arranging one or more pluralities of stack supports lying on concentric circles of the disc. This arrangement can be constructed with the planes of the sheets of material extending either tangentially or radially and with the sheets either on edge or flat, in each case with suitable modification of the collector.

In FIGS. 12 and 13, numeral 208 represents a portion of the support of a support assembly which may be the equivalent of the disc 2 in the embodiment of FIG. 1 or the main body of a reciprocating assembly or the like. A plate 210 carried by the body 208 serves as a backing for the on-edge stack of sheet material 212. The plate 210 is slidable along the body 208 and is held snugly and firmly perpendicular to it by means of a plurality of rollers 214 carried on a shaft 216 supported by ears 218 depending from foot 220 which latter slides on the upper surface of the body 208. If the body 208 be regarded as a portion of a disc such as disc 2 in the embodiment of FIG. 1, then it should be noted that the ear 218, not visible in FIG. 12, which supports the end (not visible) of shaft 216 remote from the observer of FIG. 12, extends through a slot, not shown, in the body 208. The plate 210 is urged to the left in FIG. 13 by a spring 222 but is held against motion at certain times by a pair of pawls 224 (one not visible) carried by the ears 218 and engaging ratchets 226 (one not visible). Each pawl is urged into engagement with its ratchet by a spring 228. The face of the stack of sheet material opposite that engaging plate 210 is supported by a plate 230 fastened to the body 208 by an angle portion 232 and brackets 234. A cranked rod 236 is carried by arms 238, 240 supported by ears 242 extending from the plate 230. By virtue of notched-out portions 244 of the plate 230 the end portions 246 of the rod 236 are enabled, under certain circumstances, to push against the stack of sheet material. To accomplish this pushing action, a roller follower 248 is provided carried generally at the center of a shaft 250 which connects the corresponding ends of arms 238 and 240. Follower 248 is capable of riding up on a cam 252. Similar roller followers 254 are provided for pawls 224 to coact with cams 256.

A pickup assembly shown in part at 258 is provided in the usual fashion with air blasts 260.

Operation

In operation the body 208 forming part of the support assembly moves, either rotating or translating, and its motion carries the roller followers 248 and 254 with it, of course. The roller 248 rises up on its cam 252 forcing the cranked rod 236 to the right in FIG. 13 until it is in the solid line position wherein the end portions 246 of the rod 236 force the lower portion of the stack of sheet material 212 away from the plate 230. While the rod portions 246 remain in this position the roller followers 254 ride up on their cam surfaces 256 displacing the pawls 224 from their respective ratchets 226, thus enabling the spring 222 to urge the plate 210 toward the plate 230 to take up whatever slack has occurred by the removal of a sheet of material from the stack 212 previously in the cycle. Subsequently, with further motion of the assembly, the rollers 254 ride off of their cams 256 allowing the springs 228 to return the pawls 224 into engagement with their ratchets 226. Thereafter the roller 248 descends from its cam surface returning the end portions 246 of the rods 236 to their neutral positions out of engagement with the stack 212. (The brackets 234 limit the motion of portions 246.) This permits a slight loosening of the sheets in the

stack 212 between the confines of the plates 210 and 230 enough to enable the blast from the blast tube 260 to separate the top sheets so that the pickup assembly 258 can thereafter remove the single frontmost sheet from the stack by vertical motion under the action of cams or the like as shown by the arrow and dotted line position in FIG. 13. Conveniently the sheets can be deposited in an inclined collector similar to that shown in FIG. 15 and described hereinafter.

Multiple pickup structure

Although the embodiment of FIG. 1 shows a separate reciprocating pickup assembly for each support for a stack of material, it is sometimes convenient to use a single reciprocating assembly with a pluarlity of sucker groups to act simultaneously on a plurality of stack supports. Such an arrangement is shown in part in the detailed drawings of FIGS. 14 and 15, the former being an isometric elevation view showing features of the multiple sucker arrangement about to remove sheets from several stacks and the latter being an elevation view partly in cross section showing sheets being deposited in a collector.

The stack supports shown in FIGS. 14 and 15 happen to be of the type wherein the sheets of material are oriented with their planes oblique to the plane of motion of the supports.

In FIG. 14 the numeral 262 designates a disc or similar body of a rotary or translatory assembly of supports. A plurality, shown only for example as three, of stack supports 264 is shown with the supports overlapping one another for convenient access by the multiple sucker arm arrangement generally designated as 266 and for conserving space on the body 262. The inclined orientation of the supports 264 while permitting more stacks to be associated in a given linear or circumferential distance of the assembly requires that the suckers be also inclined as apparent at 268. The pickup assembly is generally similar to that shown in the body of FIG. 1 with the exception that three separate valves 270, 272 and 274 with associated cams must be provided for the three sucker arms, respectively. Each sucker arm has associated with it in the usual manner a blast tube 276.

As is shown in FIG. 15 the collector 278 is conveniently inclined so that the sheets can be deposited in sequence from each sucker group arm. The valves 270, 272, 274 operate in sequence dropping the respective sheets into the collector 278. In FIG. 15 the first of a group of sheets from one multiple pickup arm assembly has just been released into the collector and the other two are about to follow. The jogger used with this type of inclined collector jogs only in a direction perpendicular to the plane of the drawing since gravity serves to perform the jogging function in the opposite direction by urging the sheets against the side 280 of the collector.

Refinements of the various embodiments heretofore described can include the installation of such items as automatic equipment actuated by a counter to terminate operation of the collator when a predetermined number of cycles has occurred and automatic equipment actuated by, for example, an electric contact of, say, the foot 46 with the block 5 to shut off the collator when a support is empty of sheet material.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A device for conveying and jogging sheet material into alignment comprising a support for said sheet material including a base element adapted to engage the surface of said sheet material; a pair of guide elements extending generally perpendicular to the surface of sheet material in said support against which two non-parallel edges of said sheet material are adapted to abut to align said sheet material; means including a pusher member movably mounted relative to said base member for urging said sheet material into alignment; and roller means for engaging said sheet material to eject it from said support.

2. A device for conveying and jogging sheet material into alignment comprising a support for said sheet material including a base element adapted to engage the surface of said sheet material; a pair of guide elements extending generally perpendicular to the surface of sheet material in said support against which two non-parallel edges of said sheet material are adapted to abut to align said sheet material; a pusher member having a base element forming generally an extension of the base element of said support for engaging portions of sheet material carried by said support but extending beyond the boundaries of the base element of said support; said pusher member also including pusher means for engaging two non-parallel edges of said sheet material to urge said sheet material into alignment against said guide elements; means for moving said pusher member in a direction intermediate the direction of said first mentioned two non-parallel edges of said sheet material to urge said sheet material into alignment; means mounting one of said guide elements for motion out of engagement with said sheet material to provide a free passageway for said sheet material to be ejected from said support; roller means for engaging one surface of said sheet material and coacting roller means carried by said movable guide element for engaging the other surface of said sheet material for ejecting said sheet material from said support; means for moving said movable guide element out of abutting relation with said sheet material after said sheet material has been urged into alignment; and means for driving at least one of said roller means.

3. The device of claim 2 further including power driven fastening means for fastening together sheets of said sheet material in said support and means for actuating said fastening means after said sheet material has been jogged into alignment and prior to ejection of said sheet material from said support.

References Cited by the Examiner

UNITED STATES PATENTS

1,396,436	11/21	Kately et al.	271—89
2,167,470	7/39	West	270—58
2,264,776	12/41	Spiller	1—330
2,362,134	11/44	Honig	270—58
2,393,254	1/46	Leifer	271—89 X
2,460,876	2/49	Dager	271—89
2,689,727	9/54	Rineer	270—58

ROBERT B. REEVES, *Acting Primary Examiner.*

EUGENE F. CAPOZIO, WILLIAM B. LA BORDE, *Examiners.*