

Oct. 13, 1964

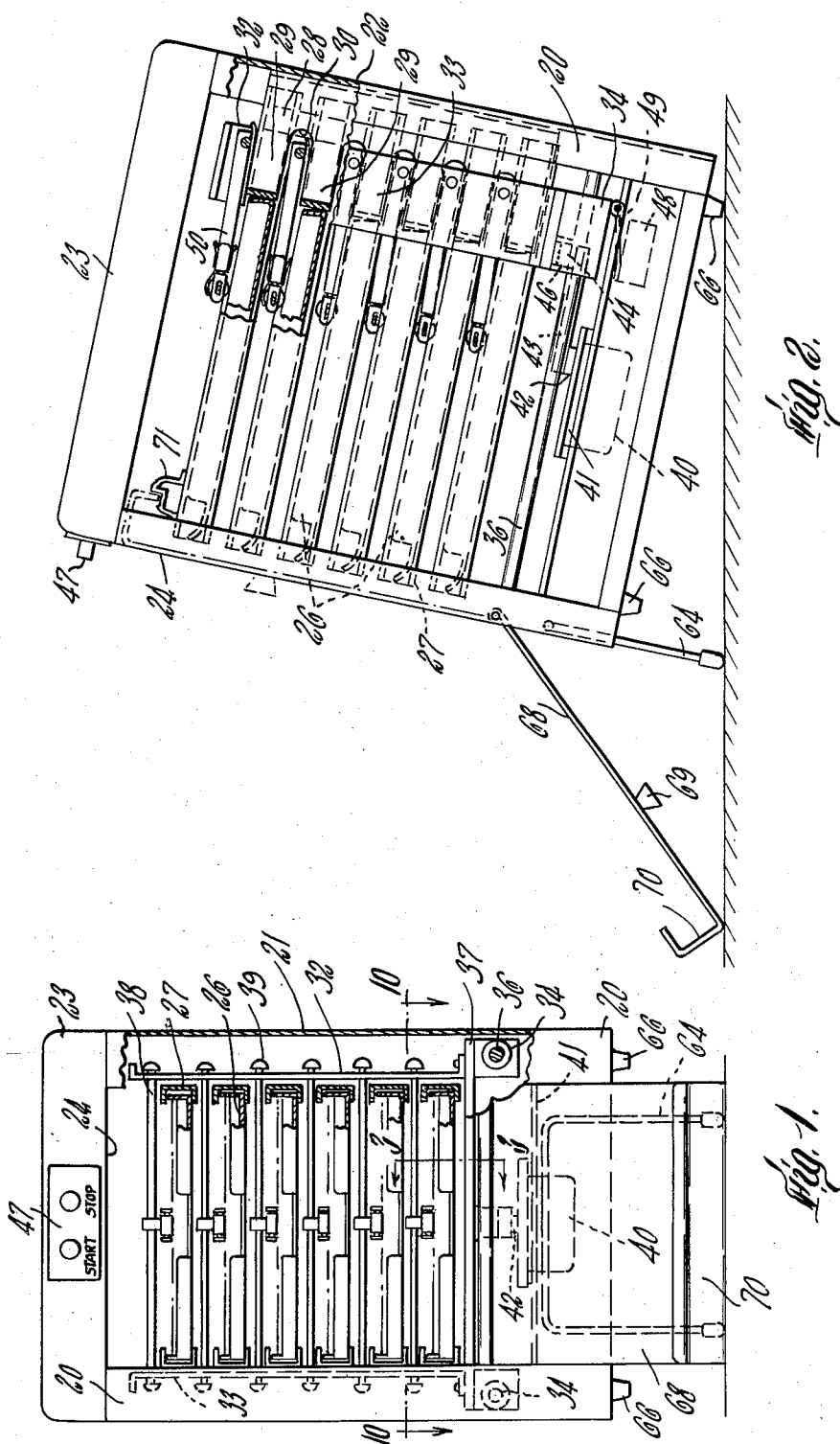
J. J. QUINN ET AL

3,152,801

SHEET COLLATING DEVICE

Filed Dec. 27, 1961

3 Sheets-Sheet 1



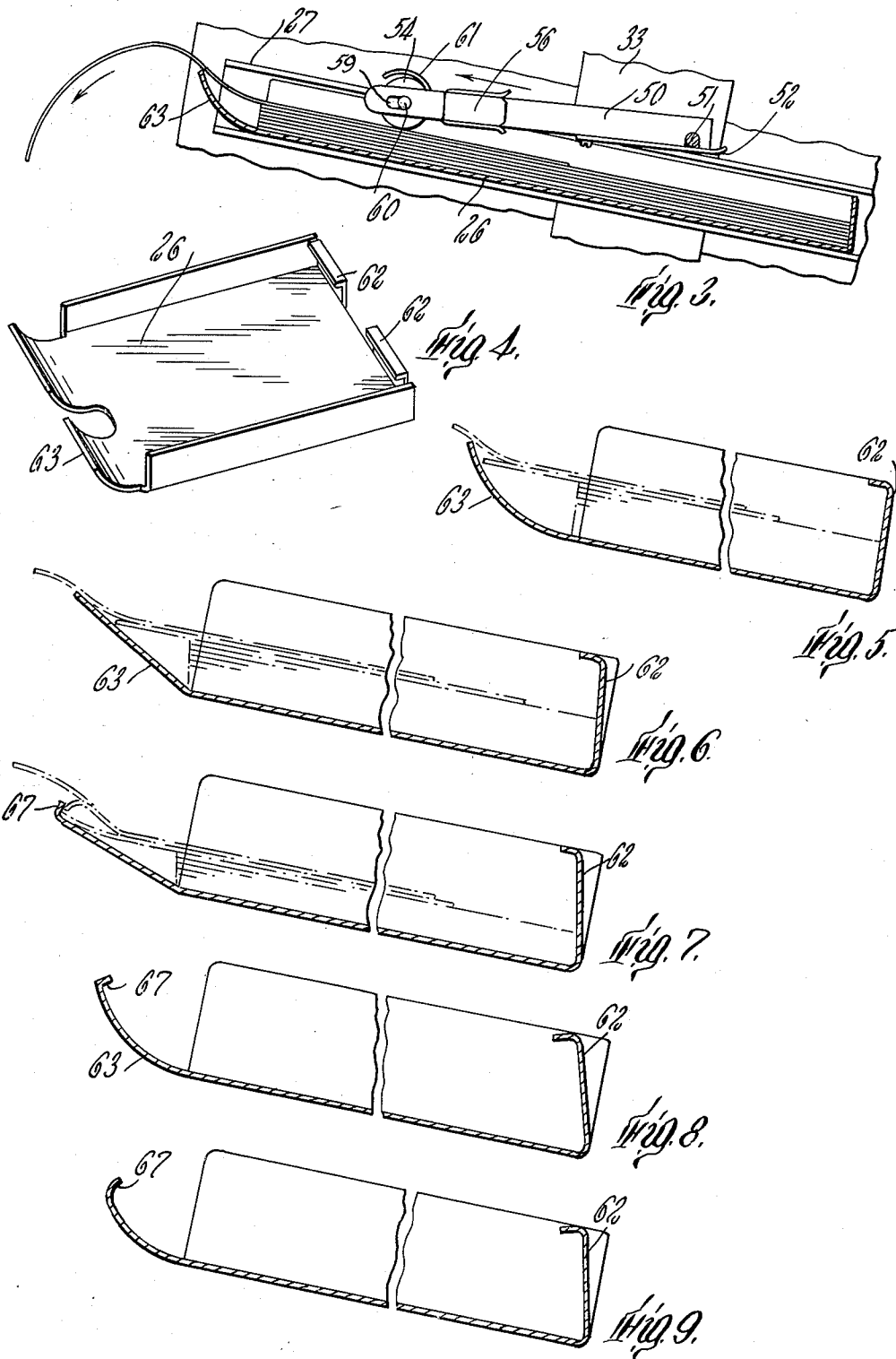
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3 Sheets-Sheet 2



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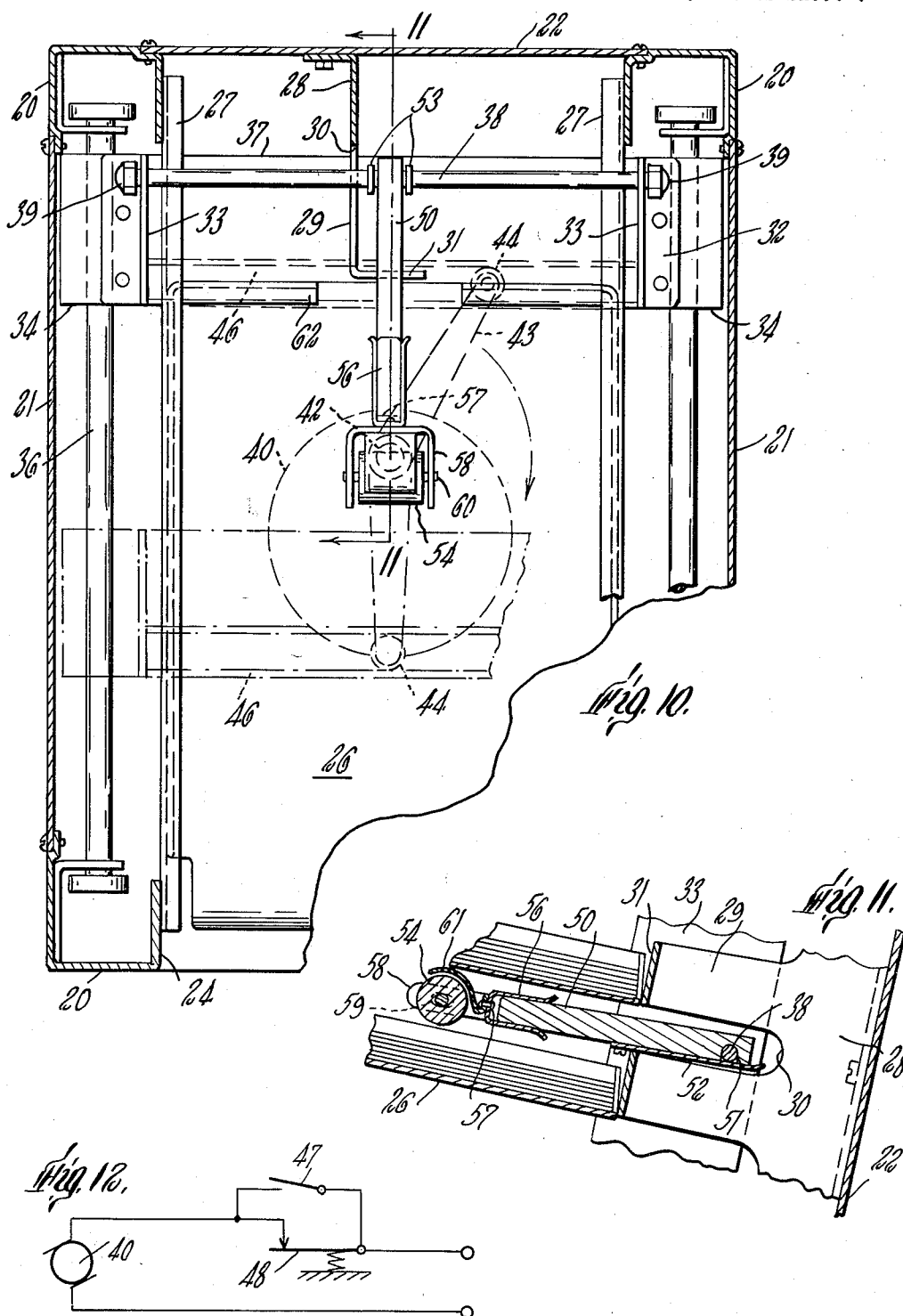
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3 Sheets-Sheet 3



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3,152,801

SHEET COLLATING DEVICE

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5 Claims. (Cl. 270—58)

This invention relates to a collating device or gatherer used in the collating or assembling of sets of sheets of paper in a chosen order. This particular gatherer is designed to eject or deal single sheets of paper periodically and simultaneously from each of a series of prearranged trays or bins in such a position that an operator may grasp all of the ejected sheets together and stack them as a set.

One object is to provide an inexpensive but dependable device of this character which is composed of but relatively few parts easily fabricated and assembled.

Another object is to provide a device in which the trays or bins holding the sheets are readily removable and interchangeable so that tray designs specifically adapted for handling particular weights or finishes of paper can be substituted or intermixed easily in the device.

An important object is to provide automatic positioning of the mechanisms for ejecting sheets from the trays so that when insertion or withdrawal of either trays or sheets is desired, this may be accomplished free from interference by the paper-ejecting mechanisms.

A further object is to provide tray designs and other arrangements which assist to an optimum degree in the separation of single sheets from a stack of sheets in a tray so that when the sheet ejection mechanism functions there will be virtually no chance of dealing two sheets at one time from the tray.

Still another object is to arrange the machine so that more paper stock may be added to any one or all of the trays without removing the trays from the device.

A still further object is to provide a shelf or rack for holding stacks or sets of papers after they have been gathered, the shelf or rack being part of the gathering device cabinet rather than a separate unit.

The principal objects of the invention are met by providing a cabinet removably holding a vertical array of nearly horizontal separate trays, each of which is designed to hold a pile of sheets of paper, each tray having a front edge assisting in the separation of the top sheet from the other sheets in the tray, and a motor driven arrangement of periodically actuating pushers, one for each tray, each pusher engaging the top sheet in each tray to eject the sheet. Controls are arranged for the motor so that when the switch normally starting or stopping the motor is turned off, the motor and the pusher drive actuated by the motor will continue until the pushers are retracted to their fullest extent and are also raised and free from the trays and from the paper which may be stacked therein. The door of the cabinet, when opened, is designed to serve as a gathering rack.

Other objects and advantages and further details of the invention will become apparent from the following description taken with the accompanying drawings which form a part thereof and in which:

FIG. 1 is a front elevational view of a device according to the invention with parts being broken away to show interior construction;

FIG. 2 is a side elevational view of the device of FIG. 1 but with one of the side panels or walls removed;

FIG. 3 is a sectional view along the line and in the direction of the arrows 3—3 of FIG. 1 showing on an enlarged scale one of the paper holding trays and asso-

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ciated paper ejecting mechanism approaching its sheet ejecting position;

FIG. 4 is a perspective view showing one of the paper holding trays or bins;

FIGS. 5, 6, 7, 8, and 9 are sectional views illustrating various forms or shapes of trays designed for handling paper of different weights and finishes;

FIG. 10 is a sectional plan view on line 10—10 of FIG. 1 showing the relationship of some of the moving parts of the apparatus;

FIG. 11 is a sectional view similar to FIG. 3 on line 11—11 of FIG. 10, but with a paper ejector in its retracted and raised position, and

FIG. 12 is a wiring diagram indicating the driving motor, its controls and their connections to one another.

The housing or cabinet of the device may be made of sheet metal formed of four vertical corner posts 20, side panels 21, rear panel 22, and a top 23 suitably secured together. This cabinet serves as a framework for supporting the rest of the parts and mechanisms and it has an open front 24 for purposes that will later be evident.

The paper holding trays 26, shown here as six in number, are made preferably of sheet aluminum. They are slidably received in channels 27 welded or similarly fastened to the corner posts 20, alongside the side panels. These trays may be inserted or removed easily through the front opening 24 of the housing or cabinet. Their rearward movement in the channels is restricted by a common stop element 28 having a series of stop arms 29 separated by cutouts 30 for clearance purposes later described. Each stop arm 29 has a front sidewise-turned end portion 31 against which the back end of a tray will rest. This stop element 28 is secured to the rear panel 22 of the housing as by welding or in any other suitable manner.

The mechanism for ejecting sheets of paper from the trays is actuated by a driving frame 32 of ladder-like form having two side pieces 33, and it is carried by sliding bearings 34 which are reciprocable on way rods 36 fastened inside the housing. The bottom ends of the side pieces of the driving frame are spaced apart and held by a bottom cross piece 37 to which they are suitably bolted or otherwise secured. The bearings 34 may also be carried by this cross piece, as shown. At spaced intervals the side pieces of the driving frame are bridged by cross rods 38, the spacing between these rods being the same as the spacing between the channels 27 supporting the trays for reasons which will be apparent. These cross rods are preferably loosely held by the side pieces of the driving frame so that they may rotate freely therein, although they are kept from endwise movement by cap nuts 39 or something similar secured over their outer ends.

The entire driving frame is moved on the way rods 36 toward and away from the back panel 22 of the housing by means of a motorized drive, starting with the motor 40, mounted on a bracket 41 extending across the bottom of the housing. A step-down gearing of commercially available design is built into the motor case itself so that its output shaft 42 has a speed of about 20 to 21 r.p.m. Fastened to the motor output shaft, as by a set screw, is a driving bar 42 with an upwardly projecting collar or roller 44 at its free end. This roller engages and rides in a channel track 46 secured under the bottom cross piece 37 of the driving frame. Obviously, as the motor output shaft rotates, the drive bar will swing in a circle, and the roller riding in the track will move the driving frame first forward and then backward in the housing.

As indicated in the wiring diagram of FIG. 12 the control for the motor includes not only a conventional ON-OFF switch 47, but also a normally closed stop switch

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48 in parallel therewith. This stop switch has an actuating arm 49 located in the path of movement of the driver frame near the end or back of its reciprocating motion in the housing. Therefore, every time that the driver frame reaches the inner end of its movement it will strike the arm 49 of the stop switch 48 and open it, thus stopping the motor if the ON-OFF switch has been turned OFF in the meantime. Naturally, if the main switch is ON, the opening of the stop switch will not stop the motor because it is in parallel with the closed main switch.

This type of control, which will stop the drive only when the driver frame is in its most rearward or fully retracted position, is provided so that the pusher arms will be out of the way and the trays may be loaded, unloaded, removed and replaced without obstruction when the machine is stopped. The pusher arms 50, of which there are six, one for each tray, are simply straight pieces, preferably made from square bar stock, pivotally connected to the centers of the cross rods of the driver frame. The pivotal connection has been shown here in the form of a notch 51 near one end of the pusher arm, fitting over the cross rod, and closed by a spring leaf 52 so that each pusher arm may be connected to or removed readily from its cross rod. Guide washers 53 on the cross rod, located on either side of the pusher arm, limit lengthwise movement of the pusher arm on the cross rod and keep it centered.

At the other end of the pusher arm a rubber covered paper feeding roller 54 is mounted as by spring arms 56 which slide over and frictionally grip the ends of the four sides of the square-sectioned pusher arm. These spring arms are loosely swiveled as at 57 by a rivet to a roller carrier 58, which has slots 59 in its sides which receive the axle pin 60 of the roller, and which has a top curved braking surface 61 which will bear against and stop rotation of the roller 54 when its axle is in the rear end of the slots 59 (i.e.—when the pusher arm is being moved forwardly) and which will be free of the roller and permit its rotation when the axle is in the front end of the slots (i.e.—when the pusher arm is being retracted). In effect, this is a one-way clutch which produces minimum frictional drag by rolling on the paper when the pusher arm is being moved rearwardly and which stops rotation of the roller to produce maximum friction between roller and paper as the pusher arm is moved forwardly. The swivel connections of the rollers to the pusher arms insure proper leveling of the rollers on the sheets of paper in the trays.

In order to make the trays readily removable, and to permit loading of the trays without interference by the pusher arms, the control for the drive will always stop the driving frame in its extreme backward position as above described. In this position the stop arms 29 serve a function in addition to locating the back edges of the trays. It will be noted that the sidewise turned portions 31 at the ends of these arms each lie under a pusher arm 50 and in front of the pivoted end of the arm when the cross rods on the driver frame are in the cut-out portions 30 of the stop element, as they will be when the driver frame is fully retracted. As each pusher arm approaches the most rearward position of its movement, its lower face will first strike against the top edge of the sidewise turned portion of the stop arm 29 associated with it, and further rearward movement of the driver frame will cause a tilting lifting movement of the pusher arm as it is dragged across the edge of the stop arm under it. This will move the arm and its roller upwardly away from the tray and away from any papers stacked therein. The pusher arms will be held in raised position as long as the driver frame is retracted, so that paper or trays may be manipulated as desired while the machine is stopped. When the machine is again started, the pusher arms will each slide forward over their stop arm supports until they drop on to the first sheet of paper in a tray. At this point

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the one way clutch on the roller will function to lock the roller and produce frictional drive of the top sheet as the pusher arm is moved forward, ejecting the sheet from the tray by thrusting it beyond the front edge.

By experiment it has been found that certain shapes of trays are best suited for handling certain weights and surface characteristics of papers. In dealing with various papers, different effective weights of pusher arms also may be provided, if desired, or removable weights may be fastened to the pusher arms and adjusted along their lengths. Rollers having varying frictional characteristics may also be substituted, or worn or damaged rollers may easily be replaced.

In choosing the paper shape of tray to use for a particular paper stock, several factors need to be considered. Among them are the coefficient of friction as between the surface of a piece of paper and the surface of an adjoining piece of paper, the coefficient of friction as between the locked roller on a pusher arm and the paper under it, and the degree of stiffness of the paper and its weight, the stiffness usually but not always being a function of its weight. Proper consideration of these and other factors will lead to the choice of a shape of tray which will enhance the separation and ejection of the single top sheet in a stack in the tray when pushed by the locked roller on the pusher arm.

Speaking generally, it is helpful if the rear wall portions 62 of the tray are slanted to "break" the pile of paper sheets so that the top sheets lie somewhat forwardly of the lower sheets at their front edges. A curve or slant 63 at the front end of the bottom of the tray enhances this effect as sheets are progressively fed from the top of the stack. Tilting the entire cabinet rearwardly also helps this effect, and the cabinet may be supported in tilted position as by a pair of swinging legs or supports 64 which are pivotally secured near the bottom at the front as shown in FIGS. 1 and 2. When not in use, these legs may be swung backward under the housing and the machine will then rest in a level position on four conventional rubber feet 66 provided near the corners of the bottom of the housing.

Going back to the tray designs, in some cases it helps to have a tiny inwardly turned lip 67 on the front edge of the tray, particularly if the coefficient of friction between sheets is high. This lip tends to catch on the first or top sheet and buckle it slightly as shown in FIG. 7. Further movement of the pusher arm will increase the buckling of this sheet, thereby decreasing the area of contact between that sheet and the one below it, and finally the first sheet will snap over the lip and reach a position in front of the tray, from which it may be gathered or picked off by the operator. If the paper is stiff enough, the following sheet will not buckle as the first one does, but forward movement of its front edge will simply be stopped by engagement with the lip. When there is a low coefficient of friction as between sheets of paper, compared to the coefficient of friction between roller and paper, a tray with a relatively low slanted or curved front edge may be used. The steeper slants or sharper curved edges have been found by experiments to be better for papers with comparatively higher coefficients of friction between sheets.

When the machine is not in use, the open front 24 of the housing may be closed by a door 68 having a knob 69 thereon for the usual purpose. If this door is hung at its bottom edge, as is preferred, the addition of a channel 70 at its free end converts the open door into a stacking tray or gathering rack wherein collated sets of sheets may be dropped after gathering by the operator. The edge of the channel may also be arranged to engage over a spring latch 71 in the housing to hold the door closed when desired. By arranging the door in this fashion the machine does not require any added racks or holders for the finished work, but is entirely self-sufficient.

Because the trays may be intermixed and one tray

readily substituted for another, stacks or sets of sheets of mixed weights or finishes of paper may be gathered at the same time with this device. Also if the full component of six trays is not needed for gathering a particular set of sheets, one or more of the trays with their accompanying pusher arms may be removed from the device, the only requirement being that the remaining trays be located adjacent each other so that gathering of the ejected sheets by an operator will be made easy. Obviously the machine may be designed with more than the six trays shown, the number being limited only by the practical consideration of how many ejected sheets an operator may grasp conveniently at the same time, and how closely the trays may be spaced.

In using this collator the operator will tilt the cabinet and swing the legs 64 forward to support the machine in the preferred operating position, on a table, desk, or other work surface as indicated in FIG. 2. The door will be opened and allowed to rest on the surface on which the machine is supported. The proper trays are selected for the kind of paper of the sheets to be collated, the trays will be loaded with piles of the selected sheets and the trays inserted in the proper order in the machine.

Then the operator stands in front of the cabinet, turns on the starting switch and waits with open hands in position on each side of the open front. As the sheets on all the trays are ejected through the open front simultaneously, the operator grasps them all together and gathers them, placing the set of gathered sheets in the channel in the open door. As the machine continues to operate and thrust groups of sheets outwardly at the rate of about one set every three seconds, the operator will gather each set and place it cross-wise of the preceding set in the gathering rack formed by the channel on the door. If the stock runs out or if there is a mis-deal or if something else undesirable happens or appears likely to happen, the operator simply turns the main switch OFF and in its next fully retracted position in the cycle the paper ejecting mechanism will stop. Adjustment, correction or loading can be accomplished with the pusher arms in their retracted and raised positions above the trays and the paper therein, and the collator may then be started as before. When not in use, the tilting support legs may be swung under the cabinet, and the door closed.

It should be clear that various modifications, substitutions or equivalents of things here disclosed could be used without departing from the true spirit and scope of this invention. Therefore, with the intent to cover those concepts coming fairly within the invention, what is claimed as new and is desired to be secured by Letters Patent of the United States is:

1. In a sheet gathering device, a housing having a rear wall and an open front, a plurality of vertically arrayed spaced horizontal paper-holding trays each separately slidably mounted in the housing for removal in a generally horizontal plane through said open front, each tray having a bottom wall with an upward slant leading to a front edge on the tray, a driving frame reciprocably mounted in said housing for movement in a forward and in a return direction between a retracted position near said rear wall and an extended position toward said open front, driving means for moving said frame in said forward and return directions, a plurality of forwardly extending pusher arms carried by said driving frame and simultaneously movable therewith over said trays, each arm lying over a tray and the paper therein and having a paper-engaging member for frictionally engaging a sheet of paper in said tray while being carried forward, said member being ineffective for frictional engagement with the paper while being carried in the return direction, means simultaneously lifting said pusher arms to positions above their respective trays and the paper therein only when

said driving frame is near its retracted position near said rear wall and means for stopping said driving means, said driving frame and said pusher arms only when said arms are in their lifted positions above the trays.

2. A device according to claim 1, said means simultaneously lifting said pusher arms to positions above their respective trays and the paper therein consisting of

a series of arms fixed in said housing near its said rear wall, each said fixed arm having a portion lying in the path of movement of a said pusher arm and engaging the same to lift it when said driving frame is near its said retracted position near said rear wall of said housing.

3. A device according to claim 1 including

a stop element common to all said paper-holding trays, fixed in said housing near its said rear wall and carrying a series of fixed arms, each said fixed arm having a sidewise turned end thereon serving to locate a said paper-holding tray in said housing, and each said sidewise turned end lying under the path of movement of a said pusher arm and engaging the same to lift it when said driving frame is near its said retracted position near said rear wall,

whereby said stop element comprises said means simultaneously lifting said pusher arms to positions above their respective trays and the paper therein.

4. In a sheet gathering device, a cabinet having a rear wall and an open front, a plurality of vertically arrayed paper-holding trays each separately slidably mounted in the cabinet for removal through said open front, each tray having a bottom wall with an upward slant leading to a front edge on the tray, a driving frame reciprocably mounted in said cabinet for movement in a forward and in a return direction between a retracted position near said rear wall and an extended position toward said open front, motor driven means for moving said frame in said forward and return directions, a plurality of pusher arms pivotally carried by said driving frame and simultaneously movable therewith over said trays, each arm lying over a tray and the paper therein and having a paper engaging roller frictionally engaging a sheet of paper in said tray while being carried forward, means simultaneously lifting said pusher arms pivotally to positions above their respective trays and the paper therein only when said driving frame is near its retracted position near said rear wall and means for stopping said motor driven means, said driving frame and said pusher arms only when said arms are in their lifted positions above the trays.

5. In a gathering machine for collating sheets of paper, a cabinet having an open front inclined from a vertical plane, a series of paper holding trays slidably mounted in said cabinet for removal through said open front, a corresponding series of paper ejectors in said cabinet above said trays movably mounted for simultaneous action in one direction between a retracted position away from said open front and lifted from said trays and a paper ejecting position near said open front and lowered toward said trays to thrust paper from said trays simultaneously through said open front, said paper ejectors being inactive to thrust paper when moved in the opposite direction, driving means for moving said paper ejectors simultaneously together in both directions between said retracted and paper ejecting positions, and control means stopping said driving means only when said paper ejectors are in said retracted position and lifted from said trays.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,152,801

October 13, 1964

John J. Quinn et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, line 3, for "of Bedford, Massachusetts" read -- of New Bedford, Massachusetts --; in the heading to the printed specification, line 5, for "Bedford, Mass." read -- New Bedford, Mass. --; column 4, line 14, for "paper" read -- proper --; line 60, for "experiments" read -- experiment --; column 5, line 28, for "graps" read -- grasps --.

Signed and sealed this 2nd day of March 1965.

(SEAL)

Attest:

ERNEST W. SWIDER

EDWARD J. BRENNER
Commissioner of Patents