

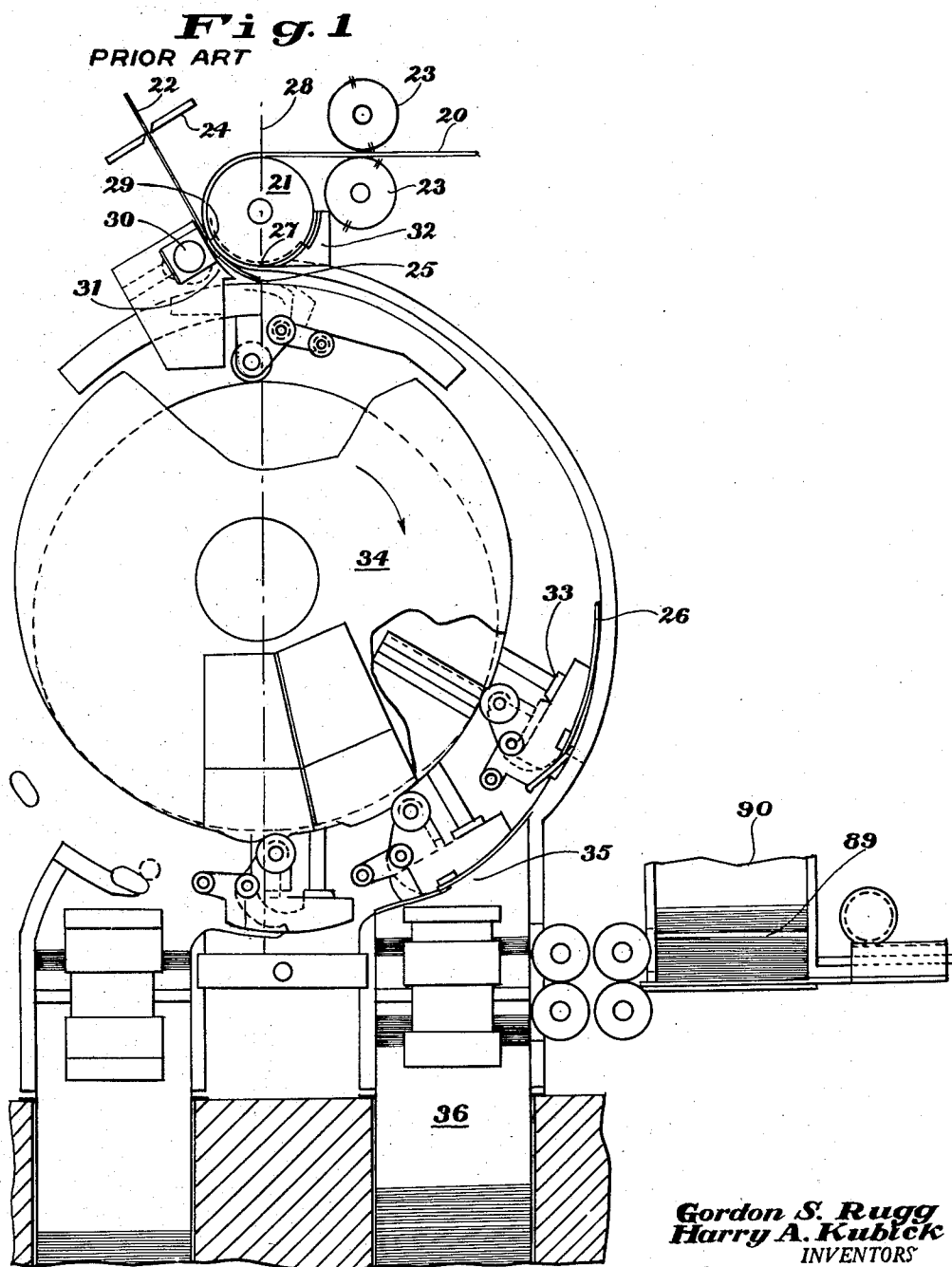
Oct. 14, 1958

G. S. RUGG ET AL
SORTER FINGER STACKER

2,855,833

Filed Sept. 28, 1956

8 Sheets-Sheet 1



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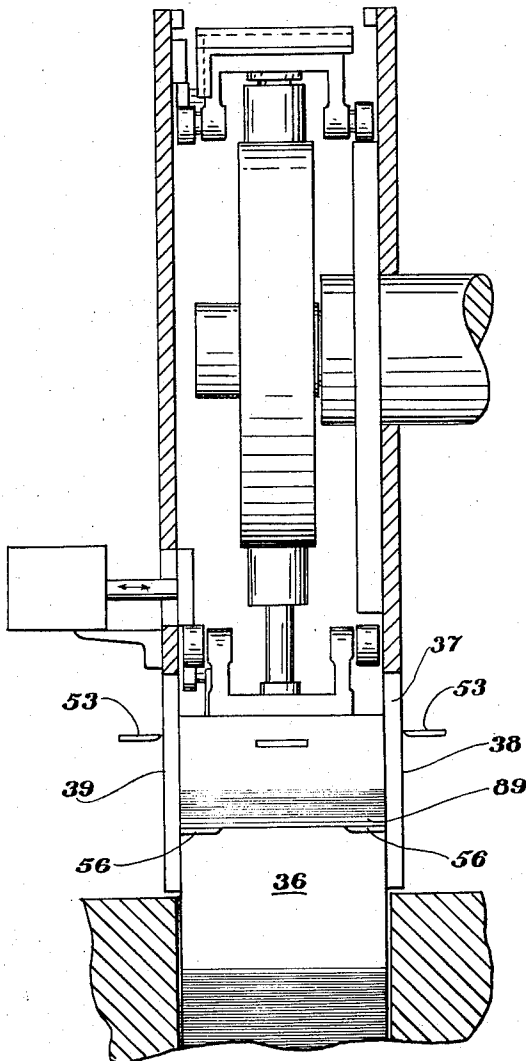
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Fig. 2



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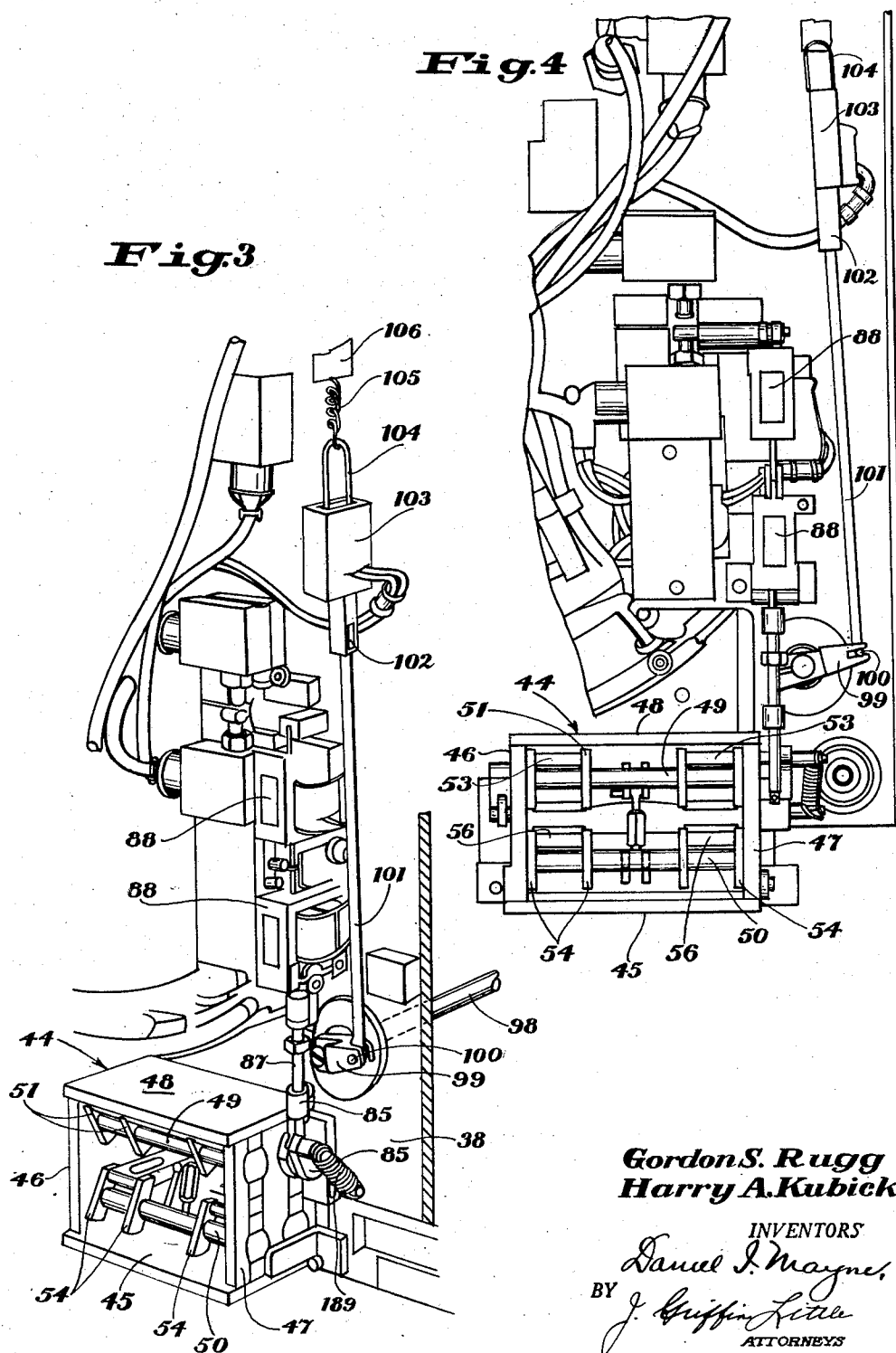
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8 Sheets-Sheet 3



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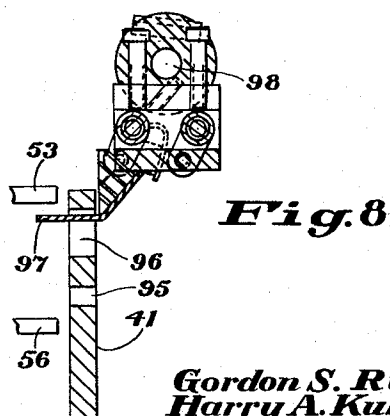
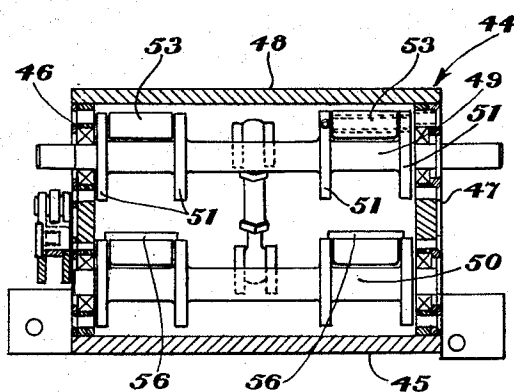
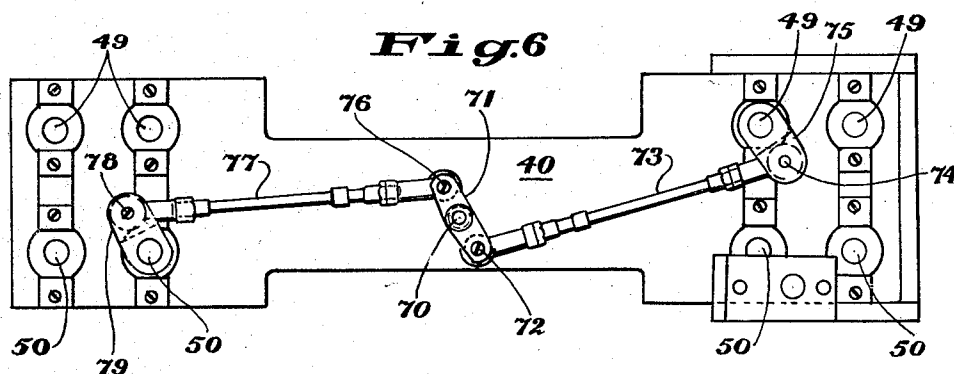
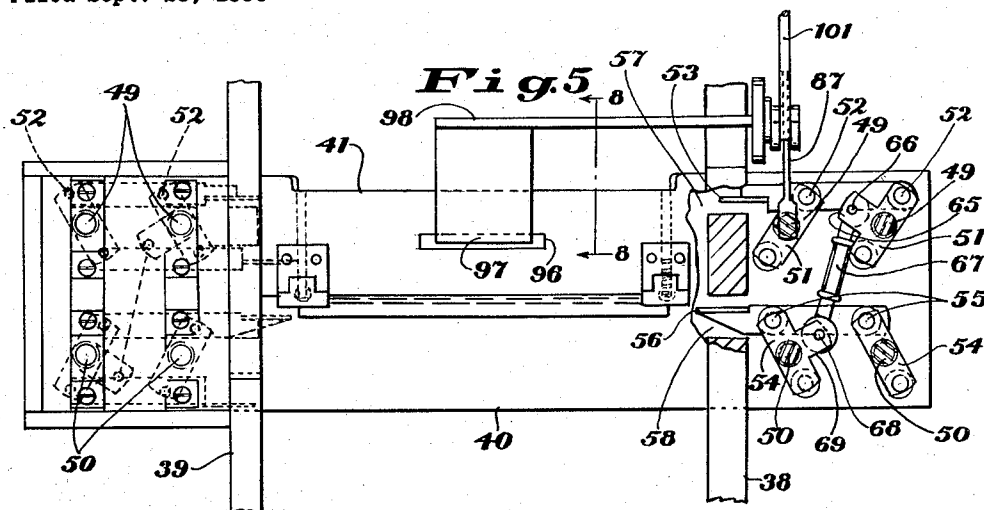
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8 Sheets-Sheet 4



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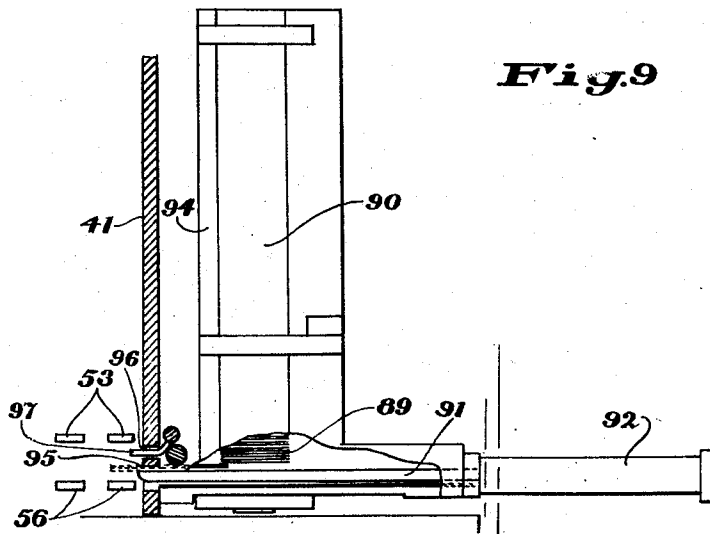


Fig. 9

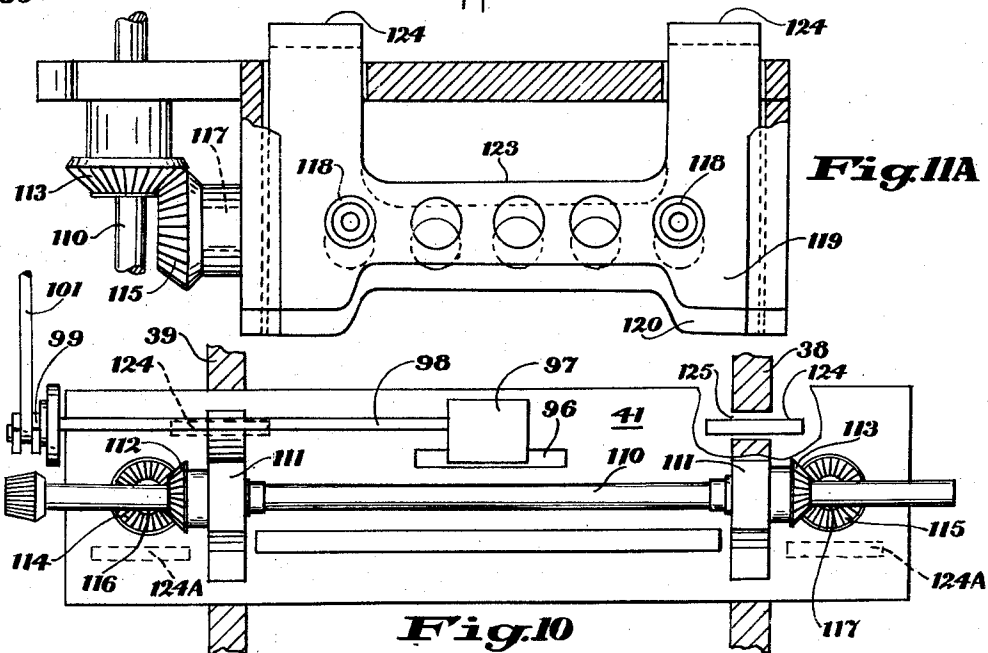


Fig. 10

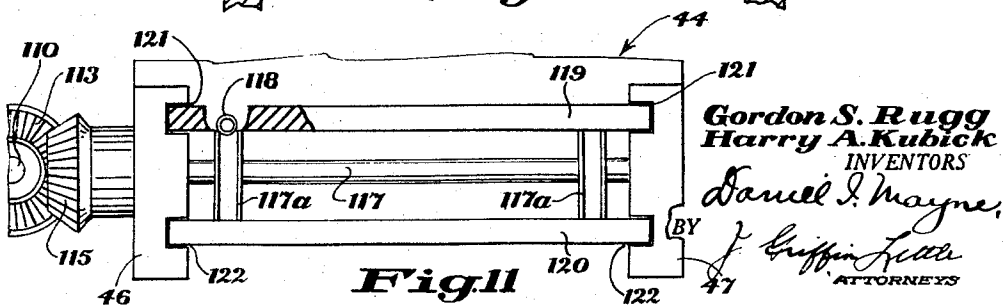


Fig. 11

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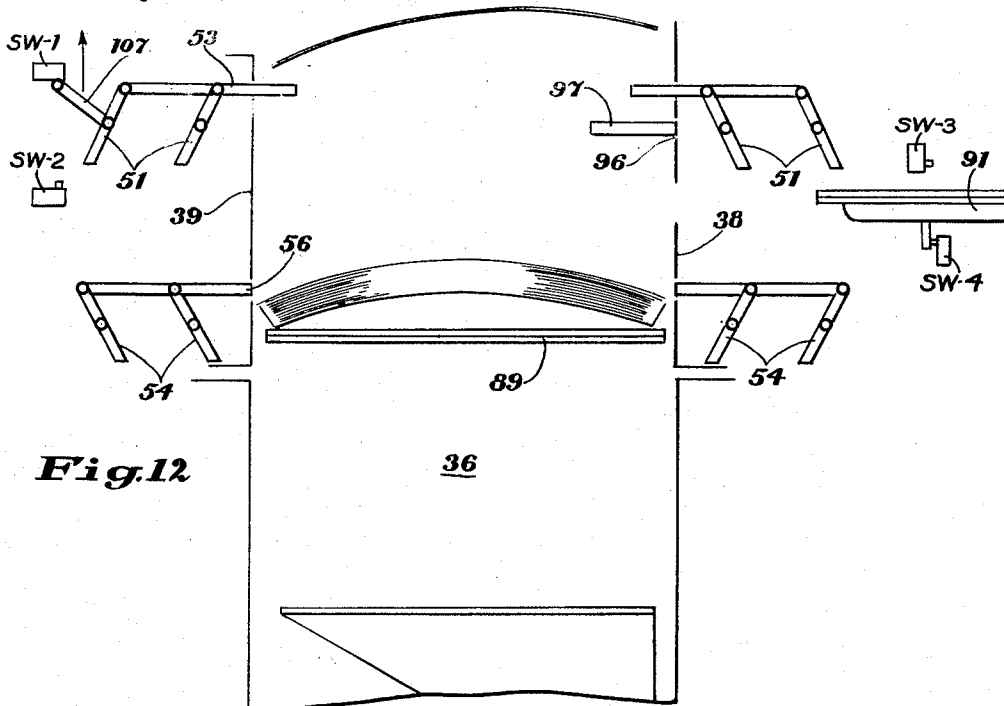


Fig. 12

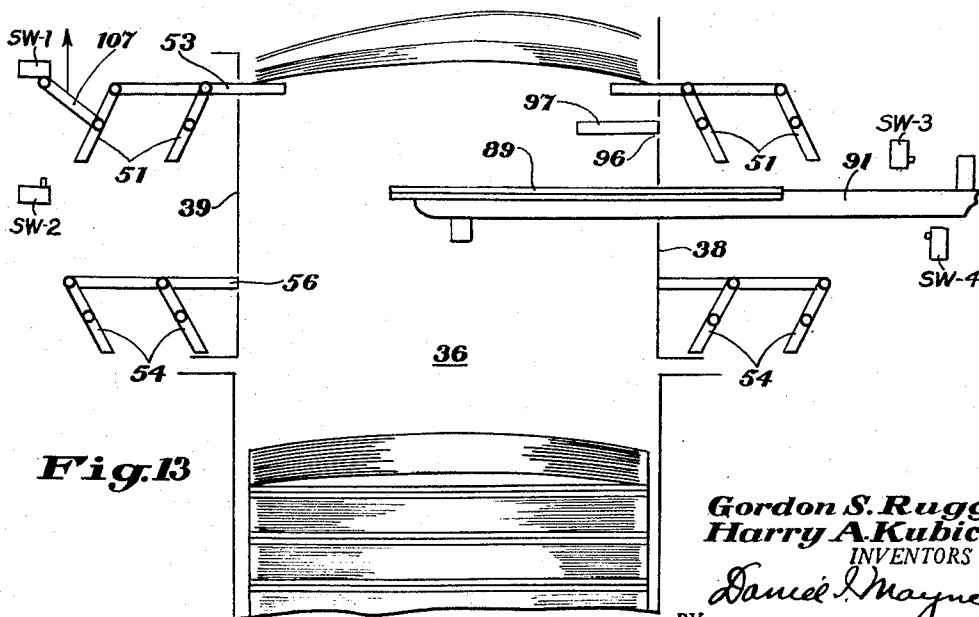


Fig. 13

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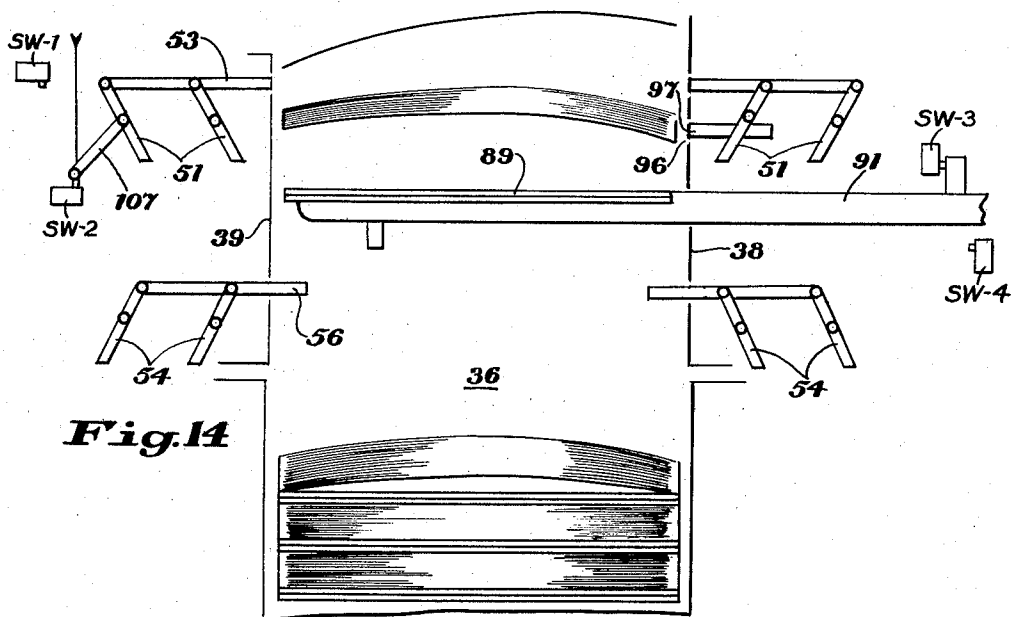


Fig. 14

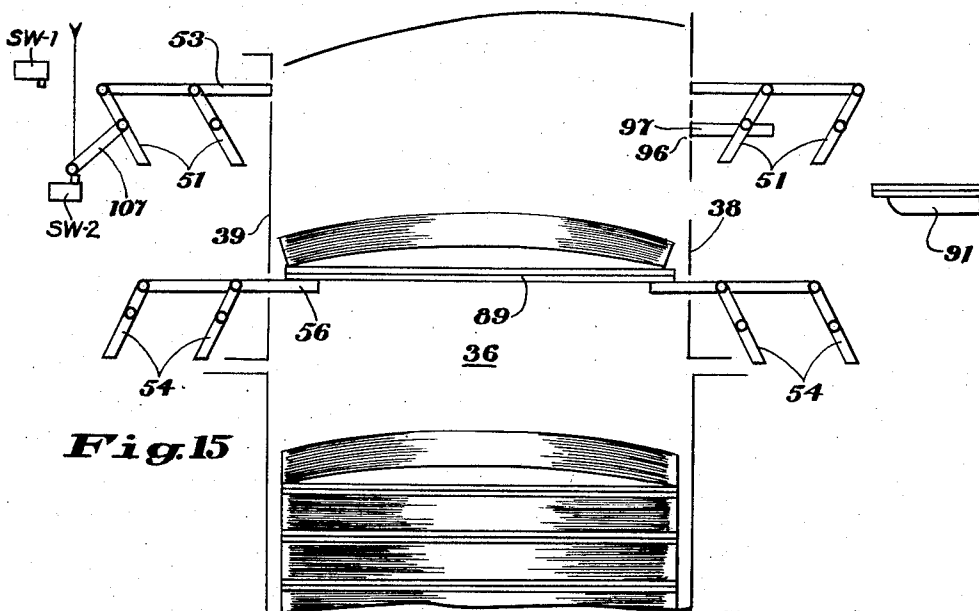


Fig. 15

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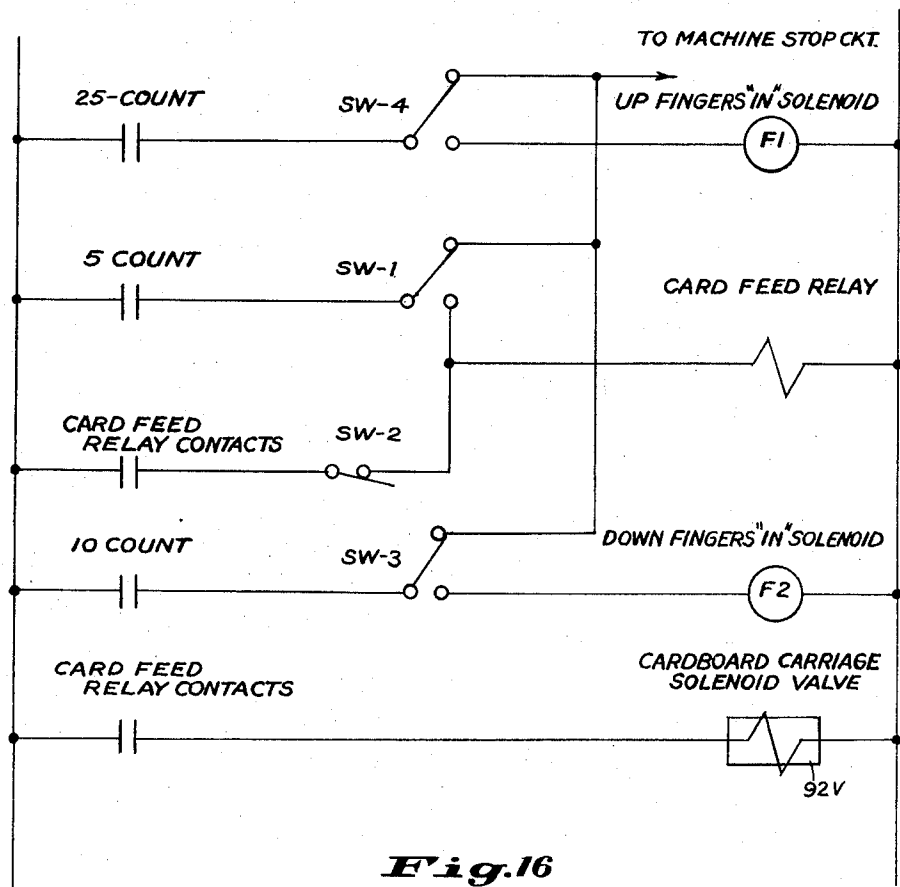
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8 Sheets-Sheet 8



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SORTER FINGER STACKER

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Application September 28, 1956, Serial No. 612,622

12 Claims. (Cl. 93—93)

The present invention relates to a sheet stacking apparatus, and more particularly to a finger stacker for stacking assemblies of film and paper of the type shown and described in U. S. application Ser. No. 403,406, filed January 11, 1954, of which one of the applicants, Mr. Rugg, is a co-inventor. This application has now matured into Patent 2,794,637, issued June 4, 1957.

The sheet stacker is used to stack acceptable film and sheet assemblies in lots or stacks of twenty-five each. During the formation of each stack, a pair of cardboard sheets or members is positioned thereon. When each stack is completed, the stack, with its pair of cardboard members, is dropped or deposited in a suitable receptacle. The result is that each stack in the receptacle is provided with a cardboard sheet at its top and bottom so that individual stacks can be easily removed from the receptacle. While in the present embodiment the stack is used to stack twenty-five assemblies of film and paper, it is obvious that the stacker could be used to stack separate or individual sheets only. Therefore, when the term "sheets" is used in the claims, it is used in a generic sense to cover the stacking of separate and individual sheets or paper and film assemblies.

The invention has as its principal object, the provision of a new and improved sheet assembler or stacker.

Another object of the invention is the provision of a stacker in which groups of sheets are moved to different positions during the formation of the stack; and when the proper number of sheets has been assembled to form a stack, the latter is delivered automatically to a suitable receptacle.

Still another object of the invention is the provision of stack-forming members which are actuated automatically and in proper timed relation.

Yet another object of the invention is the provision of a sheet stacker which is simple and automatic in its operation, comprises few parts of rugged construction, and is highly effective in use.

To these and other ends, the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a general end view of a sheet or assembly feeder or delivery mechanism, with the outer plate removed showing the relation thereto of a stacker or assembler used prior to the present invention;

Fig. 2 is a side view of the delivery mechanism illustrated in Fig. 1 showing more or less diagrammatically the relation thereto of the stacker of the present invention. For purposes of clarity certain details are omitted, but these details are shown in other views;

Fig. 3 is a perspective view of the outside of the machine casing showing one upper and one lower stacker finger and the operating mechanism therefor; also, the operating mechanism for another finger, not shown in this view;

Fig. 4 is a straight end view of the mechanism illustrated in Fig. 3, showing part of the connecting mechanism between the fingers on the opposite sides of the machine and the position of the fingers on one side of the machine.

Fig. 5 is a left side view of the finger mechanism, the connecting mechanism being omitted, and showing the relation of the pairs of fingers on each side of the machine and the connection between the fingers of each pair;

Fig. 6 is a left side view of the finger mechanism showing the connection to the sets of fingers on the opposite sides of the machine;

Fig. 7 is an end view of one set of upper and lower sheet-supporting fingers, with the walls in section, showing the supporting and connecting means of the fingers;

Fig. 8 is a transverse view of the shaft for the auxiliary finger and taken substantially on line 8—8 of Fig. 5, showing the relation of the auxiliary finger to the shaft;

Fig. 9 is an end elevation view, with the side wall in section, showing the relation of the auxiliary finger, the cardboard separator carriage and the cardboard magazine;

Fig. 10 is a side elevation view showing a modified arrangement of the operating means for the sheet supporting fingers;

Fig. 11 is an end view of the mechanism shown in Fig. 10, showing the means for moving the stack-supporting fingers of the structure illustrated in Fig. 10;

Fig. 11a is a plan view of the structure shown in Fig. 11;

Figs. 12—15 are a group of diagrammatic figures, showing the sequence of operation in the formation of a stack; and

Fig. 16 is a wiring diagram of the finger stacker.

Similar reference numerals throughout the same views indicate the same parts.

The finger stacker of the present invention is used in connection with a sheet-and-film cutter and assembly delivery means of the type shown and described in the pending application Serial No. 403,406, filed January 11, 1954, in the name of Gordon S. Rugg, a co-inventor of the present application. This application has now matured into Patent 2,794,637, issued June 4, 1957. Thus cutter and delivery means is shown for illustrative purposes only and not as a limitation, as the finger stacker of the present invention is adapted for a wide range of uses and various sheet delivering means.

Fig. 1 shows a film and paper cutting mechanism and an assembly delivery mechanism of the above-mentioned Rugg patent in which the paper web 20 is conducted horizontally to the top of a vacuum roll 21, while the film web 22 approaches roll 21 at an angle of 30° to the vertical. Both the film and paper webs are 5" wide. Just ahead of roll 21, a pair of rotating cutter knives 23 sever the paper web 20 into sheets substantially 4" long. Also, the film web 22 is severed into sheets 4" long by means of a severing mechanism, broadly indicated by the numeral 24. As the film and paper severing means forms no part of the present invention, details thereof are not shown or described. The chopping or severing means 23 and 24 move at web speeds so the severed sheets approach the vacuum roll 21 continuously. Also, the vacuum roll runs exactly at the speed of the film so there is no space between adjacent film sheets. Preferably the paper sheets are cut slightly shorter than the film sheets, and approach the vacuum roll 21 at a slightly slower speed than the film sheets, slipping on roll 21 for a short period until the sheet is completely severed from the web 20 by chopper 23. Then, the paper sheet starts traveling at the speed of roller 21, leaving a small gap between successive paper sheets on the roll 21. The choppers 23 and 24 are so

timed that the leading edge 25 of both film and paper sheets, see Fig. 1, are in alignment. Also, as shown in Fig. 1, the severed film and paper sheets are in overlying relation and provide an assembly or combination, generally indicated by the numeral 26. This assembly may be considered as a single sheet and when the term "sheet" is used in the claims, it is employed in a generic sense to cover such assembly or a single sheet. Also, while the structure shown in the above-mentioned Rugg patent is used to deliver film and paper assemblies 26, such device could be used to form or deliver single sheets, as is deemed apparent. The vacuum roll 21 is divided radially into separate compartments, not shown, and is suitably evacuated so that only the portion from the bottom 27 on the vertical center line 28 to the point 29 of film tangency is under vacuum. At the point 29 of film tangency, a spring mounted driven roller 30 holds each film and paper assembly 26, giving sufficient traction to the film sheet so that the combination can be pushed through guides 31 and 32 and be received by the grippers, broadly indicated by the numeral 33. The two guides 31 and 32 are actually stripping fingers which fit into peripheral grooves, not shown, in the roll 21, and are used to prevent the sheets following the surface of the vacuum roll 21 after the point of vacuum cut off, the point 27. These guides 31 and 32 carry the film and paper sheet combination 26 in a curved path leading to the path of the grippers 33, as shown in Fig. 1.

Mounted on a wheel or hub 34 are a plurality of peripherally spaced gripper assemblies 33, each of which is adapted to receive one film and paper assembly or combination 26 at the top of wheel 30 and to discharge successive assemblies at a point of disposal 35 adjacent the lower side of the wheel 30. Reference may be had to the above-mentioned Rugg patent for a detailed description of the grippers 33. Suffice it to say, that the grippers engage the assemblies at the top of the wheel and as the grippers reach the point of disposal 35, the grippers are opened to release the assemblies. The wheel is rotated in the direction of the arrow, see Fig. 1. Certain provisions are made for delivering test assemblies and defective assemblies at points other than point 35, but such features form no part of the invention and, accordingly, are not described.

The assemblies 26 are finally received in a receptacle, container or magazine 36, positioned in alignment with and below the point of disposal 35, as shown in Figs. 1 and 2. In the receptacle the assemblies are arranged in stacks of twenty-five assemblies with a sheet of cardboard at the top and bottom of each assembly so the assemblies may be readily and easily removed from the receptacle.

The present invention relates to a finger stacker by which the film and sheet assemblies or combinations 26 are arranged and assembled in separate stacks of twenty-five each and with a cardboard or spacer at each end of each stack. The assembling or formation of each stack and the application of cardboard spacers is automatic and the various parts therefor operate in proper timed relation and in a definite sequence.

The point of disposal 35 is connected to the stack receptacle 36 by a chute 37 through which the stacks fall individually into the receptacle 36, as shown in Fig. 2. The finger stacker mechanism of the present invention is associated with the chute 37 which has a front wall 38, a back wall 39, and opposite side walls 40 and 41, as clearly shown in Figs. 2, 3, and 4. Projecting laterally from the front wall 38 and back wall 39 are housings, generally indicated by the numeral 44, in which the stacking fingers are mounted. As each of the housings and associated stacking fingers are identical in structure, only one will be described in detail. Corresponding parts in other housings will be designated by the same numerals. Each finger housing comprises a bottom 45, opposite side walls 46 and 47 and a top 48, and has journaled in the side walls

46 and 47 thereof a pair of upper shafts 49 and a pair of parallel lower shafts 50, as best shown in Fig. 5.

Each upper shaft 49 has positioned thereon, four axially spaced, radially extending levers or links 51. The links 51 on each upper shaft 49 are arranged in pairs and the pairs on the two shafts 49 are in horizontal alignment, and each pair is pivotally connected at its upper end at 52 to the side edges of the upper fingers 53. Thus, each pair of upper shafts 49 carries a pair of upper fingers 53. It will be apparent from Fig. 5 that if either shaft 49 is rocked, both shafts will rock as a unit as they are connected through links 51 and fingers 53, and such rocking will reciprocate both the upper fingers 53 to the right or left, as viewed in Fig. 5. Also, the two lower shafts 50 are formed with similar links 54 which are connected at 55 to a pair of lower fingers 56. It will also be appreciated that if either lower shaft 50 is rocked, both shafts will rock as a unit and move both lower fingers 56 to the right or left. Thus, each housing 44 has two upper fingers 53 and two lower fingers 56 which extend through registering slots 57 and 58 in the adjacent walls 38 and 39 of the chute 37, as shown in Fig. 5. As the finger housing 44 on the opposite side of the chute 37 is similarly designed, four upper aligned fingers 53 and four lower fingers 56 are provided. The four lower fingers 56 are positioned below and in vertical alignment with the upper fingers 53.

In the formation of such stacker, it is essential that the upper fingers 53 on both sides of the chute 37 move in and out as a unit, and that the two sets of lower fingers on opposite sides of the chute also move in and out as a unit. It is also necessary that the upper and lower sets of fingers move in opposite directions. For example, when the two upper groups of fingers 53 are moved inwardly through slots 57 so as to project into the chute to support the edges of the assemblies, the two lower sets of fingers must be retracted out of the slots 58 so as to be withdrawn out of the chute. On the other hand, when the two lower sets of fingers 56 are moved inwardly through slots 58 to support the edges of the assemblies, the two upper fingers must be withdrawn from the chute and out of stack supporting relation. The upper and lower fingers move in opposite directions. Finally, it is imperative that the two sets of fingers move in proper timed relation.

In order that the upper and lower fingers 53 and 56 operate and move in proper relation and direction, the upper and lower shafts 49 and 50 in each housing 44 are movable so that if one of the shafts is rocked, the four shafts in the housing will rock to move the fingers as a unit in the proper direction. To secure this result, one of the links 51, say the right link on the right upper shaft 49, Fig. 5, is formed with a laterally extending ear 65 which is pivotally connected at 66 to a connecting rod 67, the other end of which is pivotally connected at 68 to an ear 69, which projects laterally from the left link 51 on the lower shaft 50, all as shown in Fig. 5. It will be apparent from an inspection of Fig. 5, that if either shaft 49 is rocked counterclockwise both shafts 49 will be moved similarly by reason of links 51 and finger 53, to move the latter to the left and through slots 57. Such counterclockwise rocking of shaft 49 would, through rod 67, rock the lower shaft 50 clockwise to move the lower fingers 56 to the right to draw the fingers out of chute 37. On the other hand, a clockwise rotation of shaft 49 will move the upper fingers 53 to the right to withdraw these fingers, and simultaneously rock the lower shaft 50 counterclockwise to move the lower fingers 56 to the left through slots 58 and into the chute 37. Thus, by so connecting the shafts 49 and 50, the upper and lower fingers in each housing are moved in opposite directions as is necessary for proper operation.

In addition, operating the fingers in each housing 44 in the manner above described, it is essential that the fingers in the housing on the opposite sides of the chute 37 be

connected, so that the upper fingers 53 in both housings move in and out as a unit, and the lower fingers 56 of the opposite housing also move in and out as a unit. To secure this result, means is provided to connect the shafts of both housings so that all the shafts 49 and 50 of the opposite housings 44 move as a unit and in the proper directions.

To this end, the wall 40 of chute 37 has positioned therein, a sub-shaft 70 on which is rockably mounted radial link 71, one end of which is pivotally connected at 72 to one end of a pitman 73, the other end of which is pivotally connected at 74 to a crank 75 carried by the left upper shaft 49 of the right housing 44, see Fig. 6. The other end of link 71 is pivotally connected at 76 to one end of a pitman 77 the other end of which is pivotally connected at 78 to a crank 79 carried by the right lower shaft 50 of the left housing 44, see Fig. 6. Thus, the shafts 49 and 50 in the opposite housings are connected for unitary operation.

Referring now to Fig. 6, it is deemed apparent that if upper right shaft 49 is rocked counterclockwise, the other upper right shaft 49 will be similarly rocked to move the upper fingers to the left. Also, by reason of the connection between the shafts 49 and 50, the latter will be rocked clockwise to move the lower fingers 56 to the right. Thus, the upper fingers 53 and 56 in the right housing 44 are moved in opposite directions. Also, the counterclockwise rocking of the right shaft 49 of the right housing 44 will be transmitted to crank 75, pitman 73, link 71, pitman 77 and crank 79 to rock the lower right shaft of the left housing 44 counterclockwise to shift the lower right hand fingers to the left to withdraw the latter. Thus, both sets of lower fingers will be withdrawn. In addition, this counterclockwise rocking of the lower right shaft 50 of the left housing will be transmitted to the connecting rod 67 to rock the upper shaft 49 of the left housing clockwise to move the left set of fingers 23 to the right or inwardly. Thus, by reason of the above-described linkages, the upper fingers 53 will be moved inwardly and the lower fingers will be retracted. On the other hand, a clockwise rotation of the upper shaft 49 of the right housing 44, will serve to withdraw the upper fingers of both housings and will simultaneously move the lower fingers of both housings inwardly. By means of the above-described mechanisms all of the shafts 49 and 50 and all of the fingers 53 and 56 are moved as a unit and in the proper directions, for reasons to be later more fully described.

In order that the fingers 53 and 56 may be operated in the manner above described, all that is necessary is to provide means for moving one of the shafts 49 or 50. To secure this result, one of the upper shafts 49, see Fig. 3, is extended through a side wall 41 and has connected thereto a crank 85 which is pivotally connected to the lower end of a lever 87, the upper end of which is connected to a pair of solenoids 88. The reason the two solenoids are used instead of one is because of the quick action necessary due to the fact that seven sheets a minute are being fed to the fingers. It has been found that this double solenoid arrangement gives the desired result. When these solenoids 88 are operated by a suitable countermechanism on the machine, not shown, and which forms no part of the present invention, the lever 87 is drawn upward to rock the upper right shaft 49, Fig. 3, clockwise. This movement will serve to move the fingers 53 on both sides of the machine inwardly, and will simultaneously shift the lower fingers 56 outward. When the solenoids 88 are energized in the opposite direction, the movement of the fingers is reversed. A spring 89, Fig. 3, has one end connected to crank 85 and the other end anchored to the front wall 38 and serves to hold the crank in either of the positions to which it has been moved by the solenoids 88. Thus, the movement of the fingers 53 and 56 is power operated and in timed relation

to each other and to the movement of the wheel 34, the advantages of which are deemed apparent.

When a stack is completed, as later described, it is dropped into the receptacle 36. However, it is desirable to provide some means by which the individual stacks may be identified and separated. To this end a cardboard member or separator is positioned on the top of each stack and a similar member is positioned at the bottom of each stack. Thus, each stack of twenty-five assemblies is positioned or sandwiched between a pair of cardboard spacers or members. During the formation of the stack, such a member may be positioned at the bottom of the stack, and the other member positioned at the top of the stack, while the stack is being supported on the fingers. However, it has been found to be more advantageous to position a pair of cardboard sheets or members at the bottom of each stack during the formation thereof, so that one of these members will form the top of a stack and the other member will form the bottom of the next stack. The cardboard spacers or member 89 are positioned in a suitable container or magazine 90 which is arranged just outside the chute 37 as shown in Figs. 1 and 9. A reciprocating carriage 91 is positioned in the bottom of the magazine 90 and may be operated in a manner shown in Fig. 1 of the above-mentioned Rugg application. In the present embodiment, however, the carriage is connected to a pneumatic cylinder 92 so that the latter serves to reciprocate the carriage. The cylinder 92 has positioned therein a movable piston, not shown, and air is supplied to the opposite ends of the cylinder by means of pipes which are connected through a solenoid valve which forms no part of the present invention. If desired, a spring return type of piston may be used in which case one of the air lines may be omitted. As the carriage 91 is moved to the left, it shifts or ejects the two lower cardboard sheets 89 from the bottom of the pile of the magazine and moves these sheets through a slot in the side wall 94 of the magazine and through registering slot 95 in the wall 41 of the chute 37, and into position between the upper and lower fingers 53 and 56, respectively, as shown in Fig. 9 and diagrammatically in Figs. 12-15, to be later more fully described. Thus, the two cardboard spacers are fed into position between the fingers 53 and 56, while the initial sheets of the stack are accumulated on the upper fingers 53.

As the sheets or assemblies 26 are being deposited or accumulated, one or more sheets, due to the curling of the sheets, may not engage both upper fingers and a part of the sheet may lie below one of the upper fingers. A sheet thus misplaced may interfere with the free inward movement of the carriage 91 and the latter may engage and jam on the imperfectly positioned sheet. In order to eliminate such possibility, the present invention provides an auxiliary supporting means which will support any improperly positioned sheet to retain the latter out of the path of the inwardly moving carriage.

To this end, the side wall 41 of the chute 37 is formed with a slot 96 positioned between the upper fingers 53 and the carriage opening 95, as shown in Figs. 8 and 9, and illustrated diagrammatically in Figs. 12 and 15. An auxiliary finger 97 is movable through slot 96 and is connected to one end of a shaft 98, as shown in Fig. 8. The other end of the shaft extending out through the front wall 38 of the chute 37 and carries a crank 99 which is pivoted at 100 to a lever 101, the upper end of which is connected to the armature 102 of a solenoid 103. The top of the armature 102 is connected through a yoke 104 to a spring 105, the upper end 106 of which is anchored to wall 38. The reason for the single solenoid in connection with the auxiliary finger 97 is due to the fact that this finger does not have to operate as fast as the fingers 53 and 56. The relation is such that when the solenoid 103 is energized, the armature 102 and lever 101 are moved downward to rock crank 99 and shaft 98

clockwise, as viewed in Figs. 3 and 8, to move the finger 97 through slot 96 and into position between the fingers 53 and the carriage 91. Such downward movement of the armature 103 stretches and tensions the spring 105. Now, when the solenoid 103 is deenergized, the tensioned spring 105 rocks the shaft 98 counterclockwise, see Figs. 3 and 8, to withdraw the finger 97 out of slot 96.

With the above structure in mind, attention is now directed to Figs. 12-15, which show diagrammatically the position of the parts at different times in the cycle. In order to simplify this description, the carriage 91 and auxiliary finger 97 are shown as moving through front wall 38 rather than through side wall 41, as stated above. However, in this diagrammatic arrangement the parts operate in the same manner as in the actual machine.

The finger stacker cycle starts with the upper fingers 53 in the "in" position, and fingers 56 in the "out" position as illustrated in Fig. 12. The upper left finger shaft 49 has secured thereto, a switch arm 107 which is moved into engagement with a switch SW1 or into engagement with a switch SW2, as shown in Fig. 12. With the parts in the position shown in Fig. 12, the arm 107 engages switch SW1 and sheet fingers 53 are in the position to receive the first sheets of the assembly, as the sheets are discharged from the wheel 34. Switch SW1 then sets up a potential circuit to the card feed relay coil, Fig. 16. This circuit is established when three sheets or assemblies of film and paper are on the upper fingers 53, Fig. 12, and the normally opened 5-count relay contact is closed momentarily. When the card feed relay is energized, both normal open card feed relay contacts are closed. The circuit is held and the circuit to the cardboard carriage solenoid valve is completed. Thus, air is ported to the double action pneumatic cylinder 92 which moves the cardboard carriage 91 into chute 37 below the fingers 53 with the two cardboard sheets as shown in Fig. 13.

With the card feed relay holding contacts closed, the carriage feed-in circuit is held until normally-closed switch SW2 opens. At the count of ten assemblies or sheets, switch SW2 opens, and the card feed relay drops out; in turn, the cardboard carriage solenoid valve is deenergized, and the direction of air flow to the cylinder 92 is reversed and the carriage 91 is retracted.

When the cardboard carriage 91 is moved the required distance, switch SW3 sets up a potential circuit through a solenoid F2, Fig. 16 (down fingers in). Upon a count of ten sheets the 10-count relay coil is energized and the 10-count relay contact closes to complete the circuit through solenoid F2 and the down fingers move in.

At the point where the cardboard carriage is fully retracted, the sheets of film and cardboard have been stripped off the carriage and have fallen to the lower fingers 56. When fully retracted, the cardboard carriage closes switch SW4 to set up a potential circuit through solenoid F1. At the count of twenty-five sheets, the 25-count relay coil is energized and the normally open 25-count contact closes to complete the circuit through solenoid F1 to move out the lower fingers and to move in the upper fingers to start the following cycle. Then, the stack of twenty-five sheets or assemblies with the two cardboard spacers positioned thereunder drops from lower fingers 56 into the magazine and the upper fingers are moved in and ready to accept sheets of the next succeeding packet or stack.

To summarize briefly, the cycle starts with the upper fingers 53 and 97 in the "in" position, as shown in Fig. 12, and the lower fingers 56 being in the "out" position. The sheets start to drop on the upper fingers 53. If the fingers 53 are jammed or fail to complete their inward travel, switch SW1 will not be actuated and the machine stops at the count of five. If, however, the fingers move in properly, at about the count of five sheets the cardboard carriage starts to move in, as shown in Fig. 13, and completes its inward movement at the count of seven or eight. The carriage then remains stationary until the

fingers are moved to the position shown in Fig. 13 at the count of ten. If the carriage fails to complete its inward travel by the count of ten, switch SW3 will not be actuated and the machine stops. The package of ten sheets and the cardboard spacers drop to the lower fingers 56, Fig. 15, as the carriage is withdrawn. The parts then remain in this position until the count of twenty-five sheets is reached at which time the fingers move to the position shown in Fig. 12, in which the lower fingers have moved out of contact with the packet and the latter drops into the container. The upper fingers 53 and auxiliary finger 97 move inwardly into position to start the new cycle. Thus, the stack starts on the upper fingers 53, then the cardboard spacers 89 are moved into position under the sheets to receive fingers 53. Then the upper fingers 53 and 97 are withdrawn and the lower fingers 56 are moved in. The few sheets which have accumulated on the upper fingers now drop onto the spacers which are supported by the carriage 91. After about ten sheets have accumulated on the carriage, the latter is withdrawn and the accumulated sheets drop to the lower fingers 56 where they remain until the stack is completed. However, if the carriage 91 is not fully retracted, switch SW4 is not closed and the machine stops. Thus, the stack is formed progressively at three points; partly on the upper fingers 53, partly in the intermediate position on the carriage 91, and is finally completed in the lower position in the lower fingers 56. The operation of the parts which provide this stage building is automatic, rapid and satisfactory.

Figs. 10, 11 and 11a show a modified arrangement for actuating the sheet-holding fingers in the proper timed relation and in the proper direction. In this embodiment, shaft 110 extends along the wall 41 and is supported in suitable bearings 111 mounted on wall 41. The right end of shaft 110, Fig. 10, is connected to a lever-and-solenoid arrangement, not shown, similar to lever 87 and solenoid 88 by which shaft 110 may be rocked similar to shaft 49 above described. The shaft 110 has secured thereto for movement therewith a pair of bevel gears 112 and 113, which mesh, respectively, with bevel gears 114 and 115 carried on shafts 116 and 117 journaled in the opposite walls 46 and 47 of housing 44, as shown in Fig. 11. It will be apparent from an inspection of Fig. 10, that the gears 112 and 113 mesh on opposite sides of gears 114 and 115 to rotate the latter in opposite directions so that the fingers on both sides of the chute will move in the proper direction. Each shaft 116 or 117 has mounted thereon, a pair of axially spaced, rocker arms 117a, the ends of which form a ball and socket joint 118 with an upper plate 119 and a lower plate 120 which slide in slots 121 and 112, respectively, formed in the side walls 46 and 47 of the housing 44. Thus, as the shaft 116 is rocked, the plates 119 and 120 move in opposite directions along the slots 121 and 122. Due to the arrangement of the gears 112 and 113, as the upper plate 119 on opposite sides of the chute moves inwardly, and the lower plate 120 moves outwardly, as is deemed apparent. Each plate 119 and 120 has formed on or secured thereto at its inner edge 123, a pair of spaced fingers 124 and 124a, which move through registering slots 125 in the walls 38 and 39 of the chute. These fingers 124 correspond to the fingers 53 and 124a correspond to the above-described fingers 56, respectively. Thus, each time the shaft 110 is rocked by the solenoid, opposite rocking movements are imparted to the rocking shafts 116 and 117 to move the upper fingers 124 in one direction and the lower fingers 124a in the opposite direction in the manner above described. Thus, the fingers 124 and 124a serve to support the sheets in the upper and lower positions in the same manner as the fingers 53 and 56 above described. While not shown in Figs. 10, 11 and 11a, the side auxiliary finger 97 and the cardboard carriage 91 may be, and preferably are, used with the embodiment

in Figs. 10, 11 and 11a, but for the purpose of clarity the carriage has been omitted in these figures.

The present invention thus provides a finger stacker in which sheets or assemblies of a definite number are formed. During the formation of such a stack, a pair of cardboard separators is positioned in a definite relation with each stack. The apparatus is simple and rugged in construction, automatic in its action, and highly effective in use.

While certain embodiments of the invention have been disclosed, it is to be understood that the inventive idea may be carried out in a number of ways. Therefore, this application is not to be limited to the precise details described, but is intended to cover all variations and modifications thereof which fall within the scope of the appended claims.

What we claim and desire to secure by Letters Patent of the United States is:

1. A sheet assembler for forming sheets stacks, each of which has a predetermined number of sheets, comprising, in combination, means to feed sheets individually and continuously to a point of disposal, a stack receiving receptacle positioned below and in stack receiving relation with said point, means movable into the path of the sheets below said point to receive and support a number of sheets, but less than a stack, above said receptacle, a supply of stack separating members, means to move a pair of said members into position below said sheet receiving means, means to move said sheet receiving means out of sheet supporting relation to allow said accumulated sheets to fall onto the members and in position to receive additional sheets from said point, lower sheet supporting means positioned between said receptacle and said member moving means, means to move said member moving means out of member supporting relation to allow said members and said accumulated sheets to fall on said lower supporting means and in position to receive sufficient additional sheets to form a stack, and means to move said lower supporting means out of supporting relation to allow a stack of sheets to fall from said lower supporting means into said receptacle.

2. A sheet assembler for forming sheets stacks, each of which has a predetermined number of sheets, comprising, in combination, means to feed sheets individually and continuously to a point of disposal, a stack receiving receptacle positioned below and in stack receiving relation with said point, means movable into the path of the sheets below said point to receive and support a number of sheets, but less than a stack, above said receptacle, a supply of stack separating members, means to move a pair of said members into position below said sheet receiving means, means to move said sheet receiving means out of sheet supporting relation to allow said accumulated sheets to fall onto the members and in position to receive additional sheets from said point, lower sheet supporting means positioned between said receptacle and said member moving means, means to move said member moving means out of member supporting relation to allow said members and said accumulated sheets to fall on said lower supporting means and in position to receive sufficient additional sheets to form a stack, means to move said lower supporting means out of supporting relation to allow a stack of sheets to fall from said lower supporting means into said receptacle, and means for connecting said sheet supporting means so that when said last means is moved out of supporting relation to allow a stack to fall into said receptacle the first means is moved into position to start the new stack.

3. A sheet assembler for forming sheet stacks, each of which has a predetermined number of sheets, comprising, in combination, means to feed sheets individually and continuously to a point of disposal, a stack receiving receptacle positioned below and in stack receiving relation with said point, upper sheet supporting means movable into the path of the sheets below said point to receive a

number of sheets, less than a pack, a supply of stack separating members, means to move a pair of members into an intermediate position below said supporting means and while the latter are in sheet supporting relation, means to move said sheet supporting means into supporting relation to allow the accumulated sheets to fall onto said members while supported by the member moving means and in position to receive additional sheets at said intermediate position, a lower sheet supporting means positioned between said member moving means and said receptacle, means to move said member moving means out of member supporting relation to allow said members and the sheets accumulated thereon to drop onto said lower supporting means and in position to receive additional sheets to form a stack, and means to withdraw said lower supporting means out of stack supporting relation to allow the stack and the pair of members thereunder to drop into said receptacle.

4. A sheet assembler for forming sheet stacks, each of which has a predetermined number of sheets, comprising, in combination, means to feed sheets individually and continuously to a point of disposal, a stack receiving receptacle positioned below and in stack receiving relation with said point, upper sheet supporting means movable into the path of the sheets below said point to receive a number of sheets, less than a pack, a supply of stack separating members, means to move a pair of members into an intermediate position below said supporting means and while the latter are in sheet supporting relation, means to move said sheet supporting means into supporting relation to allow the accumulated sheets to fall onto said members while supported by the member moving means and in position to receive additional sheets at said intermediate position, a lower sheet supporting means positioned between said member moving means and said receptacle, means to move said member moving means out of member supporting relation to allow said members and the sheets accumulated thereon to drop onto said lower supporting means and in position to receive additional sheets to form a stack, means to withdraw said lower supporting means out of stack supporting relation to allow the stack and the pair of members thereunder to drop into said receptacle, and means connecting said upper and lower supporting means so that the latter will operate in proper phase relation whereby when the lower means is moved to drop a stack into said container the upper means will be moved into sheet supporting relation to start the next stack.

5. A sheet assembler for forming sheet stacks, each of which has a predetermined number of sheets, comprising, in combination, means to feed sheets individually and continuously to a point of disposal, a stack receiving receptacle positioned below and in stack receiving relation with said point, means movable into the path of the sheets below said point to receive and support a number of sheets, but less than a stack, above said receptacle, a supply of stack separating members, means to move a pair of said members into position below said sheet receiving means, auxiliary sheet supporting means positioned between said first means and said member moving means, means for moving said auxiliary means into position below said first means to support any sheet which may bypass said first means to maintain the sheets above said member moving means, means to move said sheet receiving means out of sheet supporting relation to allow said accumulated sheets to fall onto the member and in position to receive additional sheets from said point, lower sheet supporting means positioned between said receptacle and said member moving means, means to move said member moving means out of member supporting relation to allow said members and said accumulated sheets to fall on said lower supporting means and in position to receive sufficient additional sheets to form a stack, and means to move said lower supporting means out of supporting relation to

allow a stack of sheets to fall from said lower supporting means into said receptacle.

6. A sheet assembler for forming sheet stacks, each of which has a predetermined number of sheets, comprising, in combination, means to feed sheets individually and continuously to a point of disposal, a stack receiving receptacle positioned below and in stack receiving relation with said point, means movable into the path of the sheets below said point to receive and support a number of sheets, but less than a stack, above said receptacle, a supply of stack separating members, means to move a pair of said members into position below said sheet receiving means, auxiliary sheet supporting means movable into the path of said sheets between said first means and said member moving means, said auxiliary means serving to support above said member moving means any sheets that may not be supported fully on said first means to insure proper operation of said member moving means, means to move said sheet receiving means out of sheet supporting relation to allow said accumulated sheets to fall onto the members and in position to receive additional sheets from said point, lower sheet supporting means positioned between said receptacle and said member moving means, means to move said member moving means out of member supporting relation to allow said members and said accumulated sheets to fall on said lower supporting means and in position to receive sufficient additional sheets to form a stack, and means to move said lower supporting means out of supporting relation to allow a stack of sheets to fall from said lower supporting means into said receptacle, means to connect said upper and lower sheet supporting means so that when the lower supporting means are withdrawn to allow a stack to drop into said receptacle, the upper supporting means are moved into sheet supporting relation, and separate means for moving said auxiliary supporting means so that the latter is moved into sheet supporting relation substantially simultaneously with said upper supporting means and before the member moving means is moved.

7. A sheet assembler for forming sheet stacks, each of which has a predetermined number of sheets, comprising, in combination, means to feed sheets individually and continuously to a point of disposal, a stack receiving receptacle positioned below and in stack receiving relation with said point, upper sheet supporting means movable into the path of the sheets below said point to receive a number of sheets, less than a stack, a supply of stack separating members, means to move a pair of members into an intermediate position below said supporting means and while the latter are in sheet supporting relation, auxiliary sheet supporting means movable into position between said upper supporting means and said member moving means, means to move said auxiliary means into sheet supporting position below said upper means and substantially simultaneously with the movement of the latter and prior to the movement of said member moving means to provide a support for any sheets which might be improperly supported on said upper means to prevent interference with the free movement of said member moving means, a lower sheet supporting means positioned between said member moving means and said receptacle, means to move said member moving means out of member supporting relation to allow said members and the sheets accumulated thereon to drop onto said lower supporting means and in position to receive additional sheets to form a stack, means to withdraw said lower supporting means out of stack supporting relation to allow the stack and the pair of members thereunder to drop into said receptacle, means connecting said upper and lower supporting means so that the latter will operate in proper phase relation whereby when the lower means is moved to drop a stack into said container the upper means will be moved into sheet supporting relation to start the next

stack, and separate means for moving said auxiliary means into and out of sheet supporting position.

8. A sheet assembler for forming sheet stacks, each of which has a predetermined number of sheets, comprising, in combination, means to feed sheets individually and continuously to a point of disposal, a stack receiving receptacle positioned below and in stack receiving relation with said point, a chute positioned between and connecting said point and said receptacle, a pair of upper sheet supporting fingers movable through opposite side walls of said chute and into the path of the sheets below said point to receive and support a number of sheets, but less than a stack, on said fingers, a supply of stack separating members, a reciprocating carriage movable through a wall of said chute normal to said side walls to move a pair of members into said chute and below said upper fingers, means to withdraw said fingers out of sheet supporting relation to allow said sheet to drop on said members to be supported thereby and by said carriage and in position to receive more sheets by less than a stack, a pair of lower sheet supporting fingers movable through said first side wall and positioned below said carriage, means to move said carriage out of sheet and member supporting relation to allow said members and the accumulated sheets to drop onto said lower fingers to receive the additional sheets necessary to form a stack, means to connect the upper and lower fingers on each side of said chute so that said fingers will operate in a definite relation, and means for connecting the upper and lower finger on opposite sides of said chute so that said upper fingers will move inwardly to support sheets to start a stack as the lower fingers are moved out of sheet and member supporting relation to drop a completed stack into said receptacle, said carriage moving means being independent of said finger moving means but operating in timed relation therewith.

9. A sheet assembler for forming sheet stacks, each of which has a predetermined number of sheets, comprising, in combination, means to feed sheets individually and continuously to a point of disposal, a stack receiving receptacle positioned below and in stack receiving relation with said point, a chute positioned between and connecting said point and said receptacle, a pair of upper sheet supporting fingers movable through opposite side walls of said chute and into the path of the sheets below said point to receive and support a number of sheets, but less than a stack, on said finger, a supply of stack separating members, a reciprocating carriage movable through a wall of said chute normal to said side walls to move a pair of members into said chute and below said upper fingers, an auxiliary sheet supporting finger movable through the same wall as said carriage but between the latter and said upper finger, said auxiliary finger serving to support above said carriage any sheets not properly supported by said upper fingers to permit unobstructed movement of said carriage into sheet supporting position, means to withdraw said fingers out of sheet supporting relation to allow said sheet to drop on said members to be supported thereby and by said carriage and in position to receive more sheets, but still less than a stack, a pair of lower sheet supporting fingers movable through said first side wall and positioned below said carriage, means to move said carriage out of sheet and member supporting relation to allow said member and the accumulated sheets to drop onto said lower fingers to receive the additional sheets necessary to form a stack, means to connect the upper and lower fingers on each side of said chute so that said fingers will operate in a definite relation, means for connecting the upper and lower finger on opposite sides of said chute so that said upper fingers will move inwardly to support sheets to start a stack as the lower fingers are moved out of sheet and member supporting relation to drop a completed stack into said receptacle, said carriage moving means being independent

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of said finger moving means but operating in timed relation therewith, and means for moving said auxiliary finger independently of said carriage and said upper finger but in timed relation therewith so that said auxiliary finger is moved into and out of said supporting relation substantially simultaneously with said upper fingers.

10. A sheet assembler for forming sheet stacks, each of which has a predetermined number of sheets, comprising, in combination, means for feeding sheets to a point of disposal, a stack receptacle positioned below said point, an upper pair of sheet supporting fingers movable into position below said point to support sheets delivered therefrom, a lower set of sheet supporting fingers positioned below said first fingers, means to connect said sets of fingers so that as the upper set moves into sheet supporting relation the lower set moves out of such relation to drop a formed stack into said receptacle, a supply of stack supporting members, a carriage for moving a pair of members into position between said sets when a specific number of sheets has accumulated on said upper fingers, said upper fingers then being movable out of sheet supporting relation to drop the accumulated sheet onto said members supported by said carriage, an auxiliary sheet supporting member being movable into position between said upper fingers and said carriage to maintain the sheets out of the path of the carriage to enable the latter to move said members into position below said upper fingers, means to move said auxiliary finger into and out of sheet maintaining relation, said lower fingers being movable into sheet receiving and supporting relation when said upper fingers are moved out of sheet supporting relation, said carriage being movable out of supporting relation with said members and sheets after a predetermined number of sheets has accumulated on said members to allow the members and accumulated sheets to drop onto and to be supported by said lower fingers, when a full stack of sheets has accumulated on said lower fingers the latter are moved out of supporting relation to allow a stack with a pair of supporting members positioned thereunder to fall into said receptacle, means to connect said sets of fingers for operating in proper timed relation, means to move said carriage in timed relation to the movement of said sets of fingers, and means to move said auxiliary finger substantially as a unit with said upper set of fingers.

11. A sheet assembler for forming sheet stacks, each of which has a predetermined number of sheets, comprising, in combination, means for feeding sheets to a point of disposal, a stack receptacle positioned below said point, a delivery chute positioned to direct sheets from said point to said receptacle, an upper pair of sheet supporting fingers movable into position in opposite sides of said chute to support opposite edges of sheets delivered from said point, a lower pair of sheet supporting fingers movable into position in opposite sides of said chute to support opposite edges of sheets delivered from said upper fingers,

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a rocker shaft positioned between the upper and lower fingers in each side of said chute, a pair of rocker arms connected to said shaft and extending radially from opposite sides thereof, an upper finger rockably connected to one end of each arm, a lower finger connected to the opposite end of the arm, said connections serving to move said upper and lower fingers in opposite directions relative to said chute when said shaft is rocked, actuating means for said rocker shafts, means to connect said shafts to said actuating means to rock said shafts on opposite sides of said chute in opposite directions so that said upper fingers will move in and out of said chute as a unit and said lower fingers will move in and out of said chute as a unit but in a direction opposite to the movement of said upper fingers, and means for inserting a pair of stack separating members into said chute between said upper and lower fingers.

12. A sheet assembler for forming sheet stacks, each of which has a predetermined number of sheets, comprising, in combination, means for feeding sheets to a point of disposal, a stack receptacle positioned below said point, a delivery chute positioned to direct sheets from said point to said receptacle, an upper pair of sheet supporting fingers movable into position in opposite sides of said chute to support opposite edges of sheets delivered from said point, a lower pair of sheet supporting fingers movable into position in opposite sides of said chute to support opposite edges of sheets delivered from said upper fingers, a rocker shaft positioned between the upper and lower fingers in each side of said chute, a pair of rocker arms connected to said shaft and extending radially from opposite sides thereof, an upper finger rockably connected to one end of each arm, a lower finger connected to the opposite ends of the arms, said connections serving to move said upper and lower fingers in opposite directions relative to said chute when said shaft is rocked, actuating means for said rocker shafts, means to connect said shafts to said actuating means to rock said shafts on opposite sides of said chute in opposite directions so that said upper fingers will move in and out of said chute as a unit and said lower fingers will move in and out of said chute as a unit but in a direction opposite to the movement of said upper fingers, means for inserting a pair of stack separating members into said chute between said upper and lower fingers, and auxiliary sheet supporting means movable into said chute between said upper and lower fingers to hold said sheets out of the path of said separating members.

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