

Aug. 24, 1954

W. E. SOOY ET AL

2,687,301

DEVICE FOR HANDLING PRINTED SHEETS

Filed May 24, 1949

7 Sheets-Sheet 1

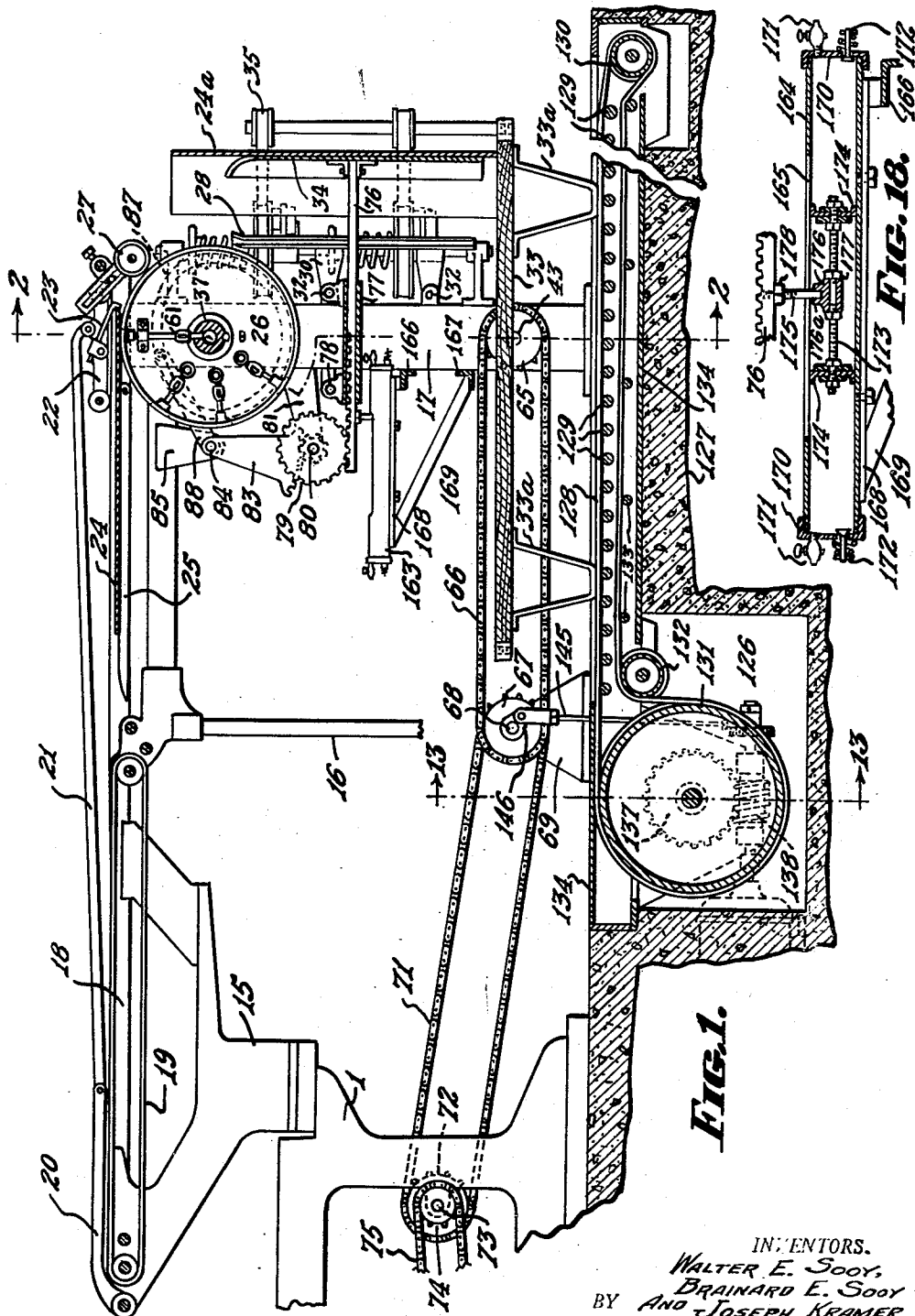


FIG. 1.

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DEVICE FOR HANDLING PRINTED SHEETS

7 Sheets--Sheet 2



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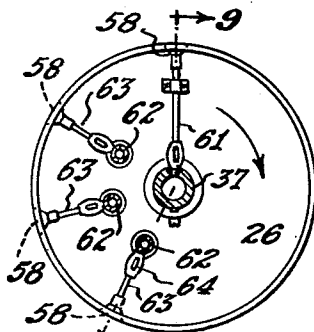
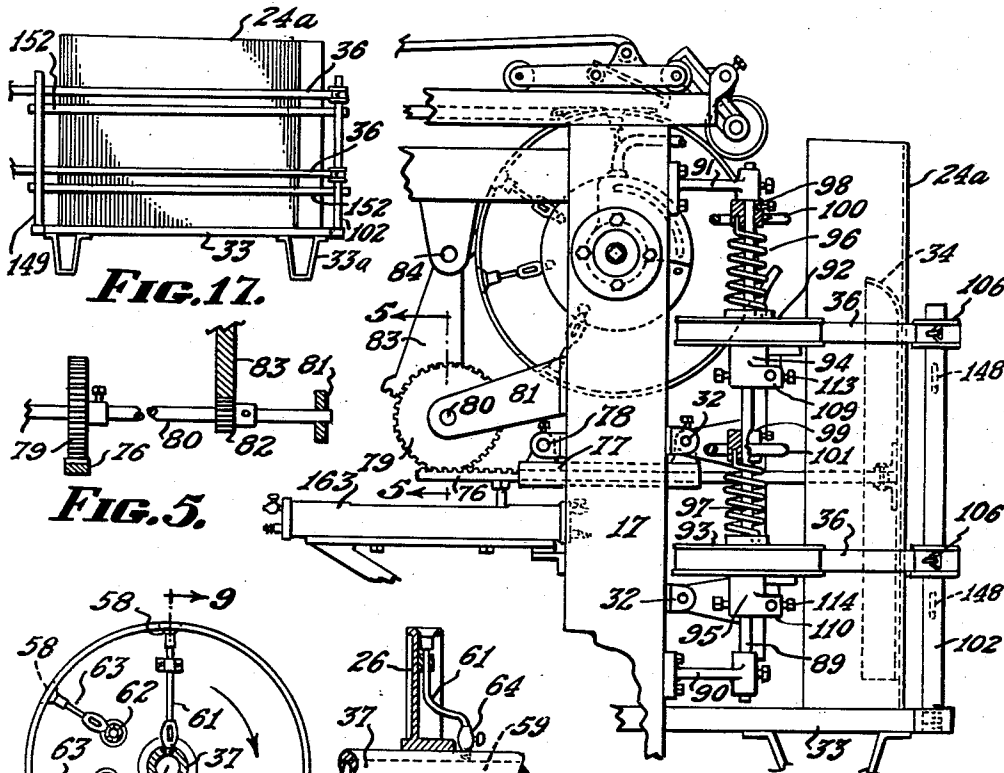
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7 Sheets-Sheet 3



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7 Sheets-Sheet 4

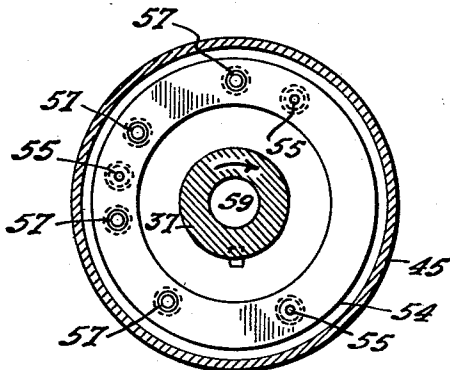


FIG. 12.

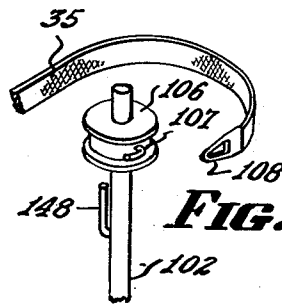


FIG. 15.

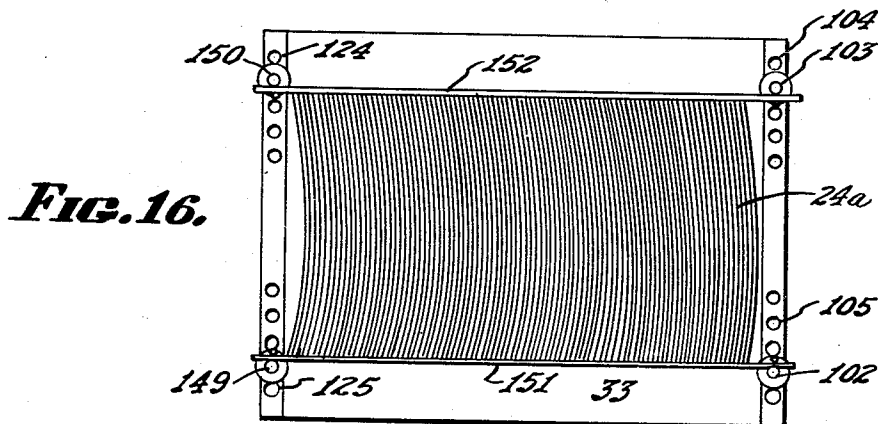


FIG. 16.

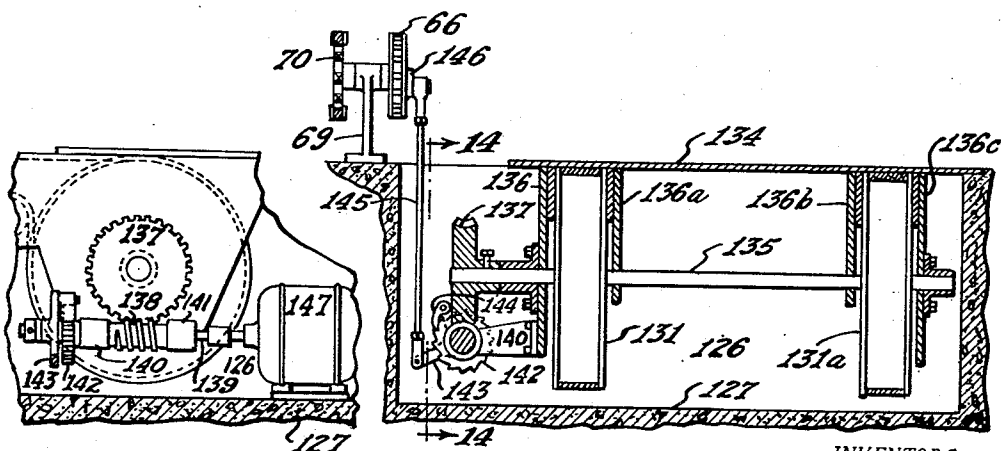


FIG. 14.

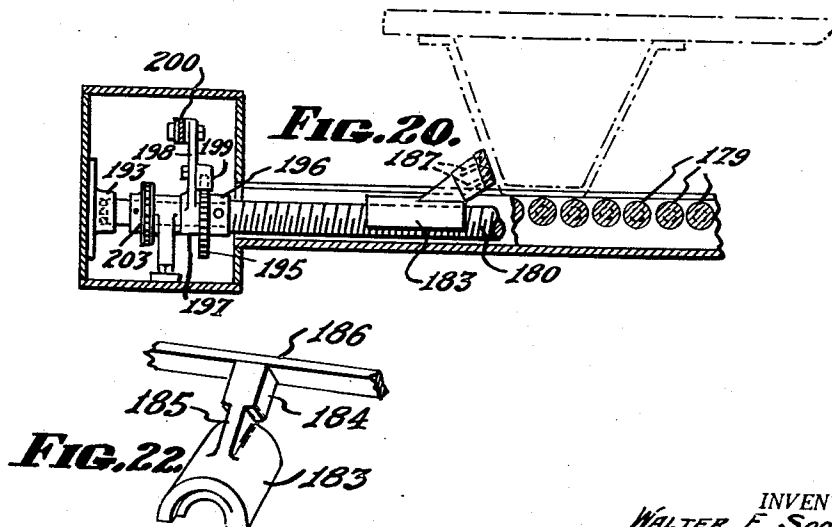
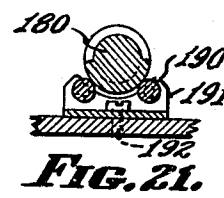
FIG. 13.

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DEVICE FOR HANDLING PRINTED SHEETS

7 Sheets-Sheet 5



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DEVICE FOR HANDLING PRINTED SHEETS

Filed May 24, 1949

7 Sheets-Sheet 6

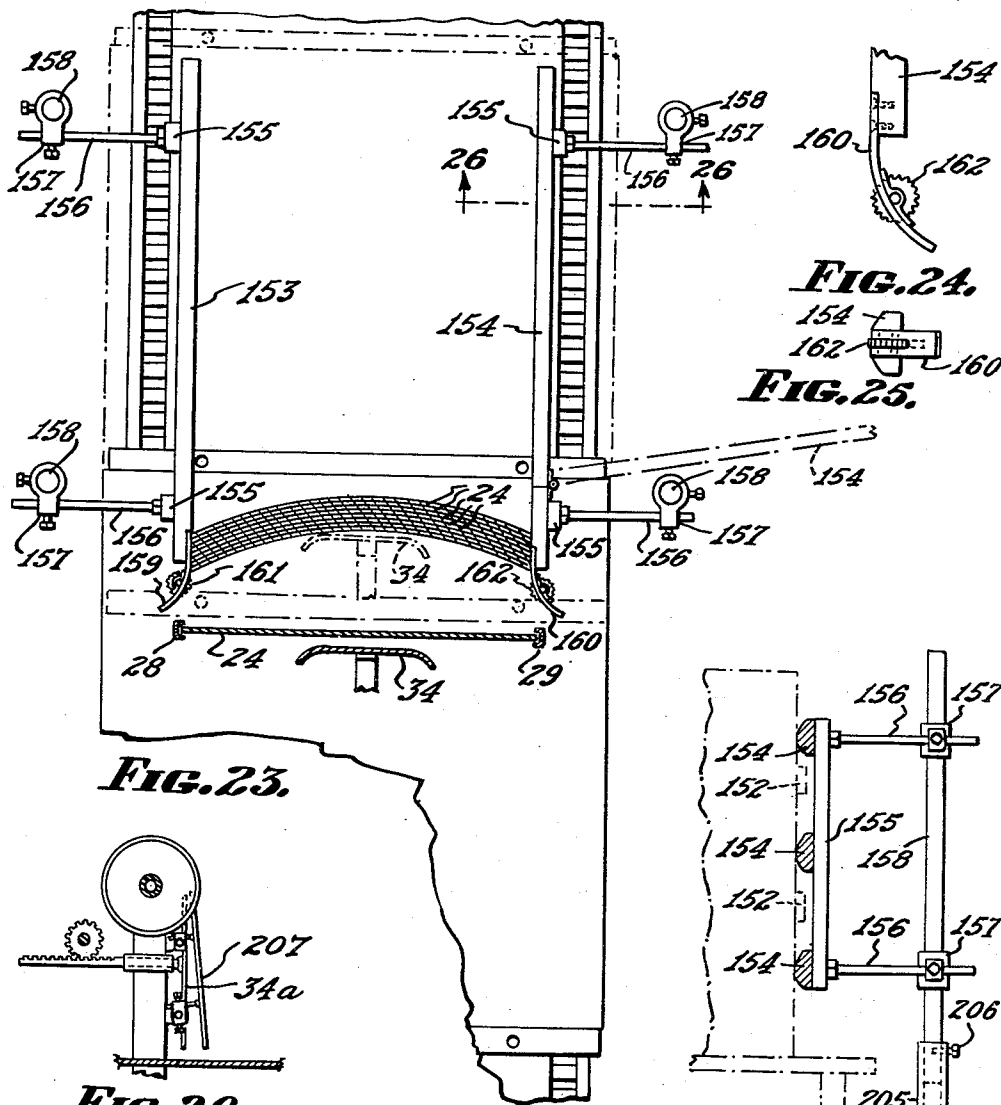


FIG. 23.

FIG. 28.

FIG. 27.

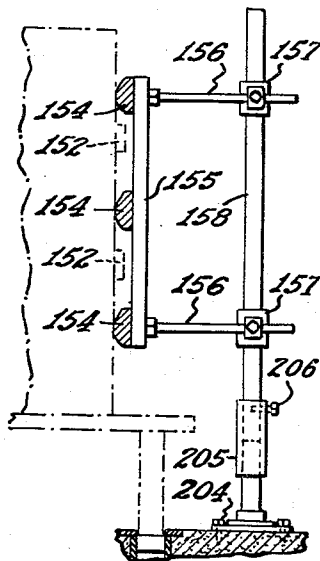
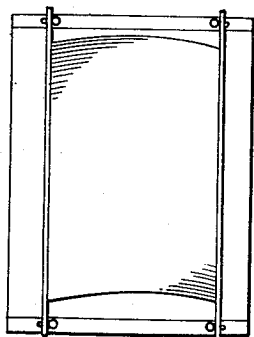


FIG. 26.

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DEVICE FOR HANDLING PRINTED SHEETS

Filed May 24, 1949

7 Sheets-Sheet 7

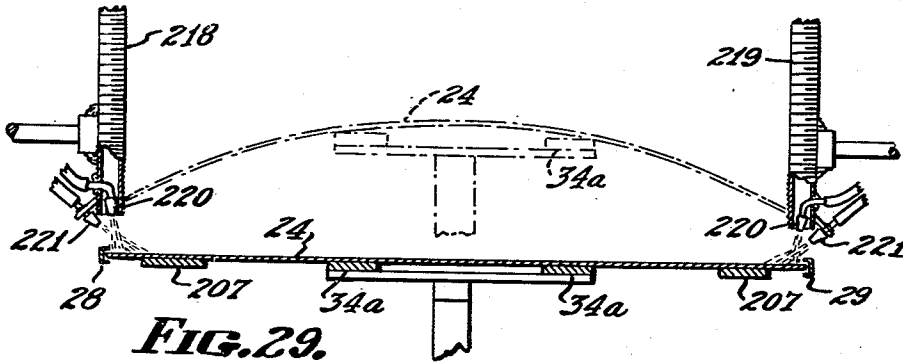


FIG. 29.

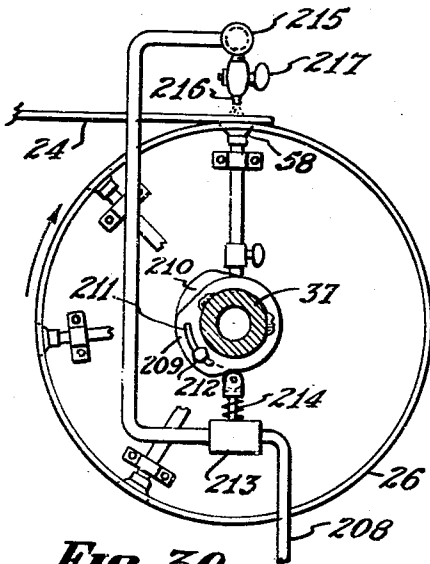


FIG. 30.

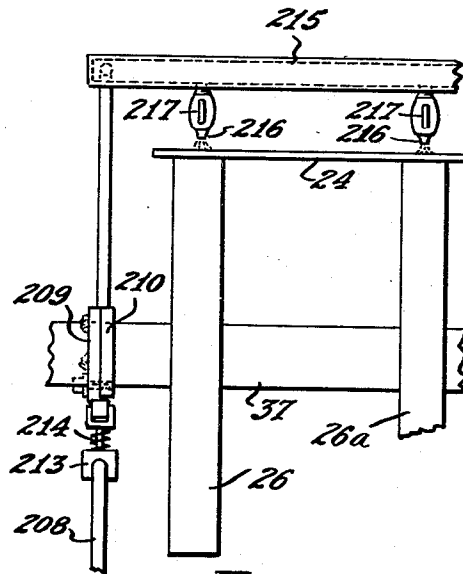


FIG. 31.

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UNITED STATES PATENT OFFICE

2,687,301

DEVICE FOR HANDLING PRINTED SHEETS

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Application May 24, 1949, Serial No. 95,008

16 Claims. (Cl. 271—87)

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Our invention deals generally with the problem of handling and protecting printed sheets, especially in accumulating them at the delivery end of a printing press. The principal object of the invention is the provision of a means and method for handling freshly printed sheets to avoid smearing and offsetting both from relative movement of the sheets with respect to each other, and from the pressure of printed sheets in a stack while the ink thereon is not fully dried, as well as the protection of the surfaces of the sheets from general mechanical damage. While it is thus an object of our invention to prevent the destructive contacting of sheet surfaces, we do not object to contacting under pressures insufficient to cause smearing, marring, offsetting and the like.

It is an object of the invention to provide a means and mechanism whereby printed sheets may be handled and accumulated in convenient multiple units for further handling and transportation, but without the surfaces of the sheets being exposed to contact with one another under conditions of accumulative pressure.

It is a further object of the invention to provide a means and mechanism for the automatic accumulation of printed sheets at the end of a press with the advantages set forth above.

These and other objects of the invention which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, we accomplish by that procedure and in that arrangement and construction of parts of which we shall now describe an exemplary embodiment, having to do with the accumulation of boxboard sheets after printing but before cutting and scoring in the general operation of box making, it being understood that the utility of our invention is not confined to such sheets or such an operation. Reference is made to the accompanying drawings wherein:

Figure 1 is a longitudinal sectional view of the delivery end of a printing press embodying the features of our invention.

Figure 2 is a transverse sectional view taken along the section line 2—2 of Figure 1.

Figure 3 is a horizontal sectional view of the same mechanism taken along the section line 3—3 of Figure 2.

Figure 4 is a partial side elevational view of the mechanism at the end of our assembly, certain parts being shown broken away.

Figure 5 is a partial vertical sectional view taken along the section line 5—5 of Figure 4.

Figure 6 is a plan view of a belt guiding and positioning mechanism.

Figure 7 is an elevational view thereof with a part in section, the section being taken along the line 7—7 of Figure 6.

Figure 8 is an elevational view of a vacuum disc for moving the sheets, the shaft being shown in section.

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Figure 9 is a sectional view of the same disc taken along the line 9—9 of Figure 8.

Figure 10 is a partial longitudinal section of a valve mechanism.

Figure 11 is a transverse sectional view thereof taken along the line 11—11 of Figure 10.

Figure 12 is also a transverse sectional view thereof taken along the line 12—12 of Figure 10.

Figure 13 is a partial transverse section of a means for driving an accumulating platform, and is related to the section line 13—13 of Figure 1.

Figure 14 is a transverse sectional view of the same apparatus taken along the section line 14—14 of Figure 13.

Figure 15 is a partial perspective view showing one mode of engagement of the straps with an end column on a platform.

Figure 16 is a top plan view of a loaded platform.

Figure 17 is a lateral elevational view thereof.

Figure 18 is a horizontal sectional view of the cushioned guide means provided for the rack rod of the pusher shoe.

Figure 19 is a plan view, with parts broken away, of modified means for driving an accumulating platform.

Figure 20 is a side view, partly in section, taken along the line 20—20 of Figure 19.

Figure 21 is a transverse section taken along the line 21—21 of Figure 19, means for supporting the drive screw for the accumulating platform.

Figure 22 is a perspective view of the means by which the accumulating platform is driven by the screws.

Figure 23 is a plan view of modified means for guiding sheets onto the accumulating platform.

Figure 24 is an enlarged plan view of the leading edge of the modified guide means.

Figure 25 is a front elevation of the structure shown in Figure 24.

Figure 26 is a transverse section taken on the line 26—26 of Figure 23.

Figure 27 is a plan view of an accumulating platform loaded with sheets according to our invention.

Figure 28 is a side view of a portion of our apparatus showing the use of substantially vertical guide members for directing sheets from the direction changing means to the accumulating platform.

Figure 29 is a plan view, partly in section, of modified means for guiding sheets onto the accumulating platform.

Figure 30 is an enlarged view showing a modification or addition to the device 26 of Figure 1.

Figure 31 is a side view of the device of Figure 30 as seen from the right in that figure.

Briefly, in the practice of our invention we accumulate printed sheets at the end of a press or other treatment apparatus in such a way that the surfaces of the sheets are either kept sub-

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stantially separated one from another without the provision of physical spacers therebetween or are allowed to touch without smearing motion and without such pressure as would cause offsetting. By printed sheet we mean one printed or coated as with ink, varnish, lacquer or any other substance which easily rubs, smears, mars, offsets and so forth in its undried condition on the paper or board surface. This, we have found, can be accomplished by changing the direction of movement of the sheets, and by accumulating them upon a platform or other suitable base in an on-edge or vertical position. The sheets are rigidified against collapse by maintaining in them an arcuate curvature by the engagement of their side edges with certain supports hereinafter to be described. These supports also maintain the position of the sheets frictionally, so that their surfaces do not contact one another under conditions of accumulative pressure. The platform or other accumulator may be moved during the accumulating operation, and when it is full, means are provided to maintain the position of the sheets during transportation and further handling, or until the ink or other substance on the surface of the sheets has sufficiently dried.

Referring to Figure 1, we have indicated at 1 the frame of the end of a printing press which may be of any suitable variety, such as a flat bed cylinder press or a rotary cylinder press, and capable of printing one or more colors. A superstructure 15 and supports 16 and 17 maintain rails 18 (one on each side of the press) at an upper delivery level. The press may be equipped with a conventional delivery conveyor 19 at this upper level and suitably driven from the press mechanism, as well as a sheet delivery mechanism comprising pivoted and mechanically actuated arms 20, links 21 and a carriage 22, riding on the rails 18, and provided with means 23 for engaging the ends of printed sheets 24 and carrying them to the end of the delivery level.

Hitherto in press assemblies of this type, the sheets 24 have been delivered to a series of sticks or movable supports 25 which, after they have received a sheet, move out of the way and permit the descent of the sheet onto a receiving platform located therebelow. In some press structures means for raising and lowering the receiving platform have been provided to minimize the distance of descent of the sheet.

In the practice of our invention, and in the application of our mechanism to a printing press of this type, we eliminate the mechanism hitherto provided for raising and lowering the platform, and we fix the supports 25 in position or provide other permanent supports for the sheets, our purpose being to deliver these sheets off the end of the delivery level hereinabove described.

At the end of the delivery level we provide a vacuum roll or its equivalent in a number of vacuum discs mounted upon a shaft (one of which discs is indicated at 25 in Figure 1) which will engage leading portions of the moving printed sheets 24, change their direction of motion, and deliver them downwardly in a vertical path. It will be understood that the sheets 24 come off the press with their printed sides uppermost, so that the vacuum discs do not engage that side of the sheets which has received fresh ink in the printing operation. At the end of the upper delivery level of the press we may if desired provide adjustable roller guide means indicated at 27 for assisting the leading edge of the sheets to conform to the vacuum roll or vacuum discs.

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It will also be understood that in connection with the carriage 22 the conventional means will be provided to release the sheet engaging devices 23 so as to free the sheets when they are engaged by the vacuum discs. At each side of the vertical path of travel of the sheets we may provide vertical side guide elements of U-shape indicated at 28 and 29. These may be adjustably mounted on brackets 30 and 31 on rods or shafts 32 extending across between the side frames 17 of the delivery end of the device. This construction enables the guides 28 and 29 to be moved to accommodate different widths of the printed sheets 24, the sheet as engaged by the guides being in flat vertical condition as most clearly illustrated in Figure 3. Moving down the side guides, when it is released by the vacuum disc or cylinder 25, the sheet comes to rest with its lower end upon a platform 33. It is also within the scope of our invention to use conventional edge gripping means rather than the vacuum cylinders 25 above described.

Equivalent mechanisms for taking over the movement of the sheets and changing the direction of their movement from a horizontal to a vertical direction may be employed, such for example as grippers moving on chains or discs, as will be evident.

As shown in Figure 28, instead of the U-shaped side guides 28 and 29 we may use a series of strips 207 tilted slightly towards the direction changing means employed. As a sheet is discharged from the direction changing means its leading edge will be thrust slightly forward thus causing it to lean against and be supported substantially in a vertical position by the strips 207.

The sheet as so positioned lies in front of a pusher or shoe member 34 occupying the position shown in dotted lines in Figure 3. This shoe may comprise a single member as shown or a plurality of vertical strips fastened together, one of which may be seen in Figure 28 at 34a. When the sheet has come to rest with its lower edge upon the platform 33 this shoe is actuated to move forwardly to the position shown in the solid lines. This action moves the sheet out of engagement with the guides 28 and 29 or strips 207 and, as illustrated in Figures 3 and 4, into engagement with one or more belt members on each side, indicated at 35 and 36. Adjacent the guides, these belts lie in slanting positions 35a and 36a; but the effective straight and parallel portion of these belts has a spacing between the guides 28 and 29. As a consequence as the printed sheet is pushed forward from the dotted line position 24 in Figure 3 to the solid line position 24a in the same figure, the sheet is bent arcuately in a horizontal direction as will be clear. It is thereby stiffened and prevented from collapsing by bending or folding on horizontal lines; and it is thereafter frictionally engaged and held at its side edges by the belts 35 and 36.

An alternative arrangement for use in guiding the sheets onto an accumulator platform is shown in Figures 23 to 27. Instead of the guide belts 35 and 36 we use rigid member 153 and 154. As seen in Figure 26 we provide three of these members at each side of the platform but the number used does not constitute a limitation of our invention. Each of the guide members 154 is fixed to a pair of vertically disposed brace members 155. Each of the brace members 155 is fixed to the ends of a pair of rods 156. These rods are slidably mounted in clamps 157 which are adjustably mounted on posts 158 which are

fixed to the floor at four points about the machine as best seen in Figures 23 and 26. It is to be understood that the members 153 are similarly arranged.

Fixed to the receiving ends of the members 153 and 154 are a pair of arcuate pieces 159 and 160. Each of the arcuate pieces 159 and 160 is provided with a horizontally mounted, freely rotatable spur gear or the like 161 and 162. The detail of this arrangement is best seen in Figures 24 and 25. The spur gears 161 and 162 aid in the receiving of sheets from the pusher 34 and in starting them between the members 153 and 154.

As in the case in which belts 35 and 36 are utilized, the members 153 and 154 are spaced apart a distance less than the width of the printed sheets and less than the spacing between the guides 28 and 29. In this manner the sheets are made to assume an arcuate shape and thereby stiffened and held in frictional engagement between the members 153 and 154 as is the case when the belts 35 and 36 are used.

It will be seen that the pusher shoe 34 contacts the rear face of the sheet 24, i. e. the face which does not bear a fresh coating of ink. When a sheet has been positioned as at 24a, the shoe 34 returns to the dotted line position prior to the delivery of another sheet, as will be more fully described hereinafter. It is a feature of our invention that the platform 33 is moved forwardly a certain distance after the delivery of each sheet (or continuously) so that the sheets accumulate between the belts 35 and 36, these belts being drawn out from reels as the platform moves. In that modification of our invention last described these sheets will, of course, accumulate between the members 153 and 154. In either of these ways, the sheets accumulate in proper relationship upon the platform without any marring of the freshly printed surfaces of the sheets.

In Figure 29 we have disclosed yet another arrangement for guiding the sheets 24 onto an accumulator platform. In this arrangement the rigid guide members 153 and 154 may comprise threaded pipes 218 and 219 so that as the sheets are pushed there between they are positively maintained in position by the threaded portions of such pipe. In this latter modification the pipes 218 and 219 are extended without the guides 159 and 160 (or the rails 153, 154) to a position much closer to the members 28 and 29—or the members 207 as the case may be. (In Figure 29 we have indicated the presence of the members 28—29 as well as the members 207 simply to illustrate their relative position with respect to the pipes 218—219. In practice we would ordinarily use either one or the other of such guides for the substantially vertical movement of the sheets 24.)

In place of the members 159 and 160 of Figure 23 we utilize air jets 220 and 221 (Figure 29). These jets perform the same function as the members 159—160. The jets 221 are located above the pipes 218—219 and are directed downwardly. The jets 220 are located in the ends of these pipes. These jets 220 and 221 thus combine to prevent the printed surfaces of the sheets 24 from striking the ends of the pipe guides 218—219 as the pusher 34 or 34a pushes such sheets from the guide members 28, 29 or 207 as the case may be.

The device 26 may be in the form of a vacuum cylinder, but is most conveniently arranged as a plurality of vacuum discs rigidly affixed to a rotating shaft 37. The purpose of the device is

to engage the sheets on their under sides by the vacuum as they are delivered at the upper delivery level horizontally, and change their mode of motion to a vertical one with their edges engaged by the side guides 28 and 29. As a consequence, to accomplish this, the device 26 must engage the leading end of the sheets 24 and deflect it downwardly into the guides 28 and 29, but must release the leading end of the sheet when this has been accomplished, while retaining driving relationship with other portions of the sheet until all parts of it have been introduced into the side guides. Hence automatic means must be provided both to effect and to release the vacuum engagement of the cylinder or disc with the sheets depending upon the rotative position of the cylinder or discs. Referring to Figure 2, the vacuum discs 26, 26a, 26b etc. are mounted upon a shaft 37 which is journaled in bearings 38 and 39 in the side frame members 17 of the end extension of the press. The shaft may be fitted with a sprocket 40 connected by a chain 41 to a lower sprocket 42 on a stub shaft 43. Timed rotary motion will thus be imparted to the shaft 37 through motion transmitting means hereinafter described, from the main drive of the press.

Near one end of the shaft 37 we provide a valve mechanism for the control of the vacuum. This mechanism is indicated generally at 44 in Figure 2, and is detailed in Figures 10, 11 and 12. A cup-shaped member 45 having a central hub is non-rotatively affixed to the bearing 38 as by a set screw 46. A vacuum chest 47 is constructed against the rear face of the member 45 from suitable metal parts welded or otherwise fastened together. This vacuum chest may occupy somewhat more than a quadrant, and will be connected to a vacuum mechanism (not shown) by a conduit or tube 48. The wall of the member 45 is provided with arcuate slot 49 communicating with the vacuum distribution chest 47; and its inside face is also provided with a similarly slotted slip ring 50 held in place by screws 51 or otherwise.

A cooperating flange member 52, having a hub, is non-rotatively affixed to the shaft 37, as by a set screw 53. The member 52 preferably conforms closely at its periphery to the edge of the member 45 to keep dust from the valve mechanism inside. This valve mechanism comprises the slip ring 50 with its slot 49, already described, and another slip ring 54 which will slide over the surface of the first ring as the member 52 rotates with respect to the member 45. The second slip ring 54 is mounted upon the flange member 52 by means of studs 55; and coiled springs 56 serve to press the slip rings together.

As best shown in Figure 12, the slip ring 54 is provided with a series of ports 57. During the relative rotation of the members 45 and 52, it will be clear that these ports will come opposite the slot 49 in the slip ring 50, thus providing a valving action in which the several ports 57 are connected with the vacuum chest 47 in those angular positions of the shaft 37 in which the ports coincide with the slot 49. The ports will be connected with ports 58 suitably arranged in the peripheries of the vacuum discs 26, 26a, etc. so as to cause the discs to engage and release the sheets 24, as described above. Any suitable tubing may be employed for these connections. The shaft 37 may be provided with a central bore 59 to which one of the ports 57 is connected by a tube 60, as in Figures 8 and 10. In that event one of the ports 58 of each of the vacuum discs will be connected to the bore of the shaft by a

tube indicated in Figures 1, 2, 8 and 9 at 61. Others of the ports 57 in the second slip ring will be connected to longitudinal conduits 62 paralleling the shaft 37 and connected to others of the ports 58 in the vacuum discs 26 by tubing 63. The operation of this mechanism, as will readily be understood, is to produce vacuum engagement between portions of the sheet 24 and the vacuum discs 26, 26a, etc. at the several ports 58, to cause the rotating discs to move the sheets 24 from a horizontal path to a vertical path, delivering them into the side guides 28 and 29, and releasing the vacuum engagement selectively as the several portions of the sheets are delivered into the side guides.

The several vacuum connections may be valved individually as 64 so that the vacuum discs 26, 26a etc. may be rendered selectively inactive for the purpose of adjusting the mechanism to sheets 24 of different widths.

In connection with the above described device we may also provide, as is illustrated in Figures 30 and 31, means to positively insure that the vacuum discs will properly grasp the printed sheet. Compressed air is forced into the conduit 208 by any suitable means. Fixed to the shaft 37 is a cam plate 209. Slidably mounted on the shaft 37 is another cam plate 210. Plate 209 is provided with an arcuate slot 211 and plate 210 with a projection nicely fitting this slot and having a nut 212 by means of which the plates 209 and 210 may be secured together. Thus we are able to adjust this cam to various positions by loosening the nut 212 and sliding the plate 210.

A suitable air valve 213 is provided with a spring maintained plunger 214, said plunger being adapted to be operated by the cam 209—210. A header element 215 is also provided. From this header a series of air jets or nozzles 216 depend, each being positioned above one of the discs 26, 26a etc. Each of the nozzles 216 is valved individually as at 217 so that these nozzles may be rendered selectively inactive for the purpose of adjusting the mechanism to sheets 24 of differing widths.

Thus we have provided means to insure the proper functioning of the discs 26, 26a etc. for as each of the vacuum cups comes into play the sheet 24 is forced into contact therewith by means of the air jets 216. When the plunger 214 is depressed by the cam 209—210 the valve 213 is closed and the air cut off.

As above stated conventional edge gripping mechanism may be employed in place of the vacuum arrangement we have shown, and in its broadest aspects our invention is intended to include such a structure.

As most clearly shown in Figure 1, the stub shaft 43 bears a sprocket 65 which is connected by a chain 66 to a sprocket 67 on a stub shaft 68. This stub shaft is journaled in any suitable way, as in a bracket 69 on the floor. The stub shaft 68 bears a sprocket 70 (Figure 13) which is connected by a chain 71 to a sprocket 72 on a stub shaft 73 journaled on the frame 1 of the press. This stub shaft also bears a sprocket 74 which is connected by a chain to the main drive of the press by a suitable set of gears (not shown).

The pusher shoe 34 is mounted upon a rack rod 76 which is engaged in a slide 77, as most clearly shown in Figures 1 and 3. One end of this slide is mounted upon the upper rod 32, and the other is mounted upon a rod 78 extending across between the frame members 17. As shown in Fig-

ures 1, 4 and 5, a gear wheel 79 has teeth meshing with the teeth of the rack bar 76. This gear wheel is mounted upon a shaft 80 journaled in brackets 81 on the side frame members 17. The shaft 80 adjacent one of its ends bears a pinion 82 which is engaged by the teeth of a gear segment 83. The gear segment is fixed to a stub shaft 84 journaled in a bracket 85 on an end frame member of the machine. In Figure 2 it will be clearly seen that the shaft 37 bears a cam member 86 having a cam track 87. A lever 88 is fixed to the stub shaft 84 (Figure 1) and has a cam follower engaged in the cam track 87. As the shaft 37 revolves, the gear segment 83 will be rocked by this mechanism, and in turn will produce the timed movement of the pusher shoe 34 which has been described above, and which results in pushing the sheets 24a from the side guides 28 and 29 and engaging them in arcuate configuration between the belts 35 and 36.

It is to be understood that other suitable means, such as an air cylinder for example, may be provided to actuate the sheet pusher 34.

In connection with the rack rod mechanism we have provided for effecting movement of the sheet pusher as above described, we have also provided additional means to insure accurate movement of the pusher 34. As best seen in Figures 1, 4 and 18 this means comprises a double dash pot arrangement indicated generally at 163. The double dash pot comprises a cylinder 164 provided with a longitudinal slot 165 in one side thereof. This cylinder is mounted on the machine by means of a bracket 168 fixed to a pair of angle members 166 and 167 fixed to the members 17. The bracket 168 is provided with a leg 169 depending from one of its ends and supported by the angle member 167. The other end of the support 168 is suitably fixed to the angle member 166. The cylinder 164 of the double dash pot 163 is fixed to the support 168 by suitable bolts or the like.

Referring now to Figure 18 it is seen that the cylinder 164 is provided—at each of its ends—with caps 170 having a regulator valve 171 and air release valve 172 mounted therein. Mounted for sliding movement within the cylinder 164 is a piston rod 173 having cup shaped piston members 174 fixed to each of its ends. Suitably secured centrally of the shaft between the two members 174 is a rod 175. This rod 175 may be so secured by means of a sleeve 176 provided with a hub 176a and fixed to the piston rod 173 by means of nuts 177, the rod 173 being threaded for this purpose. The rod 175 extends out through the slot 165 within which it just nicely fits. At its outer end the rod 175 is threaded so that it may be securely fixed in a threaded hole in the rack rod 76 and locked by means of a nut 178.

As will be apparent from an examination of Figure 18 the double dash pot operates as follows: As the pusher 34 moves forwardly, the piston rod 173 does likewise. During the first part of such movement air within the right hand portion of the cylinder escapes through the slot 165. When the member 174 has passed the end of this slot, however, the air in this end of the cylinder will begin to compress, thus cushioning the movement of the piston rod 173 and rack rod 76. The amount of cushioning obtained may be regulated by means of the valve 171. When the pusher 34 is returned to starting position air is admitted to that portion of the cylinder just described through the conventional air inlet valve 172. In similar manner a cushioning effect is also ob-

tained at the return position of the pusher 34, rack rod 76 and piston rod 173. This arrangement provides positive control and guidance of the rack rod 76 during the actuation of the pusher 34.

For that modification of our invention wherein we provide for the use of guide belts 35 and 36 we mount, on each of the vertical end frame members 17, a vertical shaft or rod 89 in brackets 90 and 91. This is detailed in Figure 4. Reels indicated in this figure at 92 and 93 are provided for each of the belts in the sets 35 or 36. As many belts in each set may be provided as desired. We have illustrated two. The reels 92 and 93 are either journaled on the vertical rods 89 or on collars 94 and 95 fixed to these rods adjustably by set screws. The belts may thus be shafted vertically to accommodate different lengths of the sheets 24. The reels 92 and 93 have torsion springs indicated at 96 and 97. One of the ends of each of these springs is affixed to one of the reels 92 or 93, while the other ends of the springs are fixed to collars 98 or 99. These collars have set screws whereby they may be held on the rods 89; and they are preferably also provided with hand wheels 100 and 101 whereby their positions may be adjusted to control the tension on the belts. It will be understood that the springs 96 and 97 urge the reels 92 and 93 rotatively in directions to take up the belts 35 and 36 and hence tension the belts.

On the platform 33 we provide forward posts 102 and 103. These are engageable in sockets on the end member of the platform; and we provide several such sockets 104, 105 so that the positions of the posts may be adjusted for sheets of different widths. The posts are provided with means whereby the belts may be engaged with them. As shown in Figure 15, one way of doing this is to provide adjustable spool-like elements 106 mounted on the posts, and provided with hooks 107 for engagement with loops or eyes 108 on the ends of the belts 35 or 36. The radial thickness of the spool-like elements 106 fixes the forward end of the planes of the belts somewhat away from the surfaces of the posts, for a purpose which will be set forth hereinafter.

To fix the inner ends of the planes of the belts, which also must be done in an adjustable manner, we provide ears 109 and 110 on the collars 94 and 95. Rod members 111 and 112 (Figure 3) are engaged in the perforations in these ears, and may be held by set screws 113 and 114 (Figure 4). The rod members 111 and 112 carry heads indicated in Figures 6 and 7 at 115; and these heads have vertically extending stub shafts 116. For each head we provide a rocker arm 117 having a hub 118 surrounding the stub shaft 116, and provided with a set screw 119 whereby its position thereon may be fixed. Adjacent each end of the rocker arm 117, we provide upwardly extending stub shafts 120 and 121, and on these we rotatively mount spool or sheave elements 122 and 123. As will be most clearly understood from Figure 3, a belt 36 passes from the reel 92 over the sheaves 122 and 123 before passing forwardly to engage the spool element 106 on the post 102. The sheave elements 122 and 123 change the path of the belt, and establish the slanting portion 36a which, coacting with the pusher 34, first establishes the arcuate condition of the sheets 24a as they are thrust forwardly.

As has already been explained, the platform 33 moves forwardly as the sheets 24a accumulate on it, and as this occurs, the belts 35 and 36 pay out

from the reels 92 and 93 but remain in tensioned condition by reason of the springs 96 and 97, so that the belts 35 and 36 maintain the positions of the accumulating sheets by frictional engagement with their edges.

The platform element 33, with the exception of the socket members 104 and 105 at one end, and corresponding socket members 124 and 125 at the other, can be the ordinary or conventional platform member used for accumulating printed sheets flatwise at the end of a press, as has hitherto been done. It will be equipped with the usual legs 33a which hold it above the floor and permit it to be engaged and moved by the conventional elevator-equipped trucks. In that modification of our invention wherein we dispense with the belts 35 and 36 the general arrangement of the platform element 33 does not change materially. The posts 102 will differ only in that the spool and hook arrangements 106 and 107 will be omitted. The manner of retention of the sheets on the platform in each modification will be described in detail hereinafter.

We shall now describe suitable mechanisms for moving the platform as the sheets 24a accumulate thereon. Figures 1, 13 and 14 show one form of such mechanism.

In a suitably shaped recess 126 in the floor 127 we provide a conveyor for each pair of the legs 33a of the platform 33. The length of the effective portions of these conveyors will be such that the platform may be located initially under the delivery end of the press and then moved forwardly as the sheets accumulate on it at least substantially its own length and preferably one and a half or two times its length, as will be readily understood. In their most convenient form, the conveyors are belt members 128, supported throughout their working flights by closely spaced rollers 129. The belts have forward sheaves 130, and rear driving sheaves 131, together with supplementary sheaves 132 to keep the belts in contact with the driving drums 131 and 131a, and such intermediate supports for their return flights as may be required. These are rollers indicated at 133.

A housing may be provided for the combined conveyor mechanisms, and may be formed from suitable pieces of plate metal welded together. The housing is indicated at 134. It will be understood that the working flights of the conveyors are exposed upwardly.

The driving drums 131 and 131a may be mounted upon a shaft 135 which is journaled in depending ears or brackets 136, 136a, 136b etc. welded to an upper plate of the housing 134. The shaft 135 carries a worm gear 137 which meshes with a worm 138 on a shaft 139 journaled in brackets 140 and 141 on the bracket 136.

The shaft 139 also carries a ratchet wheel 142 affixed to it. A rocker arm 143 is rotatably mounted on the shaft, and carries a pawl engaging the teeth of the ratchet wheel 142. The rocker arm 143 is connected by a link or pitman 145 with a crank 146 on the stub shaft 68. It will be seen therefore that the conveyors comprising the belts 128 are linked up mechanically with the drive of the press and with the mechanism hereinabove described for accumulating the sheets on the platforms. The mechanism is synchronized, and as each sheet is delivered edge-wise to the platform, the platform is moved forwardly a sufficient distance to assure a desired separation of the sheets as they accumulate. To this end the crank 146 is made adjustable so that

the radius of rotation can be varied from zero up to a full stroke which would impart approximately 90° of rotation to ratchet wheel 142. By changing the radius of rotation of crank 146, the oscillating stroke of pitman 145 is varied, therefore varying the number of ratchet teeth engaged by the pawl. Thus the intermittent forward motion of the platform can be varied to meet any condition or requirement.

In practice the platform 33 is placed in position at the rear of the machine, even while the press is running and delivering sheets, to a platform being loaded. When it is desired to change platforms, a motor 147 coupled to the shaft 139 is used to run the mechanism forward, thus putting the empty platform in position for loading and running the loaded platform forward out of loading position and into a location such that a truck can remove it. In this manner continuous operation of the press can be adequately handled.

An alternative method of driving the platforms is shown in Figures 19 to 22. In this arrangement the legs of the platforms rest directly on a series of rollers 179 suitably mounted in the floor. Also set in the floor between the two rows of rollers 179 are a pair of screws 180. A covering 181 is provided for the greater part of the openings in which these screws are located, there being, however, a rectangular opening 182 left at the rear end of each screw. For each screw there is provided a threaded half-sleeve 183 to be driven thereby, each of said sleeves having a lug 184 projecting centrally from its outer portion, said lugs having a narrow stem portion 185. A bar 186 extends across said lugs being fixed thereto by means of bolts or the like 187. The opening 182 is just large enough to receive the sleeves 183 and the lug 184 carried by the sleeve just nicely fits a slot 188 provided in the covering 181. When the screws are driven in a manner shortly to be described, the half-sleeves 183 are moved forward and with them the bar 186 which rests against the legs of a platform positioned on the rollers 179, thus moving the platform.

As best seen in Figures 19 and 20, each of the screws 180 is supported at its rear end by a bracket 189 and bearing 193 in which it is journaled. As seen in Figure 21 the screws 180 are supported at their other ends by rollers 190 mounted in a suitable bracket 191 fixed in position on the mechanism by bolts 192.

Pinned at 194 to each of the screws 180 is a ratchet wheel 195 having a hub 196. On a sleeve 197 freely rotatable with respect to the screws 180, there is fixed a rocker arm 198. Centrally pinned to each of the arms 198 is a ratchet pawl 199 engaging the teeth of the ratchet wheel 195. A tie rod 200 is pinned to the ends of both the rocker arms 198 so that movement of one such arm will cause a corresponding movement of the other. To one of these arms, as seen in Figure 19, there is also pinned the link or pitman 145 previously described and shown in Figure 13. It will be seen therefore that the conveying screws 180 are linked up mechanically with the mechanism hereinabove described for accumulating sheets on the platforms. The mechanism is synchronized, and as each sheet is delivered edge-wise to the platform, the platform is moved forwardly a sufficient distance to assure a desired relationship of the sheets as they accumulate.

As also seen in Figure 19, a gear 201 is mounted on one of the screws 180. This gear is driven by the motor 147 which is provided with a gear 202 for that purpose. A sprocket 203 is pinned

to each screw and these sprockets may be joined by a chain or the like. Thus when the motor 147 is actuated both of the screws 180 are simultaneously driven thereby for the purpose of running the mechanism forward in order to position and move the platforms as previously described.

We have hereinabove described how the sheets 24a accumulate upon the platform as it is moved forwardly. The sheets are maintained in the arcuate formation, whereby they are stiffened, through the action of the tensioned belts 35 and 36 or the rigid members 153 and 154 as the case may be. When a full complement of sheets has accumulated upon a platform, we locate other posts 149 and 150 in the sockets 124 and 125 at the rear end of the platform, as will be seen in Figures 16 and 17. We then engage rods 151 and 152, which may be of metal or wood, with the side edges of the accumulated sheets, resting these rods in hook members 148 provided on the several posts (see Figure 15). The sheets are now retained in position by the rods 151 and 152, and it becomes possible, in one modification of our invention, to disengage the several belts 35 and 36 from the spool elements 106. The belts thereupon are taken up by the reels 92 and 93. The platform may be engaged by the elevator of a suitable truck and carried away from the press to a suitable position of storage, where the ink can be allowed thoroughly to dry while the sheets remain in positions out of destructive contact with one another. A fresh platform may be delivered to the conveyor belts 128 as hereinbefore described. The belts 35 and 36 are then engaged with the spool elements 106 on posts 102 and 103 inserted in the sockets on the leading end of the fresh platform, and the operation is repeated. We have hereinabove described how the operating instrumentalities may be adjusted for sheets of varying dimensions.

In that modification of our invention wherein we use the rigid members 153 and 154 fixed to rods 156 adjustably mounted on posts 158 at the sides of the machine, the procedure is somewhat different. One of the posts 158, see Figures 23 and 26, is so arranged that after the retaining rods 151 and 152 have been inserted the members 154 may be swung to one side so that a truck may approach a loaded platform from the side, thus effecting a saving in space. In order to effect this, the post 158 above referred to is made in two sections, one such section being bolted to the floor as at 204. Nicely fitting the two sections of the post is a sleeve 205 pinned to the upper section as at 206. When it is desired to swing the members 154 to one side, the pin 206 is pulled out, the sleeve 205 dropped and the upper section of the post swung to the position shown in dotted lines in Figure 23. It is to be understood that there may be other ways of accomplishing this result without departing from the spirit of our invention. For example, the posts 158 might be positioned in sockets from which they could be unscrewed in order to permit the bars 154 to be swung aside.

In the modification incorporating the use of belts 35 and 36 the retaining rods 151 and 152 may easily be fixed to the posts 102, 103, 149 and 150 by reason of the fact that the pulleys 106 project farther out from the posts than do the hooks 148. In that modification wherein the rigid members 153 and 154 are used, this same ease of insertion is obtained by reason of the fact that the members 153 and 154 are made large enough in cross-section, see Figure 26, to enable the rods

151 and 152 to pass freely between the sheets 24 and braces 155.

While we have disclosed our invention in connection with a printing press, it will be clear that its utility is not confined thereto, and that it may be employed in connection with any mechanism wherein sheets are formed or have their surfaces treated, and wherein it is desired to maintain the sheets in separated condition sufficient to protect their surfaces and yet at the same time accumulate them in large groups suitable for transportation and storage. After the sheet surfaces have dried, the horizontal pile may readily be converted to a vertical pile for subsequent operations if desired.

Modifications may be made in our invention without departing from the spirit of it. Having thus described our invention in an exemplary embodiment, what we claim as new and desire to secure by Letters Patent is:

1. A process of accumulating sheets out of accumulating pressure contact with each other which comprises feeding said sheets flatwise vertically until their lower edges rest upon a platform, said sheets being supported by substantially vertically extending guide members, and pushing said sheets horizontally from said guide members and between retaining members contacting the side edges of said sheets and spaced apart less than the width of said sheets whereby to impart a curvature to said sheets, and for each sheet so fed moving said platform forwardly a distance at least equal to the thickness of a sheet, and moving said sheet edge contacting means forwardly a like amount.

2. A process of accumulating printed sheets without offset, which comprises feeding said sheets flatwise horizontally in spaced relationship, changing the motion of said sheets to a vertical downward direction, and feeding said sheets in said direction adjacent substantially vertical guides until their lower ends contact a platform, then horizontally pushing said sheets from said guides and between edge retaining members spaced apart horizontally less than the width of said sheets, and concurrently with the feeding of said sheets moving said platform and said edge contacting means forwardly for each sheet a distance at least equal to the thickness thereof, so that said sheets are accumulated on said platform out of destructive surface contact with each other.

3. In apparatus for the purpose described, means for feeding sheets flatwise individually downwardly to bring their lower ends into contact with a support, substantially vertical guides for engaging the sheets as so fed, a pusher for pushing the sheets laterally from said guides, an elongated element located to receive said sheets between them and to contact the side edges of said sheets when said sheets are pushed from said guides, said elements being spaced from each other less than the width of said sheets whereby said pusher causes said sheets to assume an arcuate configuration whereby they are stiffened, and means for moving said support forwardly in the direction in which said sheets are pushed by a distance for each sheet at least equal to the thickness thereof whereby said sheets are successively arranged between and held by said elements out of destructive surface contact with each other, said elements comprising belts engaging at their ends posts on said support and said belts being provided with reels, maintaining tension on said belts and paying said belts out when said support moves.

4. The structure claimed in claim 3 including deflecting means for said belts located adjacent said substantially vertical guides and serving to dispose portions of said belts adjacent said guides slantwise to the direction of motion of said sheets as produced by said pusher whereby to provide a constricting throat to assist in the arcuate curvature of said sheets.

5. The structure claimed in claim 4 wherein said feeding means comprise a rotary vacuum device for engaging said sheets when in a horizontal position and moving them into said vertical path of travel, said vacuum device having a plurality of ports, and valve means for controlling the engagement and release of said sheets.

6. The structure claimed in claim 5 wherein said vacuum device is mounted upon a driven shaft, wherein said pusher is slidably mounted for a path of travel beginning at one side of said substantially vertical guides and ending on the other, wherein said shaft bears a cam and wherein a cam follower engaging said cam is operatively connected with said pusher to move it in timed relationship with the movements of said vacuum device.

7. The structure claimed in claim 6 wherein said support is a platform having legs and wherein said means for moving the support comprises a pair of conveyors upon which said legs rest, and means for moving said conveyors in timed relationship to the movements of said vacuum device and pusher.

8. The structure claimed in claim 7 wherein said platform has sockets at each end, said posts being inserted in said sockets at the forward end of said platform, wherein said belts are detachably engaged with said posts, wherein other posts may be engaged in the sockets at the rear end of said platform, wherein said several posts have hooks, and wherein bar-like supports may be engaged with said posts by means of said hooks to support the side edges of an accumulation of sheets, whereupon said belts may be disengaged and said platform with the accumulated sheets thereon may be removed from said conveyors.

9. In combination with a printing press having a horizontal end delivery on which printed sheets are delivered with their printed face uppermost, rotary feeding means for engaging and feeding said sheets flatwise individually into a vertical path of travel, substantially vertical guides to engage said sheets in said vertical path and to guide them therein until their lower ends come to rest upon a platform, a pusher mounted for horizontal reciprocation in a path of travel beginning at one side of said guides and ending at the other, said pusher acting to dislodge sheets from said guides and move them in a horizontal direction, flexible members for engaging side edges of said sheets as so moved and spaced apart less than the width of said sheets so as to impart a curvature to said sheets as moved between them by the pusher and to retain said sheets by engagement with their side edges, said vertical guides being located away from the receiving ends of said flexible members, and synchronized driving means for said sheet moving means and said pusher, spring reels for said flexible elements, means for moving said platform and a drive for said last mentioned means synchronized with movements of said moving and pushing means.

10. In apparatus for the purpose described,

means for feeding sheets flatwise individually downwardly to bring their lower ends into contact with a support, substantially vertical guides for engaging the sheets as so fed, a pusher for pushing the sheets laterally from said guides, rigid elongated elements located to receive said sheets between them and to contact the side edges of said sheets, said vertical guides being located away from the receiving ends of said rigid elements, said rigid elements being spaced from each other less than the width of said sheets whereby said pusher causes said sheets to assume an arcuate configuration whereby they are stiffened, and means for moving said support forwardly in the direction in which said sheets are pushed by a distance for each sheet at least equal to the thickness thereof whereby said sheets are successively arranged between and held by said rigid elements out of destructive surface contact with each other, the said rigid elements located at one side of the apparatus being mounted for pivotal movement about a vertical axis.

11. In apparatus for the purpose described, means for feeding sheets flatwise individually downwardly to bring their lower ends into contact with a support, substantially vertical guides for engaging the sheets as so fed, a pusher for pushing the sheets laterally from said guides, rigid elongated elements located to receive said sheets between them and to contact the side edges of said sheets, said vertical guides being located away from the receiving ends of said rigid elements, said rigid elements being spaced from each other less than the width of said sheets whereby said pusher causes said sheets to assume an arcuate configuration whereby they are stiffened, and means for moving said support forwardly in the direction in which said sheets are pushed by a distance for each sheet at least equal to the thickness thereof whereby said sheets are successively arranged between and held by said rigid elements out of destructive surface contact with each other, the sheet receiving ends of said rigid elements being provided with outwardly extending arcuate guide members.

12. The structure of claim 11 in which at least one of said arcuate guide members is provided with a rotatable toothed wheel to aid in receiving the sheets as they are pushed between said rigid elements.

13. In apparatus for the purpose described, means for feeding sheets flatwise individually downwardly to bring their ends into contact with a support, substantially vertical guides for engaging the sheets as so fed, a pusher for pushing the sheets laterally from said guides, and elongated elements located to receive said sheets between them and to contact the side edges of said sheets when said sheets are pushed from said guides, said elements being spaced from each other less than the width of said sheets whereby said pusher causes said sheets to assume an arcuate configuration whereby they are stiffened, and means for moving said support forwardly in the direction in which said sheets are pushed by a distance for each sheet at least equal to the thickness thereof whereby said sheets are successively arranged between and held by said elements out of destructive surface contact with each other, said support comprising a platform having legs and said means for moving the support comprising a pair of roller conveyors upon which said legs rest and a pair of screws provided with nuts moved thereby, said nuts operatively engaging said legs, and means for turn-

ing said screws and moving said nuts in timed relationship to the movement of said pusher.

14. In apparatus for the purpose described, means for feeding sheets flatwise, individually downwardly to bring their lower ends into contact with a support, substantially vertical guides for engaging the sheets as so fed, a pusher for pushing the sheets laterally from said guides, and elongated elements located to receive the said sheets between them and to contact the side edges of said sheets when said sheets are pushed from said guides, said elements being spaced from each other less than the width of said sheets whereby said pusher causes said sheets to assume an arcuate configuration whereby they are stiffened, and means for moving said support forwardly in the direction in which said sheets are pushed by a distance for each sheet at least equal to the thickness thereof whereby said sheets are successively arranged between and held by said elements out of destructive surface contact with each other, and a double dash pot, a rack rod for said pusher and an operative connection between said rack rod and a piston member provided within said dash pot.

15. In apparatus for the purpose described, means for feeding sheets flatwise, individually downwardly to bring their lower ends into contact with a support, substantially vertical guides for engaging the sheets as so fed, a pusher for pushing the sheets laterally from said guides, and elongated elements located to receive said sheets between them and to contact the side edges of said sheets when said sheets are pushed from said guides, said elements being spaced from each other less than the width of said sheets whereby said pusher causes said sheets to assume an arcuate configuration whereby they are stiffened, and means for moving said support forwardly in the direction in which said sheets are pushed by a distance for each sheet at least equal to the thickness thereof whereby said sheets are successively arranged between and held by said elements out of destructive surface contact with each other, and air jets provided adjacent the receiving ends of said elongated elements whereby said sheets are prevented from striking the ends of said elongated elements.

16. The apparatus of claim 5 in which air jets are provided above said rotary vacuum device to force said sheets into operative contact with said ports.

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