

July 27, 1965

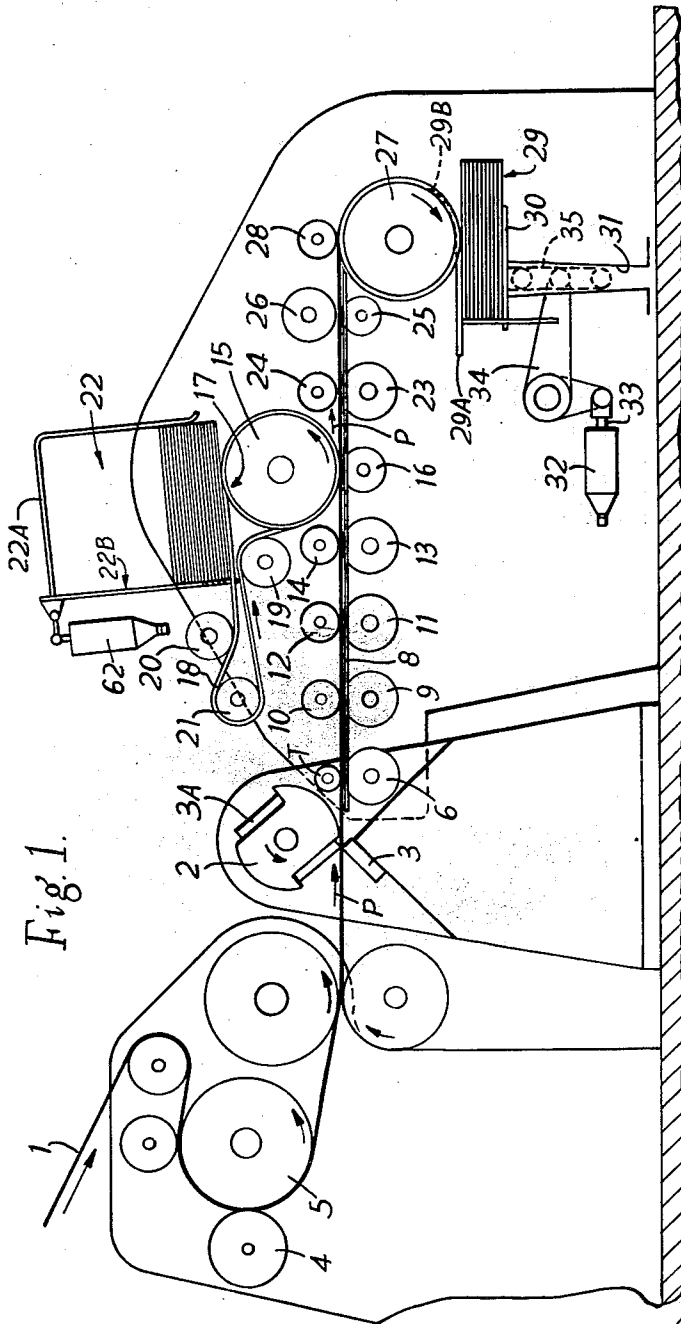
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3,197,200

SHEET STACKING APPARATUS

Filed Jan. 21, 1963

4 Sheets-Sheet 1



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SHEET STACKING APPARATUS

Filed Jan. 21, 1963

4 Sheets-Sheet 2

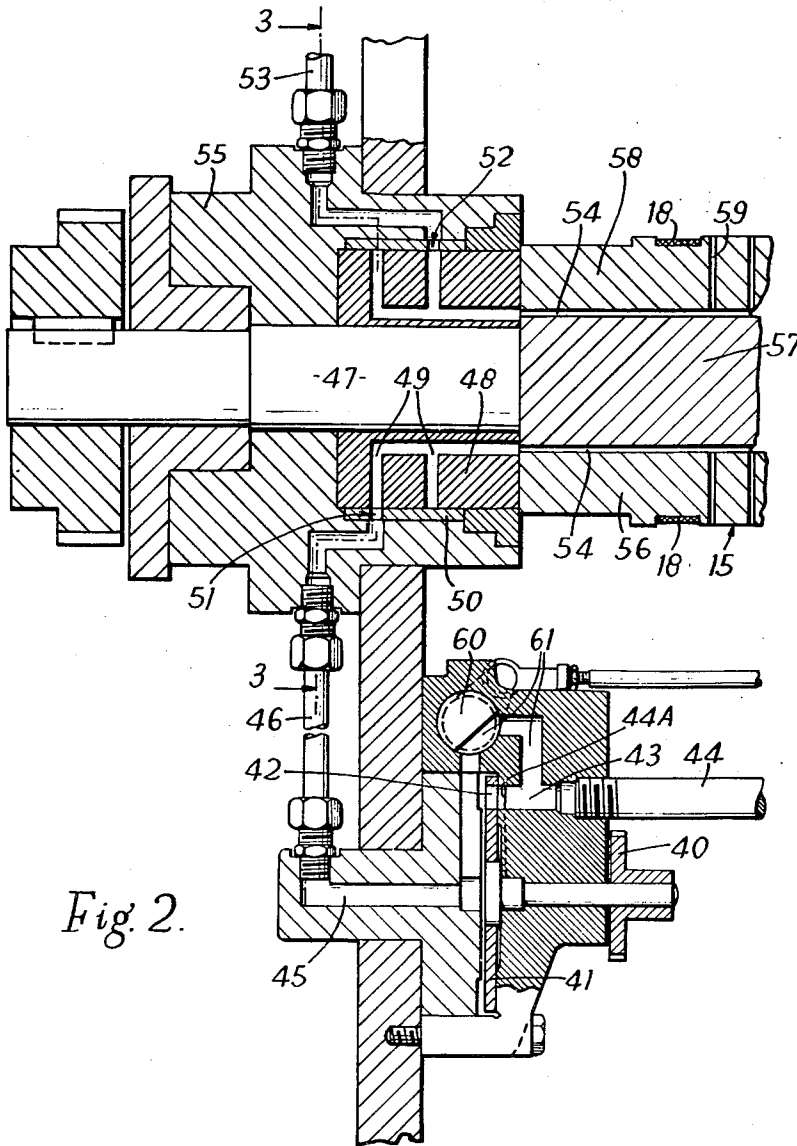


Fig. 2.

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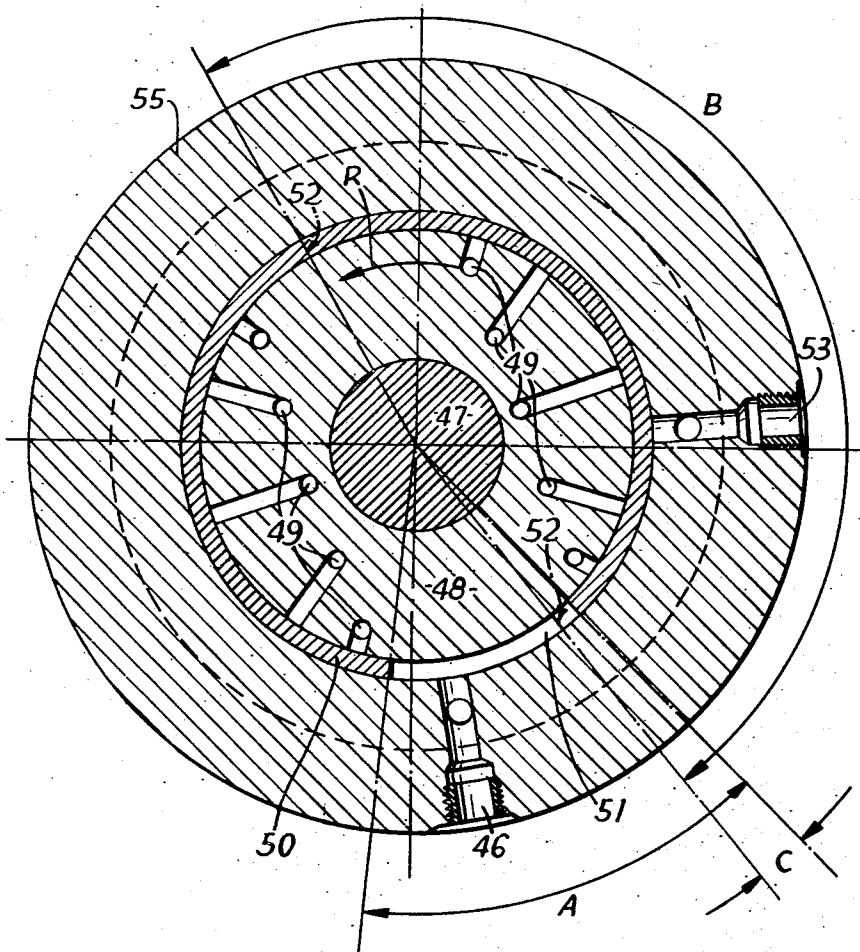
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SHEET STACKING APPARATUS

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4 Sheets-Sheet 3

Fig. 3.



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SHEET STACKING APPARATUS

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4 Sheets-Sheet 4

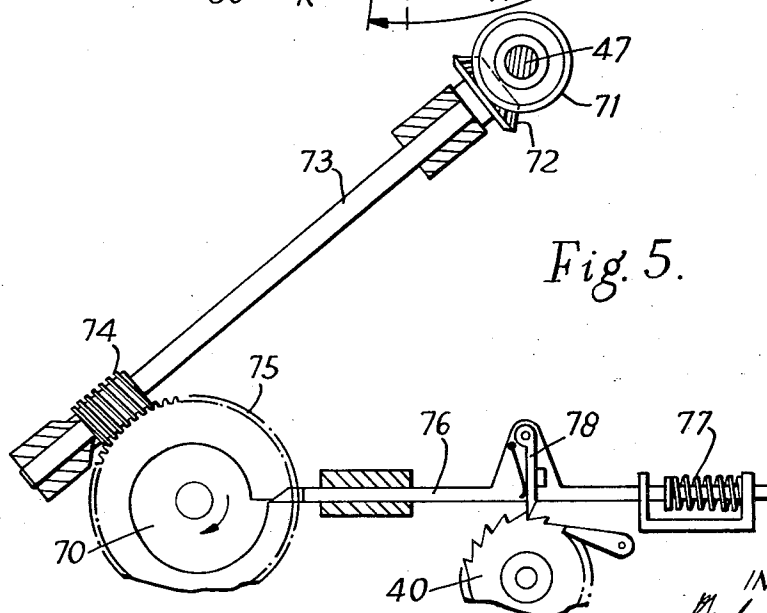
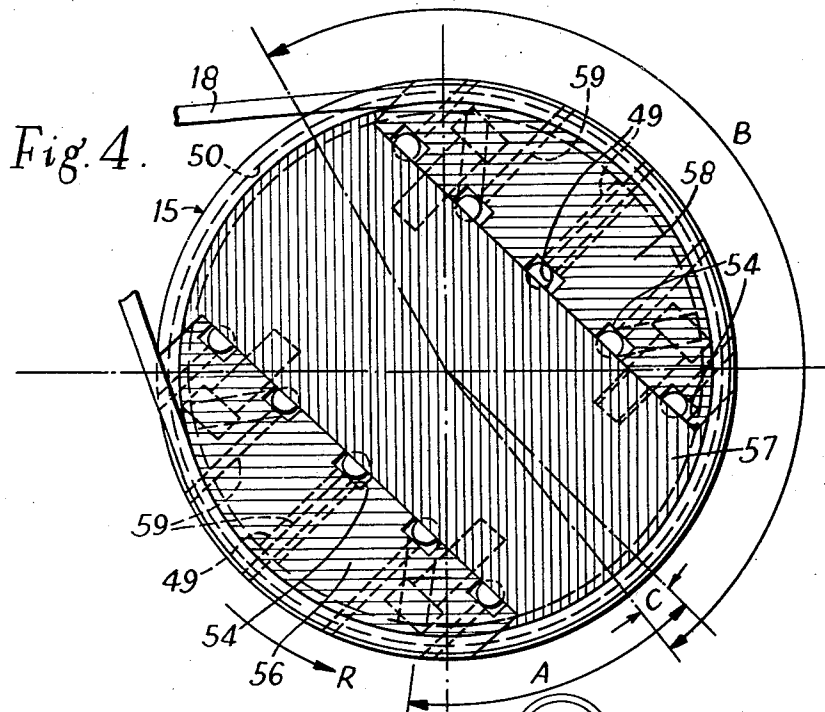


Fig. 5.

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SHEET STACKING APPARATUS

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Claims priority, application Great Britain, Jan. 26, 1962,
3,098

4 Claims. (Cl. 271—3)

This invention concerns improvements in sheet stacking apparatus such as is used on printing and other machines where sheets emerging from the machine are collected in stacks or piles, and consists in devices for forming stacks containing a definite number of sheets.

The apparatus for stacking sheets is of the kind comprising means for feeding sheets in succession along a path, a rotatable suction roller mounted adjacent said path and arranged to remove the sheets in succession therefrom, stripping means associated with the roller to remove each sheet therefrom and a stacker adapted to receive the stripped sheets and stack them and counting of the sheets forming into a stack is effected by a valve operated by a counting device moving in synchronism with the suction roller, to shut off the roller completely from a source of suction so as to stop suction through the roller periphery at the position adjacent the aforesaid path where the roller removes a sheet from said path, after the suction roller has rotated a desired number of revolutions and has thus stacked a desired number of sheets.

When the valve has operated to completely shut off a source of suction from the suction roller, the sheets may continue to move in succession along the path to a second suction roller and associated stacker so that a second stack is formed and, after the first suction roller has again rotated through the desired number of revolutions, the valve operates to connect it again to the source of suction. In this way each stacker collects the same number of sheets and one stacker may be emptied while the other is being filled.

Generally speaking it is preferable to cut sheets from a moving web at a position somewhat in advance of the first suction roller but the apparatus is not limited to such a method as it can be used to stack piles of sheets which have been fed to the printing or other machine as separate sheets.

The invention will be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is a diagram of a machine embodying the sheet stacking apparatus,

FIGURE 2 is a cross-section of part of such a machine showing suction-roller valve control devices, part of a suction roller, and a rotary valve for shutting off a source of suction from the roller, all in section,

FIGURE 3 is a section of FIGURE 2 on the line 3—3,

FIGURE 4 is a cross-section through a suction roller,

FIGURE 5 shows a driving device for a ratchet wheel for operating the rotary valve.

Referring to FIGURE 1 a web 1 coming from a printing machine passes into a cutting device comprising a rotary knife head 2 and a fixed knife 3 which co-operates with the moving knives 3A to cut sheets from the moving web. The edges of the knives are canted in the known manner to obtain a shearing cut across the width of the web. The web is thus cut into a succession of following sheets but normally a wide web is used and this is first slit into narrower webs by slitting knives 4 cutting against a roller 5 and thus a number of side-by-side sheets are cut at once. For simplicity of explanation it will, however, be assumed that the web is merely cut into a succession of following sheets. A cut sheet is engaged by a feeding roller 6 and a co-operating pressure roller 7 and moves along a path P which is substantially defined by a plate 8 through which the roller 6 protrudes. Similar

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pairs of rollers, 9 to 14 inclusive, similarly arranged, carry the sheet onwards until eventually it comes into contact with a suction roller 15, and a cooperating pressure roller 16. The feeding rollers run at a peripheral speed higher than the web speed to space the sheets apart. The suction roller will be described in detail later with reference to FIGURES 2 to 4 but for the moment it is sufficient to say that it is provided with suction control valve arrangements operated by the rotation of the roller, as is usual in this kind of apparatus, and seizes a sheet by its suction effect and carries it through about 180° to a stripping position at 17. A belt 18 runs in a groove in the periphery of the roller 15 so as to lie inside the periphery, said belt passing over guide rollers 19 and 20 and a tightening roller 21. For wide sheets there are several belts 18 and corresponding grooves. It will be seen from the figure that the upper run of the belt 18 leaves the suction roller 15 at a tangent and will thus strip a sheet from the roller. To facilitate the stripping action and avoid injury to the sheet the suction is cut off progressively as each portion of the suction roller periphery, in turn, approaches the stripping position. Above that position is a stacker 22.

As will be seen from the drawing, the relative positions of the suction roller 15 and the stacker 22 are such that the sheets in the stacker, at that side where sheets enter the stacker, overhang the top part of the roller by some distance and the gap between the following part of the roller and the lowest sheet in the stacker forms a kind of wedge-shaped or converging entry or mouth. This permits each successive sheet to pass into the stacker beneath the lowest sheet in the stack, the sheet movement being imparted partly by drive from the suction roller and partly by the belt 18.

In order to assist in maintaining the sheets in a neat stack, a pivoted fence 22A is provided. This may be lifted manually, when a stack is to be removed, but it may be moved automatically as related later. The plate 22B against which the sheets form into a stack is grooved to pass over the belt and provide small projections below the level of the belt so that the plate forms an effective stop for the sheets.

In order to have piles of a definite number of sheets, means are provided to shut off a source of suction from the roller 15 at given intervals. Thus, after a desired number of sheets has accumulated in the stacker 22, the suction in roller 15 for picking up the sheets from path P is completely stopped for a time, as related later, so further sheets, instead of being stacked at 22, continue to move along the path P under the influence of feeding and pressure rollers 23 to 26 inclusive, until another suction roller 27, having a pressure roller 28, is reached. This suction roller is arranged for convenience of operation to feed sheets into a downwardly descending pile in another stacker 29, the sheets being stripped from the drum by a plate 29A having a curved and tapered end 29B which lies inside the periphery of the suction roller and a horizontal part tangential to the periphery of the roller. The stacker has a base plate 30 which moves down in guides 31 as each fresh sheet is fed into the stacker. Control of the base plate movement may be effected by an air cylinder 32, which is filled with fairly low pressure air to raise the base plate to its top position and has a bleeder valve (not shown) which permits air to escape as the base plate is to be moved downwards. The cylinder has a piston rod 33 connected to a bell-crank lever 34 having a link 35 at the end of its longer arm, which link is pivoted to the base plate. In an alternative arrangement (not shown) the plate may be balanced by a balance weight which is sufficient to hold the plate in the up position but permits the plate to move downwards under the thrust of incoming sheets fed into the stacker. As in the case of the stacker 22, the suction roller 27 and stacker 29 are

so arranged that the sheets in the stacker extend beyond the roller and a wedge-shaped mouth or entry is formed, as before, so that each successive sheet easily runs over the preceding sheet in the stack.

The shutting off of a source of suction from the roller 15 so that the roller no longer picks up sheets can be followed from FIGURES 2 and 3 which show portions of the valve arrangements to a large scale. Referring first to FIGURE 2 a ratchet wheel 40 is rotated a tooth at a time by a slow moving cam 70, FIGURE 5. Assuming each counted pile is to have 500 sheets, the cam rotates once for each 50 sheets passing to the stacker and thus ten cam strokes mean that 500 sheets have passed. The ratchet wheel has twenty teeth and it will be moved through ten teeth by the ten cam strokes, or half a revolution. A rotary valve disc 41 is attached to the ratchet wheel and it has a perforation at 42. As shown, this is aligned with a hole 43 leading to a suction pipe 44 (the counting suction pipe) and, ignoring other things, it will be understood that a small rotation of the valve disc 41 would shut off the roller from the suction pipe 44. The hole 43 is however in communication with an arcuate slot 44A so that a considerable movement of the disc is necessary before the suction roller 15 is shut off from the suction pipe 44. It will be noticed that in the drawing the valve disc 41 is shown as by-passed by passages 61, controlled by a valve 60, but the purpose of this is explained later. It is a manually operated valve but during regular sheet counting operations it is closed. Because of the slot 44A the hole 43 is for some time in communication with another passage 45 and a pipe 46 which leads to a valve arrangement attached to the suction roller 15, and operated by the roller rotation, which will now be explained with reference also to FIGURE 3. 47 is the shaft of the suction roller 15 which rotates in the direction of the arrow R, FIGURES 3 and 4. To the shaft is fixed a valve piece 48 having two sets of passages 49, as shown, and this valve piece rotates in a fixed bush 50 having a slot 51 which extends over the arc A and with which the pipe 46 communicates. As the valve piece 48 rotates, one set of its passages 49 pass across the slot 51 and are thus connected to the counting suction pipe 44 through the pipe 46. Another slot 52 is made in the bush 50 and extends over the arc B. There is an overlap C between the arcs whose purpose is explained below.

Therefore as the valve piece 48 rotates, its other set of passages 49 pass across this slot 52, as can be seen from FIGURE 2, and connect to a further suction pipe 53 (the stacking suction pipe). The terms "counting" and "stacking" in respect of the pipes 44 and 53 are used as convenient distinguishing terms for ease of explanation although, as will be seen later, both suction pipes are concerned at times with delivery of sheets to the first stacker, 22, FIGURE 1.

Along the length of the suction roller are passages 54, FIGURE 2, whose shape is best seen in FIGURE 4, and explained in more detail with reference to that figure. The part marked 55 in FIGURES 2 and 3 to which the pipes 46 and 53 are attached is stationary and provides a bearing for the roller shaft 47.

Referring now to FIGURE 4, the body of the suction roller 15 is built up of three pieces 56, 57 and 58, and the pieces 56 and 58 have long rectangular grooves made in them to provide the suction passages 54. It will be seen that these register with the passages 49 in the valve piece 48 and thus suction through the pipe 53 is (subject to control by the rotation of the valve piece 48) effective along these grooves 54, from which suction ports 59 extend to the periphery of the roller.

As the roller rotates, the passages 49 in one part of the valve piece 48 connect with slot 51 when said part is at its lowest position, see FIGURE 2. Suction is thus exerted on a sheet from pipe 44 by ports 59, through passages 54, passages 49, slot 51, pipe 46, and hole 43. The sheet therefore moves round with the roller a distance

equal to arc A, FIGURE 3, by which time, due to the overlap C, the suction through the said ports is continued by suction from pipe 53 through slot 52 the other set of passages 49 and the passages 54. The sheet is therefore held to the roller for rather more than half a revolution, as suction ceases at the upper end, FIGURE 3, of arc B. The leading end of the sheet can therefore be easily stripped by the belt 18 and stripping continues as the suction ports holding said sheet continue to be shut off from suction by the valve piece movement.

This operation continues for such time as it takes to deliver 500 sheets to the stacker by which time the valve disc 41 has rotated far enough to shut off the suction from pipe 44. This renders slot 51 inoperative and so no more sheets are picked up by the roller. The remainder pass along to the second suction roller 27 where they are handled in much the same fashion. Meanwhile the valve disc 41 continues to rotate and, after a further ten ratchet teeth movements during which time 500 sheets have collected in stacker 29, suction will be once more available from pipe 44 so the sheets will again be carried up to the first stacker by the roller while the second stacker has its quota which can be removed. No control is therefore necessary on the second suction roller except that a bush, similar to the bush 50, causes suction to be effective from a position near the top of the roller round to the stripping position. This avoids wasted suction effort during roller movement from the stripping position to the top position of the roller.

When a web printing machine is first put into operation a considerable length of web is run through before any is fit for use. It is therefore necessary to dispose of defective sheets before serious work starts and to this end the manually operated valve 60, FIGURE 2, is provided. As explained earlier this valve is shut during normal operation but when sheets cut from a defective beginning of the web are to be separated from the normal product, the valve is opened. In this way roller 15 will feed sheets up to stacker 22 irrespective of the position of valve disc 41. When satisfactory sheets are forthcoming the valve is shut. If the valve disc is then in the appropriate position these sheets will continue to pass to stacker 22 until the aperture 42 is closed. Then, as before, sheets will go to the stacker 29 and all sheets accumulated in stacker 22, bad and good, are discarded. If however the valve disc is not in the appropriate position the good sheets succeeding the defective ones will go to stacker 29 forming an incomplete stack which is discarded. Thereafter the stackers fill up alternately.

The fence 22A on stacker 22 may be raised and lowered automatically by means of an air cylinder 62. The fence is down all the time sheets are accumulating in the stacker and for some time after the pile is complete for, say, while 50 sheets are collecting in stacker 29. It is then raised by the air cylinder. When, say, 450 have collected in stacker 29 the fence is lowered again. In the interval the operator removes the pile from 22 and the stacker is then ready to collect the new pile.

Control of the air cylinder may be by a valve system operated by a ratchet wheel like 40, or even by said ratchet wheel, which can be arranged to open a valve after say one tooth has moved after valve disc 41 has shut off suction to roller 15 and to open another valve to drive the piston of the air cylinder in the reverse direction after eight more ratchet teeth have moved.

FIGURE 5 shows a suitable drive for the ratchet wheel 40. To the suction roller shaft 47 is fixed a mitre gear wheel 71 engaging another mitre gear wheel 72 on a shaft 73 having a worm 74 at one end. This worm engages a wormwheel 75 to which is fixed the cam 70 which has a radial step down which a cam rod 76 can move under pressure of a spring 77. A pawl 78 pivoted to the cam rod moves the ratchet wheel 40 sharply as the end of the cam rod snaps down the radial step.

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Where, as will generally be the case, wide webs are being printed and the suction rollers are of considerable length, the suction pipes and control valves are duplicated, one set at each end of a roller, so as to equalise, as far as possible the pressure within the rollers.

What I claim as my invention and desire to secure by Letters Patent is:

1. In apparatus for stacking sheets of the kind comprising means for feeding sheets in succession along a path, a rotatable suction roller mounted adjacent said path and arranged to remove the sheets in succession therefrom, a source of suction for said roller, stripping means associated with the roller to remove each sheet therefrom and a stacker adapted to receive the stripped sheets and stack them, means for counting the sheets forming into a stack comprising a cam driven in synchronism with the suction roller, a ratchet wheel intermittently rotatable by said cam and a rotatable valve interposed between said source of suction and the roller and rotated by the ratchet wheel, whereby said ratchet wheel will close said valve after said roller has made a predetermined number of revolutions from the commencement of the stack in operation, shutting off said roller from said source of suction and preventing said roller from removing further sheets from said path.

2. Apparatus as claimed in claim 1 in which the stripping means comprises an endless belt which wraps around the roller for a part of its circumference and extends away from the roller tangentially at the stripping position, the belt being arranged to lie inside the roller periphery so as to be out of contact with a sheet carried by the roller until the stripping position is reached, at which position the belt engages the sheet to separate it from the roller.

3. In apparatus as claimed in claim 1, a second suction roller connected to a source of suction and an associated stacker spaced along said path from the first suction roller and stacker whereby when the ratchet wheel has rotated the valve sufficiently to shut off the first suction roller from the source of suction, the following sheets continue along the path and are removed and stacked by the second suction roller and associated stacker, and after the first

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suction roller has again made the predetermined number of revolutions the ratchet wheel opens the valve to again connect the source of suction to the first suction roller, which thereupon commences to remove sheets to be transferred to the first stacker.

4. Apparatus as claimed in claim 3 comprising a manually operated valve interposed between the source of suction and the first suction roller and which can be opened to by-pass the rotatable valve operated by the ratchet wheel and render it ineffective, so that when the apparatus is first put into operation all sheets fed to it will be passed to the first stacker, irrespective of the position of said rotatable valve, said manually operated valve being closed when satisfactory sheets are being fed to the apparatus so that said rotatable valve is again effective for sheet counting, any sheets collected in the first stacker during the time from starting until the time at which said rotatable valve shuts off the source of suction from the first suction roller being discarded, while if said rotatable valve is positioned to shut off the source of suction from the first suction roller at the time the manual valve is closed, succeeding sheets will collect in the second stacker and can be discarded as soon as the first suction roller commences again to feed sheets to its stacker.

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