

July 13, 1937.

R. REINARTZ

2,086,577

SHEET FEEDING MACHINE

Filed March 26, 1932

8 Sheets-Sheet 2

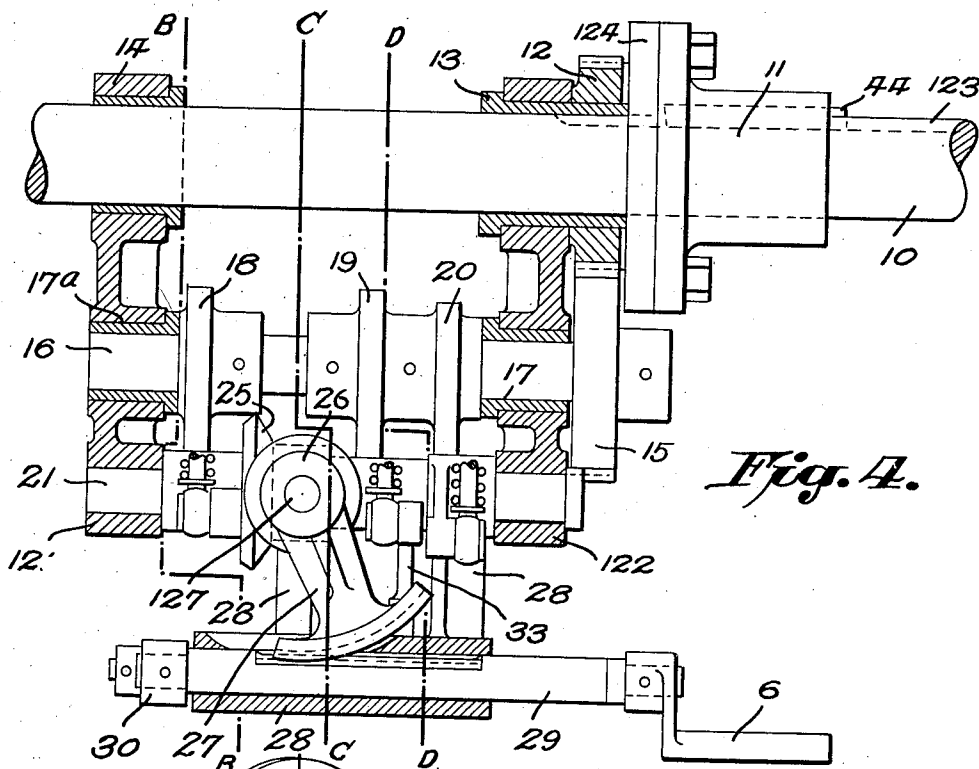


Fig. 4.

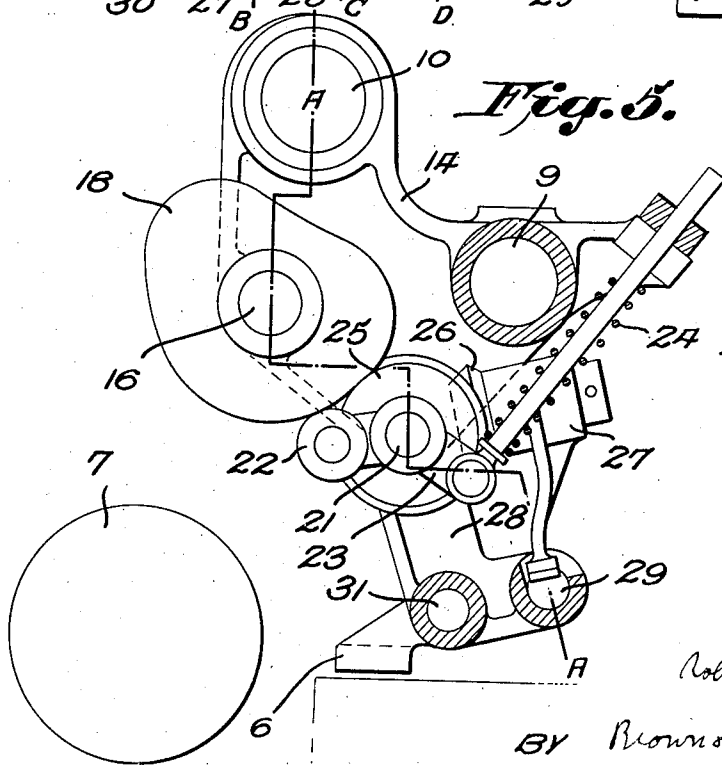
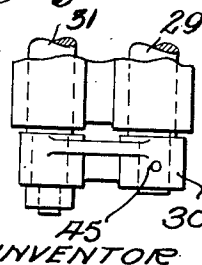


Fig. 5.

Fig. 5a



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Fig. 7.

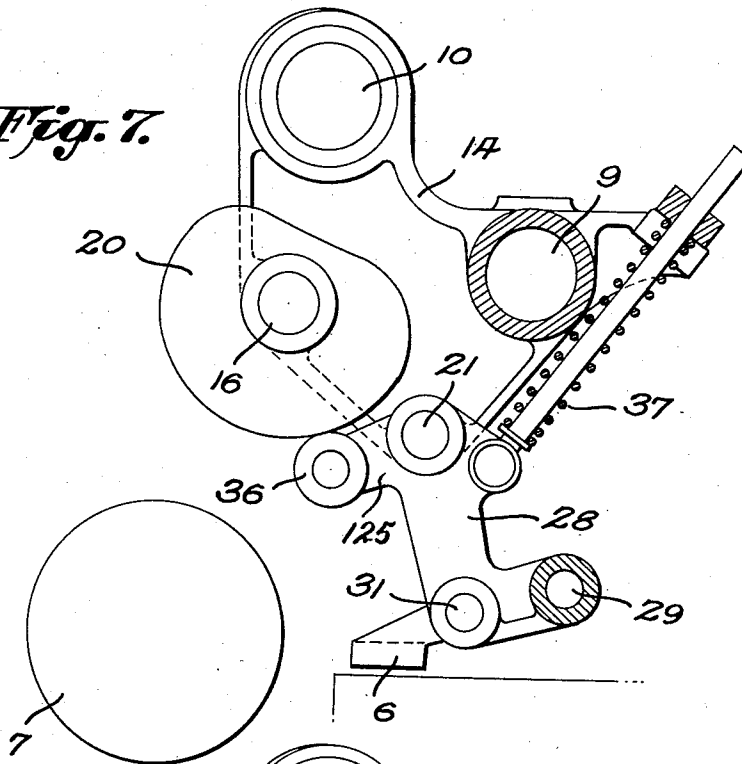
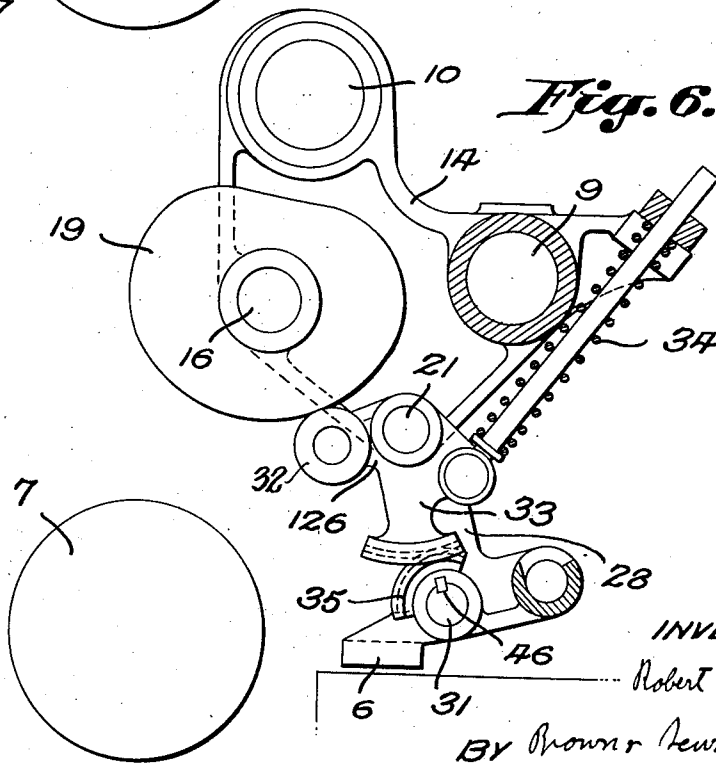


Fig. 6.



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8 Sheets-Sheet 4

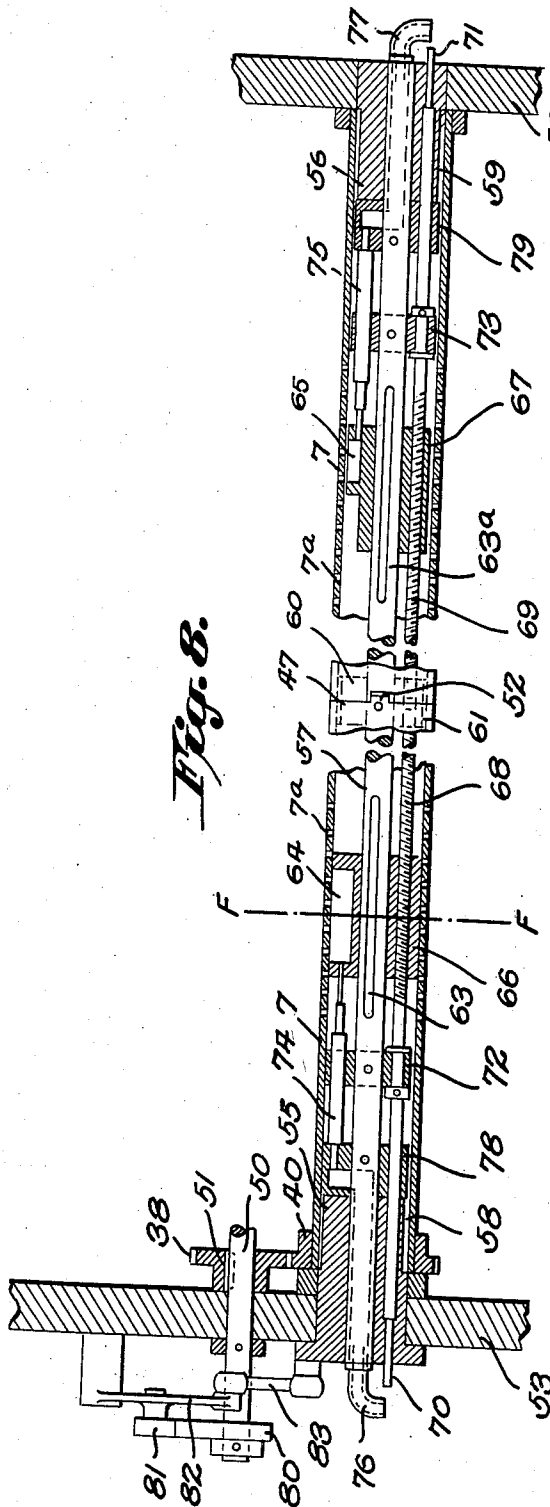


Fig. 8.

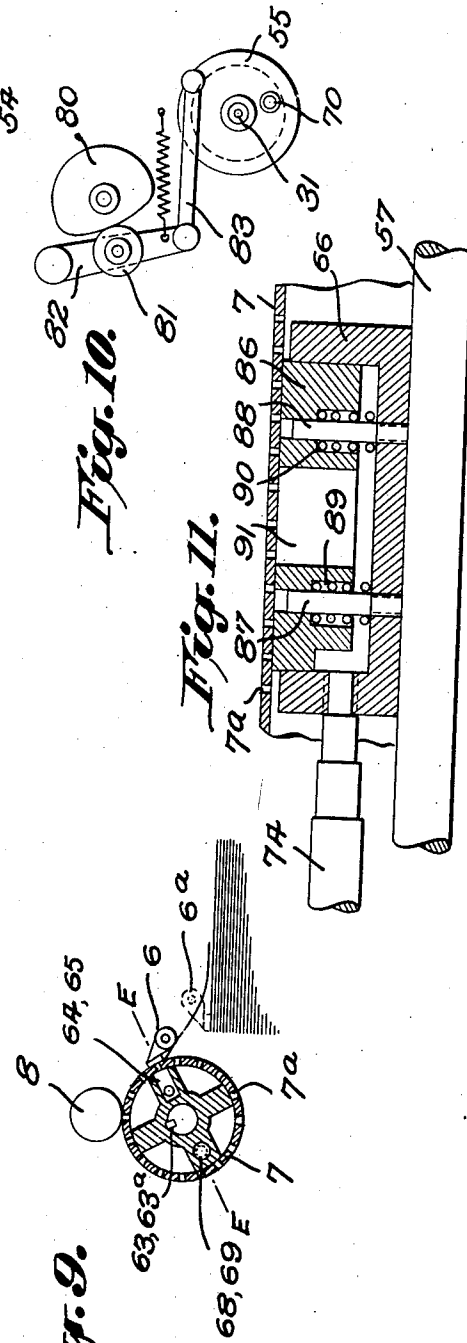


Fig. 10.

Fig. 11.

Fig. 9.

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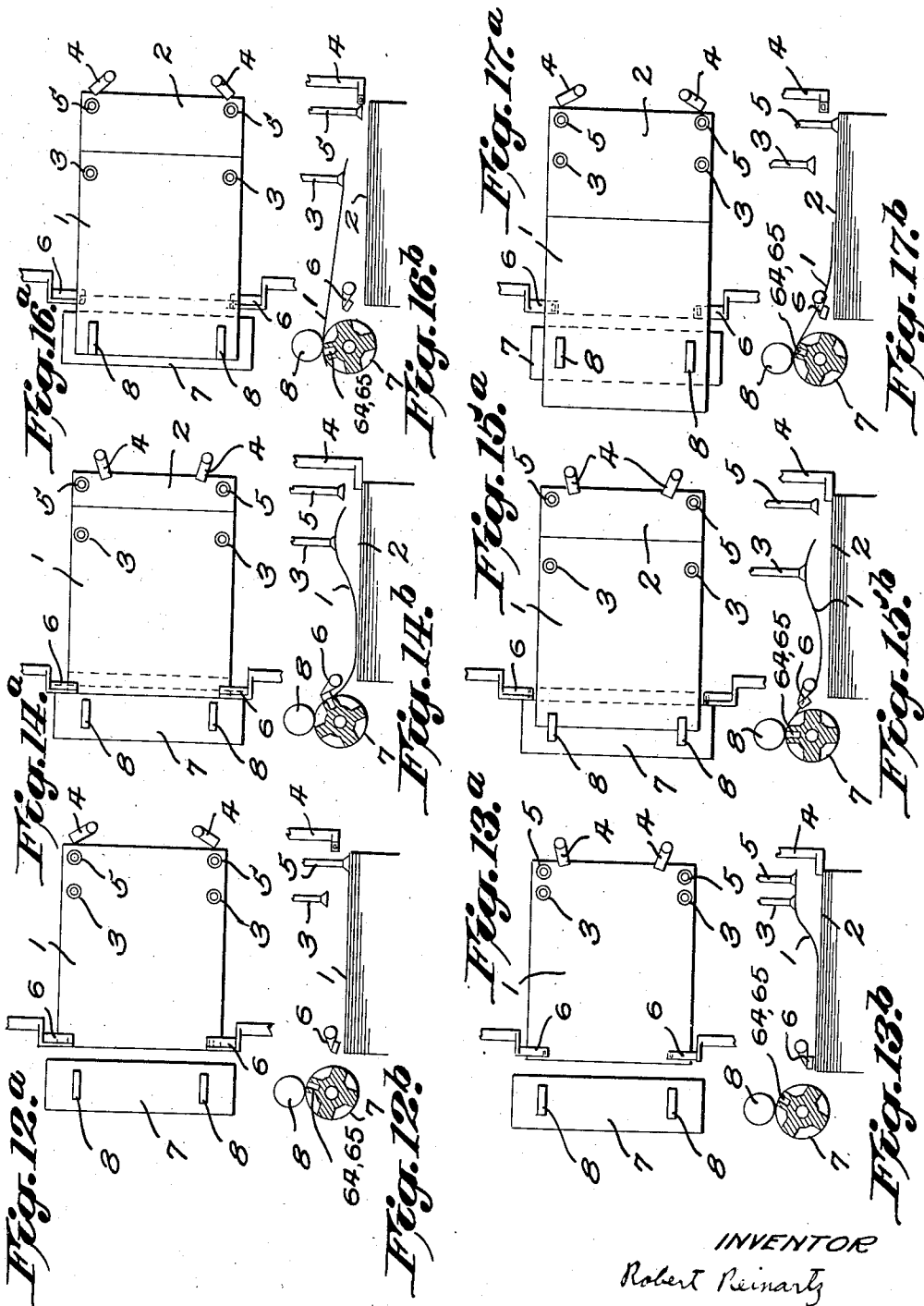
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Fig. 19.

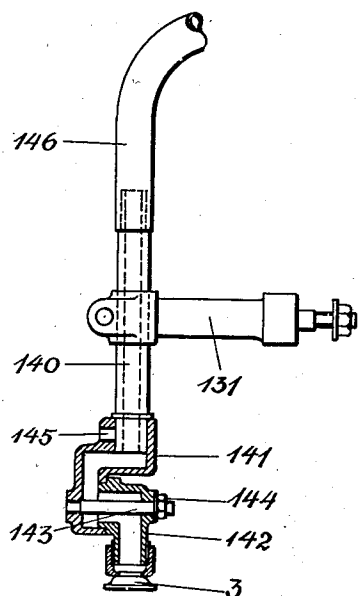


Fig. 20.

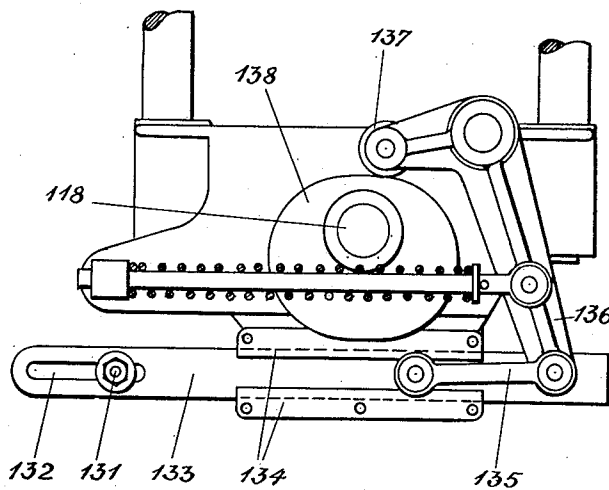
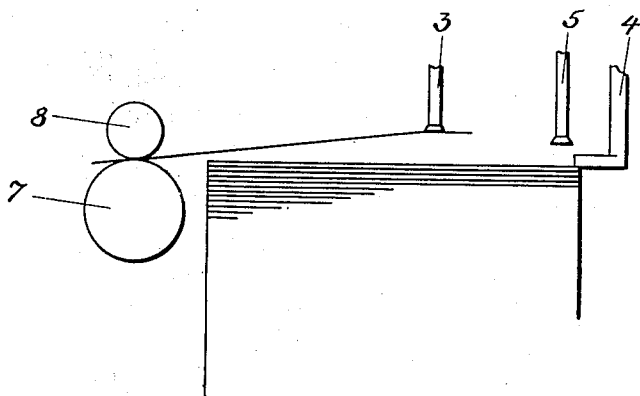


Fig. 18.



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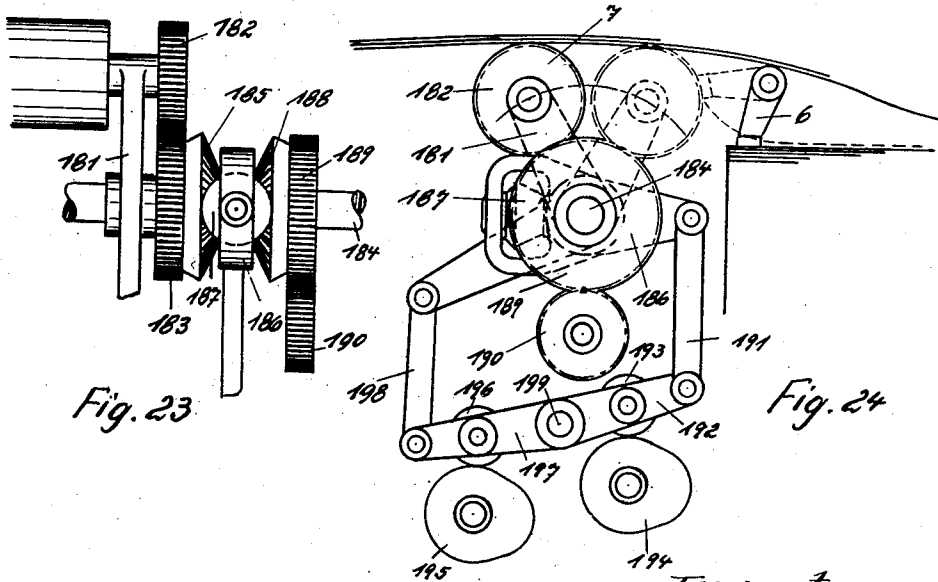
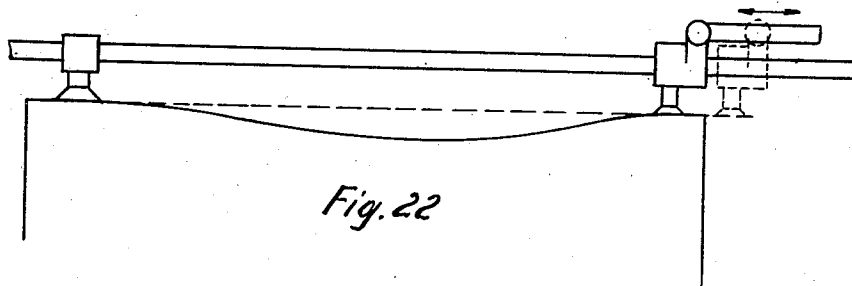
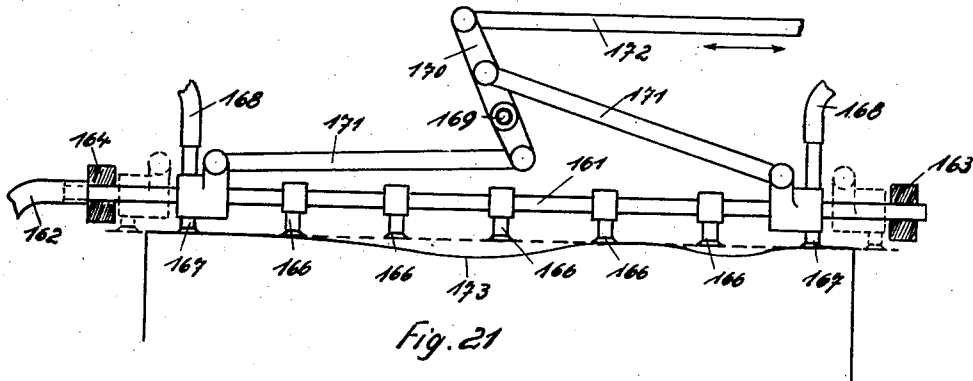
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Filed March 26, 1932

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8 Sheets-Sheet 8

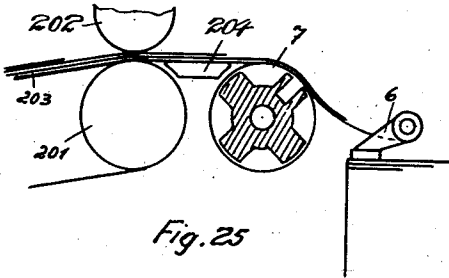


Fig. 25

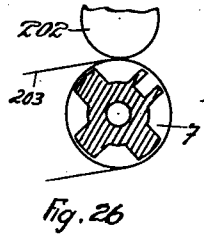


Fig. 26

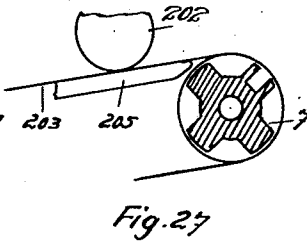


Fig. 27

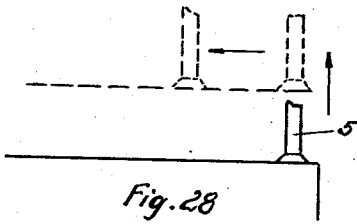


Fig. 28

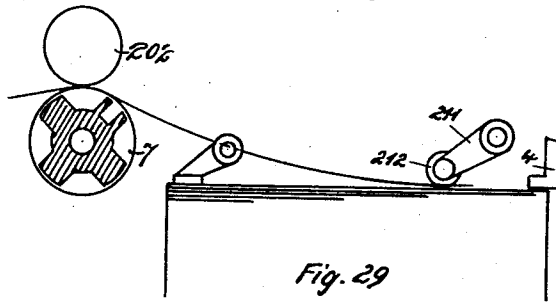


Fig. 29

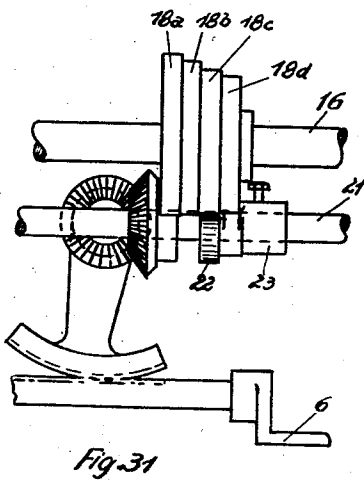


Fig. 31

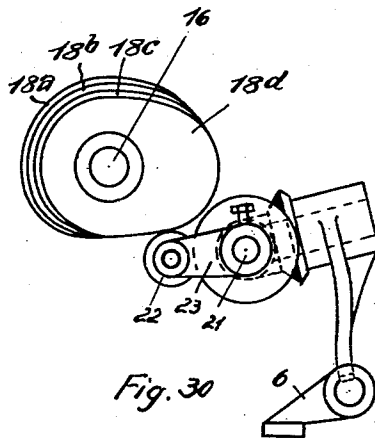


Fig. 30

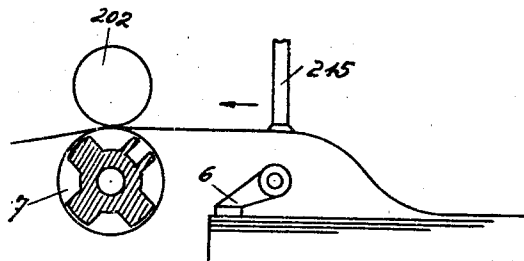


Fig. 32

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UNITED STATES PATENT OFFICE

2,086,577

SHEET FEEDING MACHINE

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Application March 26, 1932, Serial No. 601,380
In Germany March 31, 1931

52 Claims. (Cl. 271-27)

One of the objects of my invention is to provide a mechanism by which sheets of paper, card board or the like may be automatically fed into a printing press, folder or other machine, the working speed being extraordinarily high in consequence of all parts of the mechanism making very short and smooth motions.

A second object of my invention is to provide a mechanism working surely, independent of the fact that sheets often lie on the pile in a wavy condition.

Another object of my invention is to provide a mechanism by which the sheets of paper may be fed into the printing press or the like in an overlapped condition.

Another object of my invention is to provide a mechanism in which the same parts are made use of in a different way depending on the quality of the sheets handled.

My invention may be understood from the following description and drawings, in which

Fig. 1 is a front elevation looking from the machine, to which the sheets are to be fed toward the pile of sheets, some parts being taken away with the purpose to show other parts that otherwise would have been hidden.

Fig. 2 is a side elevation of the main parts of the feeding machine, one side frame being omitted.

Fig. 3 is a plan of the machine showing but one half of it, the other half being symmetrically the same on the other side of the machine.

Fig. 4 is a section parallel to the main shaft of what will be called the "transmitting device".

Figs. 5, 6 and 7 are cross sections of the transmitting device taken along the lines BB, CC, DD respectively in Fig. 4. In Fig. 5 the line AA denotes where the section shown in Fig. 4 has to be imagined. Fig. 5a is a detail top plan view of parts shown partly in section in Fig. 5.

Fig. 8 is a longitudinal section of the suction roller.

Fig. 9 is a cross section of the same, along the line FF in Fig. 8, whilst the longitudinal section, Fig. 8, is taken along the line EE of Fig. 9.

Fig. 10 shows a part of the drive for the suction roller.

Fig. 11 is a fragmentary detail longitudinal section of the suction roller on an enlarged scale.

Figs. 12-18 schematically show successive stages in the operation of the machine, each of these figures except Fig. 18 being divided into a plan denoted by "a" and a side elevation denoted by "b".

Fig. 19 is a section of one of the suction nozzles.

Fig. 20 is a side elevation of the drive mechanism of the nozzle shown in Fig. 19.

Figs. 21 and 22 show modified forms of the invention according to which suction rods are used.

Figs. 23 and 24 represent, in front and side elevation respectively, a modified arrangement for mounting the suction roller 7.

Fig. 25 represents a manner of arranging a tape conveyor to cooperate with the suction roller.

Figs. 26 and 27 represent modified arrangements of the tape or band conveyor, shown as mounted directly on the suction roller.

Fig. 28 shows a modified portion of the suction nozzle 5 whereby it also serves the function of the nozzle 3.

Fig. 29 shows a modified form of sheet retarding means.

Figs. 30 and 31 show, in side and front elevation respectively, a special form of cam for use in place of the cam 18 of Fig. 5.

Fig. 32 represents an alternative arrangement for maintaining a fed sheet above and out of the way of the suction nozzle 6.

Referring to Figs. 1-3, 53, 54 are the parts concerned of two side frames of the feeding machine. Between these two side frames is arranged a pile of paper 95 being disposed on a table not shown, guided vertically and fed upwards in the usual way. The sheets are to be fed to a printing machine or the like which has to be imagined to be disposed on the left of Figs. 2 and 3.

On the inner side of the frames 53, 54 are fixed two racks 100, 101, on each of which a slide 102 is adjustable by means of a spur gear 103. A second slide 102a riding on rack 101 and a second spur gear 103a are not shown because both in Fig. 1 and in Fig. 3, of the similar devices arranged bisymmetrically with respect to the middle axis, one only is shown. The two gears 103, 103a on both sides of the machine are connected by the shaft 105 which can be turned by a square head 106. After the slides 102, 102a having been adjusted according to the length of the sheets to be fed, they are fixed to the racks by set screws.

The two slides 102, 102a are connected by two transverse rods 107, 108 fixed into them. On a spot depending on the width of the sheets to be fed the bridge 109 (and its twin not mentioned again herein) can be fixed on the rods 107, 108 by means of the set screw 110. In two vertical holes 112, 111 provided for in the bridge 109 slide two bolts 113, 114 fixed in a box 115 containing

what will be called "separating device". Guided vertically by bolts 113, 114 the separating device may be lowered and lifted by means of a hand-wheel 116 and a spindle 117, the female of which is in the bridge 109.

In bearings provided for in the box 115 is turning a shaft 118 being driven by mitre wheels 119, 120, extendible shaft 43, mitre wheels 42, 41 and main shaft 10, which extends between the two frames 53, 54 and turns exactly once for every sheet to be fed.

By this means the separating device can be adjusted in three directions and the shaft 118 contained in it nevertheless can be driven so that it makes one turn for every sheet to be fed.

In the box 115 are arranged cams, levers, etc., that give the motion required to a suction nozzle 5 and a blast nozzle 4. Details of this mechanism have neither been described nor drawn because both their construction and function are as usual and do not form a part of my invention.

It is, however, of special interest that the position of the nozzles can be adjusted in respect of the height and of the angle in every thinkable sense and nevertheless the nozzle deviates very little from the axis of the spindle. If the surface of the nozzle is adjusted horizontally, the nozzle is concentric with the spindle, as is to be seen in Fig. 19.

At the lower end of a spindle 140 (Fig. 19) which itself may be adjusted vertically by any suitable means, is fixed a Z-shaped tube 141 in such a way that it can be adjusted under any angle horizontally. At the lower end of this Z-shaped tube 141 in a vertical plane is a circular face to which is fitted the lower part 142 forming the nozzle. The nozzle is fixed by a bolt 143 and nut 144 arranged in the axis of the circular face mentioned whilst the Z-shaped tube is secured to the spindle by a set-screw 145. The air conduct leads through the spindle and the two lower parts described, so that the elastic tube 146 fixed to the other end of the spindle is far away from the pile. All other elastic tubes connecting the nozzles with the valves and pumps are not shown because they all are arranged in a similar way to that described here.

Attached to the nozzle 142 shown in Fig. 19 is a nozzle portion 3, and the whole nozzle structure just described is mounted on the box 115 containing the separation-device; its function will be described below. This nozzle 3 is fixed to an arm 131 in such a way that it can be adjusted vertically, whilst the arm 131 itself may be adjusted lengthwise in a slot 132 provided in a slide 133 (Fig. 20). Slide 133 moves to and fro in a guide 134 and is driven by a connecting rod 135, bell-crank lever 136, roll 137 and cam 138 secured on shaft 118 mentioned above.

On a transverse rod 9 fixed between the side frames 53, 54 are secured the frames 14 of two transmitting devices, one of which only is shown in the drawings as was the case with the separating devices. Through these frames 14 extends shaft 10 preventing them from turning around rod 9 and communicating motion to the parts contained in frames 14.

Referring now to Figs. 4-7 in which one of the transmitting devices is shown in a larger scale there may be seen an axle 21 supported by bearings 121 and 122. On this axle 21 is fixed a rocking arm 28 clearly shown in Figs. 7 and 4, containing two bearings parallel to the axle 21. In one bearing is arranged the rack 29 which, controlled by the spur segment 27, moves to-and-fro,

but does not turn. Rack 29 is connected with an axle 31 moving in the other bearing by means of bridge 30, in such a way that the axle 31 will make the same longitudinal movement as 29, but is able to turn around its axis at the same time. On the inner end of the axle 31 is fixed a suction nozzle 6 which, as will be seen from the disposition described, will make three motions superposing each other, viz. going to-and-fro from right to left in Fig. 4, turning upwards around the axis of axle 31 in Fig. 7 and swinging from left to right around the axis of shaft 21 in Fig. 7.

As has been told the transmitting device derives its motion from the main shaft 10 this being done in the following way. The shaft 10, by a longitudinal groove 123 (Fig. 4) and a key 44 fastened to a flanged hub 11, drives this hub though it can be adjusted along said shaft. The flange of hub 11 is bolted onto a flange 124 in such a way that the angle of transmission can be adjusted according to what will be needed. On the tube 13 are fastened said flange 124 and a spur gear 12 which drives another spur gear 15 fastened on a shaft 16 which runs in bushings 17, 17a. On shaft 16 are fixed three cams 18, 19, 20 which respectively produce the three motions of the transmitting nozzle 6 mentioned above.

The rocking motion of the rocking arm 28 is derived from cam 20 (Fig. 7) by means of an extension 125 of the arm and a roll 36, the contact of this roll with cam 20 being maintained by a spring 37.

The swinging up and down of nozzles 6 is produced by cam 19 (Fig. 6). Loose on shaft 21 is a gear-segment 33 having an extension 126 with roll 32 running on cam 19, the roll 32 being kept in contact with the cam 19 by spring 34. The segment 33 gears with another segment 35 in which the axle 31 can be shifted lengthwise while it is forced to turn around together with the segment 35 by means of a key 46. A lengthwise motion of the segment 35 is prevented by the arm 28 being forked and suitably shaped.

The cam 18 gives a rocking motion to the bell-crank lever 23 (Fig. 5) loose on shaft 21. On one arm of the bell-crank lever 23 is a roll 22 kept in contact with cam 18 by means of the spring 24 connected to the other arm of the bell-crank lever. The bell-crank lever is fixed to a bevel gear 25 (Figs. 4 and 5) which gears with another bevel gear 26 riding on a pivot 127 which is fastened on the shaft 21 so that it will rock together with the arm 28. The bevel gear 26 is fixed to the segment 27 mentioned above which gears with the rack 29.

The suction roller 7 to which the sheet is transmitted from the transmitting nozzles 6 is to be seen in Figures 8-11.

I call a suction roller a tube adapted to rotate or rock provided with many holes in its circumference, these holes being closed from inside by another tube connected with a vacuum pump and only one or two rows of holes being open in consequence of a longitudinal slot in the inner tube, through which the suction may act on the paper to be handled by the suction roller. The operation of such a suction roller is so that the sheet of paper which is applied on to the outer tube on that part of the circumference where the longitudinal slot of the inner tube is, is pressed on the circumference of the outer tube in consequence of the suction effect and will be moved by friction when the outer tube is turning. In my case the outer tube is supposed to rotate constantly in such a manner

that the sheets are transported from right to left in all figures where a section of the suction roller is to be seen, and with such a speed that the distance of the sheets descending to the press will be what is required.

As is clearly to be seen in Fig. 2 the angle on which the suction roller has to take over the sheet is different from that on which it delivers it on to the sheet feeding table leading to the printing machine or the like. Therefore it is desirable that the suction roller be constructed otherwise than is usual with devices of this kind, viz. the slot of the inner tube does not stand still, but moves according to the progressing sheet.

Besides the new fact that the inner tube does not stand still there is another novel feature in the suction roller, I shall describe. As a rule the longitudinal slot in the inner tube is as long as the largest sheet to be handled. If a smaller sheet is applied, there will be some overlapping holes which are not closed by the sheet of paper and much suction pressure is lost therefore. Instead of one full length inner tube I provide therefore two narrow suction nozzles only which can be adjusted laterally according to the width of the sheet. This has the further advantage that if the sheet is handed over to the suction roller in a deflected condition as may be the case in consequence of there being two transmission nozzles only, this deflection of the sheet is not conserved by the suction effect extending over the whole width of the sheet. On the contrary, the front edge of the sheet will automatically change into a straight line in consequence of the new bending of the sheet around the suction roller, since there are no intermediate suction holes to prevent this correction.

The outer tube 7 of the suction roller may be divided into two parts if larger sheets are to be handled, this division being shown at 47 (Fig. 8). The tube 7 is soldered into the hub of a spur gear 40 which may be induced to rotate by a suitable means which is represented in Fig. 8 by a further spur gear 38, secured on shaft 50 (see also Fig. 2). The spur gear 38 gears with spur gear 39 fixed on main shaft 10 and from the difference of the size of gears 39 and 40 it can be arranged that the tube 7 of the suction roller will not rotate with the same speed as the main shaft 10. The second part of the tube 7 on the right (Fig. 8) is rotated by means of a projection 52.

By the frames 53, 54 two pivots 55, 56 are supported, the two pivots being connected to each other by a central shaft 57. Fixed to the pivots are bushings 58, 59 which the tube 7 turns on. In the case of larger sheets and when the tube 7 is divided, on the shaft 57 is fixed a ring 60, which supports the middle of the tube 7 by means of a bushing 61, which by suitable means is adapted to run without lubrication. Such a supplementary support may be recommendable even if the tube 7 is not divided.

Many holes 7a are drilled in tube 7, but the air is sucked in only by those holes which incidentally run over the nozzles 64, 65 formed in the cross-shaped bodies 66, 67 respectively which ride on shaft 57 in such a way that they can be shifted lengthwise, but will turn around with it in consequence of grooves 63, 63a and keys sliding therein. The nozzles 64, 65 are shorter than the rows of holes 7a and can be adjusted according to the width of the sheet as has been explained.

This longitudinal adjustment of the nozzles 64, 65 is effected by threaded spindles 68, 69 which

may be turned by means of the square-heads 70, 71. The spindles are supported a second time in the pivots 55, 56 and the device preventing them from moving longitudinally could have been arranged there too, but I preferred to build in for this purpose two other rings 72, 73 fixed on the shaft 57 and not touching the outer tube 7.

The vacuum pump is connected with fixed tubes 76, 77 mounted in holes drilled into the opposite ends of shaft 57. From there the air conduits lead to two rings 78, 79 and then in two telescope shaped tubes 74, 75 which on the other end are screwed into the cross shaped bodies 66, 67, containing the nozzles 64, 65.

The pivot 55 gets its rocking movement by means of cam 80 fixed on the shaft 50 which by means of a key 51 is rotated by the spur gear 38. On the cam 80 runs roll 81 fixed to a lever 82, the outer end of which moves a connecting rod 83 connected to pivot 55. Through the shaft 57 the rocking motion of the pivot 55 is transmitted to the bodies 66, 67.

It is desirable that between the cross shaped bodies 66, 67 and the outer tube 7 much suction is not lost and those holes only work which are running exactly over the nozzles. On the other side these parts cannot easily be lubricated though they are exposed to much paper dust which is sucked in. It will therefore be desirable to apply the device such as shown in Fig. 11. In these drawings the effective nozzle is 91 only, whilst the opening in the cross-shaped body 66 is much larger than this. But whilst body 66 does not touch the outer tube 7, there is a sealing member 86 which is guided by two studs 87, 88 and pressed outwards by the springs 89, 90. This sealing member may be made of compressed carbon similar to the commutator brushes of electric machines.

The operation of the device described is as follows:

In Figs 12a, 12b the separating nozzles 5, which by the means described may be adjusted so that they are near the rear corners of the sheet, are lowered to seize the uppermost sheet 1. The nozzles 3 are moving backwards, but do not touch the sheet. The nozzles 4 have been lifted a certain distance and swung outwards so that they will not be touched by the sheet as it is moved upwards by the nozzles 5. The nozzles 6 are moving backwards, downwards and inwards.

In Figs. 13a, 13b the nozzles 5 have lifted up the uppermost sheet 1, whilst the second one 2 is pressed down by the nozzles 4 which have swung inwards and gone downwards as soon as the nozzles 5 have risen sufficiently high. Immediately after this has been done the nozzles 4 emit a blast of air completing the separation of the uppermost sheet. Any means known from other feeding machines adapted to prevent the second sheet from being taken along may be applied.

As the nozzles 3 have now arrived just in front of the nozzles 5 or very near to them in any other direction, they are able to seize the sheet as soon as a corresponding valve is opened. The nozzles 6 are still idle, but have reached the position backward, inward and downward that enables them to seize the sheet in the very next moment.

Between the two phases shown in Figs. 13a, 13b and 14a, 14b respectively the following changes have taken place. By closing a corresponding valve not shown the nozzles 5 have let go of the sheet. The nozzles 6 which by the action of a corresponding valve have seized the front corners of the sheet, swing forwards and upwards so

that they reach the position shown in Fig. 14b very near to the suction roller 7. Though the nozzles 3 holding the rear end of the sheet follow this motion, it will be noticed that this does not contribute very much to the transport of the sheet except that the sheet being lifted from both ends, friction is partly or totally eliminated as shown in Figs. 14b and 15b. The more essential feature however is that the sheet is drawn from its forward end.

At this moment the suction nozzles 64, 65 inside of the suction roller are in the position shown in Fig. 14b. A corresponding suction valve not shown is now opened and the valve controlling the nozzles 6 is closed so that the front edge of the sheet is transmitted to the suction roller, which in consequence of its rotation at once begins to transport the front edge of the sheet.

At the same time the suction nozzles 64, 65 inside of the suction roller move upwards until they reach the position shown in Fig. 15b so that the front edge of the sheet will enter between the suction roller and two other rollers 8 (Figs. 2 and 12 to 18) which act upon the suction roller or tapes (if these are needed) in the usual way known from solid rollers. The suction nozzles 64, 65 in the suction roller may now return slowly, the corresponding valve being closed.

The nozzles 3 up to this phase have still followed the movement of the sheet or almost followed it so that the sheet in its middle part will be slightly raised. The nozzles 5 begin their downward motion as soon as the rear end of the sheet moving forward will clear their path. The nozzles 4 still press down the second sheet 2 so that it will not be taken along by the nozzles 6 and by the remaining friction of the sheet 1 being transported forwards.

The nozzles 6 swing a little over the point of transmission so that their velocity in the moment of transmission may be the same as the circumferential speed of the suction roller, and at the same time begin to move outwards so that after a short while they will surely be outside of the sheet as is shown in Fig. 16a. At the same time they are going backwards and downwards. The suction roller 7 together with the roller 8 continues to act like a normal solid roller and thus moves forwards the front part of the sheet, whilst the nozzles 3 retard their motion or even stand still or go backwards. The consequence of this difference of speeds will be that the sheet will be tautened so that there is plenty of room for the nozzles 6 to enter into the space over the second sheet 2 and under the first one 1 being transported above it.

As soon as the nozzles 6 are partly covered by sheet 1, the nozzles 3 leave hold of the sheet and go backwards to their initial position. At the same time the nozzles 4 are lifted and swung outwards so that the same position as in Figs. 12a, 12b is reached in every respect except that the rear end of the first sheet may still cover the nozzles 6, which are moving backwards, inwards and downwards.

The whole device may now remain in this condition whilst the first sheet is still being transported by roller 7 and rollers 8, so that the second sheet 2, when it will be treated by the same manner as was sheet 1, will not touch the latter. But the whole arrangement has been provided in the manner described in order that it will not be necessary to do so. On the contrary, it is possible to reiterate the operation even though the first sheet is still lying over the nozzles 6. This

overlapping may be much narrower than is shown in Fig. 17b because the whole length and width of the sheet is condensed in these drawings. In fact the dimensions normally are more like those shown in Fig. 2 than those shown in Fig. 17b.

In order not to interrupt the description of the main operation I did not mention an accessory motion made by the nozzles 6 (see Fig. 14a). As will be seen, the nozzles 6 in these drawings are shown at a greater distance from each other than in Fig. 13a. In fact these nozzles go outwards for a small distance as soon as they have seized the sheet; but this outward motion may soon be stopped, its purpose being to tauten the front edge of the sheet before it is bent upwards as shown in Fig. 14b. For if the upper surface of the pile, as it often happens, is not flat, the two nozzles 6 without this accessory motion will not be able to bend upwards a wide sheet, so that this will deflect in such a degree that a transmission to the suction roller in such a condition as it is needed will be impossible. It is not necessary that this little outward motion be finished before the bending of the sheet begins, but it must be finished before the transmission from the nozzles 6 to the suction roller takes place. The measure of this outward motion may be adjustable so that it may even be done away with. For if the pile is absolutely flat the outward motion could be detrimental.

In Figs. 30 and 31 is shown a modified form of cam 18, comprising four cams 18a, 18b, 18c, and 18d, arranged so that the roller 22 mounted on lever 23 and secured to shaft 21, may be operatively associated with any desired cam surface. These cams are so shaped that the lateral motion of the nozzles 6 may be of a greater or lesser extent, as desired, or may even be entirely eliminated.

The combined action of the nozzles 6 and suction roller 7 are necessary with thin papers because these can never be shifted from behind and must be drawn from their front edge. On the other hand heavy sheets of paper or cardboard can be shifted, but cannot be bent as shown in Fig. 14b. For this reason the operation described is neither necessary nor possible with heavy card-boards, sheets of iron or the like. Nevertheless the same device can be made use of for these materials as well. In this case the operation is as follows.

The whole transmission device is shifted outside of the pile and the motion of the nozzles is stopped by disconnecting the flanges of the hubs 11 and 124. By means of the spindle 117 and hand-wheel 116 the whole separating devices are lifted such a distance that the upper surface of the pile will almost be in the same level as the uppermost point of the suction roller. The feeler mechanism, necessary to keep the height of the pile, will be adjusted accordingly.

Referring to Fig. 18 the operation of the separating device is exactly as described before. The nozzles 3 seize the sheet as has been shown, but, instead of the sheet now being drawn forward by the nozzles 6, it is shifted from behind by the nozzles 3 their movement being exactly the same as it was when they had to support and tauten the sheet. The suction roller is now made use of without any suction effect, that is, just like a normal solid roller. The first sheet is shifted between the rollers 7 and 8 and the second, third a. s. o. follow either leaving a certain distance between each other or in an overlapped condition.

The method of tautening the sheet before it is

bent, or any other process causing it to be straight at the beginning, may be made use of in feeding machines of other kinds. If a series of nozzles 166 (Fig. 21), for instance, is secured to one suction rod 161 going across the whole width of the sheet and carried by arms or the like indicated at 163 and 164, wavy piles are very difficult to handle. In such a case one may cause the two outermost nozzles 167 to slide on the rod 161 and have them work thus: after all the nozzles have descended the two outermost nozzles 167 only seize the sheet, by suction through the hose 168, slide outwards and after the sheet thus has been tautened, suction is applied through hose 162 to the whole series of nozzles. The lateral movement of the nozzles 167 is brought about by means of the two tie rods 171 connected to a toggle lever 170 which is mounted on a fixed pin 169. The toggle lever 170 is operated by means of a rod 172 to which the desired motion may be given by cam means or the like, not shown. The outer positions of the nozzles 167 are indicated in dotted lines in Fig. 21, and the sheet 173 is represented in its wavy condition by a full line and in its straight and taut position by a dotted line.

Instead of moving both nozzles outwards one may make one of them stand still and move the other one only, as indicated in Fig. 22. In this case it will be recommendable to give the movable nozzle a smaller suction surface, so that the sheet will always be transported in the same lateral position, as determined by the stationary nozzle.

The two rocking motions of nozzles 6 upwards and forwards may be combined in such a way that the nozzle when approaching and leaving the pile moves exactly or almost vertically.

The outer tube of the suction roller may move in any other way than a continuous rotation, viz., with retardations, accelerations, interruptions or reversions of the motion.

With small sheets the tautening motion of nozzles 6 may be done away with.

Instead of that motion of the transmitting nozzles 6 that is produced by the rocking of the arm 28 around axle 21, the whole suction roller may be made to move to-and-fro, so that nozzles 6 makes two motions only. This will be especially recommendable for small sheets. The circumferential speed of the suction roller in such a case will be made so that, if needed, the advancing speed of the sheet may be constant, and mechanism for securing this result is shown in Figs. 23 and 24. In these figures the suction roller 7 is supported on lever 181 so as to swing through an arc shown in dotted lines in Fig. 24 from its position shown on the left in full lines to the position shown toward the right in dotted lines. By reason of this motion the suction nozzle 6 needs only to move through a simple arc, instead of swinging bodily as hereinbefore described. Since the rotation of the roller 7 determines the forward motion of the sheets which have been delivered to it, the effect of bodily swinging the roller 7 would be to cause the sheets to advance at irregular speeds. In order to assure a constant advancing speed of the sheet, the roller 7 is provided with a spur gear 182 which is driven by another spur gear 183 rotatably mounted on shaft 184. To the spur gear 183 is secured a bevel gear 185 which engages a small bevel gear 187 mounted on a swinging lever 186, and the bevel gear 187 engages, in turn, with a third

bevel gear 188. The bevel gear 188 is secured to a spur gear 189 and both are bodily mounted on the shaft 184. The spur gear 189 is driven in a suitable manner by a separate gear 190. It will thus be seen that, if the lever 186 is left stationary, the roller 7 will receive a uniform rotary motion through the gears 190, 189, 188, 187, 185, 183 and 182; however, if the lever 186 is swung by the tie rod 191, lever 192, roller 193 and cam 194, the roller 7 will receive additional variable driving motions through the action of the planetary gear. The cam 194 is so arranged that when the bell-crank lever 181 is given a swinging motion by the cam 195, roller 196, lever 197 and tie rod 198, the surface speed of the roller 7 will be varied so as to give a uniform speed to the sheets passing thereover. The levers 192 and 197 are supported independent of each other on a stationary pin 199.

If one transports the sheets in an overlapped condition, it is not necessary to give the suction nozzles 64, 65 a rocking motion. They may stand still in that position where the suction roller takes over the sheets transmitted to it. The front edge of the sheet will then run upwards in an oblique direction and the preceding sheet being in a forward motion will cause it to slip between roller 7 and itself. Only when starting it may be necessary to make the first sheet enter between roller 7 and 8 by hand.

Another means to do away with the rocking of nozzles 64, 65 is to extend them over the whole angle from the line of transmission to the line of contact of rollers 8.

If nozzles 64, 65 do not rock they may nevertheless be arranged to be adjusted laterally as has been described.

Instead of two spindles 68, 69 there may be one through-going spindle only having right- and left-handed thread, so that both nozzles will always be adjusted correspondingly. For special cases one of the bodies 66 or 67 may be divided into two parts adjustable toward and from one another.

The sealing member 86 need not be made of carbon but may be made of any other suitable material.

The rollers 8 running on the suction roller 7 can totally be done away with, if one causes any other means as for instance another solid transport roller in front of the suction roller to take over the sheet from that point where the suction roller shifts it to.

Tapes 203 (Figs. 25, 26, 27) may run over a separate tape roller 201 or over the suction roller and rollers 202 may run on these tapes either on that part of them that lies on the suction roller or any other point. As each sheet is fed by the suction roller 7 to the advancing pile of overlapped sheets the suction in the roller 7 is released and the sheet moves forward over the support 204 (Fig. 25) to the tape. A similar support 205 may be provided in the arrangement shown in Fig. 27 where the roller 202 does not run directly on the suction roller 7.

Instead of the rocking motion of the nozzles 64, 65 there can be provided a fully rotating motion, of varying speed if required, the admission valve being opened and closed at proper time.

Instead of the various motions of the nozzles 64, 65 there may be several slots of a fixed position which are each of them connected with an admission valve opened and closed successively. It is easy to be seen that this fully corresponds to moving nozzles.

It is also possible to have inside of the suction roller nozzles connected with a blast pump similar to those connected with the suction pump and such blast nozzles may be fixed or moved just as the suction nozzles were. The blast nozzles will lift the sheet from the suction roller at the time and point needed.

Instead of the two nozzles 3 and 5 there may be in each separating device one nozzle only that both lifts the sheet and then makes that forward motion that has been described. The motion of such a nozzle is illustrated in Fig. 28.

The tautening nozzles 3 can be arranged at any other suitable part of the sheet. Instead of two there may be one of them only, which for instance may be arranged in the middle axis of the sheet.

The tautening nozzles 3 under certain circumstances may also be done away with or put out of work. For the natural friction of the sheet being drawn forward by nozzles 6 and suction roller 7 touching the stationary pile has the tendency to tauten the sheet. This natural friction may be augmented as shown in Fig. 29 by a weight or a roller 212 mounted on a lever 211 and applied to the top of the pile at a suitable point, a sufficient distance from the front edge of the pile of sheets to ensure that the top sheet will, when tautened, be clear of the nozzle 6. Of course care must be taken that the following sheet will not be taken along, this being readily accomplished by holding the sheets down by the nozzle 4, as previously explained.

If the sheets are not transported in an overlapped condition the lifting of the sheet 1 that cover the nozzles 6 while these go back to their initial position, may be effected neither by tautening from behind nor by friction, but by special suction nozzles 215 (Fig. 32) lifting the sheet 1 just in top of nozzles 6 or very near by. If the motion of the suction roller and consequently of sheet 1 is continuous (which as has been said may not always be the case) such a lifting nozzle must move accordingly.

Instead of two separating devices there may be one only which it will be suitable to arrange in the middle of the rear edge of the pile. With certain kinds of paper separation of the sheets by nozzles 6 is sufficient so that special separation devices at the rear edge may be done away with.

What I claim is:

1. In a sheet feeding machine, a plurality of suction devices adapted to seize the upper surface of a sheet adjacent its forward corners only, another suction device adapted to receive the sheet from said first named suction devices and to seize the lower surface of the sheet adjacent the forward edge thereof, and means for operating said first named suction devices to transfer the sheet from its original position to a position adjacent the second named suction device, the sheet being at all times during its feeding under the control of at least one suction device.

2. In a sheet feeding machine, a plurality of suction devices adapted to seize the upper surface of a sheet adjacent its forward corners, another suction device adapted to receive the sheet from said first named suction devices and to seize the lower surface of the sheet adjacent the forward edge thereof, means for operating said first named suction devices to transfer the sheet from its original position to a position adjacent the second named suction device, and means for returning said first named suction devices on paths around

the respective side edges of the sheet just handled to positions adjacent the upper surface and forward corners of the next sheet to be fed.

3. In a sheet feeding machine, a plurality of suction devices adapted to seize the upper surface of a sheet adjacent its forward corners, another suction device adapted to receive the sheet from said first named suction devices and to seize the lower surface of the sheet adjacent the forward edge thereof, means for operating said first named suction devices to transfer the sheet from its original position to a position adjacent the second named suction device, and means for moving apart said first named suction means after they have seized the sheet in order to tauten it.

4. In a sheet feeding machine, a plurality of suction devices adapted to seize the upper surface of a sheet adjacent its forward corners, another suction device adapted to receive the sheet from said first named suction devices and to seize the lower surface of the sheet adjacent the forward edge thereof, means for operating said first named suction devices to transfer the sheet from its original position to a position adjacent the second named suction device, and adjustable means for moving apart a selected distance said first named suction means after they have seized the sheet in order to tauten it.

5. In a sheet feeding machine, a perforated suction roller, suction nozzles therein, and means for adjusting said nozzles to selected operative positions axially of said roller.

6. In a sheet feeding machine, a perforated suction roller, suction nozzles therein, and means for moving said nozzles through an operative arc about the axis of the suction roller.

7. In a sheet feeding machine, a perforated suction roller, suction nozzles therein, and means for moving said nozzles independently of the rotation of the suction roller through an operative arc about the axis of the suction roller.

8. In a sheet feeding machine, a perforated suction roller, a suction nozzle therein and operatively associated with a selected area of perforations, means for applying suction and moving said nozzle in one direction through an operative arc, and means for cutting off the suction and returning the nozzle to the beginning of its operative arc.

9. In a sheet feeding machine, a suction device adapted to seize the upper surface of a sheet adjacent its forward edge, another suction device adapted to receive the sheet from said first named suction device and to seize the lower surface of the sheet adjacent the forward edge thereof, means adjacent the rear edge of the sheet for separating it from other sheets in a pile, and means for operating said first named suction device to transfer the sheet from its original position to a position adjacent the second named suction device.

10. In a sheet feeding machine, a suction device adapted to seize the upper surface of a sheet adjacent its forward edge, another suction device adapted to receive the sheet from said first named suction device and to seize the lower surface of the sheet adjacent the forward edge thereof, means for operating said first named suction device to transfer the sheet from its original position to a position adjacent the second named suction device, additional means for supporting the forward portion of the sheet after the first named suction device has released it, and means for returning said first named suction device on a path around the side edge of the sheet

just handled to a position beneath said sheet and adjacent the upper surface and forward edge of the next sheet to be fed.

11. In a sheet feeding machine, a suction device adapted to seize the upper surface of a sheet, means for oscillating said device about an axis transverse to the direction of feed of the sheets, means for swinging said device and its axis of oscillation about another axis also transverse to the direction of feed of the sheets, and means for reciprocating said device in a direction parallel to said axes.

12. In a sheet feeding machine, a perforated suction roller and suction nozzles therein, the suction roller extending over the full width of the sheet to be fed, and the suction nozzles having a total width less than the width of the perforated portion of the suction roller and being disposed within said roller at points adjacent the marginal portions of said sheet.

13. In a sheet feeding machine, the combination of a sheet support, sheet forwarding means adapted to advance a series of superimposed sheets, said forwarding means comprising pneumatic means adapted to receive a sheet and engage it at its lower surface and move said sheet to bring its upper surface into contact with the lowermost one of said superimposed sheets, reciprocating sheet separating means arranged to remove a sheet from said support and advance it to said pneumatic means so that a space will be provided underneath said sheet, and means for moving said separating means into said space beneath said sheet for the purpose of engaging and separating a succeeding sheet.

14. In sheet feeding mechanism, the combination of sheet forwarding means including a rotary pneumatic member having a suction nozzle and adapted to advance a bank of seriated sheets, means to separate sheets from a stack and adapted to convey separated sheets to said nozzle, the latter being so actuated that the direction of travel of a sheet, while engaged by and under control of said nozzle is diverted through a substantial angle for the purpose of facilitating feeding of a sheet into cooperative association with other sheets previously fed to said forwarding means.

15. In sheet feeding mechanism, the combination of sheet forwarding means including a rotary pneumatic member adapted to advance a bank of seriated sheets, said member having a perforated outer member and an inner member, the latter being provided with a suction nozzle adapted to establish communication between a source of fluid pressure and the perforations in said outer member, means to separate sheets from a stack and adapted to convey separated sheets to said pneumatic member, the latter being so actuated that the direction of travel of a fed sheet, while under control of said pneumatic member, is diverted through a substantial angle for the purpose of facilitating feeding of a sheet into cooperative association with other sheets previously fed to said forwarding means.

16. In sheet feeding mechanism, the combination of sheet forwarding means including a rotary pneumatic member and a roller cooperatively associated therewith to receive and advance a bank of seriated sheets, said pneumatic member having a suction nozzle, means to separate sheets from a stack and adapted to convey separated sheets to said nozzle in a manner that the direction of travel of a fed sheet, while under control of said nozzle, is diverted through a sub-

stantial angle for the purpose of facilitating feeding of a sheet into cooperative association with other sheets previously fed to said forwarding means.

17. In sheet feeding mechanism, the combination of a stock table, rotary sheet forwarding means including a rotary pneumatic member adapted to receive and advance a bank of seriated sheets, and reciprocating sheet separating means adapted to transfer separated sheets from said table to said pneumatic member, said member having a suction nozzle arranged to engage a sheet after the leading edge thereof has been diverted substantially 90° with respect to the initial plane of said sheet and thereupon again divert its direction of travel substantially 90°.

18. In sheet feeding mechanism, the combination of a stock table, rotary sheet forwarding means including a rotary pneumatic member and a roller cooperating therewith to receive and advance a bank of seriated sheets, and reciprocating sheet separating means adapted to transfer separated sheets from said table to said forwarding means, said pneumatic member having a suction nozzle arranged to engage a sheet after the leading edge thereof has been diverted substantially 90° with respect to the initial plane of said sheet and thereupon again divert its direction of travel substantially 90°.

19. In sheet feeding mechanism, the combination of sheet forwarding means including a cylindrical, continuous smooth surfaced pneumatic member having a suction nozzle and adapted to advance a bank of seriated sheets, means to separate sheets from a stack and adapted to convey separated sheets to said nozzle, the latter being so actuated that the direction of travel of a sheet, while engaged by and under control of said nozzle is diverted through a substantial angle for the purpose of facilitating feeding of a sheet into cooperative association with other sheets previously fed to said forwarding means.

20. In sheet feeding mechanism, the combination of sheet feeding means including a rotary pneumatic member having a perforated cylinder and a suction nozzle arranged therein and adapted to advance a bank of seriated sheets, means to separate sheets from a stack and adapted to convey separated sheets to said member, the latter being so actuated that the direction of travel of a sheet, while engaged by and under control of said nozzle is diverted through a substantial angle for the purpose of facilitating feeding of a sheet from beneath a bank of seriated sheets into cooperative association therewith.

21. In sheet feeding mechanism, the combination of sheet forwarding means including a rotary pneumatic member and a roller continually rotating with said member to receive and advance a bank of seriated sheets, said pneumatic member having a perforated cylinder and a suction nozzle having its face bearing against the inner wall of said cylinder, means to separate sheets from a stack and adapted to convey separated sheets to said member in a manner that the direction of travel of a fed sheet, while under control of said nozzle, is diverted through a substantial angle with respect to the initial plane of said sheet for the purpose of facilitating feeding of a sheet into cooperative association with other sheets previously fed to said forwarding means.

22. In sheet feeding mechanism, the combination of a stock table, rotary sheet forwarding means including a rotary pneumatic member and

a roller cooperating therewith to receive and advance a bank of seriated sheets, and reciprocating sheet separating means adapted to transfer separated sheets from said table to the pneumatic member of said forwarding means, said pneumatic member having a perforated cylinder and a suction nozzle arranged therein to thereby engage a sheet and in cooperation with said roller divert its direction of travel substantially 90° with respect to the initial plane of said sheet.

23. In sheet feeding mechanism, the combination of a forwarding roller adapted to be disposed laterally in any desired position within predetermined limits and cooperating with a rotary, cylindrical, continuous surfaced, pneumatic member adapted to engage and convey a new sheet so that it will be located beneath a bank of seriated sheets which are already in the bite of said member and roller.

24. In sheet feeding mechanism, the combination of a forwarding roller adapted to be disposed laterally in any desired position within predetermined limits and continually cooperating with a rotary, cylindrical, continuous surfaced, pneumatic member adapted to engage and convey a new sheet so that it will be located beneath a bank of seriated sheets which are already in the bite of said member and roller.

25. In sheet feeding mechanism, the combination of sheet supporting means, pneumatic sheet forwarding means having a perforated suction roller and a suction nozzle therein and adapted to receive and forward a series of superimposed sheets, and pneumatic sheet separating means arranged to take a sheet from said supporting means and convey it to said forwarding means so that it will be located below the series of sheets, the lateral edges of the sheets, while being conveyed, remaining in the same vertical planes as the lateral edges of the sheets on said supporting means.

26. In sheet feeding mechanism, the combination of forwarding rollers continually cooperating with a rotary, continuous surfaced, cylindrical pneumatic member, a suction shoe rotatably arranged within said member to thereby engage a sheet and convey it to a position where it will be located beneath a bank of seriated sheets which are already in the bite of said member and rollers, and means for interrupting the suction in said pneumatic member after said new sheet has been conveyed into the bite of said member and said rollers cooperating with the latter.

27. In sheet feeding mechanism, the combination of means for feeding a bank of seriated sheets, said means comprising a pneumatic member consisting of a rotary, perforated tube and an inner suction nozzle axially adjustable within said tube, said nozzle being adapted to apply suction to a sheet forwarded to said tube in a certain axial line of its circumference and to maintain suction for the purpose of conveying such sheet through a substantial angle to forwarding rollers disposed in another axial line of the circumference of said tube.

28. In sheet feeding mechanism, the combination of means for feeding a bank of seriated sheets, said means comprising a pneumatic member consisting of a rotary, perforated tube and an inner suction nozzle axially adjustable within said tube, said nozzle being adapted to apply suction to a sheet forwarded to said tube in a certain axial line of its circumference, and to convey such sheet to another axial line of its circumferential path, and a feed roller disposed at

said latter axial line to thereby divert said sheet through a substantial angle.

29. In a sheet feeder, the combination with means for supporting and feeding a supply of sheets and means forward thereof for conveying the sheets away in lapped relation, of sheet separating and advancing mechanism adjacent the top and front of said supply and comprising two suction means both operating under a previously separated and advanced sheet, one suction means acting to separate each sheet singly from said supply and the other suction means being movable to take said sheet from said first mentioned suction means and deliver it to said conveying means under and in lapped relation with another sheet being conveyed thereby, and means for operating said two suction means in proper timed relation with each other.

30. In a sheet feeder, the combination with means for supporting and feeding a supply of sheets and means forward thereof for conveying the sheets away in lapped relation, of sheet separating and advancing mechanism adjacent the top and front of said supply and comprising two sets of suction devices extending transversely of the feeder and both operating under a previously separated and advanced sheet, one set of suction devices acting to separate each sheet singly from said supply and the other set of suction devices being movable to take said sheet from said first mentioned set of suction devices and deliver it to said conveying means under and in lapped relation with another sheet being conveyed thereby, and means for operating said two sets of suction devices in proper timed relation with each other.

31. In a sheet separating and feeding mechanism, the combination of a first suction means seizing the top surface of the front edge portion of the uppermost sheet of a pile and lifting said portion, a second suction means taking the sheet from said first suction means and advancing said sheet, means operating said first suction means and causing it to pass beyond the margin of the sheet and return under the sheet into position to operate on the next sheet of the pile, and means operating said second suction means.

32. In a sheet separating and feeding mechanism, the combination of a first suction means seizing the top surface of the front edge portion of the uppermost sheet of a pile and lifting said portion, a second suction means taking the sheet from said first suction means and advancing said sheet beneath one or more previously-fed sheets, whereby to provide a stream-line advance of sheets lapped in their direction of travel, means operating said first suction means and causing it to pass beyond the margin of the sheet and return under the sheet into position to operate on the next sheet of the pile, and means operating said second suction means.

33. The structure presented in claim 31 in which one of said suction means tautens the front edge portion of the sheet lengthwise said edge.

34. The structure presented in claim 31 in which said first suction means tautens the front edge portion of the sheet lengthwise said edge.

35. The structure presented in claim 31 in which said second suction means engages and seizes the under surface of the sheet.

36. In a sheet-feeder, the combination of means seizing and lifting the front edge portion of the uppermost sheet of a pile, sheet-advancing means taking the sheet from said first means.

operating said first means, means operating said sheet-advancing means, reciprocating means engaging the rear edge portion of the sheet and acting in conjunction with said sheet-advancing means to tauten the advancing sheet in its direction of travel, and means operating said rear edge portion engaging means.

37. In a sheet-feeder, the combination of means seizing the top surface of and lifting the front edge portion of the uppermost sheet of a pile, sheet-advancing means taking the sheet from said first means, means operating said sheet-advancing means, means engaging the rear edge portion of the sheet and acting in conjunction with said sheet-advancing means to tauten the advancing sheet in the direction of its travel, means operating said first means and moving it beyond the margin of the sheet and returning it under the sheet into position to operate on the next sheet of the pile, and means operating said rear edge portion engaging means.

38. In a sheet-feeder, the combination of means seizing and lifting the front edge portion of the uppermost sheet of a pile and tautening said edge portion lengthwise said edge, sheet-advancing means taking the sheet from said first means, means operating said first means, means operating said sheet-advancing means, means engaging the rear edge portion of the sheet and acting in conjunction with said sheet-advancing means to tauten the advancing sheet in its direction of travel, and means operating said rear edge portion engaging means.

39. In a sheet-feeder, the combination of means seizing the top surface of and lifting the front edge portion of the uppermost sheet of a pile and tautening such portion lengthwise said edge, sheet-advancing means taking the sheet from said first means, means operating said sheet-advancing means, means engaging the rear edge portion of the sheet and acting in conjunction with said sheet-advancing means to tauten the advancing sheet in its direction of travel, means operating said first means and moving it beyond the margin of the tautened sheet and returning it under the sheet into position to operate on the next sheet of the pile, and means operating said rear edge portion engaging means.

40. In a sheet-feeder, the combination of at least a pair of suction means seizing and lifting the front edge portion of the uppermost sheet of a pile and moving away from one another laterally of the sheet to tauten such edge portion lengthwise the edge, sheet-advancing means taking the sheet from said suction means, means operating said sheet-advancing means, second suction means engaging the rear edge portion of the sheet and acting in conjunction with said sheet-advancing means to tauten the advancing sheet in its direction of travel, means operating said first suction means and moving it beyond the margin of the sheet and returning it under the sheet into position to operate on the next sheet of the pile, and means operating said rear edge portion engaging means.

41. In a sheet-feeder, sheet-advancing means, means operating said sheet-advancing means, means separating the forward edge portion of the uppermost sheet of a pile from the pile, tautening said edge portion lengthwise said edge, and feeding the sheet to said sheet-advancing means, means operating said separating, tautening and feeding means, means separating the rear edge portion of the sheet from the pile and tautening said rear edge portion lengthwise said

edge, and means operating said last mentioned means.

42. In a sheet-feeder, sheet-advancing means, means operating said sheet-advancing means, means separating the forward edge portion of the uppermost sheet of a pile from said pile, tautening said edge portion lengthwise said edge, and feeding the sheet to said sheet-advancing means, means operating said separating, tautening and feeding means, means separating the rear edge portion of the sheet from the pile and tautening said rear edge portion lengthwise said edge and in conjunction with said sheet-advancing means tautening the sheet throughout in the direction of length of travel of the sheet, and means operating said rear edge separating and tautening means.

43. In a sheet-feeder, means separating and advancing sheets in lapped relation from the top and front of a pile of sheets and including, in combination, two sheet-engaging means operating below previously-fed lapped sheets, one of said two sheet-engaging means taking the sheets from the other, and one of said sheet-engaging means tautening the front edge portions of the sheets, and means operating said two sheet-engaging means in proper timed relation to one another.

44. In a sheet-feeder, the combination with suction means seizing and separating the rear edge portion of the uppermost sheet of the pile from the pile, of a second suction means seizing the top surface of the front edge portion of said uppermost sheet of the pile and lifting such portion of the sheet from the pile, a third suction means taking the sheet from said second suction means and seizing the lower surface of the forward edge portion of the sheet and advancing the sheet, and means operating said three suction means.

45. In a sheet-feeder, the combination with means for supporting and feeding a supply of sheets and means forward thereof for conveying the sheets away in lapped relation, of means for advancing sheets in such relation from the supply to the conveying means including suction devices forwarding each sheet thereto and thereafter moving beyond the margin of the sheet and returning under the same to operate on the next sheet of said supply, and operating means for the suction devices moving them as aforesaid and separating said devices to stretch each sheet forwarded thereby.

46. In sheet-feeding mechanism, the combination of means for supporting a supply of sheets, separating means provided adjacent the rear portion of said supply of sheets to separate sheets therefrom individually and in succession, suction means arranged intermediate the rear and front portion of said supply to engage separated sheets intermediate their rear and front edges and remove them from said supply at a predetermined speed, second suction means adapted to receive the forward edges of separated sheets, and sheet forwarding means operating at a speed less than said predetermined speed, and adapted to receive separated sheets from said second suction means and advance them as a continuous bank of lapped sheets to the registering means of a printing press or the like.

47. In a sheet-feeding machine, means for supporting a pile of sheets, a forwarding device adapted to move a bank of seriated sheets, a suction device arranged to operate below said bank of seriated sheets and adapted to seize the

upper surface of a sheet lying on the pile adjacent its forward edge and withdraw it from the pile and thereupon move beyond the lateral margin of said sheet into position to act on another sheet, a second suction device adapted to lift the rear portion of said sheet, and a pressure member arranged adjacent the rear edge of said pile and operative to prevent a succeeding sheet from being taken along with said first sheet.

48. In a sheet-feeder, the combination of a first suction means for receiving and feeding a sheet separated from a supply, a second suction means for separating the sheet from the supply at the rear thereof, means for carrying the separated sheet from the supply to the first suction means and including sheet holding devices acting on front portions of the separated sheet, and operating mechanism for said sheet holding devices causing them to move beyond the margin of the sheet upon delivery thereof to the first suction means and move under said sheet in travelling into position to act on another sheet.

49. In a sheet-feeder, means for conveying sheets in lapped relation, means for separating sheets one after another from a supply, means for feeding the separated sheets in lapped relation to said conveying means including suction means and sheet holding means movable with respect to each other, said sheet holding means delivering each separated sheet to said suction means, and operating means for the sheet holding means causing said holding means to move beyond the margin of each sheet carried thereby to the suction means and move under said sheet in travelling into position to act on another sheet.

50. In a sheet-feeder, means for conveying sheets in lapped relation comprising feed rollers and suction means, means for separating and

advancing sheets from a supply and including suction sheet separating means and sheet holding means, said sheet holding means delivering each separated sheet to said conveying means in lapped relation with another sheet, and operating means for said holding means causing the same to move beyond the margin of each sheet delivered thereby and move thereunder in travelling into position to act on another sheet.

51. In a sheet-feeder, feed rollers for conveying sheets in lapped relation, suction means for feeding a sheet between the feed rollers under and in lapped relation with another sheet being fed thereby, means for separating and feeding a sheet from a supply including sheet holding means moving upwardly and forwardly and delivering the sheet into position for feeding action thereon by said suction means, and operating mechanism for said holding means causing it to move upwardly and forwardly, move beyond the margin of the delivered sheet, and move thereunder in travelling into position to act on another sheet.

52. In a sheet-feeder, means for conveying lapped sheets, means for separating sheets one after another from a supply at the rear thereof, suction means for delivering each sheet to the conveying means under and in lapped relation with another sheet, said suction means acting on the under side of each sheet, sheet holding means for engaging leading portions of each separated sheet and delivering it over said suction means, and operating mechanism for said holding means causing it to move beyond the margin of each sheet delivered thereby and move thereunder in travelling into position for action on another sheet.

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