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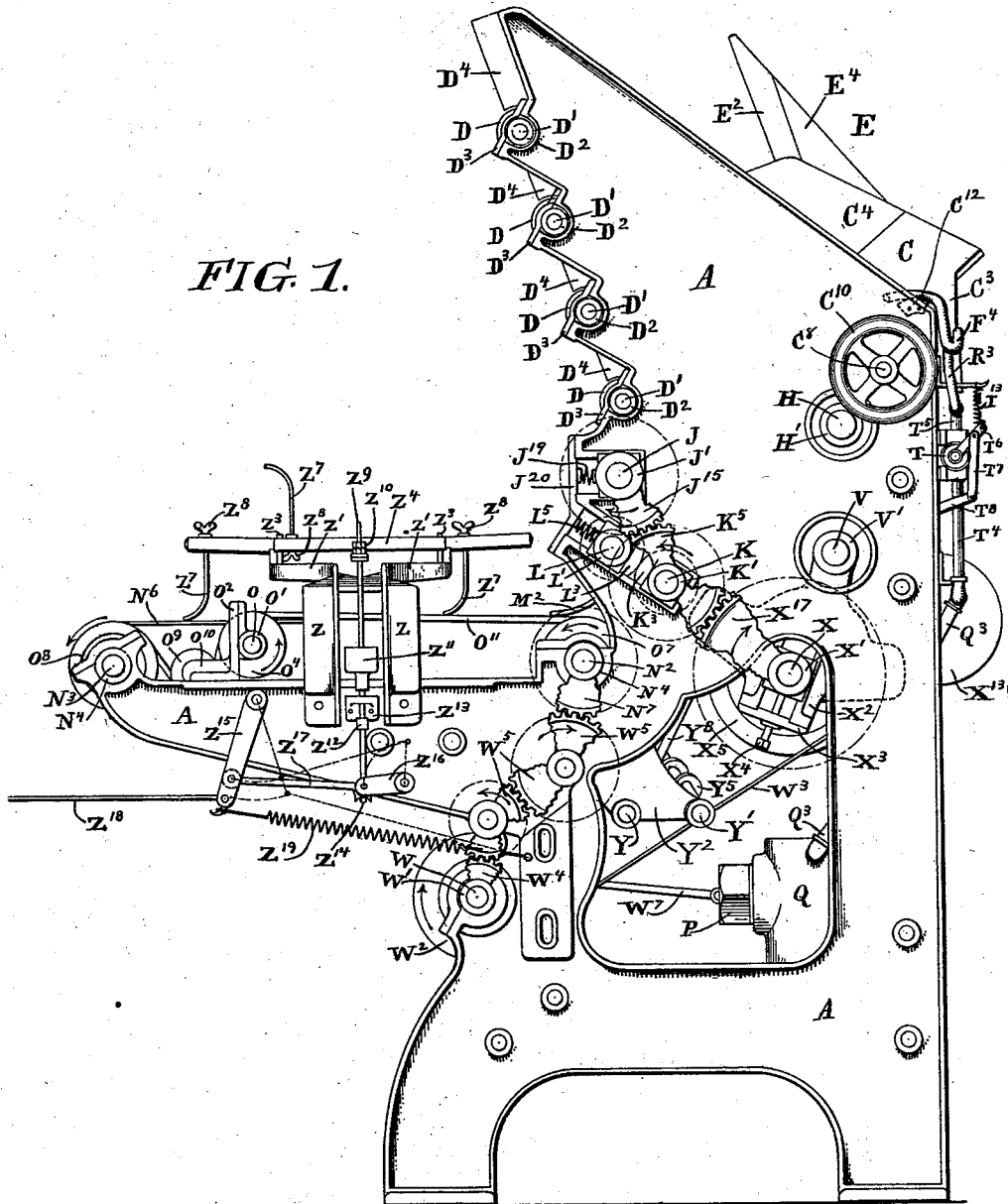
10 Sheets—Sheet 1.

J. H. KNOWLES.

MACHINE FOR FEEDING SHEETS OF PAPER.

No. 531,438.

Patented Dec. 25, 1894.



WITNESSES:

Henry Dwyer
Wm. M. M. M. M.

INVENTOR:

John Henry Knowles
By his atty.
Wm. M. M. M.

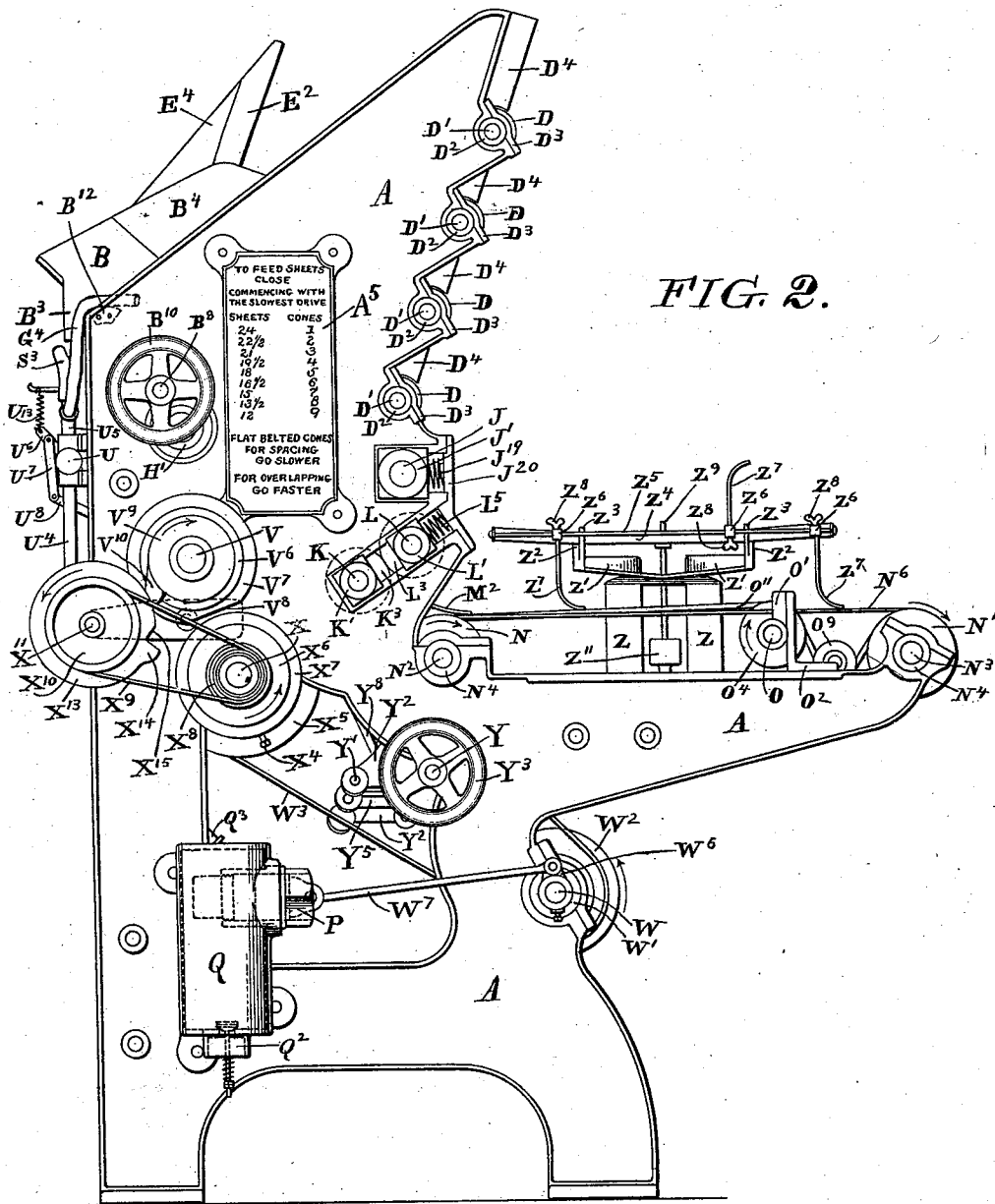
(No Model.)

10 Sheets—Sheet 2.

J. H. KNOWLES.
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Patented Dec. 25, 1894.



WITNESSES:

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INVENTOR:

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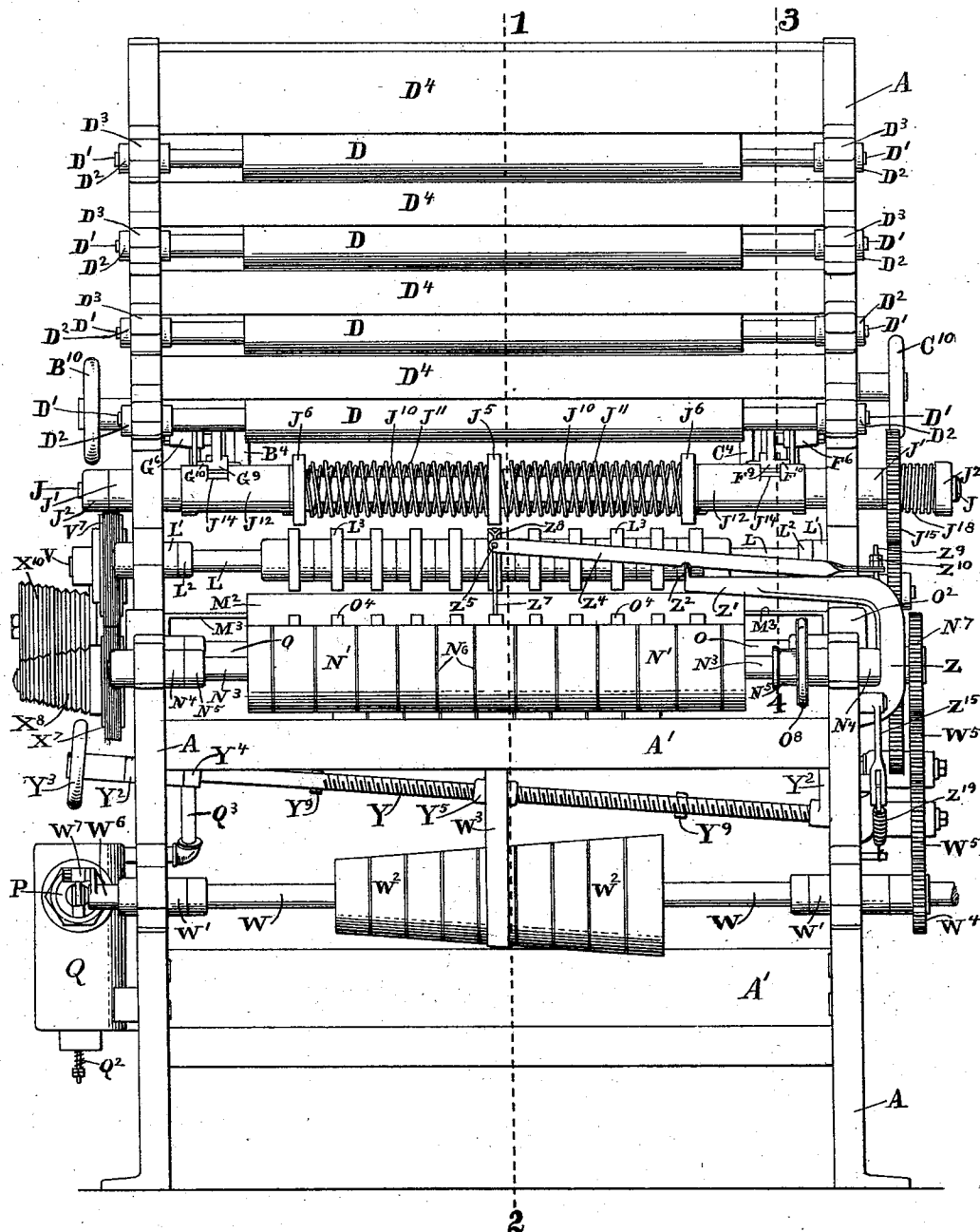


FIG. 3.

WITNESSES:

Henry Dwyer
 Ernest Wm. Smith

INVENTOR:

John H. Knowles
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[Signature]

(No Model.)

10 Sheets—Sheet 4.

J. H. KNOWLES.

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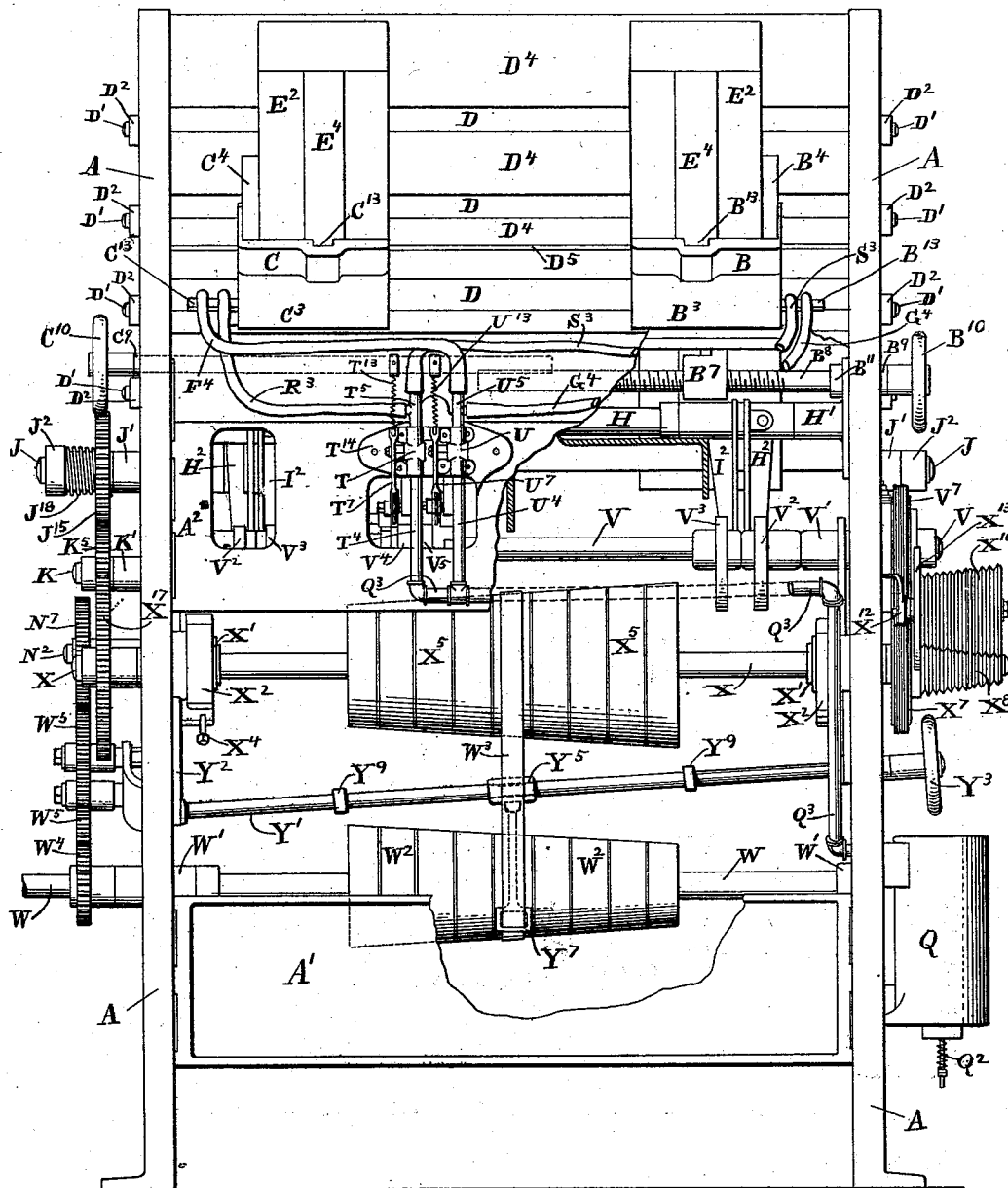


FIG. 4.

WITNESSES:

Henry Denny
Miss Maid Martin

INVENTOR:

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John Henry Knowles,
By his atty.

By his atty.
J. M. Smith &

(No Model.)

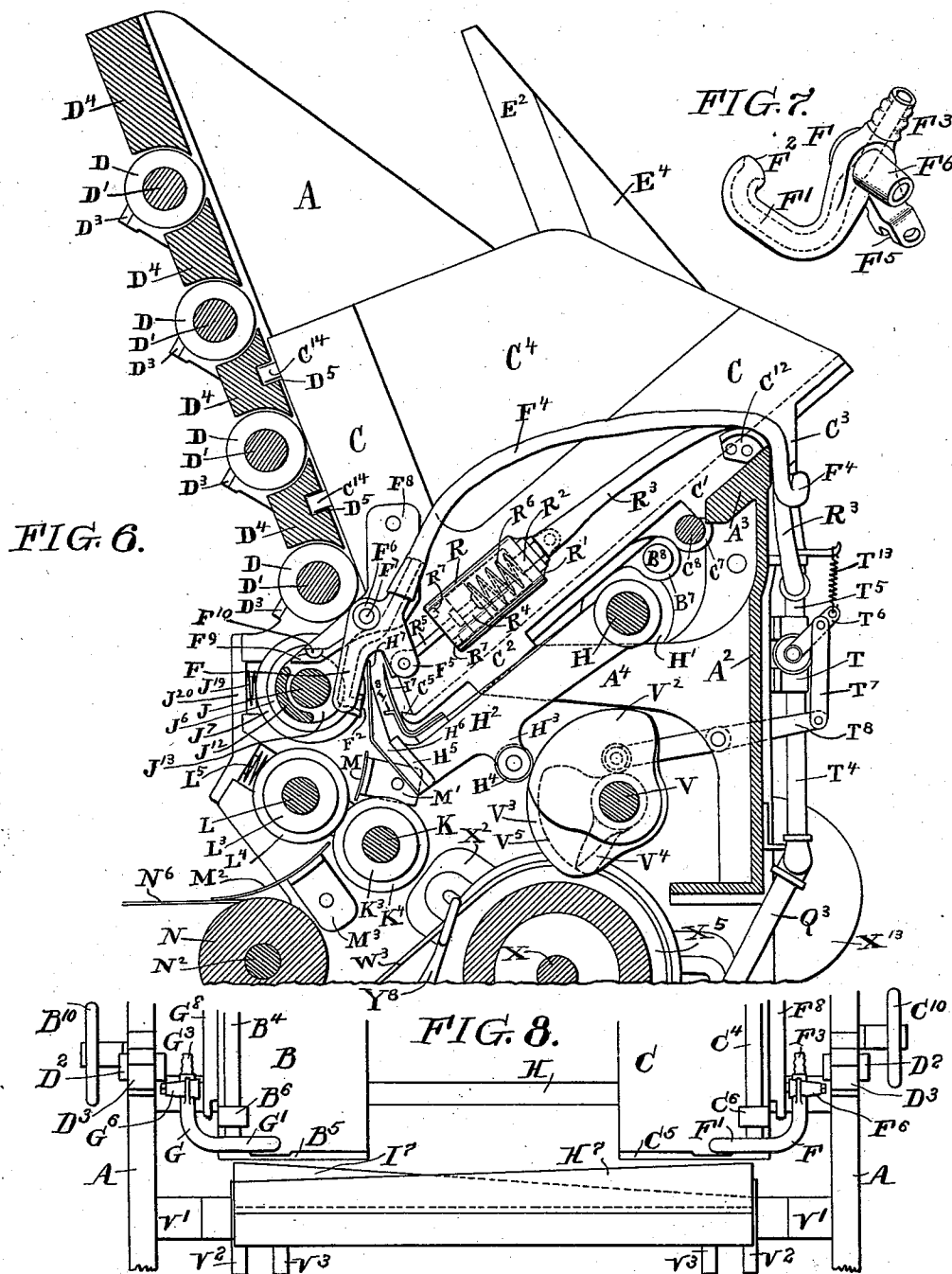
10 Sheets—Sheet 6.

J. H. KNOWLES.

MACHINE FOR FEEDING SHEETS OF PAPER.

No. 531,438.

Patented Dec. 25, 1894.



WITNESSES:

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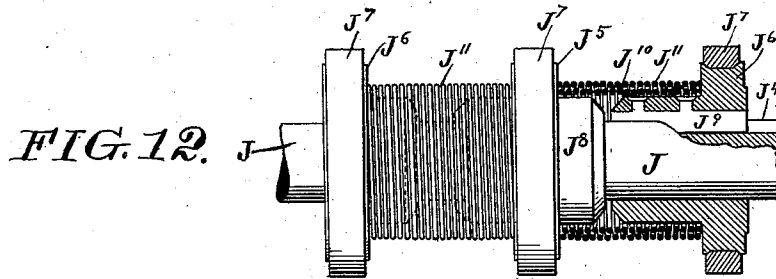


FIG. 10.

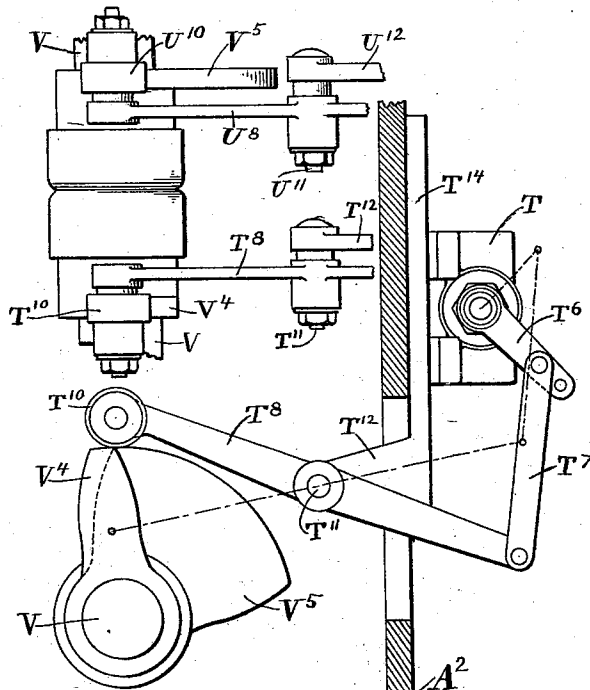
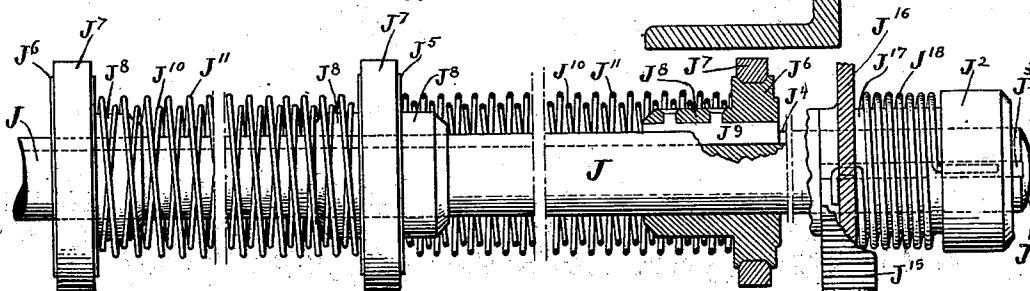


FIG. 9.

FIG. 11.



WITNESSES:

Henry Denny
Wm. H. Denny

INVENTOR:

John Henry Knowles
By his atty
[Signature]

(No Model.)

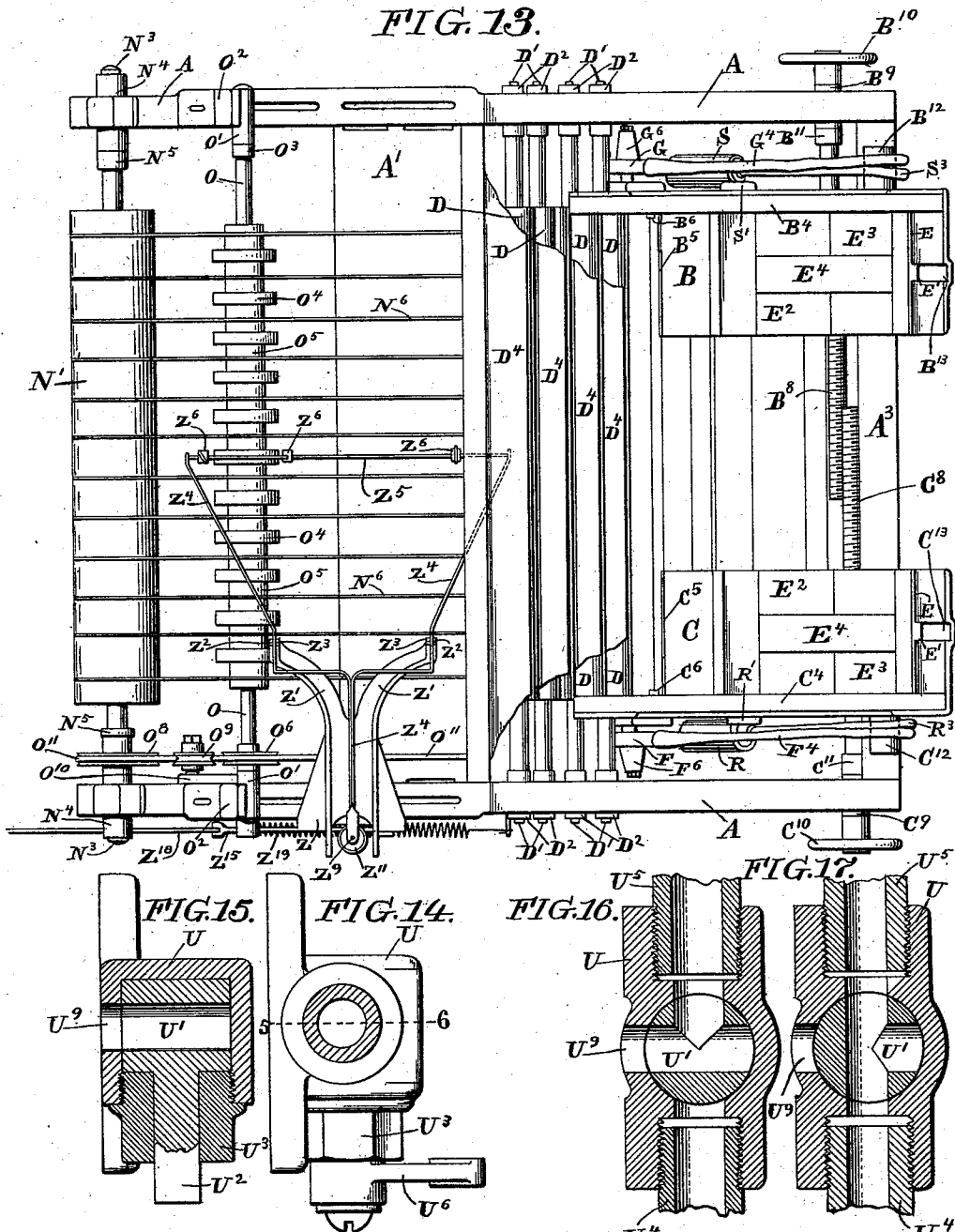
10 Sheets—Sheet 8.

J. H. KNOWLES.

MACHINE FOR FEEDING SHEETS OF PAPER.

No. 531,438.

Patented Dec. 25, 1894.



WITNESSES:
Henry Denny
Miss Maud Martin

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J. H. KNOWLES.
MACHINE FOR FEEDING SHEETS OF PAPER.

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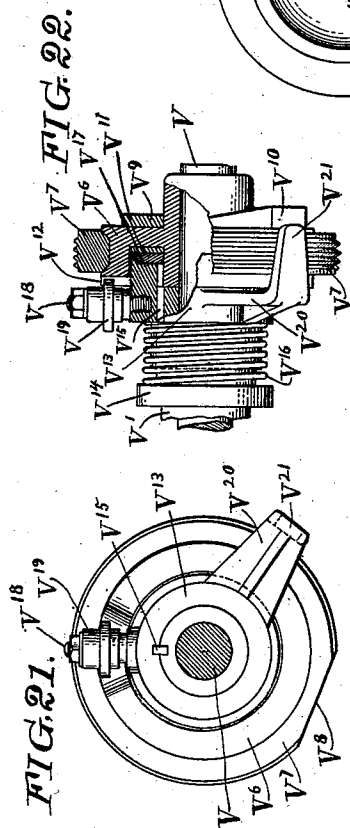
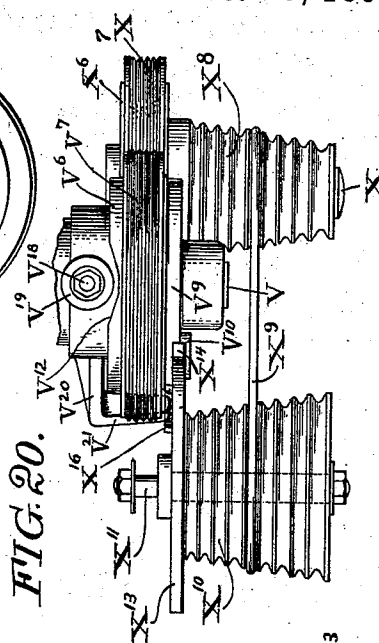
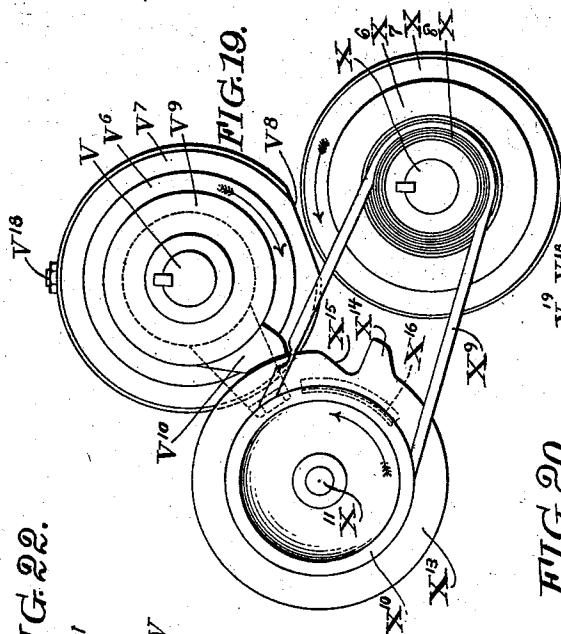
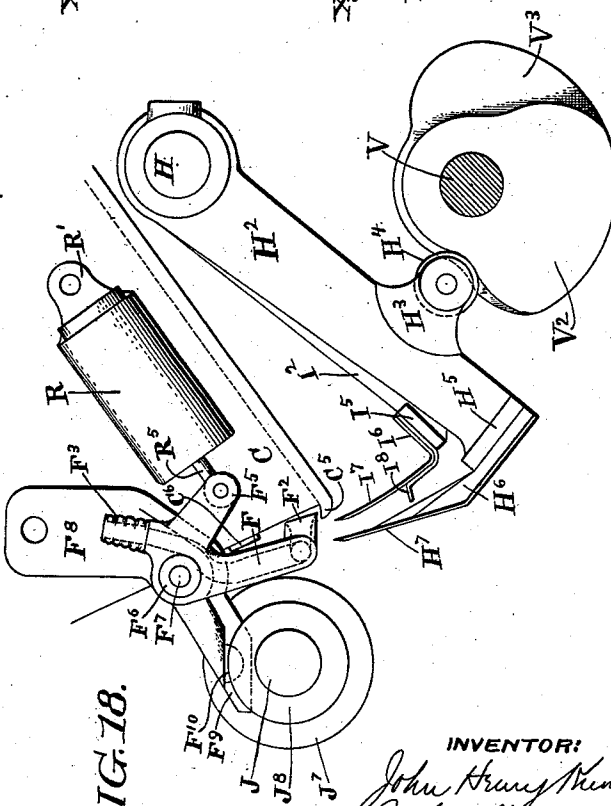


FIG. 21.

WITNESSES:

Henry Denny
Wm. Howard Smith



J. H. KNOWLES.

MACHINE FOR FEEDING SHEETS OF PAPER.

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Patented Dec. 25, 1894.

FIG. 24.

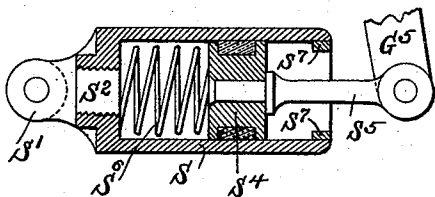


FIG. 23.

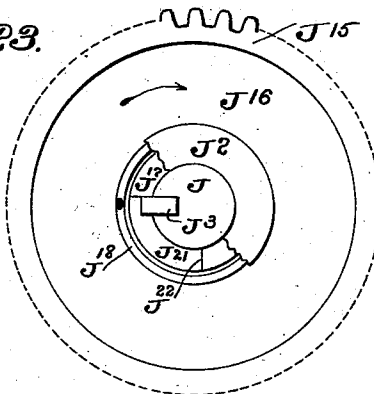


FIG. 26.

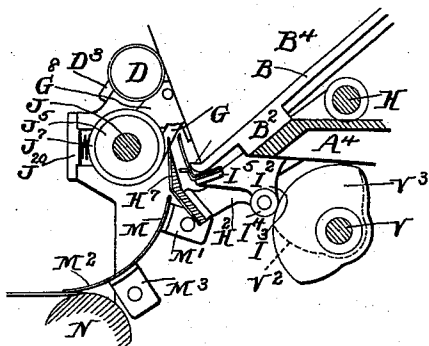
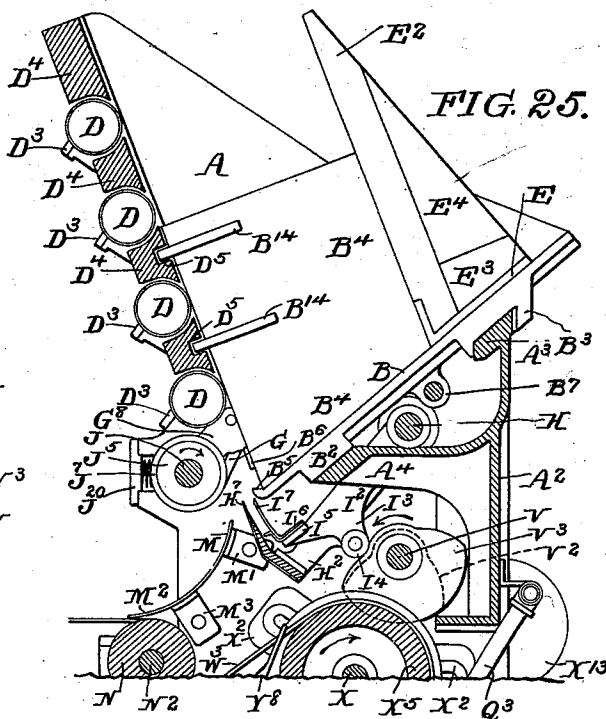


FIG. 25.



WITNESSES:

Henry Dwyer
Am. L. Evans

INVENTOR:

J. H. Knowles
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[Signature]

UNITED STATES PATENT OFFICE.

JOHN HENRY KNOWLES, OF PHILADELPHIA, PENNSYLVANIA.

MACHINE FOR FEEDING SHEETS OF PAPER.

SPECIFICATION forming part of Letters Patent No. 531,438, dated December 25, 1894.

Application filed April 5, 1894. Serial No. 506,392. (No model.)

To all whom it may concern:

Be it known that I, JOHN HENRY KNOWLES, of the city and county of Philadelphia and State of Pennsylvania, have invented an Improvement in Mechanism for Feeding Sheets of Paper, &c., of which the following is a specification.

My invention relates to mechanism for removing sheets of paper, &c., separately from a pack or pile and delivering them to any machine which it may be desired to supply with successive sheets.

I have shown my invention embodied in an organized machine having for its purpose the separation of the sheets from the pack or pile and placing them upon a conveyer or apron by which they may be delivered to the machine to be fed; but the mechanism may, if desired, be embodied in and become a part of the machine which receives and acts upon the separately fed sheets, such as a printing press, folding, ruling, or lithographing machine.

While I have shown and described my machine as specially designed for separating and feeding rectangular sheets, it may, with proper modification, be used for sheets or blanks of diamond or irregular shape.

My invention embraces improvements in the devices for holding the sheets in a pack or pile. These improved holding devices are designed to facilitate the separation and withdrawal of the sheets from the pile and also to permit the pile or pack to be easily replenished when occasion requires without stopping the machine. My improvements in the holding devices also include features of adjustability whereby the holder may be adjusted to sheets of different widths.

My invention also embraces improvements in the devices for separating sheets from the others in the pack or pile and for withdrawing the sheets when so separated.

It also includes certain pneumatic devices employed in connection therewith.

My invention further includes improvements in the driving devices for operating the various parts of the machine and the employment of features of adjustment in connection therewith, whereby the relative speeds of different portions of the mechanism may be so adjusted that the successive sheets may be

fed close together, or at any predetermined distance apart, or with their edges overlapping, and also that the machine may be easily adapted to suit sheets of different lengths.

My invention includes devices for accomplishing the overlapping of the sheets, when the same is desired, and a stop motion controlled by the sheets which are being fed, so that whenever there is any interruption or irregularity in the feeding of the sheets, the stop motion is actuated and the mechanism is brought to a state of rest.

In addition to these improvements my invention includes many other features of construction and combinations of parts, all of which are fully set forth hereinafter.

In providing my machine with features of adjustment whereby it may be adjusted to suit different sizes of sheets, or to vary the spacing or overlapping of successive sheets, it has been my object to render the adjustments as simple as possible, so that they may be performed without material delay.

The adjustment of the machine for sheets of different widths may be accomplished by the simple turning of a pair of hand wheels which has the effect, not only of changing the width of the holder to suit the width of the sheets, but also of correspondingly adjusting the separating and the withdrawing devices. The adjustment of the driving devices to adapt the machine to a change in the length of the sheets, or to alter the spacing or overlapping may be accomplished by the turning of a single hand wheel and the adjustment of a small driving belt. While these features of adjustment are an important portion of my invention, they may be omitted in some classes of machines where variation in the sizes of the sheets does not occur, and my improvements, aside from those relating to the features of adjustment, are as well adapted to a "one dimension machine" as to a machine adapted for different sizes of sheets.

I shall now refer to the accompanying drawings for the purpose of more particularly describing my invention.

Figure 1 is a side elevation of my improved machine for feeding sheets of paper, &c. Fig. 2 is a similar view of the opposite side of the machine. Fig. 3 is a front elevation of the machine. Fig. 4 is a rear elevation of the

same with a portion of the frame work broken away. Fig. 5 is a longitudinal vertical sectional view on the line 1—2 of Fig. 3. Fig. 6 is a similar view on an enlarged scale in the line 3—4 of Fig. 3, omitting the lower portions of the machine. Fig. 7 is a perspective view of the suction separator. Fig. 8 is a front elevation of a portion of the machine with the withdrawing devices removed to expose the separating mechanism. Fig. 9 is a detail side elevation of the cam actuated lever devices for operating the suction controlling valves, which operate the suction separating devices. Fig. 10 is a plan view of a portion of the same. Fig. 11 is a detail front elevation with part in section of the sheet withdrawing disks and their shaft. Fig. 12 is a similar view of the same showing the disks adjusted for narrow sheets. Fig. 13 is a plan view of the machine with portions of the front of the sheet holder broken away. Figs. 14 and 15 are respectively a top plan and horizontal sectional view of one of the suction controlling valves. Figs. 16 and 17 are vertical sectional views of the valve on the line 5—6 of Fig. 14, showing the valve in its two positions. Fig. 18 is an enlarged detail view of the sheet separating devices. Fig. 19 is an end elevation on an enlarged scale of the driving devices for operating the cam shaft. Fig. 20 is a plan view of the same. Fig. 21 is an end elevation of a portion of the same looking in the opposite direction from Fig. 19. Fig. 22 is a side elevation of the devices shown in Fig. 21 with part in section. Fig. 23 is an end elevation of the driving end of the shaft that supports the withdrawing disks and of the driving parts thereon, the collar J² being broken away to expose parts which lie beyond the collar. Fig. 24 is a detail view in vertical section of one of the pneumatic nozzle rocking devices. Fig. 25 is a longitudinal vertical sectional view similar to Fig. 5 of a portion of the machine showing a modification of the withdrawing devices. Fig. 26 is a similar view of parts shown in Fig. 25 but in a different position.

For the purpose of enabling the detailed construction of the machine to be easily understood, I shall refer to the different portions separately.

The frame of the machine.—A are the side frames connected together by suitable girts or braces A', A², and provided with beatings for the various shafts. The upper girt A² is provided with extensions A³, A⁴ to form ways or supports for the sheet holding and supporting devices, and may be arranged upon an inclination so as to support the said devices in an inclined position. The extension A⁴ does not extend entirely across the machine but is cut away or shortened at the ends to admit certain devices hereinafter described.

A⁵, Fig. 2, is a plate of directions that may be secured to the frame work as upon one of the side frames A.

The sheet holding and supporting devices.—These devices are designed to hold a series of sheets on edge, preferably in a position inclined slightly forward and to permit the sheets to be successively withdrawn from the front of the pack by the separating and withdrawing devices. In the drawings I have shown the preferable construction of these sheet holding devices; but it will be readily understood that these devices may be modified and varied in construction without in any way affecting the other portions of my invention.

B, C are respectively left and right hand base pieces, provided on their lower faces with guides B', B² and C', C² adapted to rest on the ways A³, A⁴ and to permit the pieces to be moved laterally to and from one another independently on the said ways B, C when desired for purpose of adjustment. The rear guides B', C' are provided with lips B³, C³ which overhang the edge of the ways A³ to retain the base pieces B and C in position vertically.

B⁴, C⁴ are side cheeks carried by the base pieces B, C respectively and forming the supports for the sides of the sheets.

B⁵, C⁵ are slightly upturned lips along the lower edge of the pieces B, C, forming a slight obstruction to the passage of the lower edge of a sheet from the base pieces of the holder.

B⁶, C⁶ are small lugs or projections extending inwardly from the front of the side cheeks a slight distance above the lips B⁵, C⁵, on the base pieces B, C, forming slight obstructions to the passage from the holder of the sides of the sheet near its lower edge.

B⁷, C⁷ are internally threaded tubular bosses carried on the bottoms of the base pieces B, C, respectively. These threaded bosses respectively receive screws B⁸, C⁸, which are journaled in suitable bearings B⁹, C⁹, in the side frames A, and are provided on their ends with hand-wheels B¹⁰, C¹⁰. The screws B⁸, C⁸, may be held against longitudinal movement in their bearings by collars B¹¹, C¹¹, and by the hubs of the hand wheels. It is apparent that by turning either screw B⁸, or C⁸, the corresponding base B, or C, with its side cheek will be moved laterally. It will thus be observed, that these parts are laterally adjustable independently and may be moved into any position desired. In this way the holder may be made wide or narrow to suit the width of the sheets to be held and the central line of the sheets may be brought into any position with regard to the central line of the machine.

The front of the holder may consist of any suitable support arranged at the proper inclination to the base pieces B, C, with its lower edge sufficiently distant from the front edge of the base pieces B, C, to permit the sheets to be separated from the pack and removed.

In the drawings I have shown the front of the holder inclining forward and arranged at an acute angle to the plane of the base

pieces, as I consider this the best manner in which to support the sheets, but this arrangement may of course be varied.

I prefer to construct the front of the holder in the manner shown on the drawings. As shown it consists of alternately arranged slats D⁴, and idler rollers D, with the peripheries of the rollers projecting slightly beyond the faces of the slats so as to act upon the face of the foremost sheet. The rollers may be provided at their ends with journals D', supported in bearings D², held in sockets in the side frames A, A, by caps D³. The slats D⁴ may be fastened at their ends to the side frames in any suitable manner. The idlers D, may be constructed of wood or other suitable material. I prefer however to construct them of metal tubes covered with felt or other material which will act with more or less friction upon the paper. The rollers D, merely act to assist the withdrawing devices in removing the foremost sheet from the holder by reducing the friction that would exist between the front of the holder and the sheet. The slats arranged between the rollers act to keep the paper smooth and flat and to prevent a sheet buckling between any pair of rollers by the pressure of the superimposed sheets of the pack. The slats are therefore separately arranged with their faces as near the tangential plane to the peripheries of the rollers as is possible without interfering with the action of the rollers. When sheets of heavy paper are to be fed, however, the slats may be omitted as such paper is not liable to bend or buckle. In this case the rollers may be arranged closer together.

To prevent the forward sheets shifting laterally into the crack or space between the front of the holder and the front edges of the side cheeks B⁴, C⁴, the cheeks may be provided with tongues B⁴, C⁴, projecting forward into grooves D⁵ in the front of the holder, as into some of the slats D⁴.

To hold the pack of sheets into place with the foremost sheet in contact with the front of the holder, I prefer to employ followers E, E, resting on the base pieces B, C. These followers E, E, may be provided on their lower faces with tongues E' adapted to the grooves B³, and C³, in the upper faces of the pieces B, and C, respectively, and acting to guide the followers as they gravitate downward upon the base pieces. As shown in the drawings the followers E, are constructed of metal base pieces turned upward at their front edges, and supporting upwardly extending pieces E², base pieces E³, and triangular brace pieces E⁴, between the pieces E², and E³, the pieces E², E³, and E⁴, being preferably constructed of wood.

While I have shown two separate followers, E, E, one carried by each member of the holder, it is apparent that a single follower may be employed if desired, but I prefer to employ two separate followers as shown, because the followers being carried by the base

pieces B, C, will be adjusted with those pieces, and, therefore, need not be changed for different sizes of sheets. I have shown followers of considerable height, suitable for long sheets. If desired shorter followers may be employed for shorter sheets.

The followers are not absolutely necessary for the purpose of properly supporting and feeding the sheets, and, if the holder be kept sufficiently full so that the weight of the sheets alone will be sufficient to press the pack forward, they may be omitted. I prefer to use them, however, as they will permit a greater number of sheets to be withdrawn before replenishment of the pack becomes necessary. To replenish the pack additional sheets are added from time to time to the back of the pack. When the followers are employed this is done by drawing back the followers and introducing the sheets between them and the back of the pack. If the pack be replenished while there remain sufficient sheets to press the front sheets forward so that the separating and withdrawing devices may operate upon them, this may be done without stopping the operation of the machine.

The sheet separating mechanism.—This mechanism consists of devices for separating the foremost sheet of the pack from the others and for withdrawing from the holder the sheet thus separated. For this purpose of separating the sheet, I employ a suction-nozzle adapted to lift a corner or flap of the foremost sheet, and a separating blade adapted to pass under the corner or flap, thus raised and thence along the edge of the sheet and separate it from the other sheets of the pack. In describing this apparatus, I shall refer more particularly to Figs. 5, 6, 7, 8, and 18.

F is a hollow suction nozzle pivoted to one of the sides of the holder, as to the base piece C, and adapted to oscillate upon its pivot to and from the corner or edge of the foremost sheet of the pack. This suction nozzle is preferably of the construction shown in Fig. 7. The nozzle F is provided with a lateral arm F' which extends in front of the sheet holder and is formed with the suction mouth F². The nozzle is so located that the mouth F², is in front of the lower corner of the foremost sheet on the holder. The mouth F², of the nozzle may be dished out to form a small edge or rim about the orifice.

F³ is a hollow extension to the nozzle adapted for attachment to the end of a flexible tube or pipe F⁴, which leads to the source of suction. The nozzle may be pivoted to the base C by means of boss F⁶, which receives a stud F⁷, carried by a stud plate F⁸, secured to the base piece C. The nozzle F is thus free to oscillate on the stud F⁷, to move its suction mouth F², to and from the sheet holder. As the suction nozzle F is carried by the base piece C, it is apparent that it moves with the said base piece whenever the same is adjusted, and thus will always be in proper position to

act upon the corner of the foremost sheet contained in the holder. The pivot stud F^7 of the nozzle should be located as nearly as possible in line with the foremost sheet in the holder, in order to give the mouth of the suction nozzle such a motion as will bend up the corner of the foremost sheet without drawing the sheet downward.

To oscillate the nozzle F , suitable power devices may be employed connected with the nozzle, as through ears F^5 , thereon. For this purpose I prefer to employ a pneumatic device to which I shall refer more fully hereinafter.

Suction is created intermittently in the nozzle F by means of suitable suction devices, which are hereinafter fully described. When the nozzle F is rocked so that its suction mouth F^2 , is brought in contact with the lower corner of the foremost sheet in the holder, suction is created in the nozzle and is maintained therein while the nozzle rocks back, carrying with it the corner or flap of the foremost sheet which adheres to its suction mouth and is therefore separated from the other sheets in the pack. The separating blade H^7 , then passes under the raised flap and the suction in the nozzle F is relieved, so that the flap or corner of the sheet is released.

I shall now refer to the separating blade H^7 , and its method of operation.

H is a shaft journaled below the sheet holder in suitable bearings H' carried by the side frames A . Carried by the shaft H are two or more rocker arms H^2 .

H^7 is the separator blade carried on the outer ends of the rocker arms H^2 . In the drawings I have shown the rocker arms H^2 connected by a tie piece H^6 , fastened to ears H^5 , on the ends of the arms H^2 , and the blade H^7 , carried by the tie piece H^6 . The blade H^7 is provided with an inclined upper edge the higher portion of which is at the end adjacent to the separating nozzle F . The blade H^7 is so located that it occupies a normal position with its edge below the front edge of the sheet holder. When the blade H^7 rises, its edge passes above the lower edge of the sheet holder and immediately behind the suction nozzle F , so that its inclined edge passes first under the flap or corner of the foremost sheet which has been lifted by the nozzle. As the edge of the blade H^7 is inclined with the higher portion at the end adjacent to the separating nozzle F , it is apparent that this edge of the blade must pass under the raised flap or corner, whatever may be the adjustment of the holder. As the blade H^7 , continues to rise its edge passes gradually under the edge of the sheet and thus separates it positively from the other sheets of the pack.

The rocking of the arms H^2 to impart the rising and falling movement to the separator blade, may be imparted in any suitable manner. For this purpose I have shown cams V^2 , carried on a cam shaft V , and acting on the

rocking arms H^2 , through friction rollers H^4 , journaled in ears or extensions H^3 , of the arms H^2 .

More or less difficulty is experienced in practice in lifting the edge or flap of the single foremost sheet by reason of the tendency of two or more sheets to adhere at the edges so that two or even more sheets may be lifted simultaneously by the suction nozzle F . For the purpose of obviating this difficulty, I prefer to construct the sheet holder with its bottom at an acute angle to the front support, and also to employ the upturned lip C^5 , at the edge of the base of the holder and the clip or projection C^6 , on the side of the holder, as has been stated.

The effect of arranging the base of the holder at an acute angle to the front support, is to slightly offset each sheet with reference to the next, and this will naturally tend to separate the sheets at their edges.

The object of the lip C^5 , and the projection C^6 , is to scrape the edges of the paper as it is lifted by the suction nozzle, and thereby cause the sheets to separate if two adhere together. The inner side of the lip C^5 , may be slightly inclined and may be cut away on either side of the portion over which the mouth of the suction nozzle swings so as to admit the passage of air under the corner or flap of the sheet when it first commences to rise under the action of the nozzle. The face of the mouth of the nozzle may be slightly inclined or beveled, so that it will not make perfect contact with the face of the paper but will rest with the upper portion of its rim in contact while the lower portion is slightly removed as is shown in Fig. 18. It results from this that the suction through the nozzle will cause the paper to bend or pucker slightly as it is drawn against the mouth of the nozzle before the nozzle commences its outward movement; and this will have a further tendency to separate the sheets.

With the construction described the lifting of the edge of the single foremost sheet may safely be relied upon under ordinary conditions, but there are circumstances under which these devices would be insufficient. Thus if the corner of the foremost sheet were torn off, so that the suction nozzle came in contact with the corner of the second sheet, two sheets would of necessity be lifted. To further insure the positive separation of a single sheet at a time, even under the rare condition just suggested, I employ an auxiliary or assistant separating device, which is in all material respects a duplicate of the primary device described except that it is arranged to act upon the other end or corner of the sheet, so that it will be necessary, in order that two sheets may be carried simultaneously from the holder, for these two independent separating devices to act defectively at the same instant. Thus if the single separating device would operate to lift two sheets

simultaneously once in a thousand times, with the auxiliary or assistant separator, that would be liable to occur only once in a million times.

G is the suction nozzle of the assistant separator pivoted to the opposite side of the sheet holder, as to the base piece B, and constructed and operated in the same manner as the nozzle F.

I⁷ is the assistant separator blade, having an inclined edge, similar to the edge of the blade H⁷, except that its inclination is in the opposite direction. This blade I⁷ may be carried by a tie piece I⁶, fastened to ears I⁵ on the ends of rocker arms I² carried by the shaft H. The rocker arms I² may be rocked in a manner similar to the arms H² as by cams V³, on the shaft V, and the arms may be provided with anti-friction rollers I⁴ journaled in extension I³, and making contact with the cams V³.

The assistant or auxiliary separator blade I⁷, is located behind the blade H⁷, so that its line or arc of movement is nearer the edge of the sheet holder than that of the blade H⁷; and the two blades are so timed in their movements that they will not in any way interfere one with the other.

The lip B⁵, and clip B⁶, on the side of the holder by which the assistant separator nozzle G is carried, correspond with the similar parts C⁵, C⁶, already described and perform similar functions.

The two nozzles F and G operate simultaneously; but with the construction shown the separator blade I⁷, acts immediately in advance of the blade H⁷. Therefore if both nozzles lift the corner or flap of the same sheet both blades will pass under the edge of the same sheet. This will be the normal operation. If however, the nozzle F should for any reason, lift two sheets, the nozzle G lifting one, the blade I⁷ would pass under the lifted edge of the single sheet lifted by the nozzle G and, as its inclined edge traveled from G to F under that sheet, it would entirely separate it from the other sheet so that only the single sheet would be fed. If, on the other hand, the nozzle F should lift a single sheet and the nozzle G should lift two, the blade I⁷, passing under the two sheets would separate them both from the other sheets in the pack, but the blade H⁷, passing under the edge of the single sheet lifted by the nozzle F, would separate the two sheets one from the other. Thus it will be seen that with the auxiliary or assistant separator a failure to separate a single sheet from the others in the pack can occur only when both nozzles F and G simultaneously lift the corners of two sheets.

I⁸ is a lip on the outer side of the blade I⁷, which acts to support the edge of any sheet which may come between the two blades, as would occur in the last case mentioned, *i. e.*, when the nozzle F lifted one sheet and the nozzle G lifted two. In this case the outer sheet is separated by the blade H⁷, and is car-

ried out by the withdrawing devices, while the second sheet, which lies in front of the blade I⁷ and behind the blade H⁷ rests upon the lip or support I⁸ until, on the next operation of the nozzles F and G, it is lifted by them and the separator blade H⁷, passes under it.

The auxiliary or assistant separating nozzle and blade may be omitted in a machine to feed exclusively such sheets as do not tend to adhere one to another.

I shall now describe the withdrawing devices, by which the separated sheet is fully withdrawn from the holder, referring more particularly to Figs. 3, 5, 6, 11, 12 and 13.

The withdrawing mechanism.—J is a shaft supported in suitable bearings J' in the side frames A, and located below the front of the sheet holder and opposite to the nozzles F, G.

J⁵, J⁶, J⁶, are disks mounted on the shaft J, and may be provided with rubber facings or tires J'. These disks J⁵, J⁶, J⁶, rotate with the shaft J, and are so located that the outer face of the separator blade H⁷, when the same is raised, will make contact with them, thus pressing the edge of the separated sheet of paper which has been released by the suction nozzle or nozzles, against the rotating disks J⁵, J⁶, J⁶ and the disks, acting on the paper against the surface of the blade H⁷, will withdraw the sheet from the holder. To insure the proper pressure between the disks J⁵, J⁶, J⁶, and the surface of the blade H⁷, the shaft J which carries the disks may be journaled in spring pressed bearings.

In the drawings I have shown the bearings J' carried in horizontal guideways and acted upon by springs J¹⁹, retained by binding caps J²⁰. The shaft J may be held against longitudinal movement by collars J².

It is apparent that when the holding devices are adjusted to contain sheets of different sizes a corresponding adjustment of the withdrawing devices J⁵, J⁶, J⁶, is necessary. For this purpose I prefer to employ the construction shown, in which the withdrawing disks are adjusted by the adjustment of the holder.

The disks J⁵, J⁶, J⁶, are free to move longitudinally on the shaft J, while revolving with it. For this purpose the hubs J⁸, of the disks may be keyed to the shaft by keys J⁹, fitting a longitudinal key way J⁴, in the shaft.

J¹⁰, J¹¹, are coil springs surrounding the shaft and interposed between the outer disks J⁶, J⁶, and the intermediate disk J⁵, and adapted to press the disks apart.

J¹², J¹², are sleeves on the shaft J, at each end exterior to the disks J⁶, J⁶, and adapted to bear against them. These sleeves J¹², J¹², are movable longitudinally upon the shaft J and constitute adjusting sleeves, as by them the disks J⁵, J⁶, J⁶, are adjusted. These sleeves J¹², J¹², are cut away or recessed, as at J¹³, so as not to obstruct the movement of the suction nozzles which must obviously have a movement sufficient to permit the paper when re-

leased by them to touch the peripheries of the disks J^5 , J^6 , J^6 .

J^{14} , J^{14} , are recesses in the top of the adjusting sleeve J^{12} , J^{12} , which receive the toe pieces F^9 , G^9 , carried by the respective members of the sheet holder, as by the side cheeks B^4 , C^4 . It is obvious that whenever either member of the sheet holder is moved the sleeves J^{12} , J^{12} , will be correspondingly moved through the pieces F^9 , G^9 , and these sleeves acting in conjunction with the springs J^{10} , J^{11} , on the disks J^6 , J^6 , will move them correspondingly. As the intermediate disk J^5 , is free to slide upon the shaft J , and is acted upon by the springs J^{10} , J^{11} , on either side, it is apparent that the pressure of the springs on each side will always become equalized, thus causing the intermediate disk J^5 , to always assume a position midway between the two outer disks J^6 , whether the sheets are being fed on the center line of the machine or on either side thereof. When either sleeve J^{12} , is moved outwardly the springs J^{10} , J^{11} , move the adjacent disk J^6 , outwardly to a corresponding extent; but, whatever the movement may be, the disk J^5 will always come to a substantially central position between the two outer disks J^6 , J^6 . Instead of the compound springs J^{10} , J^{11} , shown, a single spring of suitable tension may be employed. In Fig. 11 the disks are shown in the positions they would ordinarily occupy in feeding wide sheets, while in Fig. 12 they are shown adjusted for narrow sheets.

To hold the sleeves J^{12} , from turning on the shaft J , and by so turning interfering with the action of the suction nozzles the toe pieces F^9 , G^9 , may be provided with projections F^{10} , G^{10} , respectively adapted to sockets in the top of the sleeves. (See Fig. 18.) These projections and sockets may be rounded so as to not interfere with the slight longitudinal movement that may be imparted to the shaft J , by the springs J^{19} .

The shaft J may be driven in any suitable manner, as by a gear J^{15} . I prefer, however, to impart to the shaft J , at first a yielding movement, and to gradually increase that movement up to the full driving speed, so that at the moment the disks J^5 , J^6 , J^6 , impinge upon the sheet they will have a low speed of rotation and there will be no liability to tear or strain the paper. For this purpose, I mount the driving gear J^{15} loosely upon the shaft J and connect it with the shaft by a spring J^{18} . In Fig. 11 I have shown this construction, with the spring J^{18} secured at one end to the hub J^{17} or to the web J^{16} of the gear J^{15} and at the other end to a collar J^3 fast on the shaft J .

J^3 is a key carried by the shaft J , and extending into the hub J^{17} , which is partly cut away or recessed, as for a quarter of its circumference, so that the gear wheel, may drive the shaft J , solely through the spring J^{18} , until the end of the recessed or cut away portion of its bearing is reached, when it will act through the key J^3 , to positively drive the shaft J . This construction is clearly shown

in Fig. 23 where J^{21} is the recess for the key in the hub J^{17} . When the resistance to turning of the shaft J created by the frictional action of the frictional disks J^5 , J^6 , J^6 on that shaft has become sufficient to overcome the tension of the spring J^{18} to such an extent that the gear J^{15} has moved around the shaft until the side bearing J^{22} of the recess J^{21} of the hub of the gear has come to a bearing on the key J^3 then the shaft and the disks carried by it will be positively driven.

In Fig. 11 the outer rim of the gear J^{15} is shown broken away exposing the hub and a part of the web of the gear.

K^3 , L^3 , are feeding rollers carried on suitable shafts K , L , and located below the disks J^5 , J^6 , J^6 . The feeding rollers K^3 , L^3 , are adapted to receive the sheets as they are partially withdrawn from the holder by the disks J^5 , J^6 , J^6 , and carry them down and feed them to the carrier or other devices. These feeding rollers may be provided with tires K^4 , L^4 , of rubber or other suitable adhesive material. The shaft of one of the sets of rollers, as L^3 , may be journaled in spring pressed bearings L' , acted upon by springs L^5 , and retained by suitable caps. By this means the rollers K^3 and L^3 , may be pressed in frictional contact with yielding pressure. One of the shafts of these feeding rollers as K , may be driven by a gear K^5 , and the other may be driven by the friction upon its rollers L^3 . Collars K^2 , L^2 secure the shafts laterally.

M is a guide located between the disks J^5 , J^6 , J^6 , and the feeding rollers K^3 , L^3 , supported by brackets M' on the side frames A .

M^2 is a second guide adjacent to the feeding rollers for guiding the sheets from the feeding rollers to the devices, such as the conveyor or the carrier, which are to receive them. The guide M^2 is shown supported at its ends by brackets M^3 , on the side frames A . The guides M and M^2 may be made of sheet metal and may be slightly curved to direct the edge of the paper.

I have described the holding devices and the separating and withdrawing mechanism as adapted for adjustment to suit varied sizes of sheets, but in cases where the machine is to be used upon sheets of a constant size, these features of adjustment may be omitted.

I shall now describe the carrying mechanism which I have shown for the purpose of carrying the separated and withdrawn sheets to such mechanism as may be employed to act upon them, *e. g.* printing presses, ruling machines, &c., referring more particularly to Figs. 1, 2, 3, 5, and 13.

The carrying devices and the overlapping mechanism: N and N' are rollers having their shafts N^2 , N^3 , journaled in suitable bearings N^4 in the side frames A , over which passes a series of endless bands or cords N^6 , forming an endless carrier arranged in position to receive the sheets from the feeding rollers L^3 , K^3 . The shaft of one of the rollers, as N , may be driven by a gear wheel N^7 , carried by

it and the other roller N' may be driven by the friction of the cords or bands N⁶.

N⁵ are collars to prevent endwise movement of the rollers.

5 As it is desirable in some cases to have the sheets overlap one another for a greater or less distance, as in ruling machines, I have provided devices for producing this overlapping, and these I will now describe.

10 O⁴ are a series of disks held, as by screwed hubs O⁵, upon a shaft O, located between the shafts N², and N³, so that the peripheries of the disk O⁴, will project slightly above the plane of the carrier N⁶, and each disk is preferably located in a central position between a pair of bands or cords. The shaft O which carries these disks O⁴, is supported in vertically adjustable bearings O', which are shown attached to brackets O², carried by the frames 15 A, and adjustable horizontally thereon.

O³ are set collars to maintain the lateral position of the shaft O. The shaft O is driven in any suitable manner, preferably from the shaft N, by means of a belt O¹¹, passing about 20 pulleys O⁶ O⁷, fast on the shafts O, and N², respectively. To maintain the tension on the belt or cord O¹¹, when the shaft O is adjusted, I prefer to pass the belt O¹¹, about an idler O⁸, on the shaft N³, and thence around 25 an idler O⁹, journaled on a bracket O¹⁰, carried by one of the brackets O². As the pulley O⁹ is moved with any adjustment of the shaft O, a substantially uniform driving tension is maintained on the belt O¹¹.

35 For the purpose of causing the successive sheets to overlap, the carrier N⁶, is driven at a slower speed than the sheet withdrawing devices so that the front edge of each sheet is pushed forward by the withdrawing devices upon the carrier faster than the rear 40 edge of the previous sheet is removed. The front edge of each sheet is thus laid over the rear edge of the preceding sheet. It will sometimes happen, however, that the front edge may catch against the rear edge of the 45 previous sheet or may slip under it, and it is to correct this defect that I employ the overlapping disks O⁴. These disks are so arranged that as the sheets are carried along by the 50 conveyer they will pass over the slightly projecting peripheries of the disks O⁴, and at the moment the rearmost edge of any sheet passes from the disk and drops upon the bands N⁶ from the slightly elevated position 55 to which it has been raised by the disks, the front edge of the next sheet will be carried over the disks and will thus be caused to overlap the edge of the preceding sheet. The shaft O, should therefore be adjusted longitudinally so as to bring the disks O⁴, into position to act upon the sheet at the moment the overlapping will take place. In Fig. 5, the full lined circle O⁴, shows the position of the disks when adjusted for overlapping long 65 sheets, and the dotted circle O⁴, the position of the disks when adjusted for overlapping short sheets. When the feeding apparatus

is to be used in cases where overlapping of the sheets is not desired, the overlapping disks O⁴ may be omitted. I prefer, however, 70 to employ them on the machine with provision for adjustment whereby they may at any time be thrown out of action. For this purpose I prefer to make the bearings O' of the shaft O, capable of vertical adjustment 75 in the brackets O², so that by lowering the shaft O, the peripheries of the disks O⁴, may be brought below the plane of the carrier N⁶.

By the driving connections hereinafter described the relative speeds of the withdrawing and feeding devices and of the carriers may be regulated so that any desired extent or degree of overlapping may be obtained.

Instead of disks O⁴, the overlapping of the sheets may be accomplished by projections 85 or fingers extending above the plane of the carrier, the effect of the devices being substantially the same except that in the case of the disks their rotation assists in carrying the sheets and there is no liability of retardation. 90

I shall now refer to the pneumatic devices, which I employ for the purpose of creating intermittent suction in the separating nozzles, and also for the purpose of oscillating them, referring more particularly to Figs. 2, 95 4, 6, 9, 10, 14, 15, 16, 17, 18 and 24.

The pneumatic devices.—P is a suction pump in which suction is created by the usual 100 valved piston operated by a piston rod driven in any suitable manner, as by the pitman W⁷, operated by a crank W⁶, on a shaft W.

Q is a vacuum chamber from which the vacuum pump P sucks.

The chamber Q may be suitably supported 105 by the frame A, and should be of substantial size, so that a continuous and uniform partial vacuum may be retained within it by the suction of the pump P. The chamber Q, may be provided with a relief valve Q². The 110 casing of the pump P may be screwed into or secured to the walls of the chamber Q in such a manner that the sucking orifice of the pump shall communicate directly with the cavity of the chamber. By this arrangement 115 no pipe or connections are required between the sucking orifice of the pump and the chamber, and all leakage and consequent destruction of vacuum incident to such connections is avoided. (See dotted lines in Fig. 2.) This 120 chamber is connected with the suction nozzles F, and G, by suitable pipes Q³, in which are located valves to control the suction. The suction pipe or tube Q³ leading from the chamber Q, is connected by a branch pipe or 125 tube U⁴, with a valve U, supported upon the rear of the frame work of the machine. In the drawings I have shown the valve carried by a plate T⁴. The valve U is also connected through a tube or T U³, with the tubes F⁴, and 130 G⁴, which lead to the nozzles F, and G, respectively.

U' is a three way valve plug within the shell or case of the valve U, provided with a stem

U², passing through the bearing U³, in the valve shell. In the valve case are orifices communicating with the tubes U⁴, and U⁵, and also an orifice U⁹, to the external air. When the valve plug is turned to the position shown in Fig. 17, communication is opened from the suction chamber Q, through the pipes Q³, U⁴, to the pipe U⁵, and thence through the pipes F⁴, G⁴, to the suction nozzles F, and G. When the valve plug is turned into the position shown in Fig. 16 communication between the pipes U⁴, U⁵, is closed, and the outlet U⁹, is opened to the pipe U⁵, thereby relieving the vacuum in the nozzles F and G.

U⁶ is an arm on the end of the valve stem U², connected by a rod U⁷, with one end of a lever U⁸, which is fulcrumed as at U¹¹, to a bracket U¹², and is rocked by a cam V⁵, on the cam shaft V. On the end of the lever U⁸, may be carried an anti-friction roller U¹⁰.

U¹³ is a spring to normally draw the operative end of the lever U⁸ upward. It is shown connected with the end of the arm U⁶. By these devices the suction in the nozzles F and G, is alternately created and relieved.

I shall now refer particularly to the pneumatic devices which I prefer to employ for the purpose of rocking the nozzles F, and G. It is to be understood, however, that these pneumatic devices may be omitted and other driving connections may be substituted. These devices are shown particularly in Figs. 6, 13 and 24 and the two devices which rock, one the nozzle F and the other the nozzle G, are alike, each as the other in construction and operation except that the parts are right and left handed to better adapt them to their positions on opposite sides of the machine.

R and S are cylinders respectively carried by the side members of the sheet holder, as by the ears R', S', and are provided with pistons R⁴, S⁴ having piston rods R⁵, S⁵ which are connected with the nozzles F and G as to the ears F⁵, G⁵, thereon. The rear closed ends of the cylinders R and S, are provided with orifices R³, S³, respectively, which are connected by pipes R³, S³, with the source of suction in a manner similar to the pipes F⁴, G⁴. B¹², C¹², are curved shoe pieces arranged at

the rear of the holding devices for supporting the flexible tubes F⁴, R³ and G⁴, S³, respectively at the points where they are bent over the holder to prevent the pipes from closing at the ends.

T⁵ is a T piece connecting the pipes R³, S³, with the three way valve T.

T⁴ is a branch pipe connecting the three way valve T, with the pipe Q³, which leads to the suction chamber Q.

The construction and mode of operation of the valve T are identical with the construction and mode of operation of the similar valve U, and therefore need not be referred to in detail.

T⁶ is the arm carried by the stem of the valve plug of the valve T, and connected by the connection T⁷, with the lever T⁸, the free

end of which is operated by a cam V⁴, on the shaft V. The lever T⁸ is fulcrumed as at T¹¹ to a bracket T¹². The cam V⁴ which operates the valve T and controls the rocking of the nozzles F and G, operates in advance of the cam V⁵, which controls the valve U.

T¹⁰ is an anti-friction roller in the end of the lever T⁸.

R⁶ and S⁶, are springs located within the cylinders R and S, behind the pistons R⁴, S⁴, therein, and having a tension sufficient to normally move the pistons forward. This forward movement of the pistons is limited by stops R⁷, S⁷, within the cylinder. (See dotted lines in Fig. 6.) When the valve T is turned to open communication between the pipes T⁴, T⁵, a partial vacuum is created in the cylinders R and S, behind the pistons and the pressure of the external atmosphere upon the pistons forces them inward and compresses the springs. The nozzles F and G, are thus moved into contact with a sheet on the sheet holder in the manner described. When the valve is turned to close the connection between the pipes T⁴ and T⁵, and to open the pipe T⁵, to the outlet to external air, the air rushes into the cylinder in the rear of the pistons and the springs then push the pistons forward, thus moving the nozzles F and G forward. No stops are necessary to limit the inward movement of the pistons, as that movement is limited by the contact of the nozzles with the sheets in the holder.

The driving mechanism.—I shall now describe the driving mechanism, which I prefer to employ for the purpose of driving the various operative parts of the machine, referring more particularly to Figs. 2, 3, 4, 5, and 19 to 22. In addition to the simple driving of the machine it is my object to provide the driving mechanism with features of adjustment whereby the interval between successive sheets may be adjusted so that the sheets may be fed at a greater or less distance apart or may be caused to overlap, or a uniform intervening distance or overlapping extent may be maintained when the size of the sheets is changed.

It is apparent that the separating devices cannot be operated to separate a sheet from the pack until the withdrawing devices have completely withdrawn the previously separated sheet from the holding devices, and as an interval of time is consumed by the separating devices in separating the sheet from the pack while the withdrawing devices are still acting upon the previously withdrawn sheet, there will be of necessity a substantial space between the adjacent ends of successive sheets, as they are delivered by the withdrawing devices. It is usually desirable that this intervening space should be as short as possible.

In cases where it is desired to feed a uniform number of sheets per minute without regard to length of the sheets, as in printing presses and folding machines, the features of

adjustability for varying the driving speeds are not required. In such cases the separating and withdrawing devices are adjusted to suit the longest sheets that would be used in the machine so that there will be the shortest intervening space between the longest sheets. The cam shaft which controls the operations of the separating devices has, under this condition of feeding, a speed of revolution equal to that of the number of sheets to be delivered per minute, and the speed of the withdrawing rollers is so timed that the said rollers will completely withdraw the longest sheet during the time of one revolution of the cam shaft. Consequently no adjustment of speeds will be required when the machine is used with shorter sheets. The only difference will be that with the shorter sheets the space between successive sheets will be greater.

In machines in which the sheets are to be fed with their edges overlapping or very close together, as in ruling machines or where the same space is required between short sheets that is required between long ones, or where with a machine employing sheets of a constant length it is desired for any cause to change the intervening space between successive sheets, or the extent of overlapping, it becomes necessary to make certain adjustments in the driving devices. There may be several methods of adjustment for producing these results but I prefer to employ that which I have shown. It is evident that when feeding sheets of the same length without change in the relation of the rear end of one sheet to the forward end of the next a definite number of sheets will always be fed in corresponding intervals of time. If the length of sheet should be changed without a change being made in the relation of the ends of successive sheets or if the relation of the ends of the sheets should be changed, while the length of the sheets remains the same, or if both the length of the sheets and the relation of the ends of the successive sheets should be simultaneously changed without these changes being the same in degree but opposite in effect, a change will also be required in the number of sheets supplied per minute. Any adjustment which will properly vary the rate in which the sheets are supplied will serve the desired purpose. Thus the separating and withdrawing devices may have positive driving connection adjusted, as previously stated, so that there shall be the shortest space between the longest sheet, and these devices may have their speed adjusted as to the speed of the conveying apron; or the conveying apron and withdrawing devices may have positive driving connections, adjusted with the speed of the withdrawing devices the greatest that will be required for any style of feeding, and the speed of the separating devices only may be adjusted. In either of these instances the withdrawing devices would have an unnecessary speed when feed-

ing short sheets. It is evident that the speed of the separating device alone determines the rapidity of the feeding of the sheets. When, therefore, the separating devices have been adjusted to supply sheets with the proper rapidity for any desired feeding, the withdrawing devices must be adjusted so as to remove the sheets and place them upon the conveyer without any unnecessary speed in these devices at any time. In the adjustment that I have adopted, I contrive to withdraw the sheets in the slowest and gentlest manner possible, whatever their length may be, or the manner in which they are fed as to the relation to the adjacent ends of successive sheets.

Since there must always be a certain space between the ends of adjacent sheets as they are delivered from the withdrawing devices, as previously stated, it follows that whenever it is desired to close or diminish that space or to cause the ends of the sheets to overlap, it is necessary that the feed rollers shall run fast enough to push the sheets faster than they are carried upon the conveyer so that the sheet between the feed rollers will overtake or overlap the previous sheet on the carriers.

In adjusting the speeds of the separating and withdrawing devices with the change in the length of sheets, I first so adjust the speed of the cam shaft which operates the separating devices relatively to the speed of the withdrawing devices that the shortest intervening space will be maintained between successive sheets whether they are long or short, and then I change the speed of the withdrawing and separating devices taken together relatively to the conveyer, so that they will operate slower with long sheets and faster with short sheets. Thus the feeding of long sheets to the apron is retarded, while the feeding of short sheets is accelerated, and a constant distance between or extent of overlapping of the sheets is maintained, whether they be long or short.

In cases where the machine is operated constantly on sheets of uniform length and it is desired to vary the width of the spaces between successive sheets or to feed the sheets close together, or with their edges overlapping, I similarly adjust the feeding devices relatively to the conveyer and I so connect the devices with the mechanism for driving the cam shaft that any change made in the speed of the feed rolls will correspondingly change the speed of the cam shaft, as any change in the spacing or overlapping of the sheets upon the conveyer would, for the proper operation of the apparatus, require a change in the speed with which the sheets are supplied.

I shall now describe particularly my improvements in the driving mechanism.

V is the cam shaft upon which are secured the cams V^2 and V^3 , for operating the separator blades H' and I' , in the manner heretofore described, and also the cams V^4 and V^5 , for operating the suction controlling valves

T and U. The shaft V is journaled in suitable bearings V'. On the end of the shaft V, is a friction disk V⁶, which is provided preferably with a rubber tire or friction surface V⁷, having a portion cut away as at V⁸.

V¹⁰ is a projection carried by the disk V⁶, projecting from its surface radially toward but not up to the periphery or tire V⁷. This projection V¹⁰, may be made integral with the disk V⁶, or may be carried by a plate V⁹, secured to the face of the disk.

V¹³ is a collar carried on the hub of one of the bearings v', and free to slide longitudinally thereon, being held thereto by a key or spline V¹⁵. This collar V¹³, is located immediately in the rear of the disk V⁶, and is pressed into contact with the rear face of the disk by a spring V¹⁶, arranged between the collar V¹³, and a shoulder V¹⁴, on the hub.

V¹⁷ is a friction pad carried by the outer face of the collar V¹³, and V¹¹ is a similar friction pad carried by the opposed face of the disk V⁶. The revolution of the shaft is stopped by the friction between these two pads V¹¹ and V¹⁷, when they are pressed into contact.

V¹⁹ is a friction roller carried upon a radial stud or projection V¹⁸ on the collar V¹³, and adapted, as the disk V⁶ rotates, to run in contact with its inner face. Upon this inner face of the disk V⁶, is a depression or recess V¹², adapted at a certain portion of the revolution of the disk V⁶, to receive the friction roller V¹⁹. The friction roller V¹⁹, is so arranged that when it is running upon the face of the disk V⁶, it will push the collar V¹³, away from the disk V⁶, so as to separate the friction pads V¹¹ and V¹⁷, and permit the shaft V to rotate freely until that portion of the revolution of the shaft is reached which brings the depression V¹², adjacent to the roller V¹⁹, when the roller and the collar are permitted to move forward under the action of the spring V¹⁶, thereby pressing the friction pads V¹¹ and V¹⁷, in contact and arresting the shaft V.

V²⁰ is an arm carried by the collar V¹³, and projecting outwardly across the face of the disk V⁶, and having upon its end an angular toe piece V²¹, projecting across the periphery of the disk.

W is the power shaft to which power may be applied in any suitable manner, as from the machine to which the feeding apparatus is applied. This shaft W is journaled in the lower portion of the machine in suitable bearings W', in the side frames A.

W² is a cone mounted on the shaft W, and rotating with it.

X is a shaft below the cam shaft V, journaled in suitable bearings X', located in guideways or slides in the plates X² and carried by the side frames A.

X⁴, are adjusting screws carried by caps X³, and bearing upon the bearings X', by means of which the shaft X may be adjusted to and from the shaft V.

X⁵ is a cone mounted on the shaft X, and

rotating with it. The cones X⁵ and W² are oppositely arranged on their respective shafts X and W.

W³ is a driving belt passing around the cones X⁵ and W², by means of which the cone X⁵ and its shaft X, is driven from the cone W² and shaft W. By shifting the belt laterally upon the cones, it is apparent that the speed of the shaft X, with reference to the speed of the shaft W, may be increased or diminished.

X⁶ is a friction disk fast upon the shaft X, and making frictional contact with the periphery of the friction disk V⁶, on the shaft V, for the purpose of driving the disk V⁶, and its shaft V. The disk X⁶, like the disk V⁶, may be provided with a tire X⁷, of rubber or other suitable frictional material.

The peripheries of the disks V⁶ and X⁶, may be roughened to increase the frictional contact. By the adjustment of the shaft X, through the adjusting screws X⁴, the pressure of the periphery of the disk X⁶, upon that of the disk V⁶ may be regulated.

X⁸ is a small cone pulley carried by the disk X⁶.

X¹⁰ is an oppositely arranged cone mounted loosely on a stud X¹¹, carried by the side of one of the frames A, as by a stud plate X¹².

X⁹ is a belt passing about the cones X⁸ and X¹⁰, by means of which the latter cone is driven by the former. It is apparent that by the adjustment of the belt X⁹, on the cones X⁸, X¹⁰, the speed of the latter cone with reference to the former may be regulated. The cones X⁸, X¹⁰, are preferably corrugated as shown so that a small round belt X⁹, may be employed.

X¹³ is a disk carried by the cone X¹⁰, and provided with a projection X¹⁴, extending from its periphery, which is notched as at X¹⁵, adjacent to and immediately in front of the projection X¹⁴. The disk X¹³ is located immediately adjacent to the disk V⁶, and the projection X¹⁴, thereof is adapted to strike the projection V¹⁰, of the disk V⁶. The outer end of the projection V¹⁰, is curved so as to conform to the periphery of the disk X¹³, against which it rests when the shaft V is at rest. The disk X¹³ is also provided with a lug or projection X¹⁶ on its inner face, which is adapted to strike the end V²¹ of the piece V²⁰.

I shall now describe the operation of these parts. The shaft X is driven by the power shaft W, through the cones W², X⁵, and the belt X⁹ is constantly rotating. The disks X⁶, X¹³, are, therefore, in constant motion, the latter being driven from the shaft X, by the cones X⁸, X¹⁰, and the belt X⁹. The disk V⁶ and shaft V, are driven only when the peripheries of the disks V⁶ and X⁶ are in contact, so that whenever the cutaway portion V⁸, of the disk V⁶ is adjacent to the periphery of the disk X⁶, the peripheries of the disks are not in contact and the disk V⁶, and its shaft V are not driven. At this instant the projection V¹⁰ is adjacent to the periphery of the

disk X^{13} , and the disk X^6 , and V^6 , are shown in this relation in Fig. 19. At this time the friction collar V^{13} is pressed forward by the spring V^{16} , and the momentum of the disk V^6 , has been positively arrested by the friction pads V^{11} , V^{17} . As the disk X^{13} continues to rotate its lugs X^{16} , strikes the end V^{21} , of the arm V^{20} , and thereby pushes the collar V^{13} rearwardly and separates the pads V^{11} , V^{17} , leaving the disk V^6 , and its shaft V free to rotate. Immediately that the collar V^{13} , has operated to release the disk V^6 , the lug X^{14} , of the disk X^{13} , strikes the projection V^{10} of the disk V^6 . As the projection V^{10} at this moment reaches the notch X^{15} in the periphery of the disk X^{13} , the disk V^6 , is free to move with the disk X^{13} , until the cut away portion V^8 , is moved away from the periphery of the disk X^6 , and as the peripheries V^7 and X^7 , then come in contact the disk V^6 , and the shaft V , are driven by the disk X^6 , until the cut away portion V^8 , is again brought adjacent to the periphery of the disk X^6 . As the movement of the disk V^6 , is commenced, the recess V^{12} , on the face thereof is carried away from the roller V^{19} , of the collar V^{13} , and as this roller then rests against the face of the periphery of the disk, the collar V^{13} is held out of contact with the disk V^6 , until the recess V^{12} again reaches a position adjacent to the roller V^{19} , which occurs at the instant that the cut away portion V^8 , of the periphery of the disk V^6 , comes adjacent to the periphery of the disk X^6 . The collar is then released and under the action of the spring V^{16} is pushed forward, bringing the friction pads V^{11} , V^{17} , in contact and thus overcoming the momentum of the disk V^6 , and preventing that momentum from carrying the disk V^6 , so far that the cut away portion V^8 , of the periphery thereof would be moved away from the disk X^6 , so that the friction faces V^7 , X^7 , would again come in contact without any cessation of rotation of the disk V^6 , and its shaft, which would be liable to occur if no means are employed for overcoming their momentum; but in the event of the possible slipping of the friction pads after contact, the disk V^6 will be positively stopped by contact of the projection V^{10} , with the periphery of the disk X^{13} . By this mechanism an intermittent motion is imparted to the disk V^6 , and its shaft V , and thence to the devices operated by the shaft, *i. e.*, the separating devices. The shaft V being driven from the shaft X , through the medium of the friction disks V^6 , X^6 , (which are of the same diameter) will rotate at the same speed as the shaft X , but intermittently.

As a longer time is consumed by the withdrawing devices in withdrawing long sheets than in withdrawing short ones, it is apparent that if a uniform space is to be maintained between the sheets, a longer interval must elapse between the successive operations of the shaft V , when long sheets are being withdrawn than is necessary with short

sheets, *i. e.*, the interval should vary directly as the length of the sheets. This result I accomplish in the following manner: The diameter of the cone X^{10} , is larger than that of the cone X^8 , so that each groove on the cone X^{10} , has a larger diameter than the corresponding groove on the cone X^8 . Consequently the cone X^{10} , and its disk are always driven at a slower speed than the shaft X , with its disk X^6 . The projection V^{10} therefore, will always strike the disk X^{13} before the lug X^{14} , reaches a position opposite the shaft V . As the disk V^6 , after its motion has been arrested in the manner described, remains at rest until the lug X^{14} , acts upon the projection V^{10} , it is apparent that the interval between successive operations of the disk V^6 , and its shaft V , will depend upon the distance of the lug X^{14} , from the projection V^{10} , when the disk V^6 , reaches a state of rest. As this distance depends upon the speed of the disk X^{13} , with relation to the speed of the disk V^6 , it is obvious that by shifting the belt X^9 , upon the cones X^8 , X^{10} , so as to increase or diminish the speed of the cone X^{10} , which controls the disk X^{13} , the distance between the lug X^{14} and the projection V^{10} , and the resulting interval of time between the successive operations of the disk V^6 , and its shaft V , may be correspondingly increased or diminished.

Y is a threaded rod extending across the machine between the cones W^2 , X^5 , journaled at its ends in suitable bearings Y^2 .

Y^3 is a hand wheel on the end of the rod Y , for the purpose of turning it.

Y^4 is a set collar on the rod Y .

Y' is a second stationary guiding-rod extending across the machine parallel to the rod Y .

Y^5 is a spider casting having a threaded boss adapted to the threaded rod Y , and a second guide boss adapted to the guide rod Y' .

Y^7 , Y^8 , are arms carried by the spider Y^5 , as by bosses Y^6 thereon, and extending respectively toward the cones W^2 , X^5 . These arms are provided on their ends with eyes through which the cone belt W^3 is passed.

By turning the hand wheel Y^3 , and thus rotating the threaded rod Y , the spider Y^5 , with its belt carrying arms Y^7 , Y^8 , may be moved in either direction. The belt may thus be shifted to any position desired on the cones W^2 , X^5 . The movement of the spider Y^5 , and consequently of the belt W^3 , in either direction may be limited by stops Y^9 , Y^9 , on the guide rod Y' .

X^{17} is a gear wheel on the end of the shaft X , gearing with the gear K^5 , on the shaft K , of the feeding rollers K^3 . The gear J^{15} of the shaft J of the withdrawing rollers is geared with the gear K^5 . Thus the withdrawing and feeding devices may be driven from the shaft X .

The shaft N^2 of the conveyer N^6 , may be driven from a gear wheel W^4 , on the power

shaft W, through intermediate gears W⁵, transmitting power to a gear N⁷, on the shaft N².

The speed of the separating and withdrawing devices depends upon the speed of the shaft X. Consequently this speed is regulated by moving the belt W³, upon the cones W², X⁵. When the belt passes about the portion of the cone X⁵ of greatest diameter the speed is slowest and vice versa. The interval between the successive operations of the separating devices depends upon the speed of the disk X¹³, and consequently this speed is regulated by adjusting the belt X⁹, upon the cones X¹⁰, X⁸. When the belt passes about the portion of the cone X¹⁰, of greatest diameter the speed is slowest and vice versa. Thus by adjusting the belt X⁹ on the cones X¹⁰, X⁸, the intervals of rest of the separating devices may be varied directly as the length of the sheets. To enable these adjustments to be easily made, I prefer to divide the cone X⁵, into a series of divisions or spaces, as shown, by grooves or lines; and these spaces may be numbered from 1 to 9, or whatever the number of spaces may be, commencing with the larger end of the cone. The grooves in the cone X¹⁰ are correspondingly numbered, commencing with the large end of the cone. Thus the belts W³ and X⁹, when each is in its space or groove No. 1, are adjusted for the longest sheets of paper and so on as the length of the sheets decreases. The operator adjusts the belt W³ and X⁹ to those positions on their respective cones which correspond to the length of sheets being fed. To further simplify this operation, I prefer to attach to the machine the direction plate A⁵, by means of which the operator may instantly perceive what adjustments are required by the sheets which he has in hand. I have shown this plate adapted for a machine suited for feeding sheets between twenty-four and twelve inches in length with the successive sizes of sheets varying by one and one-half inches in length. In opposite columns are arranged the sheet lengths and the corresponding divisions on the cones. Thus for a sheet twenty-four inches long, the belts are to be adjusted to position No. 1, on the cones, and so on. In the drawings (Figs. 4 and 20) I have shown the belts W³, and X⁹, adjusted to position No. 5, which according to the plate of directions would be suited for sheets eighteen inches long. These adjustments are adapted for withdrawing the sheets and laying them upon the conveyer with their edges close together. To increase the spaces between the sheets it is only necessary to make the machine run slower, *i. e.*, to adjust the belt W³, toward the larger end of the cone X⁵. To make the sheets overlap, the machine must be made to run faster by adjusting the belt W³, toward the smaller end of the cone X⁵. The plate A⁵, may also contain these directions. They are shown upon the bottom of the plate in Fig. 2. If the sheets that are to be fed close together are of a size

between two sizes given in the plate of directions, the nearest size is selected and the belt is first adjusted to the corresponding position upon the cones, then if the size selected from the plate is actually longer than the real size of the sheet, the belt W³, is moved slightly toward the large end of the cone X⁵, and if it is shorter than the actual size the belt is moved toward the smaller end of the cone. Thus the machine may be adjusted to suit different sizes of sheets by simply turning the hand wheel Y³ and moving the belt X⁹. With the plate of directions A⁵ the operator is instructed how to adjust the belts for feeding sheets of any given size close together.

When the machine is to be used solely for such feeding as does not require any change in the rapidity with which the sheets are separated from the pack, these adjustable features in the driving devices are not required and the cam shaft may then be driven by suitable power transmitting connections with the machine to be fed, and the withdrawing and feeding devices from the cam shaft by suitable gearing.

It is desirable to provide a machine of this character with a stop motion controlled by the sheets which are being fed, so that any intermission or irregularity in the feeding of the sheets will automatically stop the machine. I shall now describe these devices:

The stop motion.—Z is a bracket carried by a forward extension of the frame A and provided with arms Z' projecting over the conveyer N⁶. The ends of the arms Z' are formed with knife edges Z².

Z⁴ is a horizontal tilting or rocking frame supported on the knife edges Z² and extending over the apron or conveyer N⁶. This frame Z⁴ may be held against lateral movement by lugs Z³ adjacent to the knife edges Z². The frame should be of light construction, and I prefer to construct it of sheet metal bent into shape shown in Figs. 3 and 13.

Z⁵ is a rod carried by ends of the frame Z⁴ and located approximately over the carrier N⁶ with its length disposed parallel to the direction in which the sheets move on the carrier.

Z⁷ are fingers adjustably carried by the rod Z⁵, as by the collar Z⁶ thereon, which may slide freely or turn on the rod.

Z⁸ are thumb screws for fastening the collars Z⁶ to the rod Z⁵ in any adjusted position.

When in operative position the fingers Z⁷ depend toward the carrier N⁶ and preferably have their forward ends bent as shown, in the direction of movement of sheets on the carrier. Normally the weight of the forward end of the frame Z⁴ is greater than that of the rear end so that its tendency is to drop forward. This tendency of the frame Z⁴ to rock upon its support Z² is overcome by the support afforded to the fingers Z⁷ by the sheets passing under them upon the conveyer N⁶, so that as long as a sheet of paper is under any

one of the fingers the tilting of the frame will be prevented. I have shown three fingers Z^7 in the drawings, one of which is turned up out of operative position (see Figs. 1 and 2).
 5 but this particular number need not always be used, as the number of fingers required will depend upon the manner in which the sheets are being fed. If the sheets are being fed with their edges close together or overlapping, so that there will be a continuous
 10 surface of paper traveling on the conveyer N^6 under proper conditions, it is apparent that a single finger Z^7 will be sufficient; but when the sheets are spaced, at least two fingers
 15 must be employed and the distance between these fingers must be at least slightly greater than the space between successive sheets, so that as soon as the rear edge of the one sheet passes from under the foremost finger
 20 the front edge of the next sheet passes under the rearmost finger, thus sustaining the frame Z^4 .

When sheets are being fed with their edges close together or overlapping, it is apparent
 25 that whenever a space occurs between successive sheets, due to any imperfection in the operation of the machine, the single sustaining finger Z^7 will fall when the space is reached, and the frame Z^4 will rock on its
 30 supports Z^3 . So also when sheets are being fed at a certain interval apart and the two fingers Z^7 are separated a distance somewhat greater than the space between the sheets, it is apparent that whenever for any cause
 35 the length of the intervening space becomes greater than the distance between the two fingers, both fingers will be unsupported when the increased space is reached and the frame Z^4 will rock.

40 Whenever the space between successive sheets exceeds the length of the sheets, it is necessary to employ a third finger Z^7 , as it is apparent that when the two extreme fingers are placed a distance apart slightly greater
 45 than the space between successive sheets, the rear edge of a sheet would have passed from under the rearmost finger before its forward edge would have passed under the foremost finger so that the two fingers would be without support and the frame would rock. A
 50 third finger located between the other two will, however, be supported by the sheet between the two extreme fingers, and will prevent the frame Z^4 from rocking, until a space is presented which exceeds the distance between the two extreme fingers.

The fingers Z^7 are so supported that they may be adjusted to suit the spacing of the sheets and any one may be turned up out of
 60 operative position as may be required.

Depending from the rear end of the frame Z^4 is a rod Z^9 , which may be vertically adjusted with reference to the frame Z^4 by the
 65 nuts Z^{10} .

Z^{11} is a balance weight on the rod Z^9 by which the balance of the rocking frame may be adjusted. The weight Z^{11} may be made

hollow to receive shot in the manner well known for the purpose of adjusting its weight.

Z^{13} is a stationary stop frame or bracket
 70 carried by the side frame A.

Z^{13} is a stop carried by the rod Z^9 below the stop frame Z^{13} . The balance weight Z^{11} and stops Z^{13} are adapted to respectively strike the frame Z^{13} when the frame Z^4 is tilted in
 75 one direction or the other and thus to limit its movements.

Z^{15} is a lever pivoted to the frame A, and connected at its lower end as by the rod Z^{18} , to the belt shifter clutch or other motion stop-
 80 ping device.

Z^{16} is a second lever pivoted to the frame A and connected with the lever Z^{15} by a connection Z^{17} , forming a toggle joint. The end of the rod Z^9 is provided with a hook Z^{14} which
 85 engages the lever Z^{16} and connection Z^{17} at their toggle joint. The lever Z^{15} , or rod Z^{18} , is connected by a spring Z^{19} with the frame A so that the parts are normally retained in the position shown in full lines in Fig. 1.
 90 When in this position the apparatus is operating. The tendency of this spring Z^{19} is to swing the lever Z^{15} and operate the rod Z^{18} and stop the machine. To accomplish this it is of course necessary to operate the toggle
 95 joint connection of the parts Z^{16} and Z^{17} . The upward bending of the joint is prevented by the fact that the joint is bent slightly below the direct line and downward bending is prevented by the hook Z^{14} .
 100

Whenever the frame Z^4 is tilted in the manner already described the rod Z^9 is lifted, and through its hook Z^{14} bends upward the joint of the parts Z^{16} and Z^{17} , so that the spring Z^{19} now being free to act, swings the lever Z^{15} and
 105 operates the motion stopping device through the rod Z^{18} . When thus operated the parts are brought into the position shown in dotted lines in Fig. 1.

The parts are restored to their former position by the act of returning the motion starting device into operation in the usual manner.
 110

I have not shown the motion stopping devices connected with the rod Z^{18} , as these may be any of the now well known appliances.
 115 These devices may operate upon the driving devices of the machine to which the sheet separating and feeding machine is applied so that upon the stoppage of that machine the sheet separating and feeding machine which
 120 is driven by it will also stop. If desired, of course, the motion stopping devices may act directly upon the driving devices of the sheet separating and feeding machine, as upon the shaft W.
 125

If desired the lever Z^{15} and connection Z^{17} , may be omitted and the rod Z^{18} may be extended and connected directly with the lever Z^{16} . I prefer the other construction however, as its operation is smoother and more sensitive.
 130

From the foregoing description of the machine its operation in separating and feeding sheets of paper will be readily understood.

A pack of sheets is placed in the holding device, which is adjusted by the hand wheels B¹⁰, C¹⁰, to suit the width of the sheets and the position with reference to the median line in which the sheets are to be fed. The followers E, E, are put in place. The belts W³ and X⁹ are adjusted upon the cones W², X⁵ and X⁸, X¹⁰, to suit the length of the sheets and the nature of the spacing or overlapping to be done. The machine is then started in operation. A partial vacuum is created in the chamber Q and when the shaft V is started in the manner heretofore described, the cam V⁴ rocks the lever T⁸ and operates the valve T to open the pipes R³, S³ to the suction chamber Q. The suction thus created in the pipes R³, S³ operates the pistons R⁴, S⁴ and through the piston rods R⁵, S⁵ rocks the nozzles F and G bringing their suction mouths in contact with the corners of the foremost sheet. The cam V⁵ then rocks the lever U⁸ and operates the valve U in a manner similar to the operation of the valve T. Suction is thus created in the nozzles F and G and the corners of the outermost sheet adhere to the suction mouths. The cam V⁴ then releases the lever T⁸ and the valve T is operated in the manner heretofore described to relieve the suction in the cylinders R and S and permit the springs therein to project the piston and thus rock the nozzles F and G forward. As the suction still exists in the nozzles F and G the corners of the sheet are drawn with them and thus become bent out or separated from the other sheets in the pile. The cam V³ then operates upon the rocker arms I² and lifts the assistant separator blade, the inclined edge of which passes under the corner of the sheet lifted by the assistant nozzle G, and then passes along the edge of the sheet and positively separates its entire edge from the other sheets. The cam V² then operates the main separator blade H⁷, the inclined edge of which passes first under the corner lifted by the nozzle F and thence along the edge, thus insuring the positive separation of a single sheet from the others in the pack. While the main separating blade H⁷ is thus operating the lever U⁸ and the valve U are operated to relieve the suction in the nozzles F and G and release the sheet. The separated sheet is pressed by the blade H⁷ against the withdrawing disks J⁵, J⁶, J⁶, by which it is partially withdrawn from the holder and fed to the feed rollers K³, L³. When the sheet is received by the rollers K³, L³ the cams V² and V³, permit the blades H⁷, I⁷ to fall and the sheet is wholly withdrawn by the feed rollers and placed upon the carrying bands, by which it is delivered to the machine which is to receive it. Upon the conveyor the overlapping of the sheets may be accomplished, if that is desired, in the manner described. When the first sheet is totally withdrawn in the manner first described the operations are repeated and the next sheet is separated and withdrawn.

It is apparent that the minor details of con-

struction shown are not material to my invention and may be varied in many ways without departing from it. Thus the feeding rollers K³, L³ for totally withdrawing the sheets, while desirable, are not absolutely necessary, and may be entirely dispensed with by simply making the cam which operates the blade H⁷ maintain the blade in an elevated position to press the sheet against the rollers J⁵, J⁶, J⁶, until the sheet has been wholly withdrawn. This construction is shown in Figs. 25 and 26. The use of the rolls K³, L³ is, however, preferable, for by their use the rapidity of feeding the sheets is increased, because after these rolls have taken hold of the sheet the separator blade may release its contact with the disks J⁵, J⁶, J⁶ and may descend without waiting for the sheet previously separated to be completely removed from the pack, to a position to separate another sheet; and the separation of the next sheet may commence the instant that the rear edge of the previous sheet has reached the bottom of the pack. In the device shown in Figs. 25 and 26 there would be an interval of time consumed by the dropping of the blades after the sheet was fully withdrawn before the next sheet could be separated.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a machine for feeding sheets successively from a pack, the combination of a support for the pack of sheets, a separating instrument or separator adapted to seize upon the surface of the outermost sheet in the pack at a point on that edge of the sheet which lies most advanced in the direction in which the sheet is to be moved, means to operate the separating instrument to bring an end of the instrument first into contact with and to cause it to seize upon the sheet then to cause that end of the instrument which has seized upon the sheet to move in a direction so related to the said most advanced edge of the sheet as to cause a portion of that edge to be bent outward without bending the entire edge of the sheet whereby a space shall intervene between the said bent out portion of the edge of the sheet and the subjacent sheets of the pack with a clear opening from said space forward in the direction in which the sheet is to be moved and then to cause the instrument to assume a state of rest thereby maintaining the outward bend in the edge of the sheet until a movable blade shall have passed under the bend and thereafter to cause the instrument to release its seizure upon the sheet, a movable blade having an edge inclined relatively to the forward edges of the sheets forming the pack, means to support and guide said blade so that when it moves its inclined edge will move in a plane adjacent to the surface of the pack, means to give a reciprocating movement to said blade whereby in its forward motion an advanced part of its inclined edge shall first enter

through said opening into said space under said bent out portion of the edge of the sheet while the said portion of the edge is maintained in an outwardly bent position by the separating instrument and thence to pass its inclined edge under all that portion of the edge of the sheet which was not bent outward by the separating instrument whereby the blade shall lie under the entire edge of the sheet and separate it from the pack, and devices to operate upon the separated edge and withdraw the sheet from the pack.

2. In a machine for feeding sheets successively from a pack, the combination of a support for the pack of sheets, a separating instrument or separator arranged adjacent to a side edge of the pack of sheets adapted to seize upon one corner of the outermost sheet on that edge which lies most advanced in the direction in which the sheet is to be moved, means to operate the separating instrument to bring an end of the instrument first into contact with and to cause it to seize upon the sheet then to cause that end of the instrument which has seized upon the sheet to move in a direction so related to the said most advanced edge of the sheet as to cause a portion of that edge to be bent outward without bending the entire edge of the sheet whereby a space shall intervene between the said bent out portion of the edge of the sheet and the subjacent sheets of the pack with a clear opening from said space forward in the direction in which the sheet is to be moved and then to cause the instrument to assume a state of rest thereby maintaining the outward bend in the edge of the sheet until a movable blade shall have passed under the bend and thereafter to cause the instrument to release its seizure upon the sheet, a movable blade having an edge inclined relatively to the forward edges of the sheets forming the pack, means to support and guide said blade so that when it moves its inclined edge will move in a plane adjacent to the surface of the pack, means to give a reciprocating movement to said blade whereby in its forward motion an advanced part of its inclined edge shall first enter through said opening into said space under said bent out portion of the edge of the sheet while the said portion of the edge is maintained in an outwardly bent position by the separating instrument and thence to pass its inclined edge under all that portion of the edge of the sheet which was not bent outward by the separating instrument whereby the blade shall lie under the entire edge of the sheet and separate it from the pack, and devices to operate upon the separated edge and withdraw the sheet from the pack.

3. In a machine for feeding sheets successively from a pack, the combination of a support for a pack of sheets, a suction nozzle adapted to suck upon and seize the surface of the outermost sheet in the pack at a point on that edge of the sheet which lies most advanced in the

direction in which the sheet is to be moved, means to operate the suction nozzle to bring an end of the nozzle first into contact with and to cause it to suck and seize upon the sheet then to cause that end of the nozzle which has seized upon the sheet to move in a direction so related to the said most advanced edge of the sheet as to cause a portion of that edge to be bent outward without bending the entire edge of the sheet whereby a space shall intervene between the said bent out portion of the edge of the sheet and the subjacent sheets of the pack with a clear opening from said space forward in the direction in which the sheet is to be moved and then to cause the nozzle to assume a state of rest thereby maintaining the outward bend in the edge of the sheet until a movable blade shall have passed under the bend and thereafter to cause the nozzle to release its seizure upon the sheet, a movable blade having an edge inclined relatively to the forward edges of the sheets forming the pack, means to support and guide said blade so that when it moves its inclined edge will move in a plane adjacent to the surface of the pack, means to give a reciprocating movement to said blade whereby in its forward motion an advanced part of its inclined edge shall first enter through said opening into said space under said bent out portion of the edge of the sheet while the said portion of the edge is maintained in an outwardly bent position by the nozzle and thence to pass its inclined edge under all that portion of the edge of the sheet which was not bent outward by the nozzle whereby the blade shall lie under the entire edge of the sheet and separate it from the pack, and devices to operate upon the separated edge and withdraw the sheet from the pack.

4. In a machine for feeding sheets successively from a pack, the combination of a support for a pack of sheets, a suction nozzle arranged adjacent to a side edge of the pack of sheets adapted to suck upon and seize one corner of the outermost sheet on that edge which lies most advanced in the direction in which the sheet is to be moved, means to operate the suction nozzle to bring an end of the nozzle first into contact with and to cause it to suck and seize upon the corner of the sheet then to cause that end of the nozzle which has seized upon the said corner to move in a direction so related to said most advanced edge of the sheet as to cause the corner seized upon to be bent outward from the subjacent sheets of the pack without bending the entire edge of the sheet and then to cause the nozzle to assume a state of rest thereby maintaining the corner in an outwardly bent position until a movable blade shall have passed under the said corner and thereafter to cause the nozzle to release its seizure upon the sheet, a movable blade having an edge inclined relatively to the forward edges of the sheets forming the pack, means to support and guide said blade so that when it moves its inclined edge

will move in a plane adjacent to the surface of the pack, means to give a reciprocating movement to said blade whereby in its forward motion an advanced part of its inclined edge shall first enter under said outwardly bent corner of the sheet while the said corner is maintained in an outwardly bent position by the nozzle and then to pass its inclined edge under all that portion of the edge of the sheet which was not bent outward by the nozzle whereby the blade shall lie under the entire edge of the sheet and separate it from the pack, and devices to operate upon the separated edge and withdraw the sheet from the pack.

5. In a machine for feeding sheets successively from a pack, the combination of a support for a pack of sheets, a suction nozzle arranged adjacent to a side edge of the pack of sheets adapted to suck upon and seize one corner of the outermost sheet on that edge which lies most advanced in the direction in which the sheet is to be moved, means to operate the suction nozzle to bring an end of the nozzle first into contact with and to cause it to suck and seize upon the corner of the sheet then to cause that end of the nozzle which has seized upon the said corner to move in a direction so related to said most advanced edge of the sheet as to cause the corner seized upon to be bent outward from the subjacent sheets of the pack without bending the entire edge of the sheet and then to cause the nozzle to assume a state of rest thereby maintaining the corner in an outwardly bent position until a movable blade shall have passed under the said corner and thereafter to cause the nozzle to release its seizure upon the sheet, a movable blade having an edge inclined relatively to the forward edges of the sheets forming the pack, means to support and guide said blade so that when it moves its inclined edge will move in a plane adjacent to the surface of the pack, means to give a reciprocating movement to said blade whereby in its forward motion an advanced part of its inclined edge shall first enter under said outwardly bent corner of the sheet while the said corner is maintained in an outwardly bent position by the nozzle and then to pass its inclined edge under all that portion of the edge of the sheet which was not bent outward by the nozzle whereby the blade shall lie under the entire edge of the sheet and separate it from the pack, and a frictional roller or rollers arranged to act by frictional contact upon the separated edge and withdraw the sheet from the pack.

6. In a machine for feeding sheets successively from a pack, the combination of a support for a pack of sheets, a suction nozzle arranged adjacent to a side edge of the pack of sheets adapted to suck upon and seize one corner of the outermost sheet on that edge which lies most advanced in the direction in which the sheet is to be moved, means to

operate the suction nozzle to bring an end of the nozzle first into contact with and to cause it to suck and seize upon the corner of the sheet then to cause that end of the nozzle which has seized upon the said corner to move in a direction so related to said most advanced edge of the sheet as to cause the corner seized upon to be bent outward from the subjacent sheets of the pack without bending the entire edge of the sheet and then to cause the nozzle to assume a state of rest thereby maintaining the corner in an outwardly bent position until a movable blade shall have passed under the said corner and thereafter to cause the nozzle to release its seizure upon the sheet, a movable blade having an edge inclined relatively to the forward edges of the sheets forming the pack, means to support and guide said blade so that when it moves its inclined edge will move in a plane adjacent to the surface of the pack, means to give a reciprocating movement to said blade whereby in its forward motion an advanced part of its inclined edge shall first enter under said outwardly bent corner of the sheet while the said corner is maintained in an outwardly bent position by the nozzle and then to pass its inclined edge under all that portion of the edge of the sheet which was not bent outward by the nozzle whereby the blade shall lie under the entire edge of the sheet and separate it from the pack, a frictional roller or rollers arranged to act by frictional contact upon the separated edge and withdraw the sheet from the pack and feeding rollers arranged to receive the sheets from the frictional roller or rollers.

7. In a machine for feeding sheets, the combination of a holder adapted to support rectangular sheets on their edges in an approximately vertical position and having an inclined bottom and an inclined front and side guides adapted to maintain the alignment of the side edges of the sheets, with a reciprocating suction nozzle adapted to suck upon and bend outward one corner of the foremost sheet, a reciprocating blade having a slanting edge adapted to enter first under the corner after it is bent out and thence to pass under the entire edge of the sheet and separate it from the pack, and means to operate upon the separated edge of the sheet to withdraw the sheet from the pack.

8. In a machine for feeding sheets from a pack, the combination of a holder adapted to support rectangular sheets on their edges in an approximately vertical position having an inclined bottom and an inclined front and side guides adapted to maintain the alignment of the side edges of the sheets, with a reciprocating suction nozzle adapted to suck upon and bend outwardly one corner of the foremost sheet, a reciprocating blade having a slanting edge adapted to enter first under the said outwardly bent corner, and thence to pass under the entire edge of the sheet and separate it from the pack, and a friction

roller or rollers arranged to act by frictional contact upon the separated edge and withdraw the sheet from the pack.

9. In a machine for feeding sheets from a pack, the combination of a holder adapted to support rectangular sheets on their edges in an approximately vertical position having an inclined bottom and an inclined front and side guides adapted to maintain the alignment of the side edges of the sheets, with a reciprocating suction nozzle adapted to suck upon and bend outwardly one corner of the foremost sheet, a reciprocating blade having a slanting edge adapted to enter first under the said outwardly bent corner and thence to pass under the entire edge of the sheet and separate it from the pack, a frictional roller or rollers arranged to act by frictional contact upon the separated edge and withdraw the sheet from the pack, and feeding rollers arranged to receive the sheet from the friction roller or rollers.

10. In a machine for feeding sheets from a pack, the combination of a holder adapted to support rectangular sheets on their edges in an approximately vertical position having an inclined bottom and an inclined front and side guides adapted to maintain the alignment of the side edges of the sheets, with a reciprocating suction nozzle adapted to suck upon and bend outwardly one corner of the foremost sheet, a reciprocating blade having a slanting edge adapted to enter first under the said outwardly bent corner and thence pass under the entire edge of the sheet and separate it from the pack, a friction roller or rollers arranged to act by frictional contact upon the separated edge and withdraw the sheet from the pack, feeding rollers arranged to receive the sheet from the friction roller or rollers, and a stationary guide to direct the sheet located between the friction roller or rollers and the feeding rollers.

11. In a machine for feeding sheets, the combination of a holder adapted to support the sheets on edge in an approximately vertical position, a reciprocating suction nozzle adapted to suck upon and bend outward one corner of the foremost sheet, a movable blade adapted to enter first under the outwardly bent corner and thence pass under the entire edge of the sheet and separate it from the pack, a friction roller or rollers adapted by frictional contact to seize upon the separated sheet and remove it from the pack, feeding rollers adapted to receive the sheet as it is carried down by the friction roller or rollers and completely withdraw it from the holder, and a conveyer to receive the sheet from the feeding rollers.

12. In a machine for feeding sheets, the combination of a holder adapted to support the sheets on edge in an approximately vertical position, a reciprocating suction nozzle adapted to suck upon and bend outward one corner of the foremost sheet, a movable blade adapted to enter first under the outwardly

bent corner and thence pass under the entire edge of the sheet and separate it from the pack, a friction roller or rollers adapted by frictional contact to seize upon the separated sheet and remove it from the pack, feeding rollers adapted to receive the sheet as it is carried down by the friction roller or rollers and completely withdraw it from the holder, a conveyer to receive the sheet from the feeding rollers, and a stop motion located over the conveyer and controlled by the sheets thereon adapted to stop the machine when the sheets are improperly fed upon the conveyer.

13. In a sheet feeding machine, the combination of a holder adapted to support a pack of sheets on edge in an approximately vertical position, a reciprocating nozzle adapted to suck upon and bend outward one corner of the outermost sheet, the reciprocating separator blade H⁷ adapted to enter under the outwardly bent corner and thence pass under the entire edge of the sheet, and friction disks arranged in front of the separator blade H⁷ and adapted to act in conjunction therewith upon the edge of the separated sheet to withdraw it from the holder, and cam devices to operate said blade.

14. In a machine for feeding sheets, the combination of a holder adapted to support rectangular sheets on their edges in an approximately vertical position with the side edges of the sheets in vertical planes and having an inclined bottom and an inclined front continuous from one side to the other of the holder and side guides adapted to maintain the alignment of the vertical side edges of the sheets, a reciprocating suction nozzle adapted to suck upon and bend outward one corner on the lower edge of the foremost sheet, and a stationary lip or projection along the horizontal lower edge of the holder adjacent to the nozzle adapted to obstruct the removal of the edge of the sheet as it is lifted by the suction nozzle and thereby assist in detaching it from the edge of the adjacent sheet.

15. In a machine for feeding sheets, the combination of a holder adapted to support rectangular sheets on their edges in an approximately vertical position with the side edges of the sheets in vertical planes and having an inclined bottom and an inclined front continuous from one side to the other of the holder and side guides adapted to maintain the alignment of the vertical side edges of the sheets, a reciprocating suction nozzle adapted to suck upon and bend outward one corner of the lower edge of the foremost sheet, and a projection extending inward from one of the side guides of the holder adjacent to the nozzle adapted to scrape upon the side edge of the sheet as it is moved by the suction nozzle and assist in separating the edge from the adjacent sheet.

16. In a sheet feeding machine, the combination of a support for a pack of sheets, a separator to bend outward a portion of an edge of the outermost sheet, a movable blade adapted

to enter first under the outwardly bent portion and thence pass under the entire edge of the sheet and separate it from the pack, a frictional disk or disks arranged to act upon the separated edge of the sheet and withdraw the sheet from the pack, and means for driving the frictional disk or disks with a yielding rotary motion.

17. In a sheet feeding machine, the combination of a support for a pack of sheets, a separator to bend outward a portion of an edge of the outermost sheet, a movable blade adapted to enter first under the outwardly bent portion and thence to pass under the entire edge of the sheet and separate it from the pack, a frictional disk or disks arranged to act upon the separated edge of the sheet and withdraw the sheet from the pack, means for driving the frictional disk or disks with a yielding rotary motion and rigidly after a predetermined limit of elastic motion has been reached.

18. In a machine for feeding sheets, the combination of a support for the pack of sheets, a separator adapted to bend outward one corner only of the outermost sheet on that edge which lies most advanced in the direction in which the sheet is to be moved, means to adjust the said separator to different positions across the width of the holder to correspond to any change in the width or position of the pack of sheets, a reciprocating blade having an inclined edge adapted to enter first under said outwardly bent corner and thence to pass under the entire edge of the sheet and separate it from the pack, the said blade having a fixed width practically equal to the width of the widest sheet which is to be fed by the machine and being so disposed as to the separator that a high part of its inclined edge may pass under the corner bent out by the separator in whatever position the separator may chance to be adjusted without requiring any adjustment of the blade, and devices to operate upon the separated edge and remove the sheet from the pack.

19. In a machine for feeding sheets, the combination of a support for the pack of sheets, a separator to separate the outermost sheet from the others in the pack a frictional disk to act upon the separated sheet and withdraw it from the pack, a driving gear for imparting motion to said frictional disk loosely mounted upon its shaft, a spring connected at one end to the shaft and at the other end to the gear, whereby a yielding rotary motion is communicated to the shaft from the gear through the medium of the spring connection to impart a yielding rotary motion to the friction disk, and a key or stop between the shaft and gear arranged to arrest the independent motion of the gear upon the shaft and cause the gear to drive the shaft positively after a given amount of elastic motion.

20. In a sheet feeding machine, the combination of a support for the pack of sheets, a reciprocating suction nozzle adapted to suck

upon and bend outward a portion of the edge of the outermost sheet, a pneumatic device for rocking the said suction nozzle, a suction creating device, independent pneumatic connections between the suction creating device and the suction nozzle and the pneumatic device respectively, and means for independently controlling the suction within the suction nozzle and the pneumatic device.

21. In a sheet feeding machine, the combination of a support for a pack of sheets, a rocking suction nozzle arranged adjacent to the support and adapted to suck upon and separate a portion of the edge of the outermost sheet from the others in the pack, a pneumatic device adapted to rock the suction nozzle, a suction creating device, an air passageway or tube between the suction creating device and the suction nozzle and the pneumatic nozzle rocking device respectively, a valve in each of the said communicating passageways or tubes, and power devices for operating said valves to automatically open and close the said air passage ways or tubes and thereby intermittently rock the nozzle and create suction therein.

22. In a sheet feeding machine, the combination of a support for a pack of sheets, means for withdrawing the outermost sheet from the pack, a conveyer to receive the sheets as they are successively withdrawn and convey them away from the holder, a rocking frame arranged over the conveyer and provided with one or more sustaining fingers resting upon the moving sheets as they are passing upon the conveyer for the purpose of normally sustaining the rocking frame, stopping devices for stopping the operation of the machine, and a connection between the stopping devices and the rocking frame, all operating together to stop the operation of the machine whenever spaces of more than a normal width occur between adjacent sheets as they are being carried forward by the conveyer.

23. In a sheet feeding machine, the combination of a support for a pack of sheets, means for withdrawing the outermost sheet from the pack, a conveyer to receive the sheets as they are successively withdrawn and convey them away from the holder, a rocking frame extending over the conveyer and provided with a series of fingers resting upon the moving sheets as they are passing upon the conveyer for the purpose of normally sustaining the rocking frame one or more of said fingers being adjustably supported by the frame whereby they may be arranged at different distances apart on a line parallel to the direction in which the sheets are moving, stopping mechanism for arresting the motion of the machine and a connection between the rocking frame and the motion stopping mechanism all operating together to stop the operation of the machine whenever spaces occur between adjacent sheets as they are being carried forward by the conveyer of a

greater width than the distance between the two extreme fingers of the series as they may be adjusted when resting upon the sheets.

24. In a sheet feeding machine, the combination of a support for a pack of sheets, means for successively withdrawing the sheets therefrom, a conveyer to receive the sheets as they are successively withdrawn and convey them away from the holder, a rocking frame arranged above said conveyer, two or more fingers carried by the rocking frame and adapted to rest upon the moving sheets as they are passing upon the traveling conveyer to normally support the rocking frame, said fingers being free to be moved longitudinally in a line parallel to the direction in which the sheets are moving for purposes of adjustment and also to be lifted out of action away from the conveyer, motion arresting devices for stopping the machine, and a connection between the rocking frame and said motion arresting devices substantially as and for the purposes described.

25. In a sheet feeding machine, the combination of a support for a pack of sheets, means for successively withdrawing the sheets therefrom, a conveyer arranged to receive the withdrawn sheets, a rocking frame extending above the conveyer provided with the rod Z^5 fingers Z^7 , carried by the rod Z^5 through movable collars Z^8 , adapted to rest upon the sheets carried by said conveyer and thereby sustain the rocking frame, a motion arresting device, and a connection between the motion arresting device and the rocking frame.

26. In a sheet feeding machine, the combination of a support for a pack of sheets, means to withdraw the sheets successively from the pack, a conveyer arranged to receive the withdrawn sheets, a rocking frame extending over the conveyer provided with one or more sustaining fingers adapted to rest on the sheets passing on the conveyer and thereby sustain the rocking frame, a motion arresting device for stopping the operation of the machine, a toggle connected with the motion arresting device, a spring acting on the toggle to normally bend it and operate the motion stopping device, and a depending rod carried by the rocking frame and engaging the joint of the toggle.

27. In a sheet feeding machine, the combination of a support for a pack of sheets, separating devices arranged adjacent to the holder to bend outward the opposite corners of the edge of the outermost sheet which lies most advanced in the direction in which the sheet is to be moved, means to adjust each of the separating devices independently to different positions, across the width of the holder to correspond to any change in the width or position of the pack of sheets, a separator blade having an inclined edge and adapted to enter first under one of the said outwardly bent corners and thence to pass under the entire edge of the sheet, and a second separator blade also having an inclined edge and adapted to

first enter under the other outwardly bent corner and thence to pass under the entire edge of the sheet in the opposite direction, whereby both blades shall lie under the same edge of the sheet, each of said blades having a fixed width practically equal to the width of the widest sheet which is to be fed by the machine and each blade being so disposed toward its corresponding separating device that a high part of its inclined edge may pass under the corner bent out by the separator in whatever position the separator may chance to be adjusted without requiring any adjustment of the blade, for the purposes described.

28. In a machine for feeding sheets from a pack, the combination of a holder for the pack of sheets, separating devices arranged adjacent to the holder to bend outward the opposite corners of that edge of the outermost sheet which lies most advanced in the direction in which the sheet is to be moved, a separator blade adapted to enter first under one of the said outwardly bent corners and thence to pass under the entire edge of the sheet, and a second separator blade adapted to first enter under the other outwardly bent corner and thence to pass under the entire edge of the sheet in the opposite direction whereby both blades shall lie under the same edge of the sheet, for the purpose described.

29. In a machine for feeding sheets from a pack, the combination of a holder to support the pack of sheets, a suction separator arranged adjacent to each side of the holder adapted to suck upon and lift the opposite corners of that edge of the outermost sheet which lies most advanced in the direction in which the sheet is to be moved, a separator blade adapted to enter first under one of the outwardly bent corners of the sheet and thence to pass under the entire edge, and a second separator blade adapted to first enter under the other outwardly bent corner and thence to pass under the entire edge of the sheet in the opposite direction whereby both blades shall lie under the same edge of the sheet for the purpose set forth.

30. In a machine for feeding sheets from a pack, the combination of a holder adapted to support the sheets on edge in an approximately vertical position, having an inclined bottom and an inclined front two reciprocating suction nozzles located one adjacent to each side of the holder adapted to suck upon and bend outward opposite corners of that edge of the foremost sheet of the pack which lies most advanced in the direction in which the sheet is to be moved, and two movable blades each adapted to enter first under one outwardly bent corner and thence to pass under the entire edge of the sheet whereby both blades shall lie under the same edge of the sheet, for the purpose described.

31. In a machine for feeding sheets from a pack, the combination of a holder to support the pack of sheets, a suction separator arranged adjacent to each side of the holder

adapted to suck upon and lift the opposite corners of that edge of the outermost sheet which lies most advanced in the direction in which the sheet is to be moved, a separator blade adapted to enter first under one of the outwardly bent corners of the sheet and thence to pass under the entire edge, a second separator blade adapted to first enter under the other outwardly bent corner and thence to pass under the entire edge of the sheet in the opposite direction, whereby both blades shall lie under the same edge of the sheet and cam devices to move said blades in succession.

32. In a machine for feeding sheets from a pack, the combination of a holder to support the sheets, a suction separator arranged adjacent to each side of the holder adapted to suck upon and lift the opposite corners of that edge of the outermost sheet which lies most advanced in the direction in which the sheet is to be moved, a separator blade adapted to enter first under one of the outwardly bent corners of the sheet and thence to pass under the entire edge, a second separator blade adapted to first enter under the other outwardly bent corner and thence to pass under the entire edge of the sheet in the opposite direction, whereby both blades shall be under the same edge of the sheet and a sustaining lug or lip carried by one of the blades and extending toward the other substantially as and for the purpose described.

33. In a sheet feeding machine, a holder adapted to support rectangular sheets upon their edges in an approximately vertical position with the side edges of the sheets in vertical planes, having a fixed inclined front continuous from one side to the other of the holder and two inclined bottom pieces or supports for the lower edges of the sheets in the pack to rest upon each provided with a side guide adapted to maintain the alignment of the side edges of the sheets, one or both of the bottom pieces or supports carrying their respective side guides being laterally adjustable to adapt them to support sheets of different widths.

34. In a sheet-feeding machine, a holder adapted to support rectangular sheets upon their edges in an approximately vertical position with the side edges of the sheets in vertical planes, having a fixed inclined front continuous from one side to the other of the holder and two inclined bottom pieces or supports for the lower edges of the sheets in the pack to rest upon each provided with a side guide adapted to maintain the alignment of the side edges of the sheets, one or both of the bottom pieces or supports carrying their respective side guides being laterally adjustable to adapt them to support sheets of different widths, combined with an independent follower carried by each bottom piece and adjustable therewith adapted to press upon the rear or back of the sheets and feed the same forward.

35. In a sheet feeding machine, a holder

adapted to support rectangular sheets upon their edges in an approximately vertical position with the side edges of the sheets in vertical planes, having a fixed inclined front formed of alternately arranged slats and rollers continuous from one side to the other of the holder and two inclined bottom pieces each provided with a side guide adapted to maintain the alignment of the side edges of the sheets, one or both of the bottom pieces carrying their respective side guides being laterally adjustable to suit different widths of sheets, combined with means for withdrawing the foremost sheet in the pack from the holder.

36. In a sheet feeding device, an adjustable holder adapted to support rectangular sheets on edge in an approximately vertical position with the side edges of the sheets in vertical planes, consisting of two independent bottom pieces or supports for the lower edges of the sheets in the pack to rest upon, one or both of the bottom pieces being provided with an upwardly extending side piece adapted to maintain the alignment of the side edges of the sheets a fixed inclined front independent of the bottom and side pieces, and adjusting screws acting upon the bottom pieces to adjust the side and bottom pieces laterally to support sheets of different widths.

37. In a sheet feeding device, an adjustable holder adapted to support a pack of sheets on edge in an approximately vertical position consisting of two independent inclined bottom pieces each provided with an upwardly extending side piece, an inclined front independent of the bottom and side pieces, adjusting screws acting upon the bottom piece to adjust the two sides and bottom pieces laterally to suit different sizes of sheets, and an independent follower carried by each bottom piece adapted to press upon the rear or back of the sheets and feed the same forward.

38. In a sheet feeding device, a holder for a pack of sheets adapted to support rectangular sheets upon their edges in an approximately vertical position with the side edges of the sheets in vertical planes consisting of an inclined front continuous from one side to the other of the holder, grooves or spaces formed horizontally across said front on that surface of the front which lies toward the pack of sheets, an inclined bottom, a side piece or side pieces adapted to maintain the alignment of the side edges of the sheets, means to adjust said side piece or side pieces laterally across the holder to support sheets of different widths and to maintain said piece or pieces in any adjusted position and tongues carried by said side piece or pieces projecting into and moving in said grooves in the front of the holder to close the spaces between the said front and the edge or edges of the said side piece or side pieces.

39. In a machine for feeding sheets from a pack, the combination of a holder having

adjustable sides to suit sheets of different width, means to withdraw the sheets successively from the pack embracing friction disks located in the front of the holder and adapted to act upon the withdrawn sheets, means to adjust the friction disks laterally to suit the adjustment of the sides of the holder or sheets of different widths, and a connection between the means for adjusting the disks and the adjustable sides of the holder whereby the said disks may be adjusted automatically with the adjustment of the sides of the holder.

40. In a machine for feeding sheets from a pack, the combination of a holder adapted to support the pack of sheets, provided with adjustable sides, whereby the holder may be adjusted to sheets of different widths, means for withdrawing the sheets successively from the holder embracing a series of friction disks mounted upon a shaft and movable longitudinally thereon, springs between adjacent disks, longitudinally movable adjusting sleeves on the shaft adapted to act upon the disks for the purpose of adjusting them, and a connection between the said adjusting sleeves and the adjustable sides of the holder, whereby the disks will be automatically adjusted to suit the adjustment of the sides of the holder for sheets of different widths.

41. In a machine for feeding sheets from a pack, the combination of a holder for a pack of sheets having adjustable sides whereby the holder may be adjusted to suit sheets of different widths, and a suction nozzle adapted to suck upon and lift the corner of the foremost sheet pivotally attached to one of the adjustable sides of the holder, whereby the suction nozzle may be adjusted with the side of the holder to suit sheets of different widths.

42. In a machine for feeding sheets from a pack, the combination of a holder for the pack of sheets having its sides adjustable to suit sheets of different widths, a suction nozzle for sucking upon and lifting outward a portion of the edge of the outermost sheet pivotally attached to one of the adjustable sides, and a pneumatic device, connected to the said suction nozzle and adapted to rock it upon its pivot, carried by the adjustable side so as to move with it.

43. In a machine for feeding sheets successively from a pack, the combination with a support for the pack of sheets, and separating devices for separating the outermost sheet from the others in the pack, of a cam shaft, power transmitting connections between the cam shaft and the separating devices for operating or controlling the same, driving devices for rotating the cam shaft intermittently, and means for controlling the periods between successive rotations of the cam shaft without varying the speed of the shaft when in the act of rotation whereby the period of intermission between successive operations of the separating devices may be varied without varying the speed with which the cycle of movements of the separating devices is performed.

44. In a machine for feeding sheets from a pack, the combination of a holder for a pack of sheets, separating devices for successively separating the outermost sheet from others in the pack, a cam shaft, power transmitting connection between the cam shaft and separating devices, a cam shaft operating shaft, a friction disk on the cam shaft having a portion of its periphery cut away, a friction disk on the cam shaft operating shaft adapted to make contact with the friction disk on the cam shaft and drive the same until the cut away portion of its periphery is reached, a rotary assistant driving disk arranged adjacent to the disk of the cam shaft and adapted to operate upon the same to turn it and move its friction face again in contact with the friction face of the disk on the cam shaft operating shaft, a variable speed transmitting connection between the assistant driving disk and the cam shaft operating shaft, a friction creating device for overcoming the momentum of the cam shaft disk when the same has ceased to make contact with the disk on the cam shaft operating shaft and means carried by the assistant driving disk for releasing said friction creating device and permitting the cam shaft disk to be moved into frictional contact with the disk on the cam shaft operating shaft, all for the purpose of operating the separating devices intermittently and for varying the period of intermission between successive operations of those devices.

45. In a machine for feeding sheets from a pack, the combination of a support for the pack of sheets, a separator adapted to separate one edge of the outermost sheet from the others in the pack, a feeding roll or rollers for seizing the outwardly bent edge and withdrawing the sheet from the holder, a conveyer having a constant surface speed and adapted to receive the sheets as they are delivered by the feeding roll or rollers, and speed regulating devices for varying the speed of the feeding roll or rollers with reference to the conveying surface, whereby the relation of the adjacent edges of the successive sheets as they are received upon the conveyer may be varied.

46. In a machine for feeding sheets from a pack, the combination of a holder for supporting the pack of sheets, a separator to separate the outermost sheet from the others in the pack, a feeding roll or rollers adapted to act upon the separated sheets and to feed them from the holder, a conveyer having a constant surface speed and adapted to receive the sheets as they are delivered by the feeding roll or rollers, the shaft W having a uniform rotary motion and carrying a cone W^2 , shaft X carrying the cone X^5 , a belt W^3 about the cones W^2 and X^5 whereby the shaft X may be driven from the shaft W, power transmitting connections between the shaft W and the conveyer, power transmitting connections between the shaft X and the

feeding roll or rollers, and means for adjusting the belt W³ upon the cones to vary the speed of the shaft X.

47. In a machine for feeding sheets from a pack, the combination of a support for a pack of sheets, a separating device adapted to separate the outermost sheet from the others in the pack, a feeding roll or rollers adapted to act upon the separated sheet and withdraw it from the holder, a conveyer having a constant surface speed arranged to receive the sheet as it is delivered by the feeding roll or rollers, a cam shaft, power transmitting connections between the cam shaft and separating devices, a driving shaft, for driving the feeding roll or rollers and the cam shaft means for driving the cam shaft intermittently from said driving shaft, power transmitting connections between said driving shaft and the feeding roll or rollers, and means to vary the speed of said driving shaft, whereby the speed of said cam shaft and feeding roll or rollers may be varied.

48. In a machine for feeding sheets from a pack, the combination of a support for a pack of sheets, a separating device adapted to separate the outermost sheet from the others in the pack, a feeding roll or rollers adapted to act upon the separated sheet and withdraw it from the holder, a conveyer having a constant surface speed arranged to receive the sheet as it is delivered by the feeding roll or rollers, a cam shaft, power transmitting connections between the cam shaft and separating devices, a driving shaft, for driving the feeding roll or rollers and the cam shaft means for driving the cam shaft intermittently from said driving shaft, power transmitting connections between said driving shaft and the feeding roll or rollers, means to vary the speed of said driving shaft, whereby the speed of the said cam shaft and feeding roll or rollers may be varied, and means for varying the period of intermittency of the rotation of the cam shaft, controlled by the power devices which drive the cam shaft, whereby the period of intermission between successive operations of the separating devices may be varied independently of the variations of the speed of the said driving shaft.

49. In a machine for feeding sheets from a pack, the combination of a support for the pack of sheets, means for withdrawing the outermost sheet from the pack, a conveyer composed of a series of adjacent bands arranged to receive the separated sheets from the withdrawing devices and having a surface speed less than the speed of the withdrawing

devices, whereby each sheet as it is fed by the withdrawing devices will overtake and overlap the sheet previously laid upon the conveyer, and devices located between the bands of the conveyer and extending above the surface thereof, whereby the forward edge of each sheet fed to the conveyer will be lifted by said devices above the rear edge of the preceding sheet to cause the overlapping of the edge.

50. In a machine for feeding sheets from a pack, the combination of a support for the pack of sheets, means for withdrawing the outermost sheet from the pack, a conveyer composed of a series of adjacent bands arranged to receive the separated sheets from the withdrawing devices and having a surface speed less than the speed of the withdrawing devices, whereby each sheet as it is fed by the withdrawing devices will overtake and overlap the sheet previously laid upon the conveyer, a series of rotary disks located between the bands of the conveyer and projecting above the surface thereof adapted to act upon the foremost sheet as it is fed to the conveyer and lift it and thereby cause it to overlap the rear edge of the preceding sheet, and a shaft for said overlapping disks carried in longitudinally adjustable bearings whereby the position of said overlapping disks may be adjusted in the length of the conveyer to suit the length of the sheets which are being fed.

51. In a machine for feeding sheets from a pack, the combination of a support for the pack of sheets, means for withdrawing the outermost sheet from the pack, a conveyer composed of a series of adjacent bands arranged to receive the separated sheets from the withdrawing devices and having a surface speed less than the speed of the withdrawing devices whereby each sheet as it is fed by the withdrawing devices will overtake and overlap the sheet previously laid upon the conveyer, a series of rotary disks located between the bands of the conveyer and projecting above the surface thereof, adapted to act upon the foremost sheet as it is fed to the conveyer and lift it and thereby cause it to overlap the rear edge of the preceding sheet, and a shaft for said disks carried in vertically adjustable bearings, whereby the said disks may be thrown below the surface of the conveyer when the overlapping devices are not required.

In testimony of which invention, I have hereunto set my hand.

J. HENRY KNOWLES.

Witnesses:

ERNEST HOWARD HUNTER,
C. H. NEWCOMB.