No. 829,459. PATENTED AUG. 28, 1906.

A. BUG.

PAPER FEEDING MACHINE.

APPLICATION FILED NOV. 10, 1905.

3 SHEETS—SHEET 1.

Fig. 1.

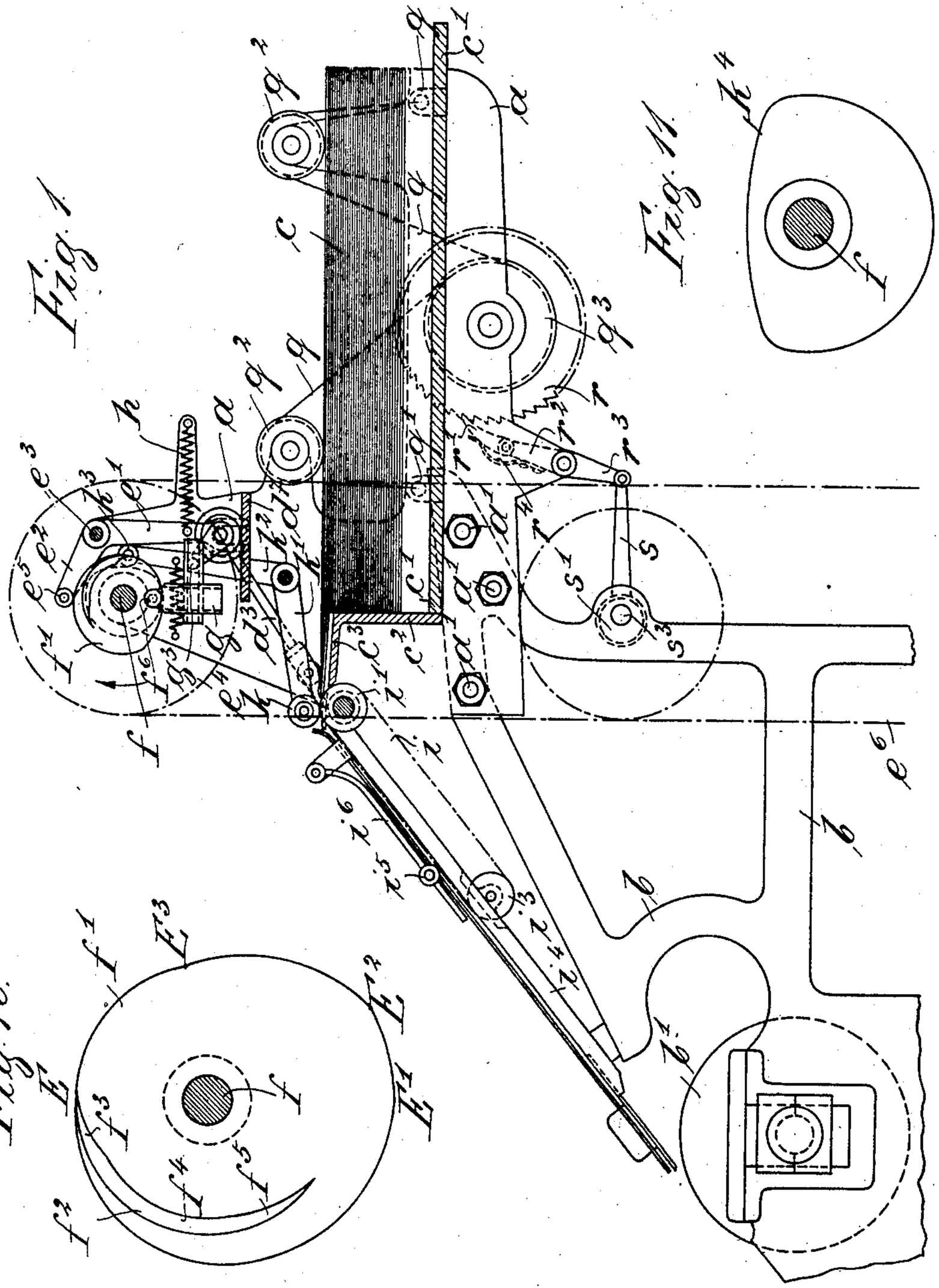

Fig. 10.



Fig. 11.



Witnesses.
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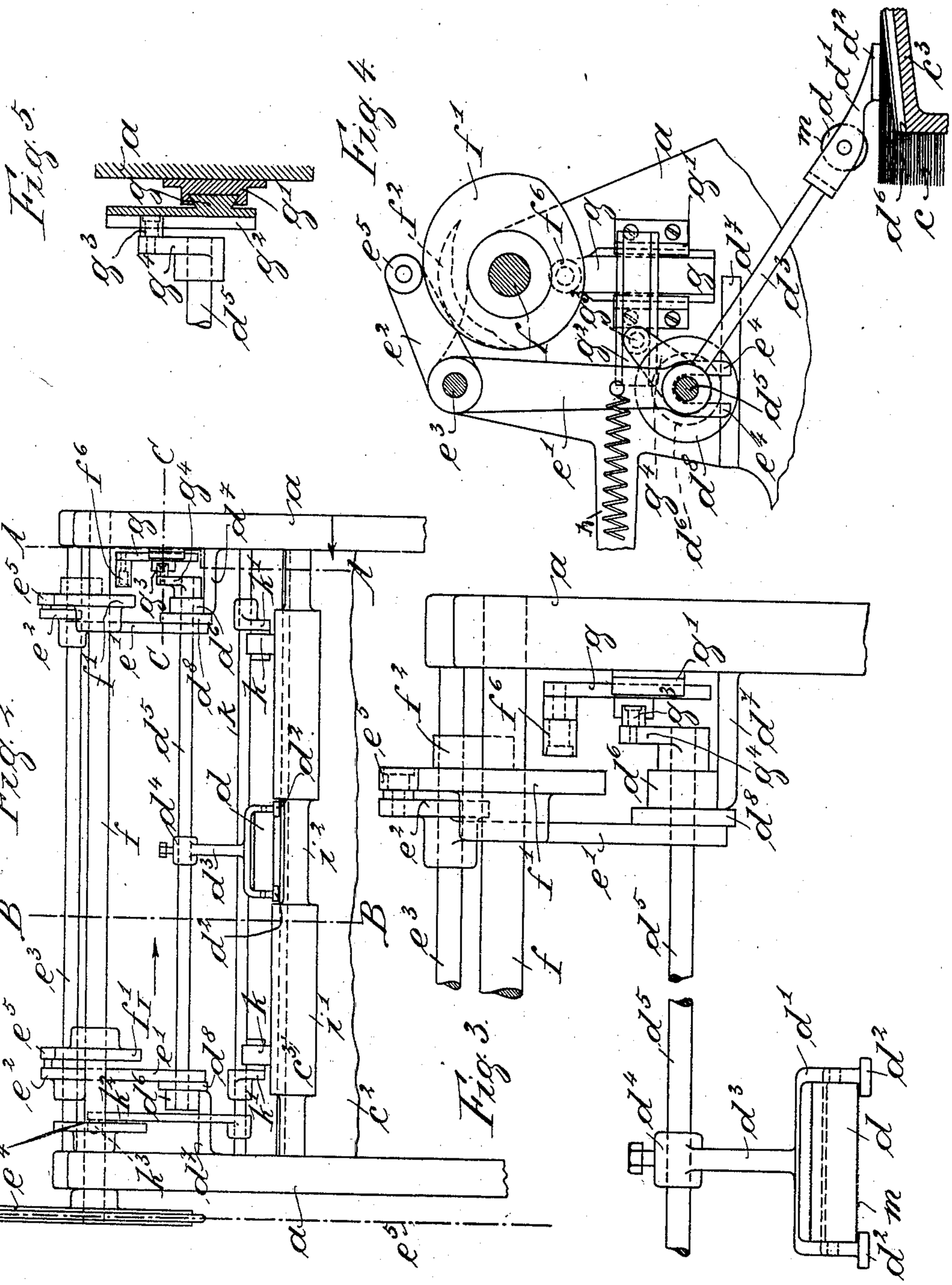
3 SHEETS—SHEET 2.

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3 SHEETS—SHEET 3.

Fig. 6.

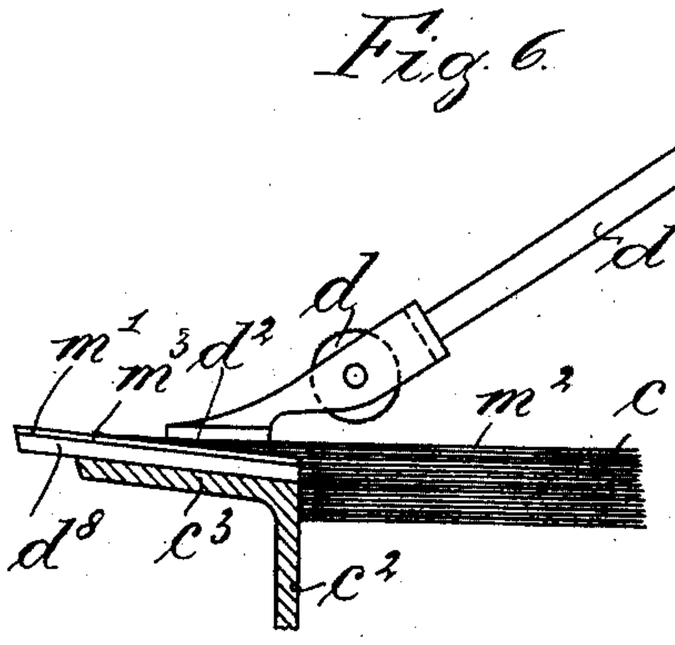



Fig. 7.

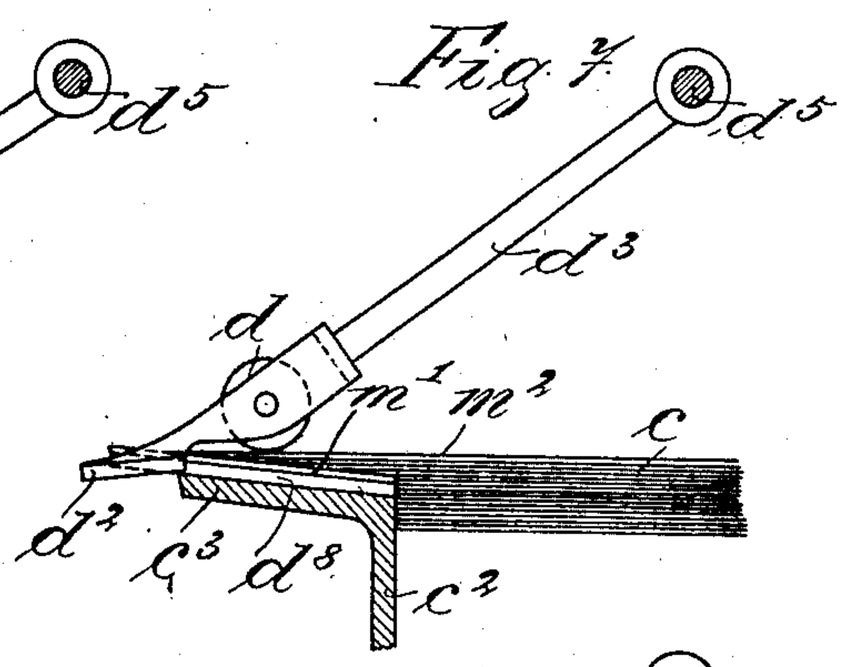



Fig. 8.

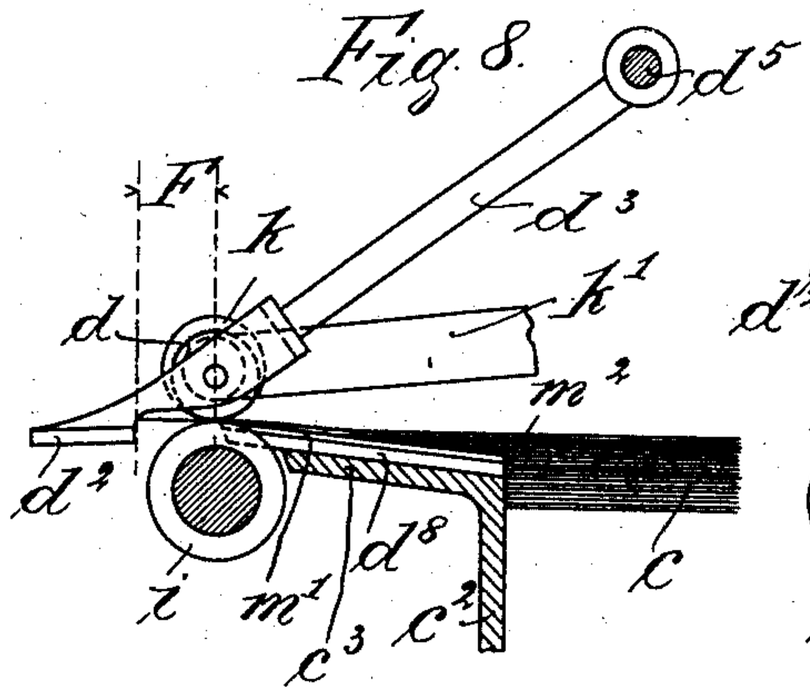



Fig. 9.

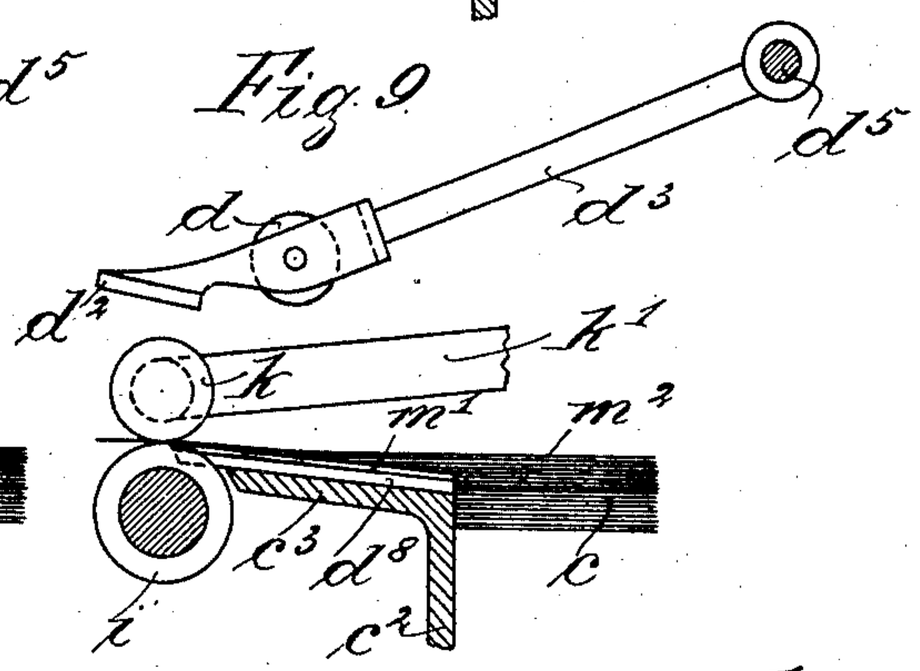



Fig. 12.

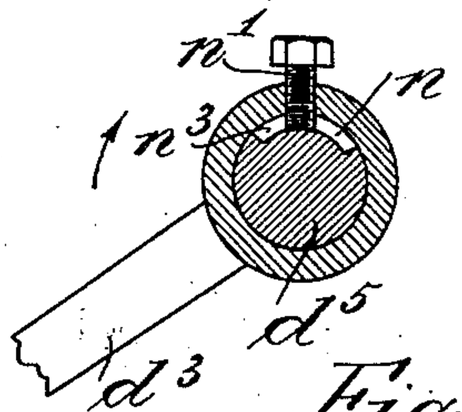



Fig. 13.

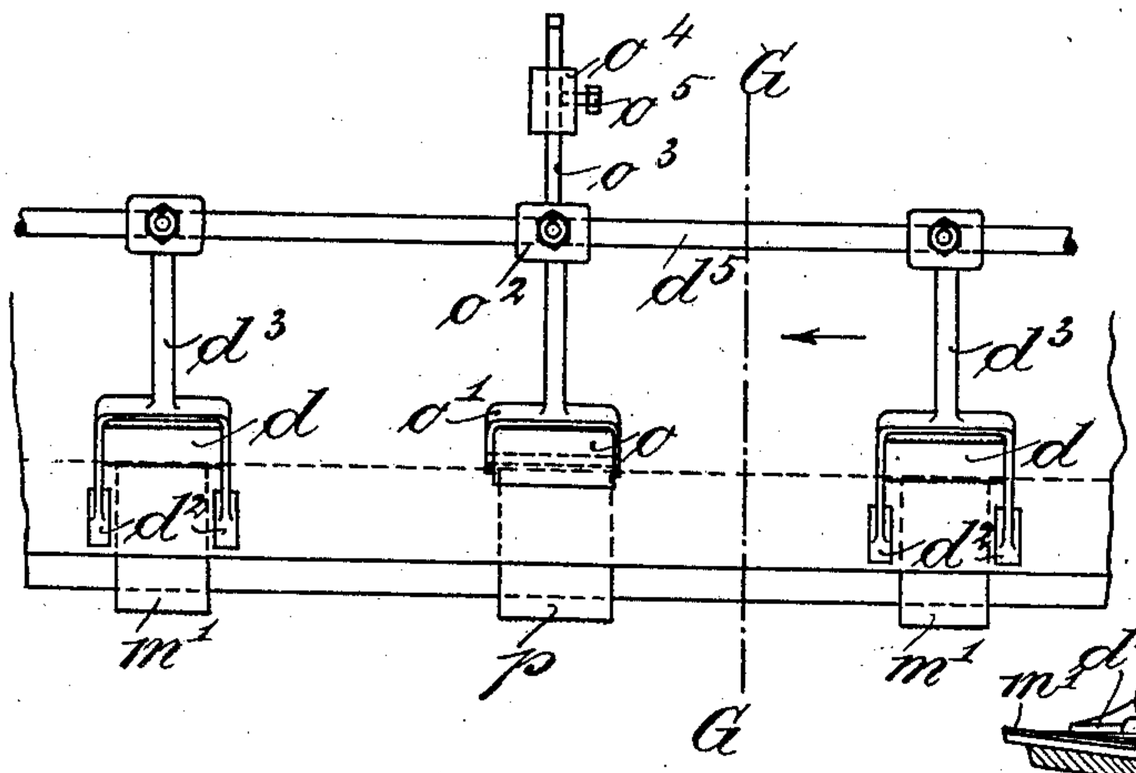
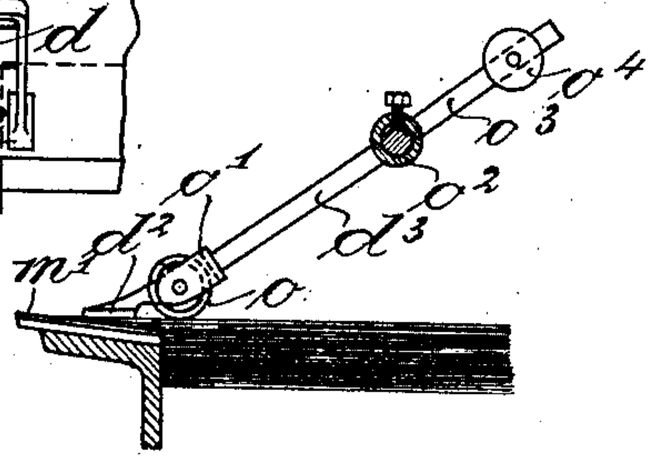



Fig. 14.




Witnesses.
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# UNITED STATES PATENT OFFICE.

ABEL BUG, OF BERLIN, GERMANY.

## PAPER-FEEDING MACHINE.

No. 829,459. Specification of Letters Patent. Patented Aug. 28, 1906.

Application filed November 10, 1905. Serial No. 286,702.

*To all whom it may concern:*

Be it known that I, ABEL BUG, a subject of the Emperor of Russia, and a resident of 22 Teltowerstrasse, Berlin, Germany, have invented certain new and useful Improvements in Paper-Feeding Machines, of which the following is an exact specification.

My invention relates to a paper-feeding machine of such kind by which the single sheets are fed off from a pile or stack of sheets by means of feeding-rollers in order to be conveyed to a printing-press or ruling-machine and the like.

To obtain great accuracy in feeding and adjusting the sheets in the printing-press or ruling-machine and the like, there is the necessity of gripping the sheets by the feeding-rollers always at the same distance from the front edge of the sheet and of separating only one sheet from the pile or stack piled up in the machine. For this purpose I have invented a special feeding mechanism, according to which feeding-rollers having a friction covering or facing and fingers coöperate for adjusting the feeding-rollers at the proper distance from the front edge of the paper to be fed off and feeding the paper to a mechanism transporting farther the sheets. Furthermore, I have provided a retarder or separator having a friction covering and being somewhat inclined toward the horizontal plane for enabling the feeding-rollers to separate the top sheet of the pile, and, finally, I have provided an arrangement permitting the use of the same feeding-mechanism for heavy papers or thin sheets.

In order to make my invention more clear, I refer to the accompanying drawings, in which—

Figure 1 is a fragmentary sectional side elevation of my improved feeding-machine on line A A of Fig. 2. Fig. 2 is a fragmentary front view of the machine. Fig. 3 shows a fragmentary front elevation, in an enlarged scale, of the arrangement for raising and lowering the feeding-roller and finger. Fig. 4 is a fragmentary sectional side elevation, in an enlarged scale, on line B B of Fig. 2. Fig. 5 is a fragmentary horizontal section on line C C of Fig. 2, illustrating a detail of the device for lifting and lowering the feeding-roller and finger. Figs. 6 to 9 show different positions of the feeding-roller and finger. Figs. 10 and 11 represent in side elevation cams for operating the feeding-roller and finger. Fig. 12 is a fragmentary cross-section illustrating the connection of the feeding-roller and finger with the shaft operating the former. Fig. 13 is a fragmentary top plan view of a modified arrangement of the feeding-rollers enabling the feeding of sheets of different nature. Fig. 14 is a fragmentary sectional side view on line *g g* of Fig. 13.

In the drawings, *a* is the side frame of the feeding-machine, being connected in the example by means of screws *a'* to the side frame *b* of a printing-press, in which *b'* represents the printing-cylinder. Between the side frames of the feeding-machine the pile *c* rests on a support *c'*, which can be raised and lowered by means of a device as hereinafter described. The front position of the pile on the support *c'* is limited by a transverse wall $c^2$, forming almost a right angle with the wall $c^3$, and the proper level of the top sheet of the pile is maintained by the arrangement as hereinafter described.

*d* is a main feeding-roller which can be moved to and fro and also lowered and raised. The roller *d* (see Figs. 3 and 4) is mounted stationary within a bow *d'*, at the lower end of which fingers $d^2$ are arranged, serving to insure the proper position of the feeding-roller on the top sheet to be fed off from the pile.

For operating the feeding-roller *d*, together with the feeding-finger $d^2$, the frame *d'* is mounted, by means of the rod $d^3$ and the eye $d^4$, on a transverse rod $d^5$, mounted, by means of rollers $d^6$, on horizontal longitudinal side ledges $d^7$, fastened to the side frame *a* of the machine. In order to prevent transverse movement of the transverse rod $d^5$, shoulders $d^8$ are provided fixed to the rod $d^5$.

Upon the ledges $d^7$ the rod $d^5$ slides by means of the rollers $d^6$ to and fro. For this purpose a double-armed knee-lever $e'$ $e^2$ is provided, mounted on a transverse rod $e^3$. The arm $e'$ of said lever has a bifurcation $e^4$ and engages thereby with the rod $d^5$. The arm $e^2$ is provided with a roller $e^5$, traveling on the circumferential face of the cam *f'*, having the form as illustrated in Fig. 10 in an enlarged scale and serving to move the rod $d^5$ to and fro. The cam *f'* is situated fixedly on the governing-shaft *f*, mounted on the side frame *a* and operated by means of a chain-wheel $e^7$ or the like, which receives its movement by a main driving-shaft (not shown in the drawings) and connected therewith by means of a driving-chain, (diagrammatically represented by $e^6$.) If the governing-shaft *f* is moved, the roller $e^5$ travels over the pe-

ripheral face of the cam $f'$, thereby swinging the arm $e'$ and moving the rod $d^5$ to and fro. Two of such cams $f'$ and $f^{1\prime}$ are arranged at both ends of the governing-shaft for maintaining a uniform movement of the rod $d^5$, carrying the feeding-roller and finger, one of said cams being adapted to raise the feeding-roller and finger owing to the following arrangement: At the cam $f'$ (see Fig. 10) there is a curved ledge $f^2$, screwed on or in any suitable manner secured to the cam $f'$. The inner or acting face of the ledge $f^2$ shows three different sections. The curve of the first section $f^3$ approaches to governing-shaft, the second section $f^4$ shows a circular curve, while the third section $f^5$ departs from the governing-shaft. The curve $f^3$ begins opposite to the most salient part of the circumferential face of the cam $f'$. On the curve $f^3$ $f^4$ $f^5$ a rotatable roller $f^6$ travels temporarily, the same being secured to a dovetail-shaped slide $g$ and moving within a corresponding guide $g'$, fixed to the side frame $a$. To the part $g$ a guiding-channel $g^2$ is fastened, in which operates a roller $g^3$, being connected with a crank-lever $g^4$. The latter is fixedly mounted on the transverse rod $d^5$. A spring $h$ tends to draw the double-armed lever $e'$ $e^2$ backward, the spring being fixed with its end $h'$ at a projection $h^2$ of the side frame $a$. For feeding further the top sheet after the feeding-roller and finger has reached its front position presser-rollers $k$ are provided arranged on levers $k'$, carried by a transverse rod $k^5$. The lever $k^2$, also carried by said rod $k^5$, is provided with a roller $k^3$, traveling on a cam $k^4$, mounted on the governing-shaft $f$ and being represented in enlarged scale in Fig. 11. The pressure-rollers $k$ coöperate with feeding-bands $i$, situated at both sides of the feeding-roller $d$ below the pressure-rollers $k$. The feeding-bands $i$ are arranged on a rear shaft $i'$, having a reduced middle part $i^2$, and on a front shaft $i^3$. For guiding the sheet fed by the feeding-band $i$ over the table $i^4$ there are spring-mounted rollers $i^5$ lying over the feeding-bands $i$ and carried by the springing bars $i^6$. From the table $i^4$ the sheet fed off by the feeding-machine reaches the cylinder $b'$ or the like.

The feeding-roller $d$ is provided with a friction covering or facing $m$, of rubber or other suitable material. Below the feeding-roller $d$ a retarder or separator $m'$, Fig. 6, is situated on a projection $d^8$ of the cross-wall $c^3$, being somewhat inclined. The fingers are lying at both sides of the separator and are not contacting the same if the feeding-roller is pressing upon the top sheet. The retarder $m'$ is composed of a band consisting of rubber or any suitable material the surface of which is somewhat smoother than that of the feeding-roller $d$, or, in other words, the coefficient of friction of the feeding-roller $d$ has a greater value than that of the retarder $m'$.

The operation of the parts as now described is the following: Supposing that several sheets of the pile $c$ have the position as shown in Fig. 6, according to which the top sheet $m^2$ is slid in its highest position on the separator $m'$, while the subsequent sheets are lying successively backward on $m'$, owing to the inclination of the retarder. This position can be imparted to the sheet either by hand or the machine proper when working. If now the governing-shaft is rotated and the rollers $e^5$ (see Figs. 3 and 4) are contacting the place E of the circumferential face of the cams $f'$ $f^{1\prime}$, (see Fig. 10,) the feeding-roller $d$ and the finger $d^2$ have the position shown in Fig. 6—that is to say, the finger rests upon the top sheet, while the feeding-roller $d$ is free therefrom. In traveling over the circumferential face the rollers $e^5$ will reach the most salient part E′ of said cams, thereby moving or advancing the transverse rod $d^5$, the finger, and feeding-roller, respectively, into the position of the Fig. 8. During a part of the travel of the rollers $e^5$ from E to E′ the top sheet will be in rest, because the feeding-roller $d$ is not in contact with the top sheet $m^2$. If, however, the finger reaches the front edge $m^3$ of the top sheet with its rear edge, it will fall down from it and the feeding-roller $d$ rests in a distinct distance from the front edge $m^3$ upon the top sheet $m^2$. Owing to the arrangement of the finger, the feeding-roller $d$ will have always the same position on the top sheet, respectively the same distance from the front edge of the sheet, determined by the horizontal distance F of the rear edge of the finger from the axes of the feeding-roller $d$, wherever the top sheet is lying on the separator $m'$. The moment of falling down of the finger from the top sheet is represented in Fig. 7. While the rollers $e^5$ are traveling farther on the cam $f'$ to the point E′ (see Fig. 10) the feeding-roller has separated the top sheet from the sheets lying underneath, and there is the possibility of taking along this top sheet by means of the feeding-roller, because the facing of the latter produces a greater friction on the top sheet than that existing between the separator $m'$ and the top sheet, while the sheets lying underneath the top sheet are prevented from movement by the rough covering of the separator $m'$, producing a friction greater than that between two subsequent sheets. In order to avoid that the fingers $d^2$ are hindered from their forward movement by the feeding-shaft $i'$, the latter is provided with a reduced part $i^2$, as shown in Fig. 2. If the feeding-roller $d$ has reached its front position, as shown in Fig. 8, the top sheet is moved between the presser-rollers $k$ and the feeding-shaft $i'$. At this moment the presser-roller is lowered to press on the sheet to be moved farther by the feeding-band $i$, arranged on the rear feeding-shaft $i'$, and the front feeding-

shaft $i^3$ being rotated in any suitable manner. At the same time if the pressure-roller $k$ is pressing upon the top sheet $m^2$ the feeding-roller and the finger is raised by means of the arrangement as illustrated in Figs. 3, 4, and 5 in details. After its rotation in the direction of the arrow, as indicated in Fig. 10, the curve $f^3$ comes in contact with the roller $f^6$ and the part $g$, together with the guiding-channel $g^2$, is raised, while the roller $f^6$ is traveling on the curve $f^3$, thereby swinging the crank-lever $g^4$ and rotating the rod $d^5$, and because there is the arrangement as illustrated in Fig. 12 the feeding-roller $d$ and the finger $d^2$ are lifted in the position as indicated in Fig. 9. The rod $d^5$ is provided with a groove $n$, into which a setting-screw $n'$ projects with its point. By the rotation of the rod $d^5$ in the direction of the arrow (see Fig. 12) the setting-screw pushes against the edge $n^3$ of the groove $n$, thereby lifting the stem $d^3$, together with the finger $d^2$ and the feeding-roller $d$ in connection therewith. Owing to this arrangement a rigid connection of the rod $d^5$ and the fingers is avoided, so that the feeding power of the machine depends only on the angle under which the rod $d^3$ is inclined toward the sheet to be fed and on the weight of the feeding-roller. When the feeding-roller $d$ and the fingers are lifted and the roller $f^6$ has reached the curve $f^4$, the roller $e^5$ is in contact with the point $E^2$ of the cam $f'$, (see Fig. 10,) and by running over the part $E^2$ $E^3$ the roller $e^5$ is lowered, thereby permitting the spring $h$ to draw back the lever $e'$, the rod $d^5$, respectively, whereby the feeding-roller and the finger are also moved backward. At the same time while the feeding-roller is moved backward the roller $f^6$ travels on the concentric curve $f^4$, thereby preventing the feeding-roller from lowering. When the roller $f^6$ travels over the curve $f^5$, it is permitted to lower itself, whereby the finger is now placed on the subsequent top sheet, as indicated in Fig. 6. The manipulation of the finger and the feeding-roller is now effected again as before. It may be noted the finger consists of metal and its sliding face is polished. The feeding power exerted between the feeding-roller and the top sheet depends on the inclination of the rod $d^3$, and it will be increased if the angle between the top sheet and the rod $d^3$ is large, or it will be diminished if the rod $d^5$ is mounted a small distance from the sheet, thereby resulting a small angle between the rod $d^3$ and the top sheet. For lifting and lowering the support of the pile in order to maintain the top sheets always in a proper position to the feeding-roller and the separator the arrangement is provided, forming, however, no part of my invention, according to which the support $c'$ is suspended from the side frames $a$ by means of thin wire ropes $q$ or any other suitable means, fixed to eyes $q'$ at the support $c'$. The wire ropes $q$ run over rollers $q^2$, suitably mounted at the side frames $a$, and are fixed to a drum $q^3$, rotatably carried by bearings at the side frames $a$. On the same shaft on which the drum $q^3$ is mounted a ratchet-wheel $r$ is situated, engaging with a pawl $r'$. This pawl is arranged at one end of a double-armed lever $r^2$ $r^3$, connected at its other end to a rod $s$ of an eccentric $s'$, arranged on a shaft $s^3$, driven in any suitable manner. If the shaft $s^3$ rotates, the double-armed lever $r^2$ $r^3$ is moved, thereby causing the pawl $r'$ to operate the ratchet-wheel and the drum $q^3$, whereby the support $c'$ is lifted. A spring $r^4$ prevents the pawl $r'$ from releasing the tooth of the ratchet-wheel if the arm $r^2$ of the lever is moved to the left-hand side. (See Fig. 1.)

In order to feed sheets of different nature, I have provided a modified arrangement of the feeding mechanism. Instead of using one excessively-broad feeding-roller I use two feeding-rollers arranged at both sides of the middle axis of the machine, and in alinement with the same I have arranged a special retarding or separating device, which is illustrated in Figs. 13 and 14. $d$ $d$ designate again the feeding-rollers, being in connection by means of the rod $d^3$ with the transverse rod $d^5$, operated therefrom in the manner as described before. $m'$ represents the former retarders, having a friction covering or facing, as before described. Between the two feeding-rollers a separating-roller $o$ is situated, mounted on the rod $d^5$ in the same manner as the feeding-rollers $d$. This separating-roller consists of metal and is provided with a smooth surface and is permitted to be rotated in the bow $o'$. At the sleeve $o^2$ of the separating-roller an arm $o^3$ is arranged, carrying a counterbalance $o^4$, which can be adjusted by means of the screw $o^5$ on the arm. The connection of the sleeve $o^2$ with the transverse rod is formed in the same manner as illustrated in Fig. 12. Underneath the separating-roller $o$ a third retarder or a separator $p$ is situated, having also a friction-covering, the coefficient of friction of which is less than that of the separators $m'$ $m'$ and the feeding-rollers $d$. The operation of this device as at present described is the following: Supposing that sheets are to be fed off consisting of heavy paper the separation of the top sheet from that lying underneath requiring much friction. In this case the required friction is produced by adjusting the counterbalance $o^4$ on the arm $o^3$ near to the transverse rod $d^5$, whereby the separating-roller $o$ is caused to press strongly upon the top sheet, so that the sheets lying underneath the top sheet are prevented from being moved by the friction existing between the separator $p$ and the sheets while the top sheet is advanced, owing to the friction between the feeding-rollers $d$ and the top sheet. The lifting and returning of the feeding-rollers $d$ $d$

and the separating-roller *o* is carried out into effect in the same manner as described in case of one feeding-roller. In order to feed off thin sheets, a small friction is necessary for retarding, respectively separating the sheets from the top sheet. In this case I have only necessary to set the counterbalance $o^4$ on the arm $o^3$ away from the rod $d^5$, thereby diminishing the pressure of the separating-roller *o* when placed on the top sheet.

Having thus fully described the nature of my invention, what I desire to secure by Letters Patent of the United States is—

1. In a paper-feeding machine in combination a non-rotating feeding-roller, a finger, the rear edge of which is a certain distance from the axis of the roller to cause the feeding-roller to attack the top sheet always at the same distance from the front edge of the top sheet when the finger is fallen down from the top sheet, a separator, means for operating said feeding-roller and finger, a support for the sheets, and means for adjusting said support to maintain the top sheet at the proper level, substantially as described.

2. In a paper-feeding machine in combination non-rotating feeding-rollers, fingers carrying said feeding-rollers, a separating-roller of metal, having a smooth surface and capable of being rotated, separators arranged underneath the feeding-rollers and the separating-roller, means for operating said feeding-rollers, fingers and the separating-roller, a support for the sheets, and means for adjusting said support to maintain the top sheet in the proper level, substantially as described.

3. In a paper-feeding machine in combination non-rotating feeding-rollers provided with a friction covering, fingers carrying said feeding-rollers, a separating-roller of metal, having a smooth surface and capable of being rotated, separators arranged underneath the feeding-rollers and the separating-roller, the separator lying underneath the separating-roller having a friction covering, the coefficient of friction of which is somewhat less than that of the feeding-rollers, means for operating said rollers, fingers and separating-roller, a support for the sheets, and means for adjusting said support, substantially as described.

4. In a paper-feeding machine, in combination a non-rotating feeding-roller, a finger carrying said feeding-roller and maintaining the proper position of said feeding-roller on the top sheet, a separator, a governing-shaft, cams mounted on said governing-shaft, double-armed levers operated by said cams for moving to and fro the feeding-roller and the finger, a crank-lever, a roller carried by said crank-lever, a guiding-channel in which the aforementioned roller travels, a dovetailed guiding-piece carrying said guiding-channel, a roller fixed to said dovetailed guiding-piece, a support for the sheets, and means for adjusting said support, substantially as described.

5. In a paper-feeding machine in combination non-rotating feeding-roller provided with friction coverings, fingers carrying said feeding-rollers on the top sheet, a separating-roller of metal, having a smooth surface and capable of being rotated, separators arranged underneath the feeding-rollers and the separating-roller, an arm connected with said separating-roller, a counterbalance movably arranged at said arm, means for operating said feeding-rollers, fingers and the separating-roller, a support for the sheets and means for adjusting said support, substantially as described.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

ABEL BUG.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.