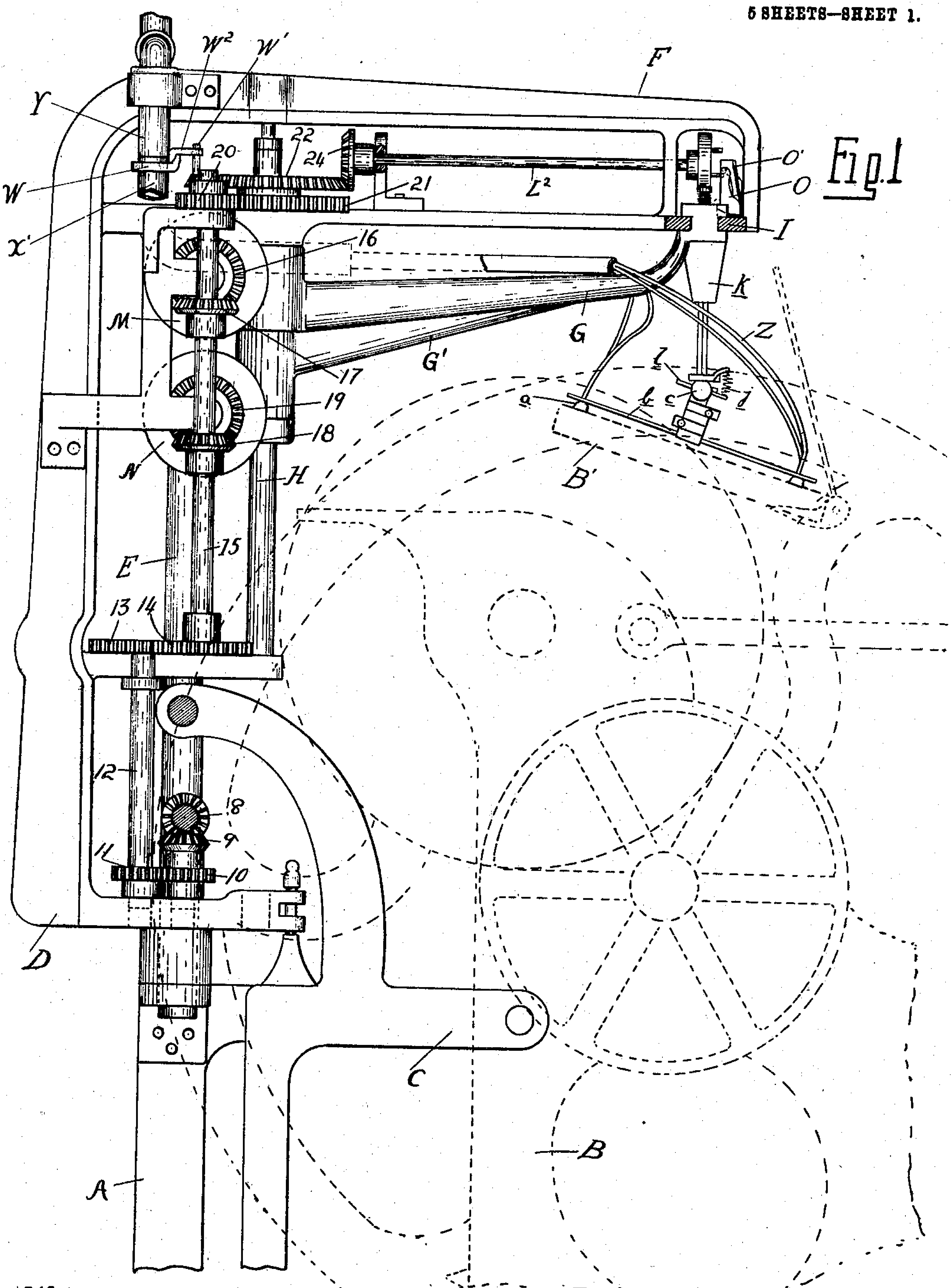
F. W. SPROWLES & J. C. LORGION.

PAPER FEEDING MACHINE.

APPLICATION FILED FEB. 12, 1908.

930,702. Patented Aug. 10, 1909.

5 SHEETS—SHEET 1.



Witnesses

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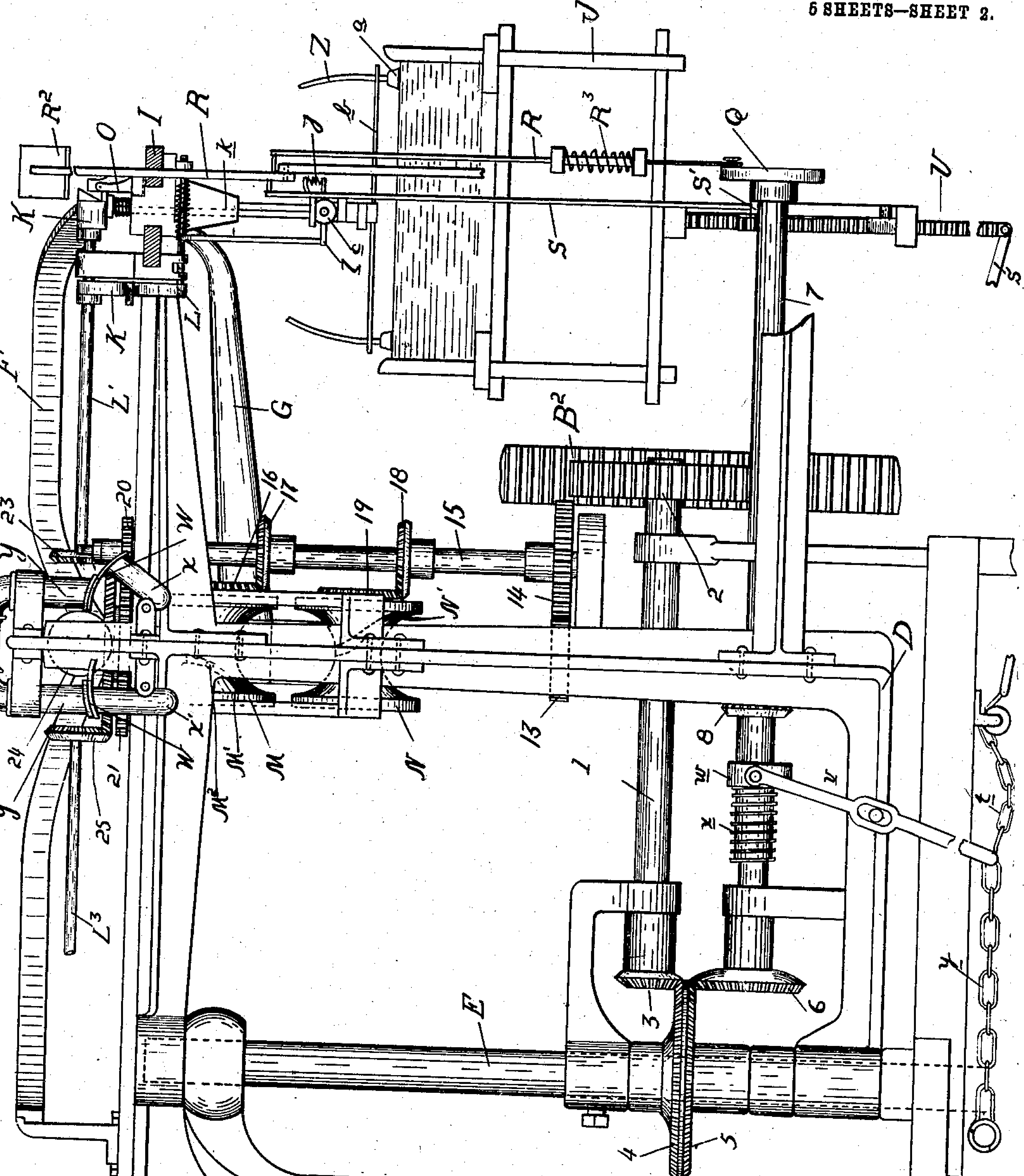

Fig. 2

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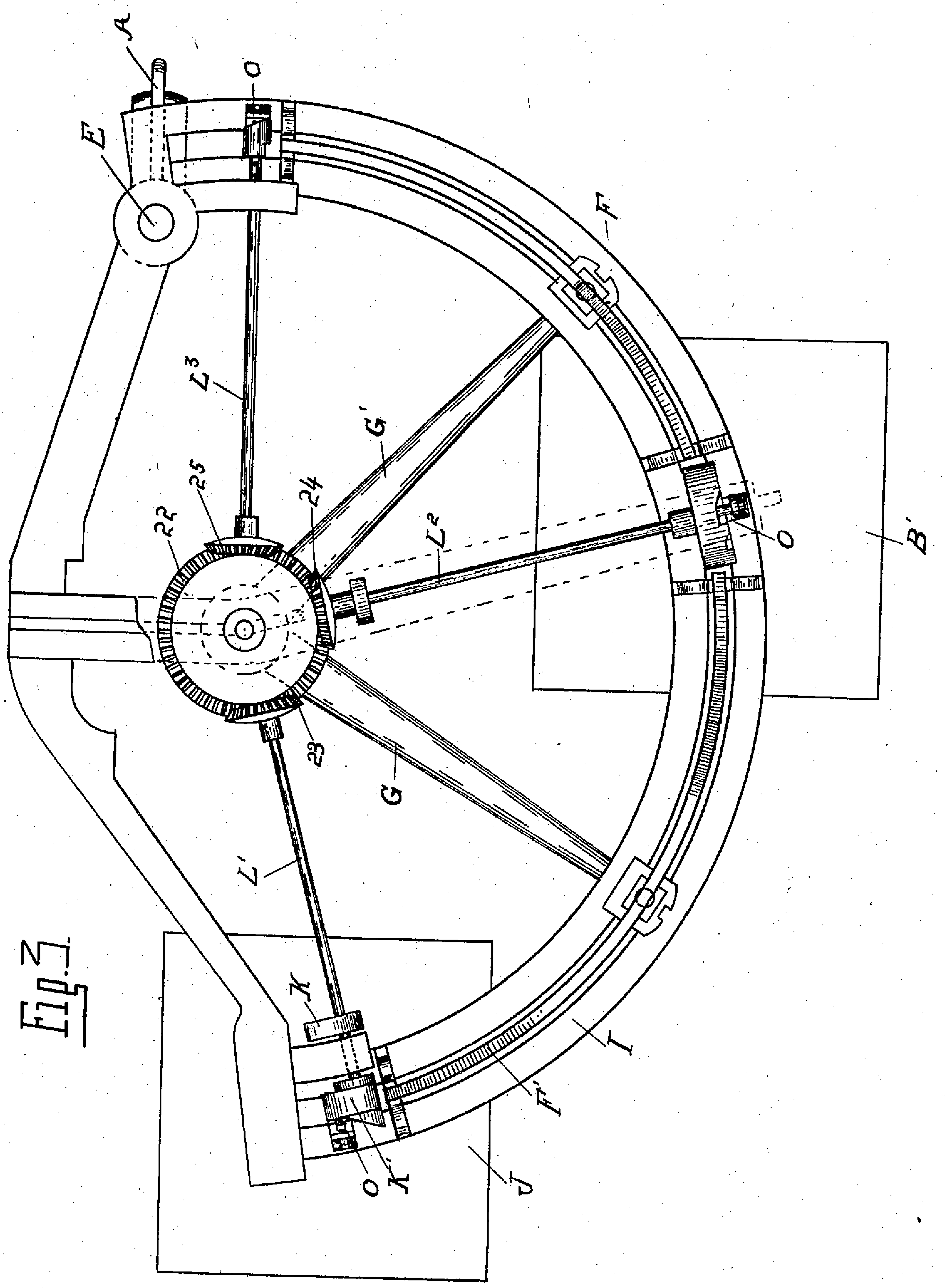

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5 SHEETS—SHEET 4.

Fig. 4.

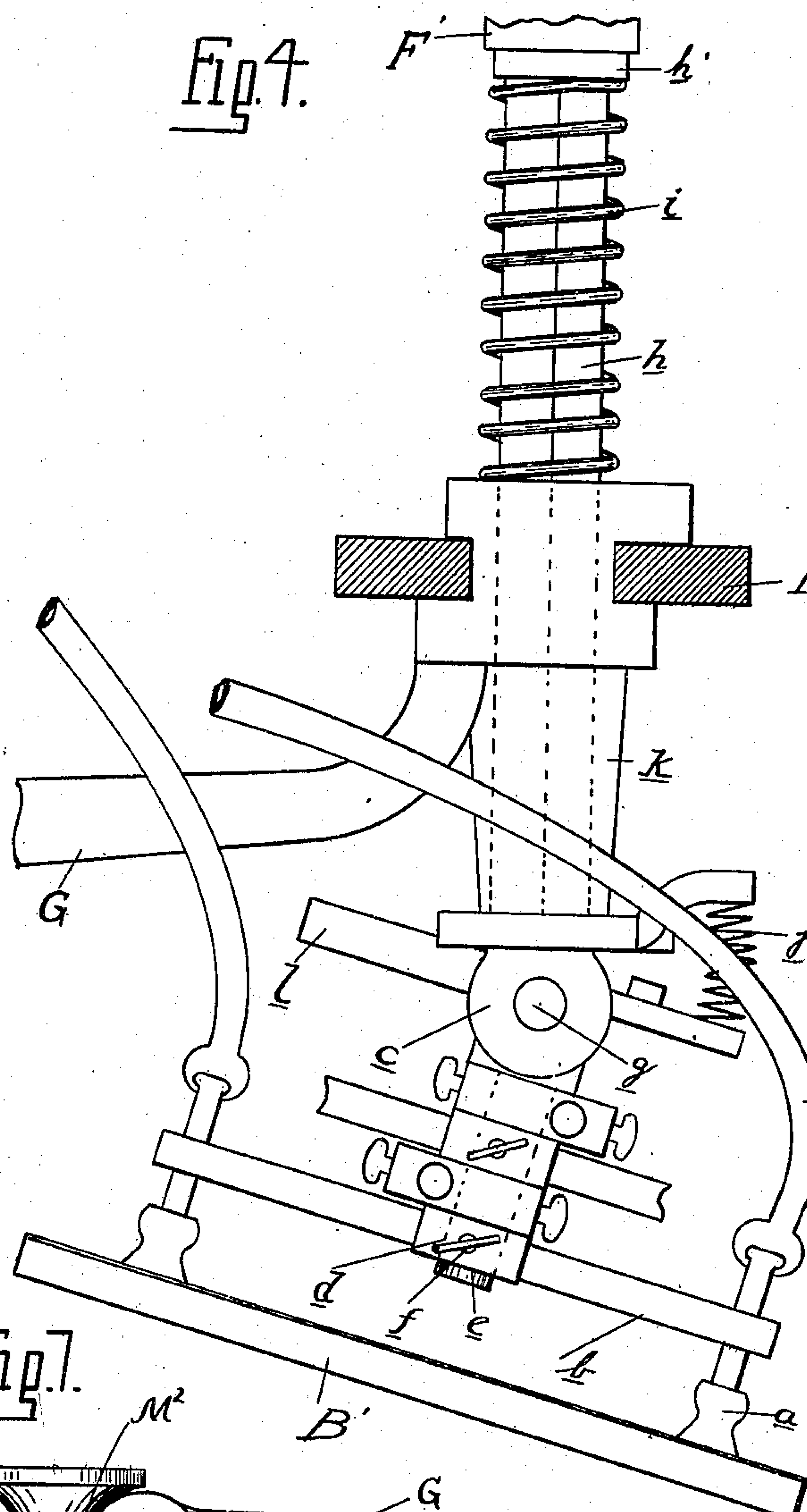


Fig. 8.

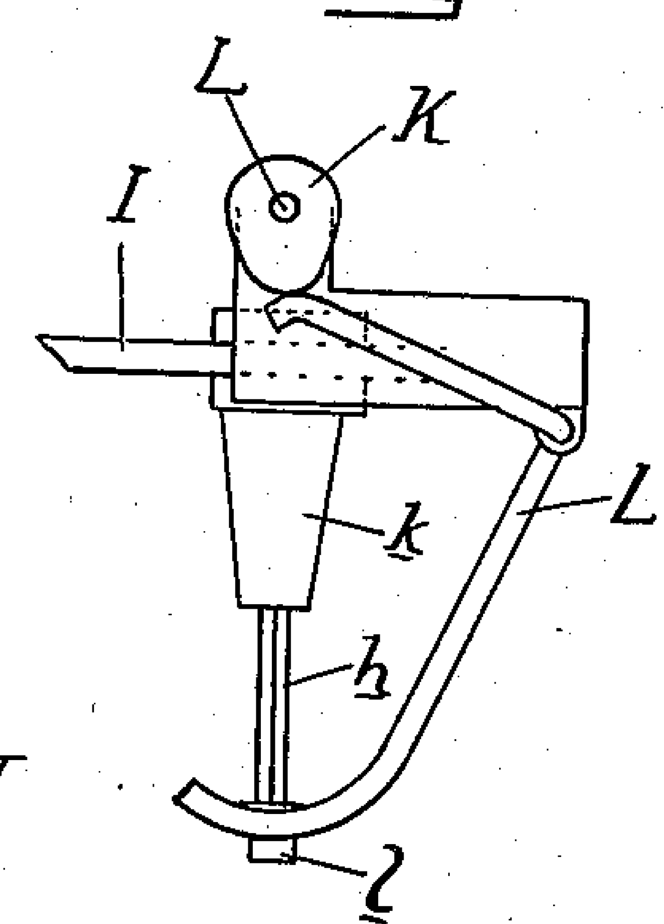
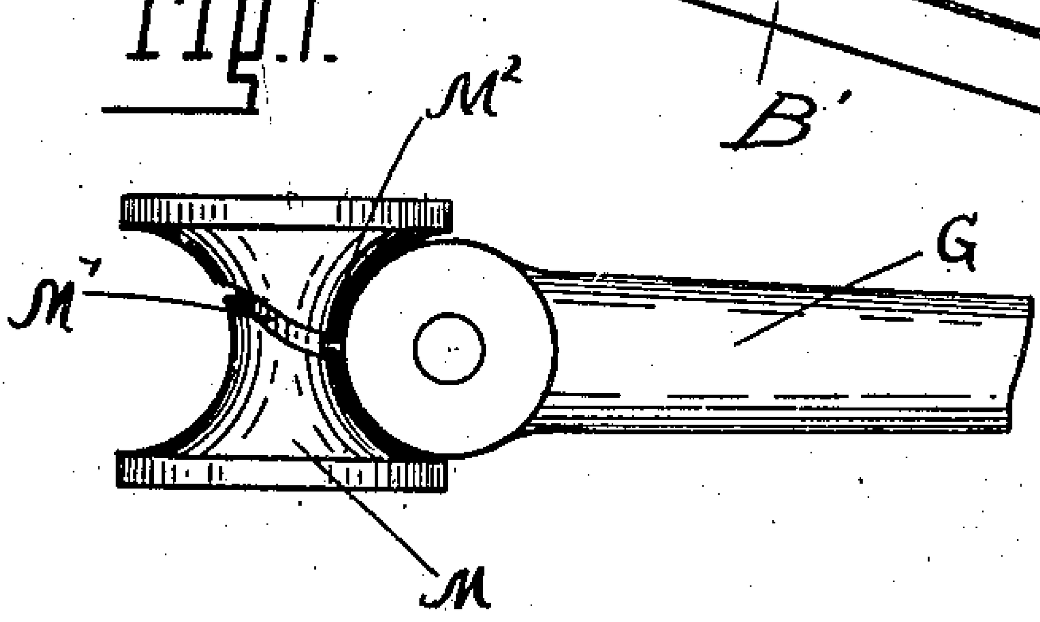


Fig. 7.



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5 SHEETS—SHEET 5.

Fig.5.

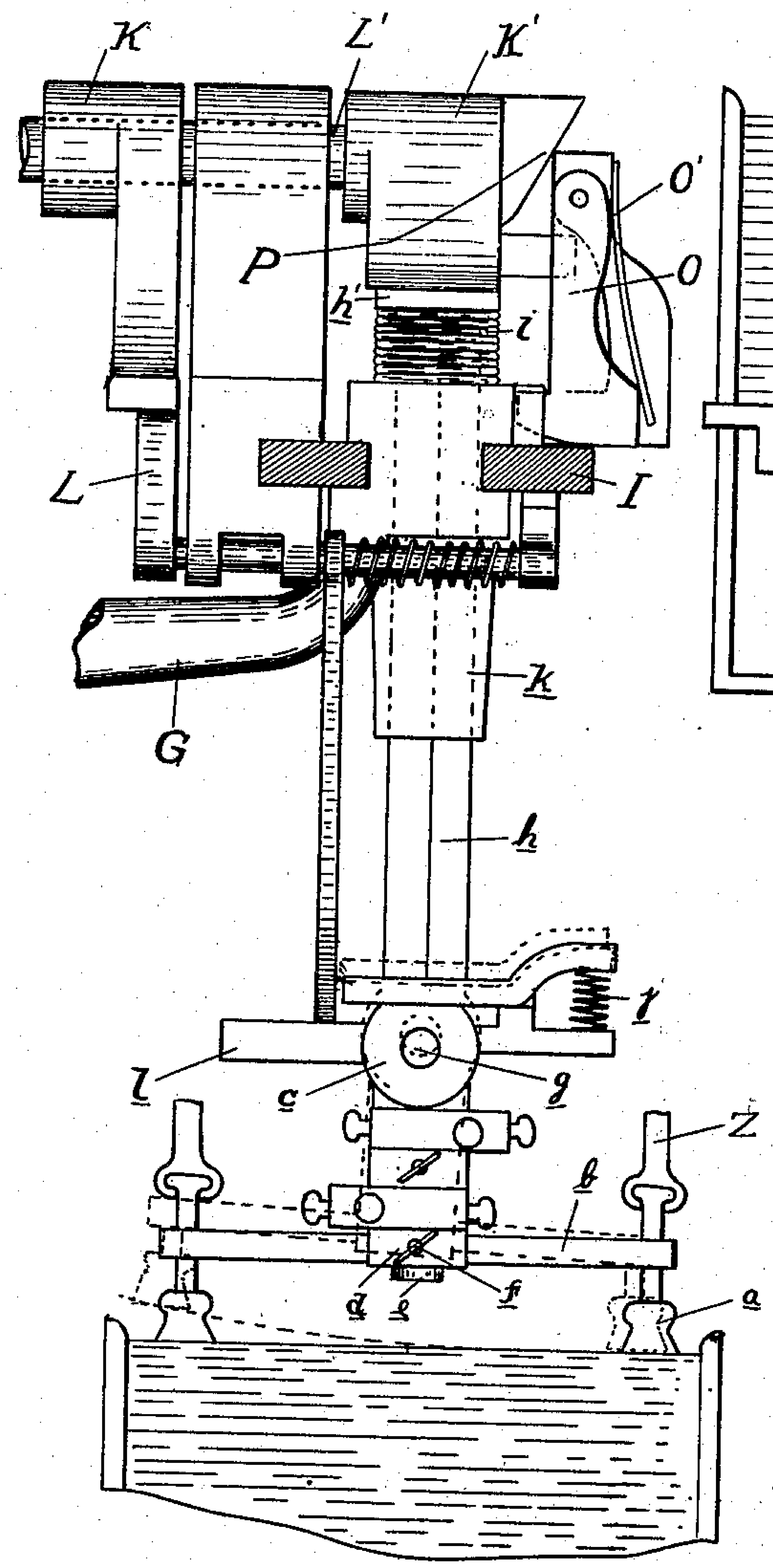
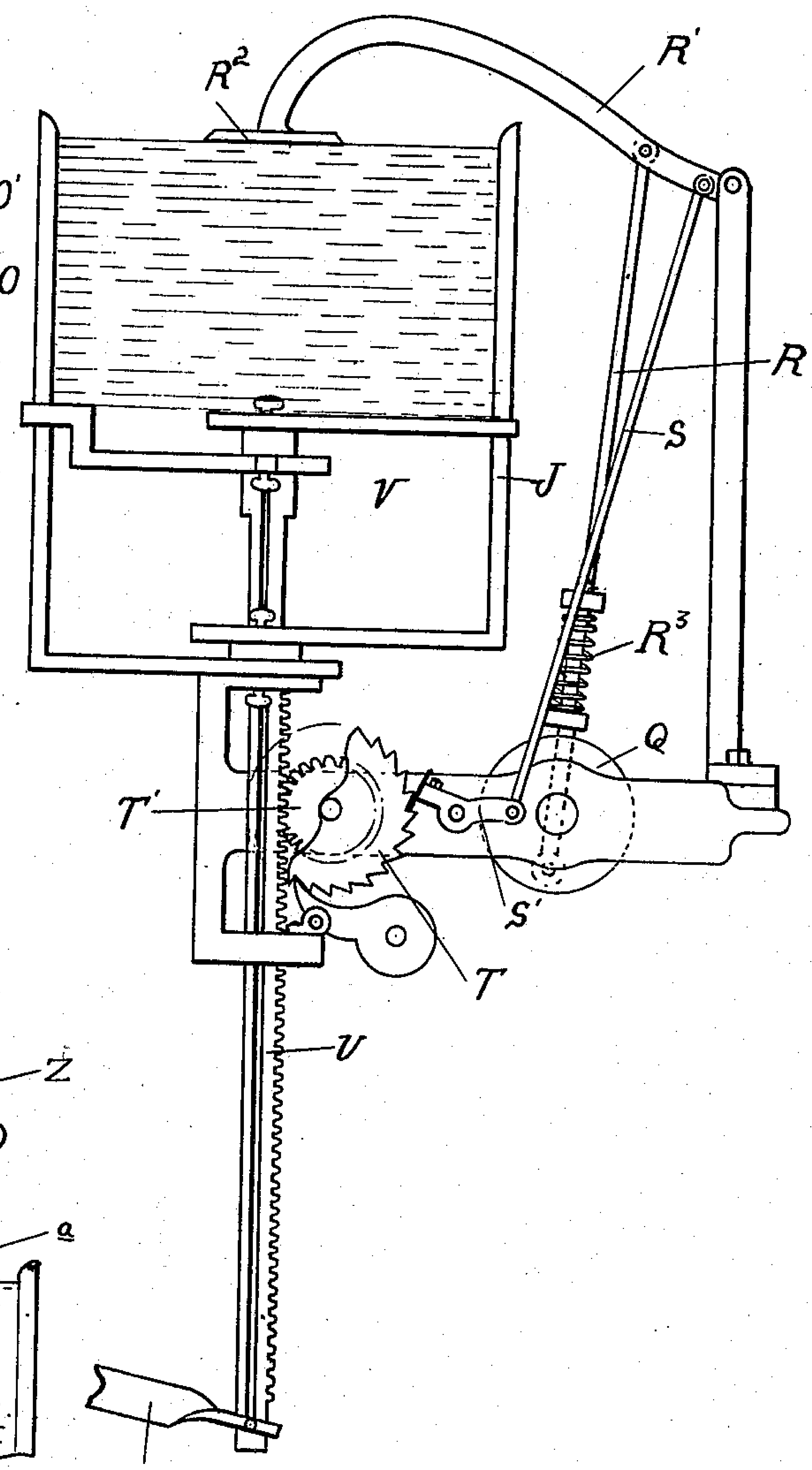


Fig.6.



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UNITED STATES PATENT OFFICE.

FRANK W. SPROWLES AND JOHN C. LORGION, OF DETROIT, MICHIGAN.

PAPER-FEEDING MACHINE.

No. 930,702. Specification of Letters Patent. Patented Aug. 10, 1909.

Application filed February 12, 1903. Serial No. 415,585.

To all whom it may concern:

Be it known that we, FRANK W. SPROWLES and JOHN C. LORGION, citizens of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Paper-Feeding Mechanism, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to paper feeding mechanism particularly designed for use in connection with printing presses, and it is the object of the invention to obtain means for successively feeding sheets from a pile to the platen of the press and for removing the printed sheets from the platen.

It is a further object to obtain means for preventing the feeding of more than one sheet at a time, and, further, to place the successive sheets in exact registration, this being particularly necessary in multi-color printing.

The invention consists in the peculiar construction of a suction lifter, further in the means employed for moving this suction lifter to transfer the sheets, further in the means employed for maintaining the pile of sheets at substantially the same level, and further in the peculiar construction, arrangement and combination of parts as hereinafter set forth.

In the drawings—Figure 1 is a sectional side elevation of the feeding mechanism as applied to a printing press, the latter being indicated by dotted lines; Fig. 2 is a front elevation; Fig. 3 is a plan view; Fig. 4 is an elevation of one of the carriers with the suction device thereon in registration with the platen of the press; Fig. 5 is an elevation of the carrier in registration with the paper magazine; Fig. 6 is a side elevation of the paper magazine and feed mechanism therefor; Fig. 7 is a plan view of one of the carrier arms and actuating cam therefor; and Fig. 8 is an elevation of the cam and lifter controlling the tilting of the lifter.

The mechanism is mounted upon a suitable frame work either formed as a part of the frame of the press or distinct therefrom, but preferably mounted on an independent frame so that it may be attached to any suitable press. Provision is also preferably made for adjusting the feeding mechanism to one side when it is desired to use the press for hand-feed work. At the same time, the construction is preferably such that the drive connections to the feed mechanism are not disturbed by such adjustment, so that there is no danger of disarranging the mechanism or throwing it out of time. As shown, A is the main frame, which is arranged adjacent to the press B (indicated in dotted lines) and is preferably rigidly secured to the press frame by the bracket connection C.

D is a swinging frame secured to the main frame upon the vertical shaft or post E at one side thereof, and upon this swinging frame all of the operating parts of the feeding mechanism are mounted. In the operative position of the feeding mechanism the frame D is arranged in front of the press and at the upper end of this frame is an overhanging portion F, which extends above the press and the platen thereof. When, however, the frame D is swung outward, it will be moved together with the portion F thereof so as to leave the space in front of the press clear.

The transfer mechanism employed comprises a pair of pneumatic or suction lifters, one for engaging the unprinted sheets and transferring them to the platen, and the other for removing the printed sheets from the platen. Each of these suction devices is carried by a swinging arm, and these arms G and G′ are pivotally mounted upon a vertical shaft or pin H centrally mounted upon the swinging frame D. The outer ends of the arms G and G′ are guided by a segmental track I which forms a part of the overhanging frame F, and which is concentric with the axis of the shaft H. This track forms a rigid support for the arms during their swinging movement and at the limits of the movement of each arm locking devices are provided, as will be hereinafter described, which accurately determine the positions of engagement and disengagement from the work so as to insure exact registration.

Each of the suction lifters comprises a plurality of suction tips, preferably one for each corner of a rectangular sheet, and these tips are adjustable in position to accommodate different sized sheets. As shown, the suction tips *a* are mounted at the ends of the arms *b*, which are radially adjustably secured to a central head *c* by means of the clamping devices *d*. The clamping devices, as shown, are collars surrounding a depending pin *e* on the head c, and each of these collars is apertured for the passage of the radial arm b which is clamped by thumb screws f. The arrangement is such that the arms may both be adjusted radially and angularly, the latter adjustment being by a turn of the collar upon the shaft e, and thus within certain limits the tips a may be adjusted to fit a sheet of any size or shape.

The heads c are pivoted at g to vertically extending shanks h which pass through bearings in the ends of the arms G and G′ and are provided at their upper ends with bearings h' for engagement with a cam track F′. This cam track is supported by the overhanging frame F and is so fashioned as to produce a vertical movement of the shanks h during the swinging movement of their carrying arms about the track I. The bearings h' of the shanks are held in contact with the track F′ by a spring i upon the shank which is of sufficient tension to lift the suction heads whenever the track F′ will permit.

j is a spring arranged between the heads c and the bearing k through which the shank h passes tending to tilt the head c into an inclined position. The angle to which the head is tilted is substantially the same as the angle at which the platen B′ of the press is inclined, and this position is normally assumed. On the other hand when the arm is in registration with the unprinted sheets of paper the head c is tilted by mechanism, which will be hereinafter explained, into a horizontal position. Thus the unprinted sheets may be removed from a pile arranged horizontally and deposited on the inclined platen, and in like manner the printed sheets may be removed from the inclined platen and deposited on a horizontally arranged pile.

The position of the platen is beneath the central portion of the track I, while the position of the piles of unprinted and printed sheets is beneath the opposite ends of said track. The unprinted sheets are preferably held in a magazine J, which is adjustable to receive different sizes of sheets, and is provided with a vertically movable follower and a suitable operating mechanism therefor, by means of which the top of the pile is maintained at substantially the same level. From this magazine the sheets are successively transferred by the swinging arm G, but, to prevent the carrying of more than one sheet at a time, a peculiar initial movement is imparted to the suction lifter, as follows: When a sheet of paper is to be separated from a pile by hand, the operator usually first lifts one corner of the sheet and then slides it out of registration with the other sheets at the same time that it is being lifted away, thereby preventing the lifting of more than one sheet. Our mechanism is designed to perform substantially the same movement, first lifting one edge of the sheet and then sliding the sheet laterally to separate it from the next adjacent sheet before it is completely lifted out of contact therewith. To accomplish this movement, the head c is first held in horizontal position, while the suction tips a are pressed in contact with the paper and until the suction is applied. The head is then permitted to tilt upon the pivot G simultaneously with the slight vertical movement of the shank h, which results in lifting the suction tips at one edge of the paper and also moving these, together with the suction tips at the opposite edge, laterally, as indicated in Fig. 5. These movements are effected by means of a cam K in registration with the shank h when the suction head is above the paper magazine, this cam operating a bell crank lever L secured to the frame F, and having its actuated arm projecting downward into contact with the bearing l on the head c. The cam K is upon a shaft L′ and upon this same shaft is mounted another cam K′ which bears against the head h' of the shank h, being located in a recess in the track F′. These cams are operated by mechanism, which will be hereinafter described, so that the suction head is held in horizontal position when pressed against the paper sheet, and is then permitted to tilt, as has been already described.

The arms G and G′ are operated by a suitable mechanism which is timed with the movement of the press and, as shown, includes a train having the following members. 1 is a shaft journaled in the stationary frame A and having mounted thereon a pinion 2, which meshes with a gear wheel B^2 upon the press, this gear wheel being timed to revolve once for each cycle of the operation of the press. 3 is a bevel gear wheel on the shaft 1 meshing with a bevel gear wheel 4 journaled upon the stationary shaft E to which the swinging frame is hinged. 5 is another bevel gear wheel fixed to the gear wheel 4, and meshing with a bevel gear wheel 6 on a shaft 7. This shaft is journaled in bearings upon the swinging frame D, but, in the operative position of the parts, is arranged parallel to the shaft 1. From the shaft 7 movement is imparted through the bevel gear wheels 8 and 9 and straight gears 10 and 11 to a vertical shaft 12, and through the gears 13 and 14 to a vertical shaft 15. The latter extends adjacent the vertical shaft H upon which the arms G and G′ are pivoted and communicates movement through bevel gear wheels 16, 17, 18 and 19 to cams M and N for respectively operating the arms G and G′. These cams, as shown, are in the form of concave drums, which embrace the hubs of the arms G and G′ and have cam slots M′ and N′ formed therein for engaging pins M^2 in said hubs. Thus the rotation of the cams will cause the swinging of the arms G and G′, and the grooves M′ and N′ are fashioned to produce the desired timing effect. The shaft L′, which operates the crank K, is also driven from the shaft 15 through the medium of intermeshing gear wheels 20 and 21, the latter being sleeved upon the shaft H, and the intermeshing bevel gear wheels 22 and 23, the former being attached to the gear wheel 21, and the latter being mounted upon the shaft L′. Similar bevel gear wheels 24 and 25 are also in mesh with the bevel gear wheel 22 and are mounted upon shafts L^2 and L^3 extending respectively to the station points above the platen and above the work delivery station. The shafts L′, L^2 and L^3 are employed for releasing the locking mechanisms which hold the arms G and G′ in exact positions when at their different station points. These locking devices, as shown, are formed by pivotal locking dogs O for engaging notches in the arms G G′ and having springs O′ for pressing them into engagement. Adjacent to these locking dogs is arranged a cam P on each of the shafts L′, L^2 and L^3 so designed as to contact with a dog and force it out of engagement with its notch or keeper in advance of the movement of the arms. The cam K′ is arranged adjacent these cams P and, as shown, are formed integral therewith.

With the arrangement just described, whenever the arms G and G′ are moved to a station point the spring actuated dogs O will automatically engage the notches in said arms, and will lock them in exact positions, but subsequently the rotation of the shafts L′, L^2 and L^3 will cause the cams P to disengage the dogs and again permit free movement of the arms.

The magazine feeding and controlling mechanism is operated by an extension of the shaft 7 beyond the bevel gear wheel 8 at the end of which is secured a crank Q. This crank actuates a pitman rod R, which is attached to a rock arm R′, having at its free end a plate R^2 for contacting with the top of the pile of paper sheets in the magazine.

S is another pitman rod connected to the arm R′ and which is attached at its opposite end to a pawl S′ engaging a ratchet wheel T.

T′ is a pinion adjacent and rotatively fixed to the ratchet wheel T, and U is a vertically extending rack bar which meshes with the pinion T′. This rack bar is attached to a follower V in the magazine upon which the pile of sheets rests, and the arrangement is such that whenever the ratchet wheel T is operated the follower will be raised to feed the paper pile upward. This movement is, however, dependent upon the movement of the rock arm R′, which is actuated by the crank Q through the medium of the pitman rod R, which has a yieldable portion R^3 therein. The arrangement is such that where the pile of sheets is at its normal height the plate R^2 will strike the topmost sheet without permitting a full movement to the rock arm R′, and as a consequence the movement imparted to the pawl S′ by the rod S is insufficient to engage with another tooth in the ratchet wheel T. Consequently, this ratchet wheel will not be operated and the follower will remain stationary. On the other hand, when the pile lowers by the removal of sheets therefrom a greater movement will be permitted to the rock arm R′ until eventually the pawl S′ will engage with another tooth of the ratchet wheel and will feed the follower upward.

The air suction for the suction tips may be produced by any suitable means and is controlled by valves W. These valves are preferably arranged adjacent the gear wheel 22 and are operated by projecting pins W′ on said gear which contacts with arms W^2 upon the valves. The valves consist of movable conduit sections X X′, which may be alternatively registered with supply conduits Y Y′ connected with the suction means. The movable sections X X′ have segmental plates attached thereto which act as shut-off valves for closing the ends of the pipes Y Y′ when not in registration therewith. The pipes X X′ are connected with flexible conduits Z which lead to each of the suction tips and the arrangement is one which will simultaneously apply or relieve the suction from all of the tips of one lifter.

In operation whenever the automatic feeding device is to be employed the swinging frame D is turned to bring the shafts 1 and 7 into parallelism and is locked in this position by suitable means (not shown). The paper holding magazine, which is preferably adjustable so as to accommodate sheets of any size within certain limits, is then adjusted to receive the pile of paper of the required size and the follower V is adjusted to bring the top sheet of the pile at proper elevation for the initial feeding operation. The press is then started in operation, motion being communicated from the gear wheel B^2 to the mechanism mounted upon the swinging frame, and this will cause the periodic swinging of the arms G and G′. When the arm G is registered with the magazine, the suction head carried thereby will be depressed by the combined action of the cams K and K′, which will press all of the suction tips *a* in firm contact with the upper sheet of paper in the pile. Suction will also be placed upon the tips by registration of the conduit section X with the conduit Y. Further movement of the cams will first cause the cam K to relieve the pressure upon the bell crank lever L and permit the spring *j* to tilt the head *c*, thereby lifting the suction tips *e* at one edge of the sheet and also moving them laterally, as has been previously described. This will break the suction exerted by the topmost sheet upon the sheet below temporarily therebetween so that in the further lifting of the head but one sheet will be carried which will be transferred by the swinging of the arm G into registration with the platen. During this movement, the suction head c will assume its inclined position so that when lowered the sheet will be laid flat upon the platen. The suction is then broken by a movement of the conduit section X out of registration with the section Y which will close the conduit Y by the segmental plate W and will open the conduit X to the atmosphere. This will permit a rush of air through the conduit X and connecting tubes Z which will assist in separating the tips from the paper sheet. The arm G is then returned again into registration with the magazine and another sheet is engaged and transferred to the platen. During the interval in which this is being accomplished and subsequent to the printing of the sheet on the platen the arm G′ is registered with the platen and the suction head carried thereby is lowered to engage the suction tip with the sheet and subsequently to lift the sheet from the platen. All this occurs before the succeeding sheet carried by the arm G reaches registration with the platen and the printed sheet is removed without interference with the unprinted sheet. The printed sheet is deposited by the arm G′ upon the pile at the opposite side of the machine, and the operations are repeated in this manner until the supply of unprinted sheets is exhausted.

To avoid continuing the operation after the last sheet has been fed, which would result in printing an impression directly upon the platen, we preferably provide an automatic stopping mechanism which is controlled by the movement of the follower actuating rack U for the paper holding magazine. The lower end of this rack is connected by a lever s with a chain or flexible connection t which in turn is connected with a lever v fulcrumed upon the frame and connected at its opposite end with an externally threaded sleeve or nut w on the shaft 7. Upon this shaft is a screw or worm x which is normally slightly separated from the threaded collar w but which upon the actuation of the lever s, chain t and lever v will be engaged with the nut or collar w. When this occurs the continued rotation of the shaft 7 will move the lever v and cause it to draw upon a chain y connected with the belt shifter or other controlling mechanism (not shown) for stopping the operation of the press.

What we claim as our invention is:

1. In a paper feeding mechanism, a pneumatic lifter, means for causing said lifter, first to simultaneously engage the opposite edges of the topmost sheet of a pile, next, to move said lifter to initially move one edge of the sheet away from the pile in advance of the other edge and to then lift the entire sheet from the pile.

2. In a paper feeding mechanism, a pneumatic lifter, means for causing said lifter, first to simultaneously engage the opposite edges of the topmost sheet of a pile, next, to move said lifter angularly to separate one edge of the sheet in advance of the other, and to then lift the whole sheet bodily from the pile.

3. In a paper feeding mechanism, a pneumatic lifter, means for causing said lifter to simultaneously engage the opposite edges of the topmost sheet of a pile, and means for moving said lifter away from the pile and simultaneously imparting an angular movement thereto whereby one edge of the sheet is lifted in advance of the other, and a limited lateral sliding movement is given to the sheet followed by a lifting of the same bodily from the pile.

4. In a paper feeding mechanism, a pneumatic lifter, means for causing said lifter to simultaneously engage the opposite edges of the topmost sheet of a pile, a carrier upon which said lifter is mounted, and means for raising said lifter upon said carrier and for simultaneously imparting an angular movement thereto to separate one edge of the sheet from the pile in advance of the other edge while the entire sheet is given a limited lateral sliding movement and to then lift the sheet bodily from the pile, and means for moving said carrier to transfer the sheet.

5. In a paper feeding mechanism, an oscillatory carrier, a pneumatic lifter, means for causing said lifter to simultaneously engage the opposite edges of the topmost sheet of a pile, a mounting for said lifter upon said carrier permitting of a vertical and angular movement thereof, and timed operating mechanism for moving said lifter and carrier whereby one edge of the sheet is lifted in advance of the other while the whole sheet is slid laterally and then lifted bodily from the pile and is transferred by the carrier.

6. In a paper feeding mechanism the combination with a holder for a pile of paper sheets having guides for preventing lateral movement thereof, of a pneumatic lifter, means for causing said lifter to simultaneously engage the opposite edges of the topmost sheet of a pile, and means for moving the lifter to initially move one edge clear of the guides for moving the sheet laterally to break the adhesion with the next adjacent sheet and to then lift the entire sheet from the pile.

7. In a paper feeding mechanism for printing presses, the combination with a platen, of a lifter for engaging the topmost sheet of a pile, an oscillatory carriage for said lifter, and means for automatically locking said

carriage in its predetermined positions whereby sheets successively fed to the platen are in exact registration.

8. The combination with a platen, of a holder for the pile of paper sheets, a pneumatic lifter for engaging the topmost sheet of the pile, a carriage for said lifter reciprocating between said holder and platen, a rigid track for guiding said carriage, and means for automatically locking said carrier at the limits of its movement in exactly determined positions.

9. The combination with a platen, of a holder for a pile of paper sheets in a plane nonparallel to that of the platen, a pneumatic lifter for engaging the topmost sheet of the pile, means for actuating said pneumatic lifter to initially move one edge of the sheet away from the pile in advance of the other, an oscillatory carriage for transferring said lifter into registration with the platen, and means whereby said lifter is moved angularly upon its carriage into parallelism with the plane of said platen.

10. The combination with a platen and a paper holder or magazine for a pile of paper sheets, of a pneumatic lifter, means for actuating said lifter to initially move one edge of the sheet away from the pile in advance of the other, an oscillatory carriage on which said lifter is mounted for transferring the same from said magazine to said platen, and means for changing the plane of said lifter in relation to the plane of movement of said carriage.

11. In a paper feeding mechanism, the combination with an oscillatory carriage, of a pneumatic lifter angularly and vertically movable upon said carriage and a stationary cam in the plane of movement of said carriage for determining the vertical movement of said lifter.

12. The combination with a platen, of transfer mechanism for the unprinted and printed sheets comprising a track, a pair of oscillatory carriages engaging said track, a pneumatic lifter upon each of said carriages, and means for locking each of said carriages at the predetermined limits of their movement.

13. The combination of a magazine or holder for a pile of paper sheets and a platen arranged in a nonparallel plane, of an oscillatory carriage, a track upon which said carriage travels, a pneumatic lifter, a bearing for said lifter permitting vertical and angular movement of the lifter in relation to the carriage, and means for angularly adjusting said lifter to arrange the same in parallel relation to said platen and the paper in the magazine while in registration therewith.

14. The combination with a printing press, of a paper feeding mechanism therefor, a frame carrying said feeding mechanism mounted upon a vertical pivot and movable thereon into and out of operative relation to said press, and a drive train for said paper feeding mechanism in permanent connection with the operating mechanism of said press and having an intermediate member concentric with the axis of said pivot whereby adjustment of said frame is permitted.

15. The combination with a transfer mechanism, of a magazine holder for a pile of paper sheets, a follower therein, a spring arm yieldably engaging the uppermost sheet of the pile, a platen, a drive train for said transfer mechanism; connections between said spring arm and drive train controlled by the former adapted to connect the drive train with the follower for maintaining the pile of papers at a substantially uniform height, and means for stopping said drive train when the last sheet has been fed.

16. The combination with a transfer mechanism, of a magazine holder for a pile of paper sheets, a follower therein, a spring arm yieldably engaging the uppermost sheet of the pile, a platen, a drive train for said transfer mechanism, a ratchet connection between said drive train and said spring arm controlled by the latter and adapted to connect the drive train with the follower when the pile of sheets falls below a predetermined level, whereby the pile of sheets is maintained at a substantially uniform height, and means controlled by the follower for stopping said drive train when the last sheet has been fed.

In testimony whereof we affix our signatures in presence of two witnesses.

FRANK W. SPROWLES.
JOHN C. LORGION.

Witnesses:
NELLIE KINSELLA,
HARRY W. GALVIN.