No. 869,326. PATENTED OCT. 29, 1907.

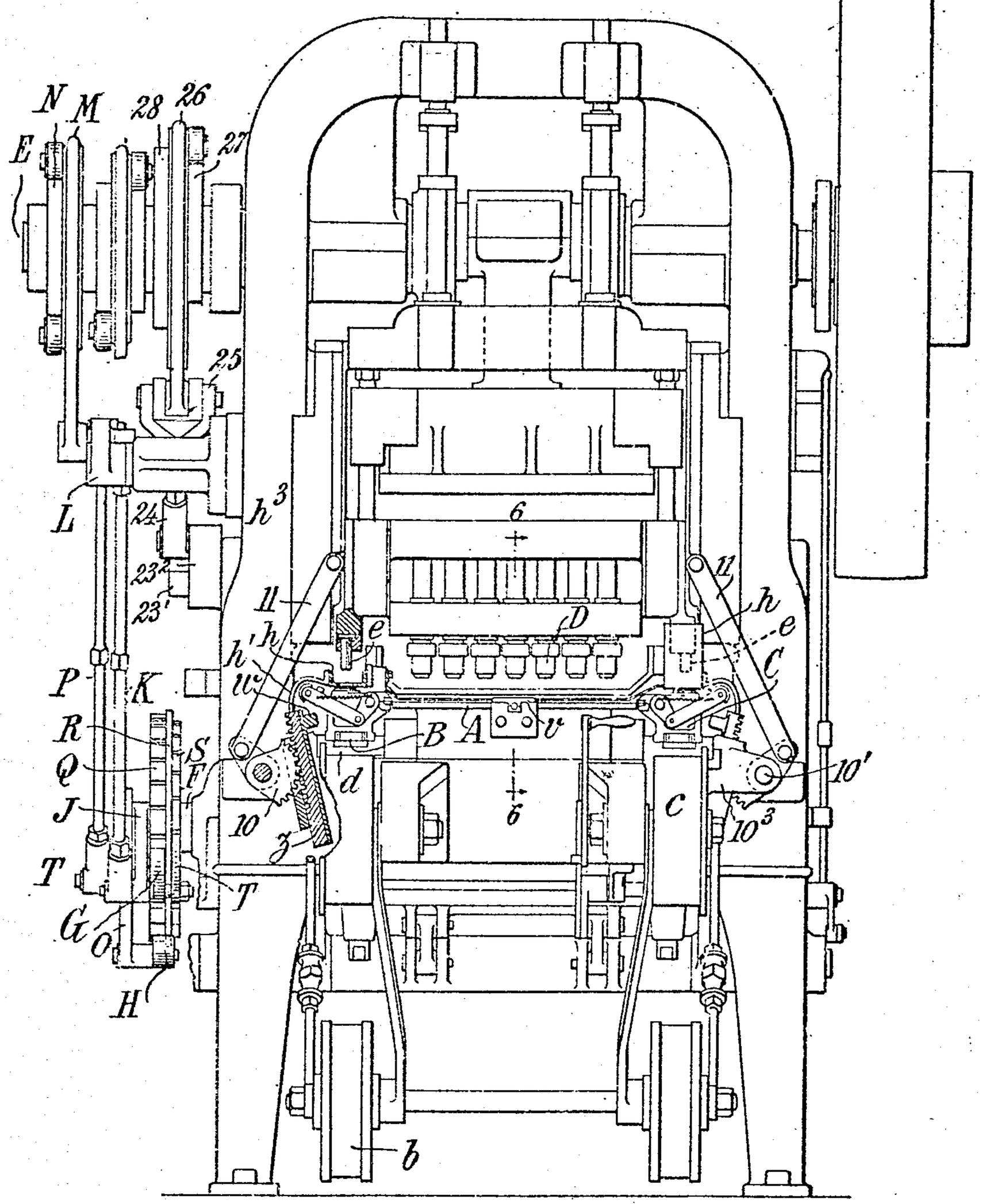
F. C. B. PAGE.

PUNCHING MACHINE AND FEEDING MECHANISM THEREFOR.

APPLICATION FILED DEC. 21, 1906.

7 SHEETS—SHEET 1.

FIG. 1.



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7 SHEETS—SHEET 2.

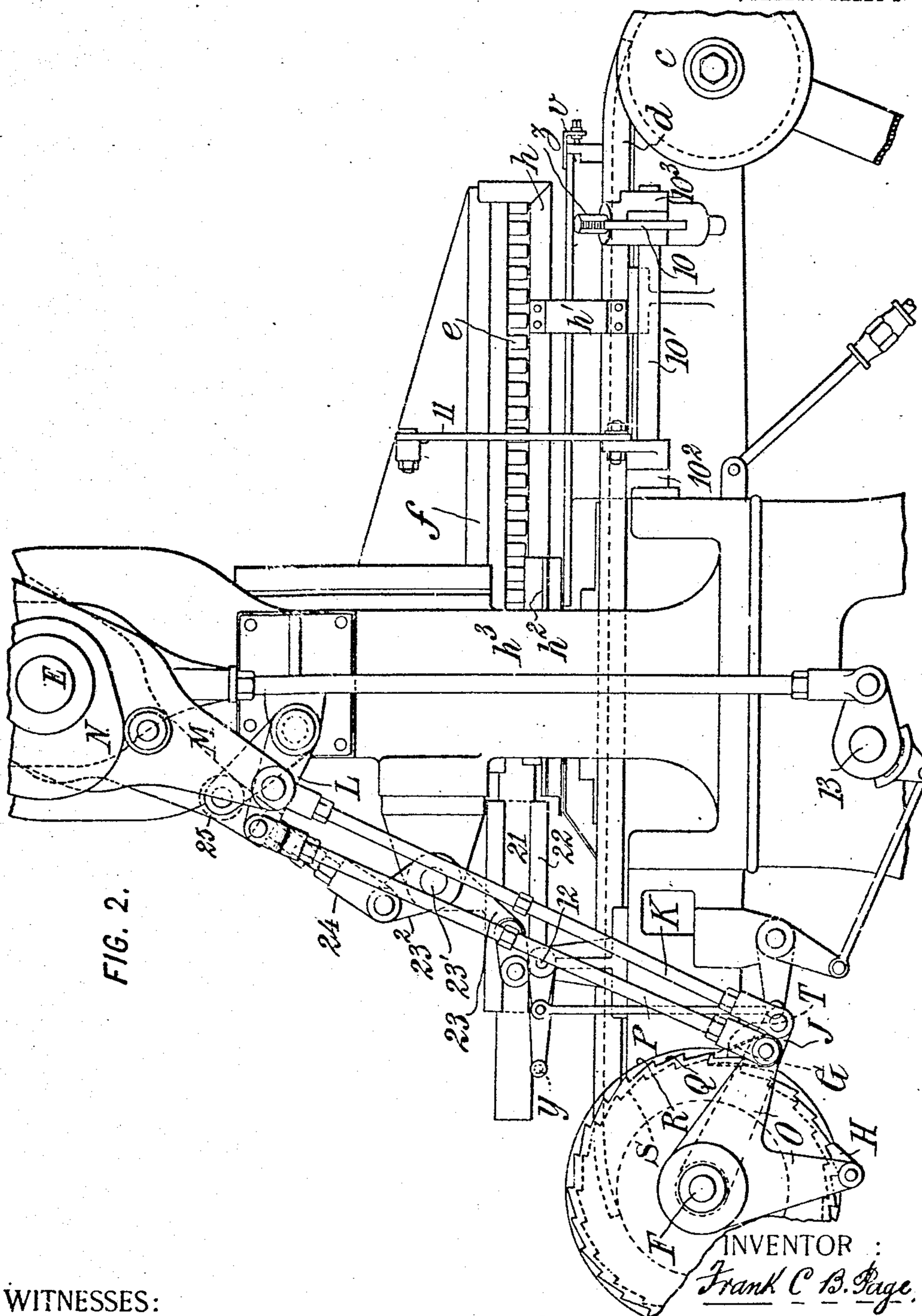

FIG. 2.

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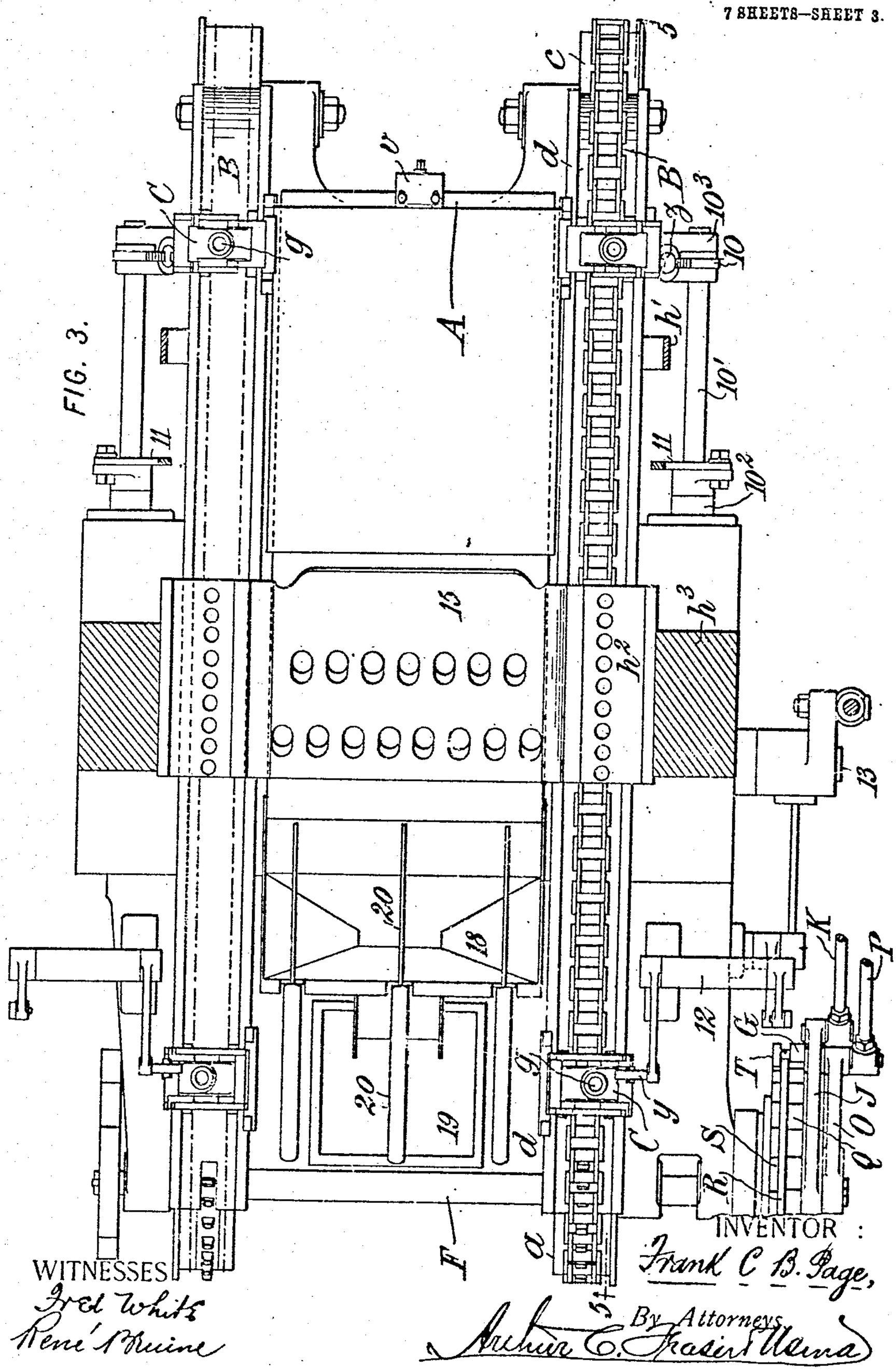
7 SHEETS—SHEET 3.

FIG. 3.



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7 SHEETS—SHEET 4.

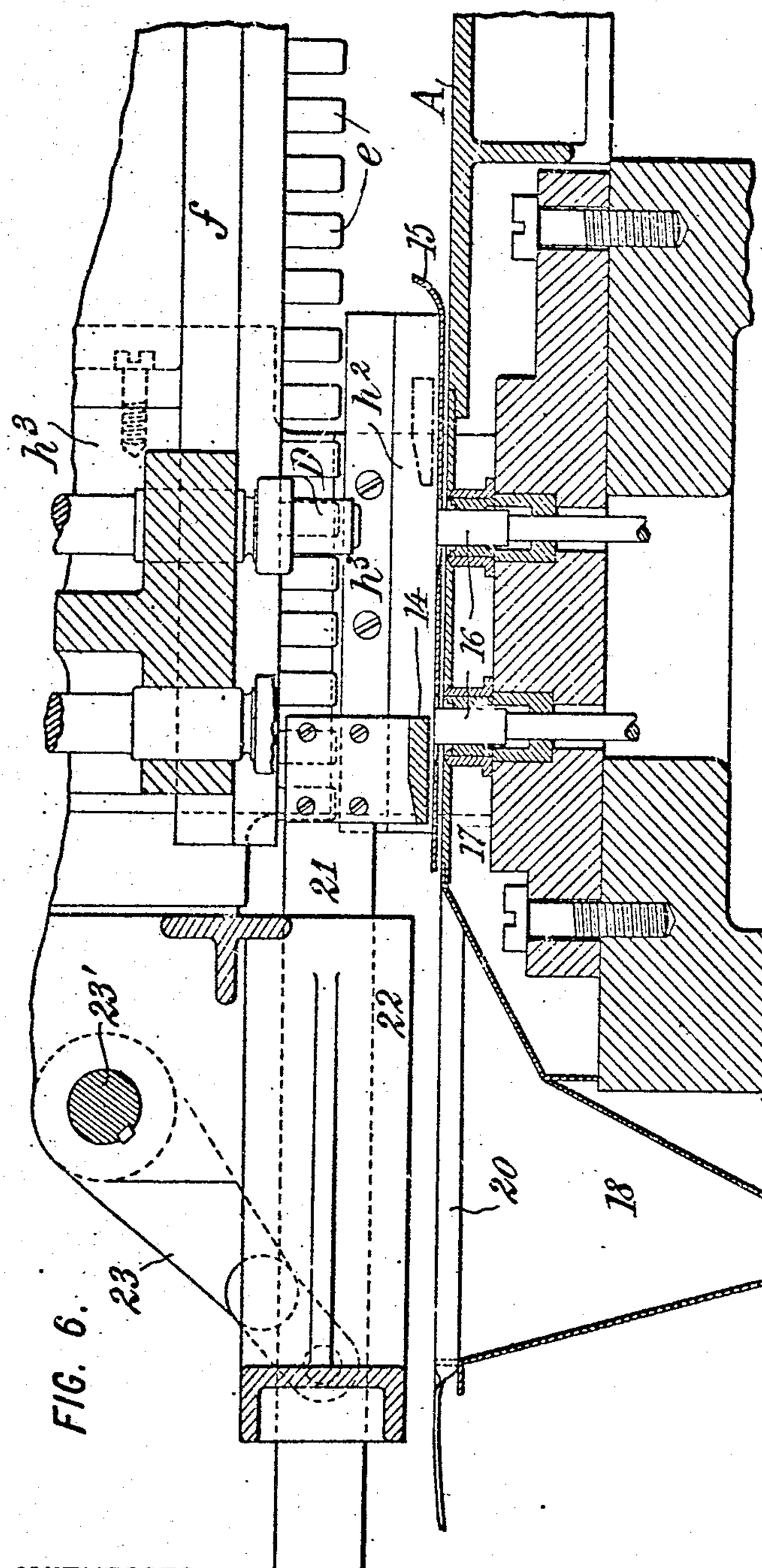

FIG. 6.

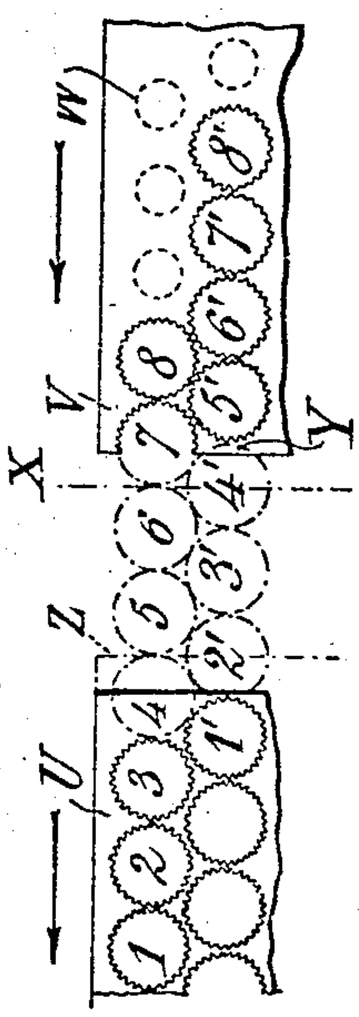

FIG. 4.

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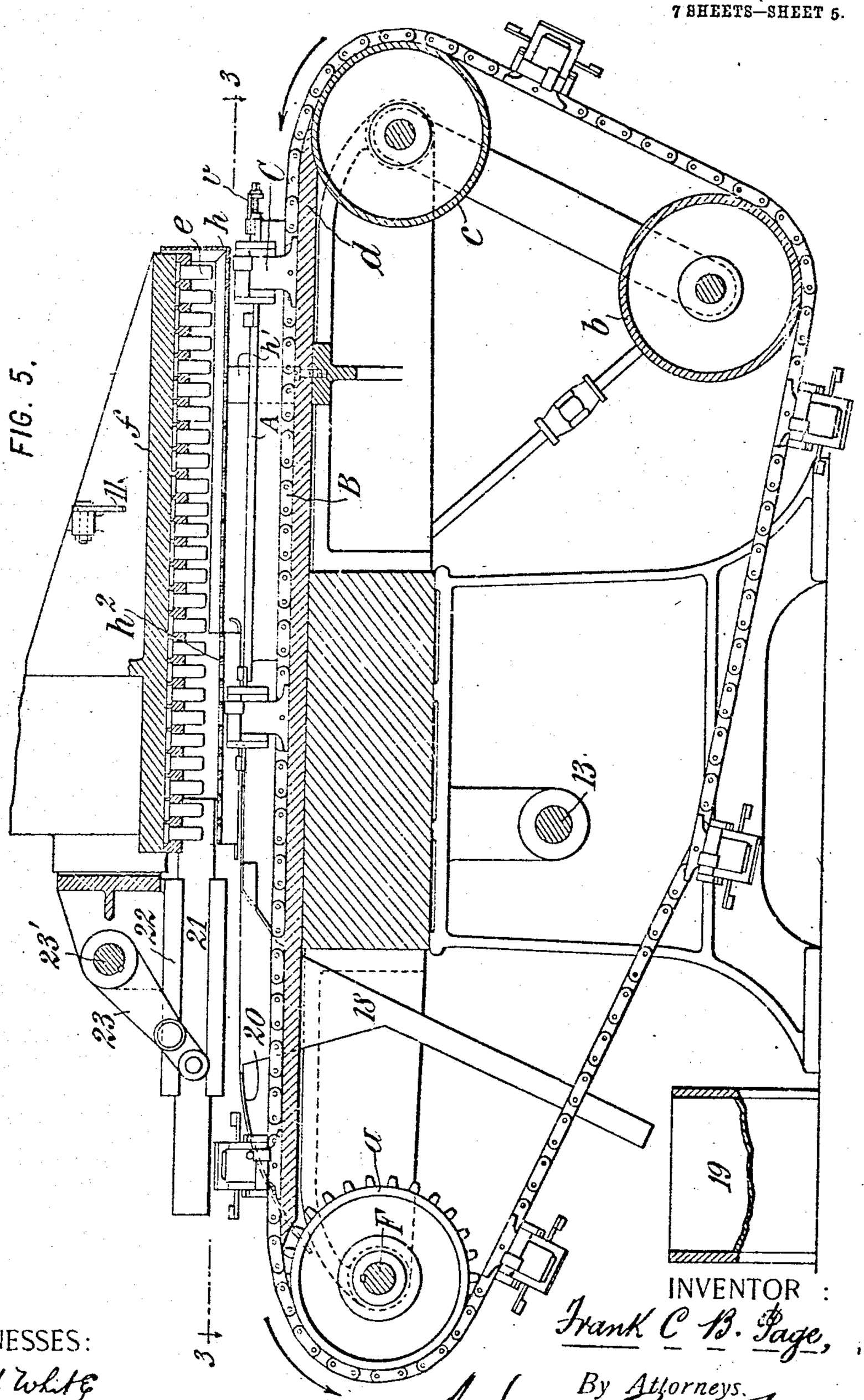
7 SHEETS—SHEET 5.

FIG. 5.



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7 SHEETS—SHEET 6.

FIG. 7.

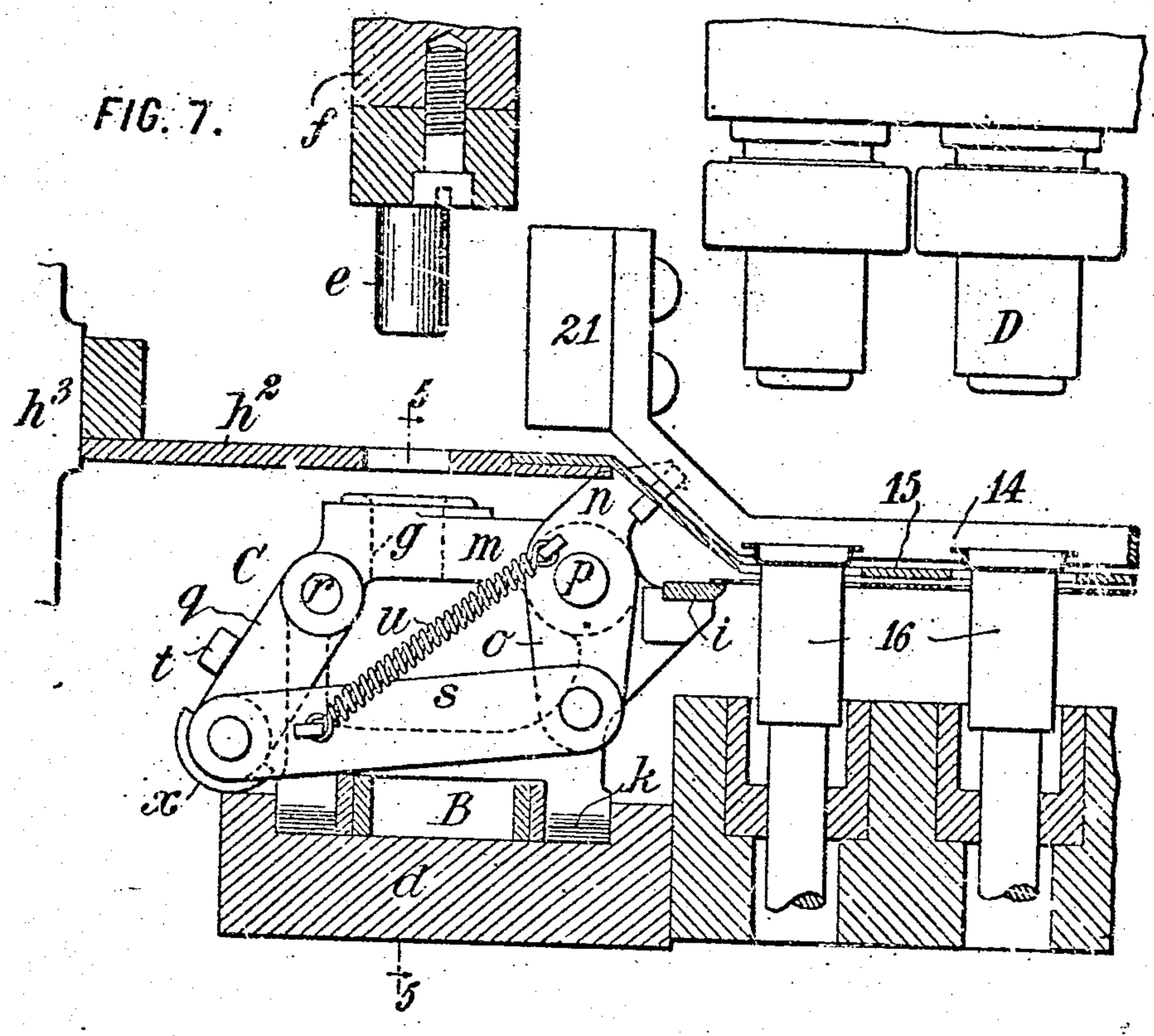
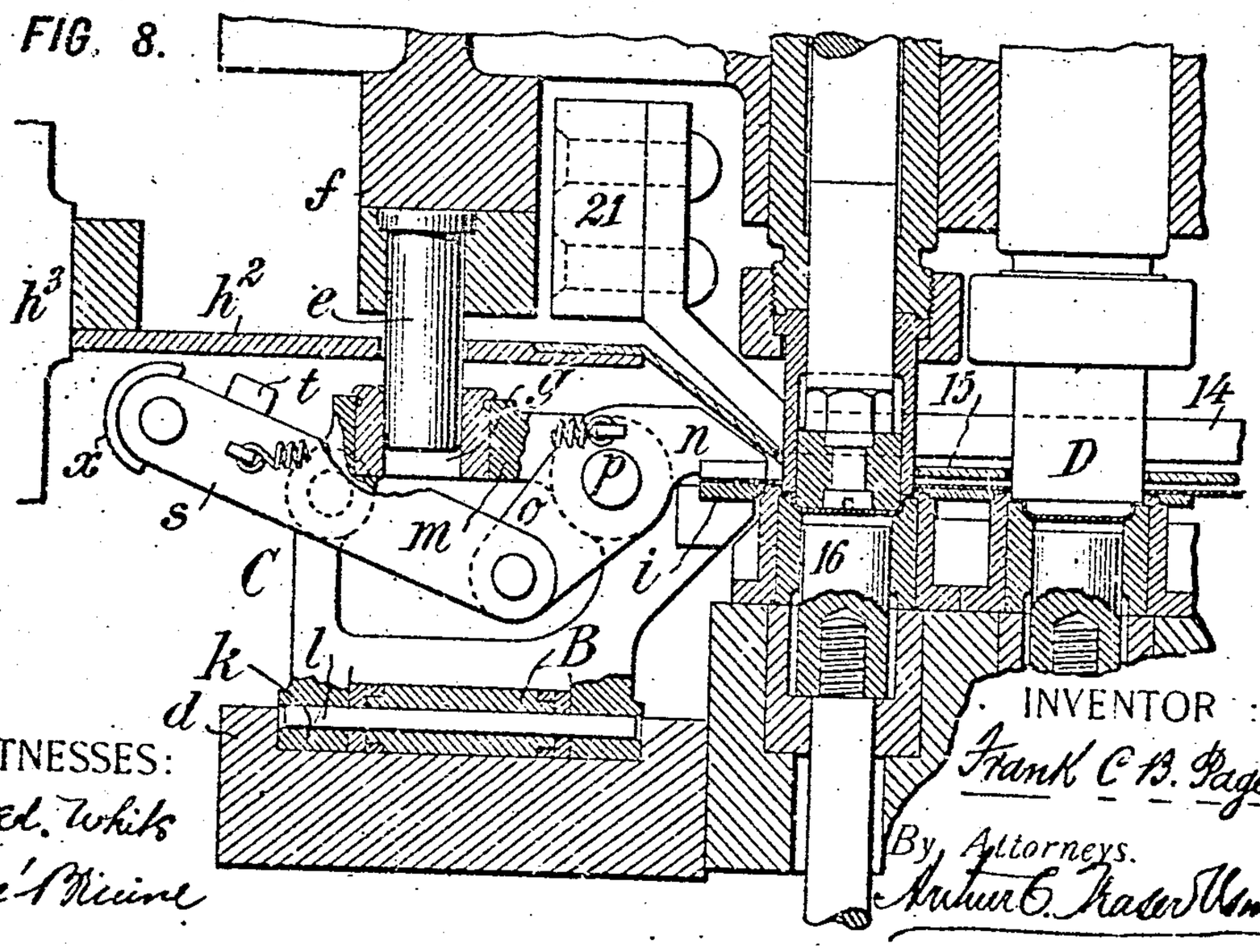


FIG. 8.



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No. 869,326. PATENTED OCT. 29, 1907.

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PUNCHING MACHINE AND FEEDING MECHANISM THEREFOR.

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7 SHEETS—SHEET 7.

FIG. 9.

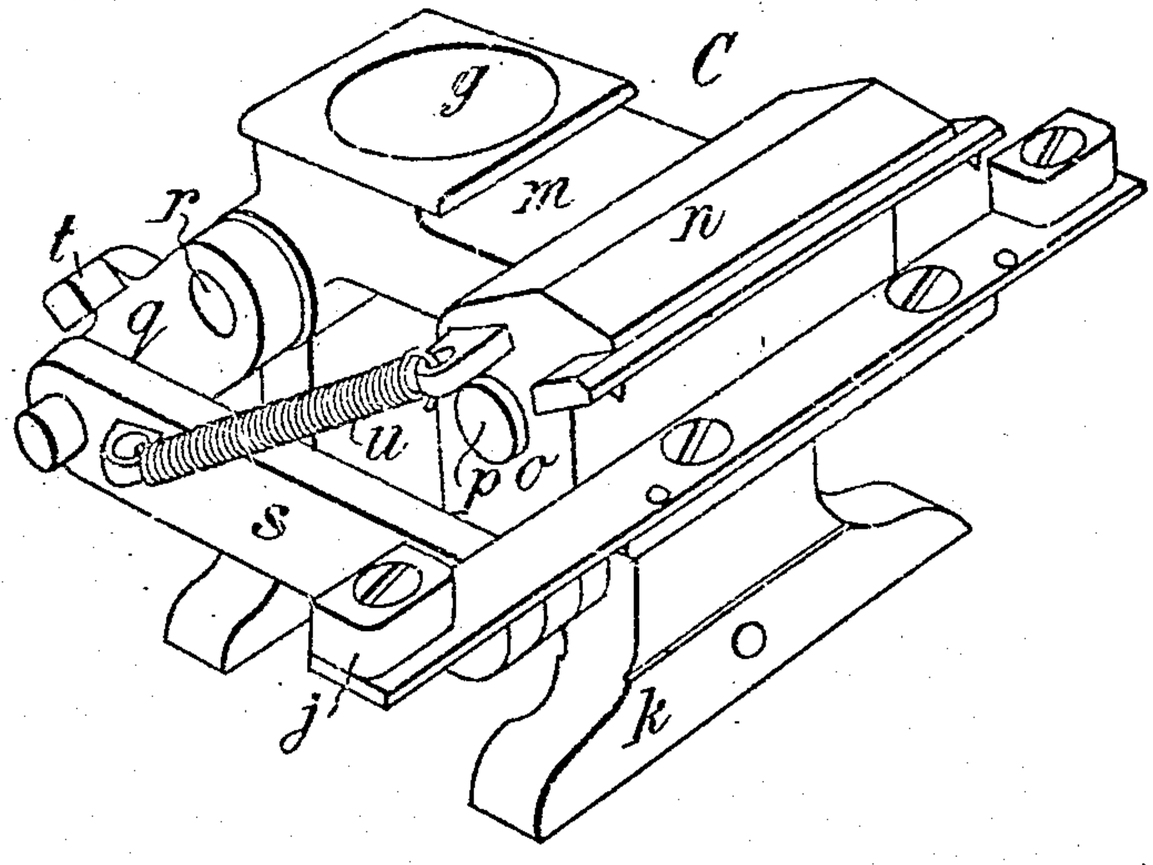
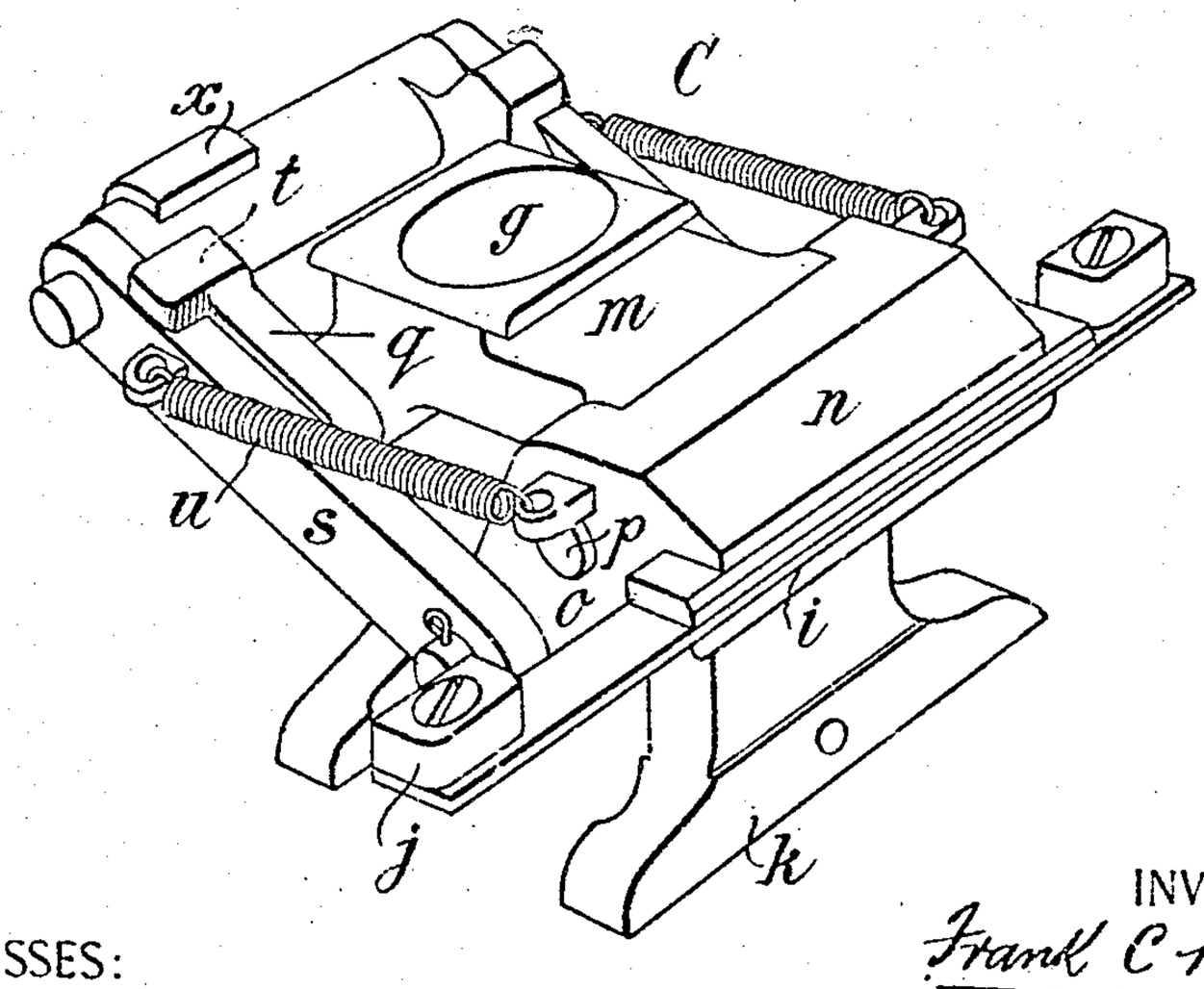


FIG. 10.



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UNITED STATES PATENT OFFICE.

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PUNCHING-MACHINE AND FEEDING MECHANISM THEREFOR.

No. 869,326. Specification of Letters Patent. Patented Oct. 29, 1907.

Application filed December 21, 1906. Serial No. 348,920.

To all whom it may concern:

Be it known that I, FRANK C. B. PAGE, a citizen of the United States, residing in the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Punching-Machines and Feeding Mechanism Therefor, of which the following is a specification.

This invention aims to provide certain improvements in punching and similar machines, especially adapted to machines which are used to punch out bottle caps and similar articles from sheets of tin previously decorated at the points where the caps are to be punched out, and which consequently require that the feeding be very accurate.

The difficulty experienced with such machines arises out of the irregularity in the lengths of sheets of tin which are practically available, and out of the fact that the lengths of such sheets are not commensurable with the pattern printed thereon and the caps to be punched therefrom. If the printed pattern be started regularly at one edge of the sheet, it is found at the opposite edge of the sheet that there are a number of parts of caps sometimes considerably smaller than halves. Where the parts of caps are larger than halves or are approximately equal to halves of a cap, there is no substantial difficulty involved. But where a very small fraction of a cap will be cut out at the edge, it sometimes finds lodgment in the die in such a way as not to be ejected. Consequently it is necessary to clean out the dies frequently in order to avoid injury to them or to the punches.

A feature of this invention is the skipping of the positions at which such small segments of caps would be punched in the regular operation of the machine. The desired operation may be obtained in a variety of ways, as, for example, by continuing the feed regularly but stopping the operation of the punches during one of the feeding intervals, or by operating the punches without interruption and giving the feeding mechanism a step of extra or double length at the desired point. The timing device for determining when the skip is to take place may be arranged at any part of the feeding and punching mechanism. Preferably the movement of the punches is uniform and uninterrupted, and the sheet carrier is operated uniformly during the punching of the main portion of the sheet, and with a double interval at an end of the sheet.

Another feature of the invention is a locking device for holding the sheet fixedly and accurately in position while the punching operation is proceeding notwithstanding any slight inaccuracy which may be permitted by the feeding means. The use of this lock permits a very rapid feeding operation.

Various other improvements are provided as hereinafter specified in detail.

The accompanying drawings illustrate an embodiment of the invention.

Figure 1 is an elevation of the front or feeding side of the machine, a detail being shown in section. Fig. 2 is a side elevation, omitting the chain carriers. Fig. 3 is a plan, the punch-supporting frame being in section just above the table, along the line 3—3, Fig. 5. Fig. 4 is a diagram illustrating the skipping operation. Fig. 5 is a longitudinal section through the principal parts of the improvement, in the plane of one of the chains, on the line 5—5, Fig. 3. Fig. 6 is a longitudinal section through the dies and adjacent parts. Figs. 7 and 8 are transverse sections at the same points, after a punching operation, at different periods. Figs. 9 and 10 are perspective views of the clamping device in different positions.

Referring to the embodiment of the invention illustrated, the sheets are fed over a table A by means of a carrier consisting of a pair of chains B arranged in vertical planes at opposite sides of the machine and carrying at suitable intervals clamping devices designated as a whole by the letter C. The punches D are arranged in two rows staggered relatively to each other, and the rows are separate from each other a substantial distance as usual. Fig. 4 indicates, by the use of corresponding numerals, 1, 1′, 2, 2′, etc., the positions relatively to each other of the punches of the two rows. The punches are reciprocated as usual from a main shaft E, and the sheet carrier is given an intermittent movement from the feeding shaft F carrying sprockets over which the chains B run.

In order to secure the skipping movement referred to the punches are reciprocated by the usual connections illustrated, or by any suitable connections, and the feeding shaft F is operated by means of a normal pawl G and a skipping pawl H. The former is given a movement corresponding to one regular step or interval of the feed, being mounted upon the arm J which is connected by means of a link K with an intermediate point of a lever L which is pivoted to and oscillated by means of a head M provided with suitable rollers and moved by a cam N on the main shaft E. The pawl H is carried upon one arm of a two-armed lever O which is operated by means of a link P connected to the outer end of the lever L. The parts are proportioned to give the pawl H a movement approximately twice as great as that of the pawl G. The ratchet wheel Q is fixed upon the feeding shaft F, and is engaged by the pawl G and transmits to the shaft the regular feeding movement. A disk R, adjacent to the ratchet wheel Q, lies in the plane of the pawl H, and serves to hold this pawl normally out of operation. It is provided with a notch, however, which allows the pawl H to come into operation at each revolution of the disk, and to engage the ratchet wheel Q and give it a double-length movement.

If the number of punches to each sheet is determined beforehand the size of the ratchet wheel Q and the spacing of the teeth will be properly designed beforehand, so that the ratchet wheel makes one revolution between sucesssive skipping operations, and the disk R will be fixed to rotate with the ratchet wheel. Where the number of steps is to be varied from that for which the machine was designed, the disk R may be arranged to make a complete rotation in any desired number of steps, by fastening it only frictionally to the ratchet wheel Q or to the shaft F, and by attaching to it a second ratchet wheel S having the diameter and the number of teeth desired, and by providing a supplementary pawl T for giving this ratchet wheel a step at each punching operation. Upon each complete rotation of the disk R the pawl H will come into play and produce a double step. The disk of course might be provided with two or more notches, and the ratchet wheel designed to have twice the number of teeth that there are regular intervals between successive skipping operations.

Referring to Fig. 4, the preferred arrangement of the mechanism will be understood. The clamping devices are arranged at such intervals, relatively to the standard lengths of the sheets, that the successive sheets U V have a desired distance between them, or approximately so, since the lengths commercially available vary somewhat. The sheets are usually printed beforehand with a design which is to appear upon the top of the cap, the design being registered exactly with one edge of the sheet, which is made the rear edge when the sheet is put into the punching machine. Such designs are indicated at W in Fig. 4. The punchings are concentric with the design, and, supposing the feed to be continuously regular, then the rear edge of each sheet will pass through the center of one of the punchings, and one-half of a punched-out disk will be pressed into the die. The successive positions of the punches of the two rows relatively to the sheets are indicated by the numerals 1, 2, 3, 4, 5, 6, 7 and 8 and 1′, 2′ etc. At position 4 an exact half a disk will be punched out from the rear edge of the sheet U. The dotted line X represents the theoretical position of the forward edge of the sheet V, to which, however, such forward edge seldom conforms in practice. Sometimes the edge is in advance of the line X, and sometimes in the rear of it. With the length of the sheet V shown, then, in position 4 there will be punched out of its forward edge a portion smaller than one-half of the disk. Where a portion of the disk which is punched out at the edge is approximately equal to or greater than a half of a disk, it is properly ejected from the die. Where it is less than half a disk, however, it is apt to become stuck in the die. When several such small pieces have been stuck in the die the latter no longer yields to the punch, and the punch will be bent or the machine otherwise put out of order. In order to avert this difficulty I have provided that the punching operation in the position 4 shall be omitted or skipped, as previously explained. The spacing of the sheets may be varied from that shown, the most important feature being the skipping of the operation which would punch out the small portion of metal Y from the edge of the disk at which the irregularity in its length is arranged (preferably the forward edge). The spacing shown in Fig. 4 has the advantage of securing all the complete punchings which can be had from the forward sheet U. Any shorter spacing, as if the rear edge of the sheet U were in the position Z, would locate a space 4 upon the sheet sufficiently large to yield a cap, but which would not be punched. Any greater distance than that described would of course diminish the speed of output of the machine.

The chains B, after passing around the driving sprockets *a* of the feeding shaft F, and, if long enough, over suitable idlers *b*, pass over guide pulleys *c* at the front of the machine. Thence the chains run in beds or troughs *d* which limit their lateral and vertical play, and which extend from pulleys *c* to driving sprockets *a*. In order to insure the registration of the successive punching positions with the printed designs upon the sheet, and also to insure the correct positions of the successive punchings relatively to each other, so as to be able to cut them as close as possible, the sheet carrier is locked in position for each punching operation. The locking may be effected in a variety of ways. In the machine illustrated it is effected by means of dowels *e* arranged upon a bracket *f* extending forwardly from the cross-head which carries the punches, and spaced apart accurately to correspond with the interval between successive feeding steps. The clamping devices are provided with openings *g* into which the dowels *e* fit. When the punches, and the cross-head carrying them, are lowered, a dowel *e* enters an opening *g* of a clamping device carrying a sheet, and thus holds the clamping device and the sheet rigidly in position regardless of the wear of the chain or any inaccuracy in the feeding mechanism. In fact this locking device permits of a perfect operation of the machine with a much less accurate feeding mechanism than has been previously permissible. The foremost of the dowels *e* is so far in advance of the punches as to lock the clamping devices and a sheet held between them at or before the time that the forward edge of the sheet enters the punching position. At the next step the second dowel *e* comes into play, and so on to the last punching operation. A guard *h* is fixed to the side frame of the machine by means of brackets *h′* so as to prevent accidental injury to the dowels, being continued as a plate h^2 on the inner side of each upright h^3, and is perforated to serve as a stripper therefor, the dowels passing through the perforations in the guard, as shown in Fig. 8. The edge of the openings *g* is flared to facilitate entrance of the dowel *e*.

A very simple and durable type of clamping device C suitable for the machine, is indicated in perspective in Figs. 9 and 10, and in side elevation in Figs. 7 and 8. A fixed member or base carries the lower jaw *i*, which is extended forwardly and rearwardly beyond the body of the device to provide a rest for the side edge of the sheet, and which carries stops *j* for limiting the position of the sheets laterally. The fixed member also includes a pair of lugs *k* arranged to fit in the trough-shaped guide *d*, and to carry one of the pins *l* of the chain B. The fixed member carries also a central portion *m* projecting upward slightly, and in which is formed the opening *g*, preferably with a renewable bushing (Fig. 8). The upper jaw *n* has a pair of arms *o* projecting downwardly and straddling the central portion *m* and pivoted thereon at *p*. Crank arms *o*

are pivoted at *r* upon opposite sides of the central fixed portion *m*, and have their free ends connected by means of links *s* with the lower ends of the downward arms *o*. The arm *q* and link *s* thus form a toggle, the arms *q* being provided with stops *t* limiting the upward movement of the links *s*. A spring *u* tends to hold the device opened or closed according as it is swung downward or upward past the center *r*.

At the forward end of the table is arranged a stop *v* (Fig. 3) against which the rear edge of each new plate is set, this stop being an adjustable gage to register the printed sheet with the punches. While the sheet stands in this position the clamping devices C come to their proper position for engagement with the sheet, and are clamped upon its edges near its rear end, and carry it forward. For closing the device in this position a tappet *w* (Fig. 1) is provided which moves up and down with the movement of the cross-head carrying the punches, and, striking the under side of the wear plate *x* carried on the rod connecting the crank arms *q* of the device, lifts the ends of these crank arms to the clamping position of Fig. 10. After the sheet has been completely punched it is released from the clamping action of the devices by means of a swinging tappet *y* (Figs. 2 and 3) striking downward upon the plate *x* of the device.

The tappets *w* are carried upon slides *z* having a rack and pinion engagement with sectors 10 carried on short shafts 10′ carried in bearings 10^2 and 10^3 and which are oscillated by means of links 11 connected to the cross-head extension. The tappets *y* are carried upon arms of short shafts 12 mounted in fixed bearings upon the frame, and oscillated from the oscillating shaft 13 running below the dies (and usually operating the ejectors).

The means for removing the finished caps is illustrated best in Figs. 6, 7 and 8. A sweeper 14 lies immediately above the fixed plate 15 (which may be supported from the plates h^2, as shown) and reciprocates from the position shown in dotted lines to that shown in full lines. When the plungers are down the sweeper lies in the dotted line position. As the plungers are raised the ejectors 16 are also raised to the level of the plate 15. Thereupon the sweeper 14 moves forward and sweeps the caps 17 off the ends of the ejectors and to the edge of the fixed plate 15, where they fall off into a hopper 18 and are gathered in a receptacle 19 below. The sheet in certain positions extends over the mouth of the hopper 18, but the caps are considerably smaller than the openings in the sheets (being drawn as well as punched), and with the constant vibration of the machine all the caps drop readily through the openings in the sheet. The end of the sheet is supported upon the guides 20, and when it has been entirely punched and released from the claniping nuts it glides off into any suitable receptacle arranged to receive the scrap.

Any suitable means may be provided for operating the sweeper, such, for example, as the slides 21 attached to the opposite bent-up ends thereof and reciprocated in fixed guides 22 by means of link connections to the constantly-oscillating inner arm 23 on a shaft 23′ having an outer arm 23^2, which is operated in turn by a link 24 connected to a lever 25 operated by a link 26 pivoted thereto and reciprocated by cams 27, 28 (Fig. 1) on the overhead shaft E.

The machine may also be made to operate without the cutting of any fractional pieces, by the use of sheets which measure with substantial exactness to the standard length. For example, the sheets may be sheared to lengths commensurate with the size of the punchings, and arranged so that their forward edges will coincide substantially with the line X, Fig. 4; and with such sheets the operation of the punches in the positions 4, 4′ would be skipped.

Though I have described with great particularity of detail certain embodiments of my invention, yet it is not to be understood therefrom that the invention is limited to the particular embodiments disclosed. Various modifications thereof in detail and in the arrangement and combination of the parts may be made by those skilled in the art without departure from the invention.

What I claim is:—

1. The combination with mechanism for punching a sheet at uniformly spaced positions throughout its length, of means for causing said mechanism to omit a punching operation at a desired position near an end of a sheet.

2. A punching machine including in combination means for feeding a sheet to punches with a substantially uniform interval between successive punching operations throughout its length, and means for altering the length of the interval when the punches are near an end of the sheet.

3. A punching machine including in combination means for feeding a sheet by substantially uniform steps throughout its length, and means for giving the sheet a movement of different lengths when the punches are near an end thereof.

4. A punching machine including in combination means for feeding a sheet to punches with a substantially uniform interval between successive punching operations throughout its length, and means for doubling the length of such interval when the punches are near an end of the sheet.

5. A punching machine including in combination two rows of punches arranged to punch at staggered positions, means for feeding sheets with a distance between them approximately equal to that between the centers of the two rows of punches, and means for feeding said sheets past the points where the punches would strike the ends thereof without permitting the punches to strike said ends.

6. A punching machine including in combination punches, means for operating them uniformly, a sheet carrier, and means for operating it uniformly during the punching of the main portion of a sheet and with an extra long interval at an end of the sheet.

7. A punching machine including in combination punches, a continuously rotating main shaft E operating said punches, a sheet carrier, a feeding shaft F operating said carrier, a feeding pawl giving said feeding shaft a regular step-by-step rotation, a skipping pawl adapted to give said shaft an extra long movement, and means for maintaining said skipping pawl normally inoperative and rendering it operative at determined intervals.

8. A punching machine including in combination a sheet carrier, means for automatically feeding it step by step, and additional means operating automatically at the end of each feeding movement for locking it in position for the punching operation.

9. A punching machine including in combination reciprocating punches, a dowel carried thereby, and a sheet carrier having an opening adapted for engagement by said dowel to lock the carrier in position for the punching operation.

10. A punching machine including in combination a sheet carrier comprising a chain with clamping devices at intervals for clamping the sheets, means for feeding said

carrier, and additional means for locking the clamping device which carries the sheet under the punches.

11. A punching machine including in combination a sheet carrier consisting of a pair of endless chains carrying clamping devices at intervals adapted to clamp the opposite edges of the sheets, means for drawing said chains, reciprocating punches, and a row of dowels on each side of the machine and in advance of the punches and reciprocating therewith, the successive dowels being adapted to engage and lock the clamping devices in their successive positions.

12. A punching machine including in combination reciprocating punches, a dowel *o* carried thereby, and a sheet carrier having an opening adapted for engagement by said dowel to lock the carrier in condition for the punching operation, and a fixed guard having an opening for the passage of said dowel.

13. A clamping device for a sheet-feeding mechanism, including in combination a pivoted upper jaw having a downward arm *o*, and a crank arm *q* and link *s* constituting together a toggle adapted to swing past its center in both directions and connected to said downward arm *o* for locking it in either of its positions.

14. A clamping device for a sheet-feeding mechanism having a crank arm, and a movable jaw operated thereby, in combination with a tappet *w* for swinging said crank arm to close said jaw, rack and pinion mechanism for reciprocating said tappet *w*, and a link 11 connecting said rank and pinion mechanism with a reciprocating part of the machine.

15. A punching machine including in combination a punch, and an ejector, a plate 15 through which the punch passes and to the level of which the ejector rises, a sweeper 14 arranged immediately above said plate, and means for moving said sweeper across said opening to remove the punched article when the ejector has raised it to the level of said plate.

16. A punching machine including in combination a punch, and an ejector, a plate 15 through which the punch passes and to the level of which the ejector rises, a sweeper 14 arranged immediately above said plate, means for moving said sweeper across said opening to remove the punched article when the ejector has raised it to the level of said plate, a hopper 18 at the edge of said plate and into which the punched articles are swept, and supports for said sheet supporting it above said hopper so that the punched articles pass through the sheet into the hopper and the sheet of scrap is carried beyond.

17. A punching machine including in combination a sweeper, a hopper into which the punched articles are swept, and supports for the sheet supporting it above the hopper so that the sheet of scrap is carried beyond the hopper.

18. A punching machine including in combination a feeding shaft, a ratchet wheel and pawl transmitting to said shaft a regular feeding movement, a skipping pawl adapted to give to said shaft a movement of extra length, and means operated independently of said ratchet wheel for holding said skipping pawl normally inoperative and allowing it to become operative at determined intervals.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

FRANK C. B. PAGE.

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