(No Model.) 3 Sheets—Sheet 1.

W. H. R. TOYE.

PRINTING MACHINE.

No. 534,298. Patented Feb. 19, 1895.

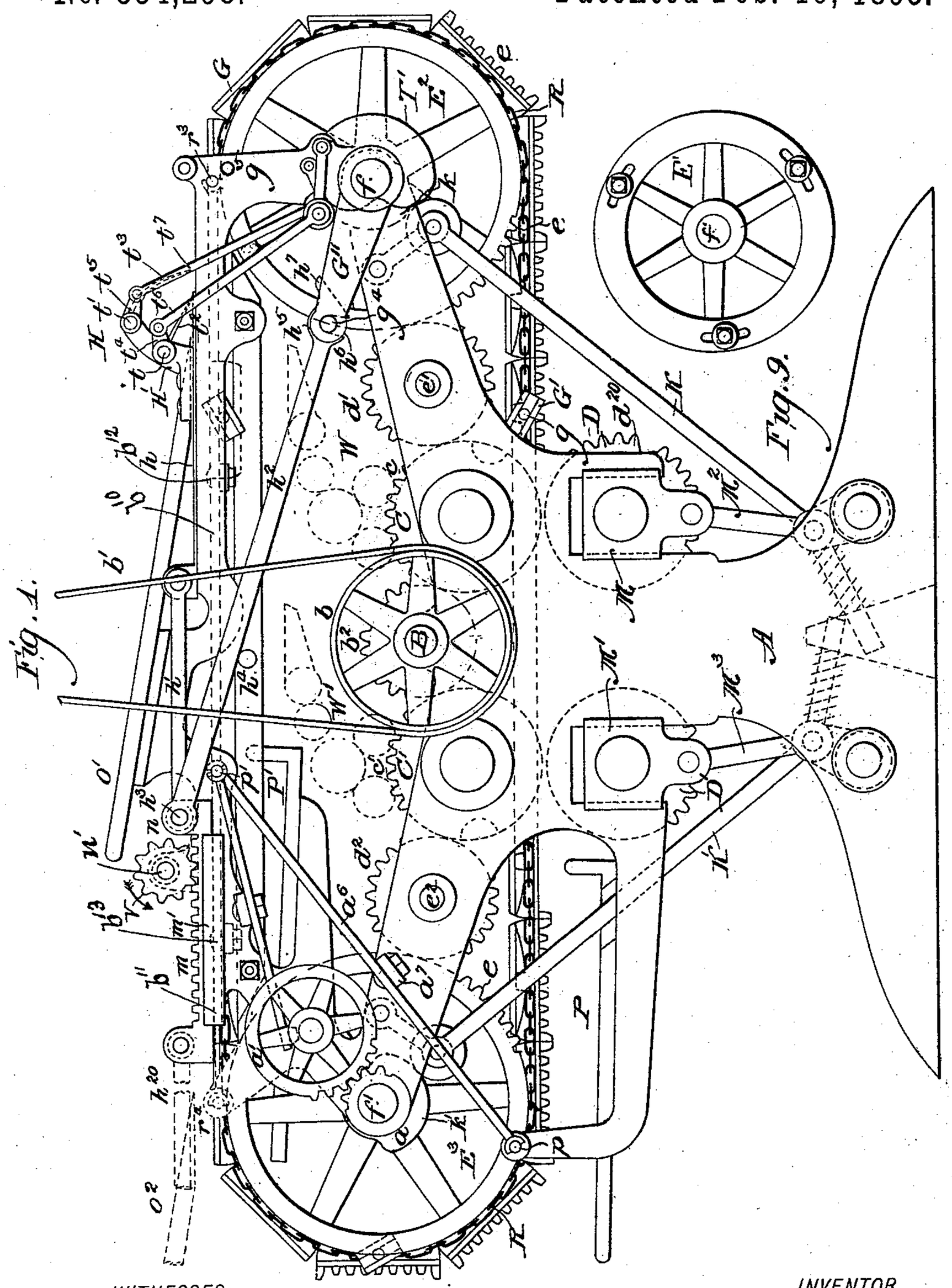

Fig. 1.

Fig. 9.

WITNESSES:

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(No Model.) 3 Sheets—Sheet 2.

W. H. R. TOYE.

PRINTING MACHINE.

No. 534,298. Patented Feb. 19, 1895.

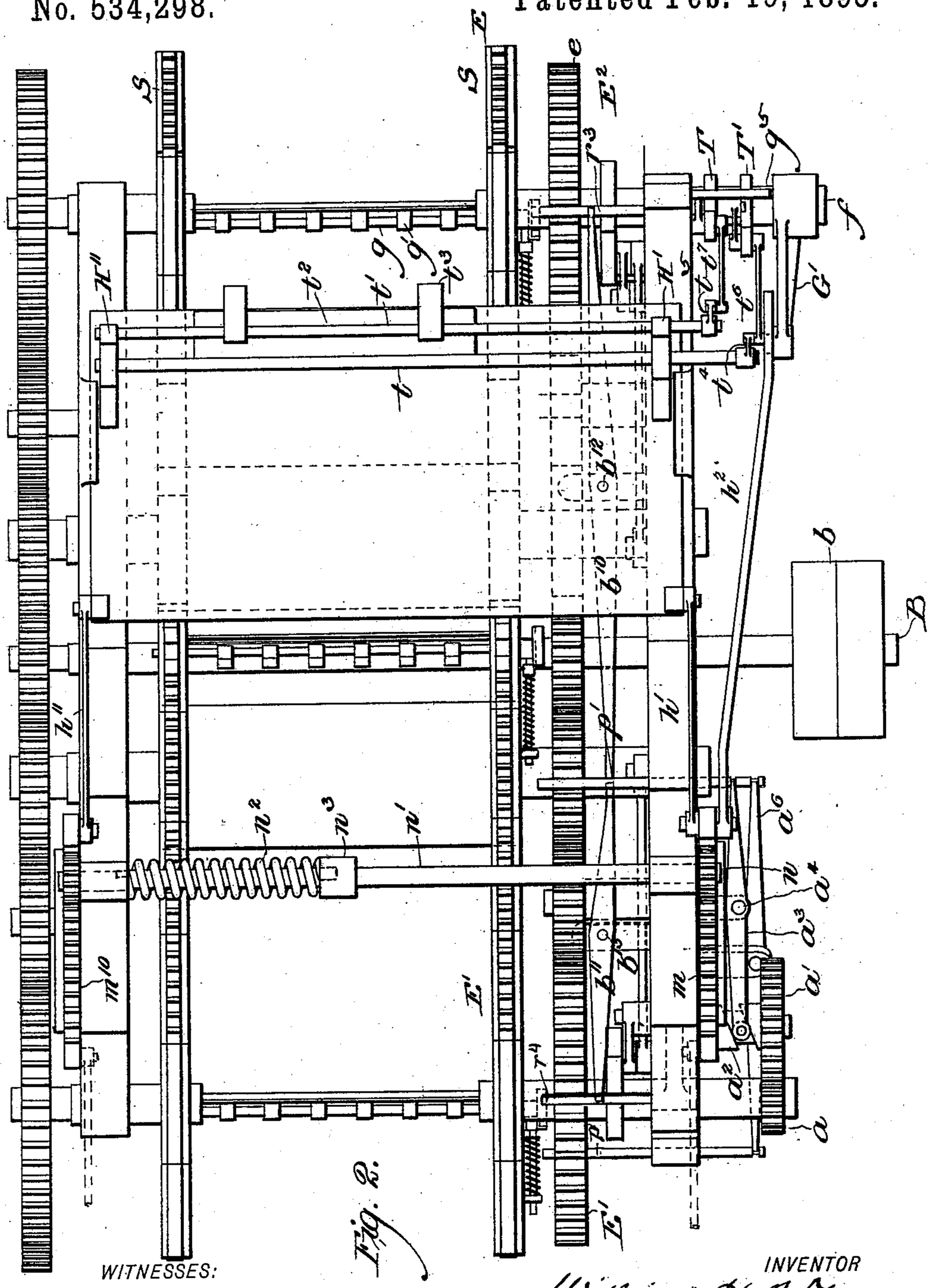

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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PRINTING MACHINE.

No. 534,298. Patented Feb. 19, 1895.

Fig. 3.

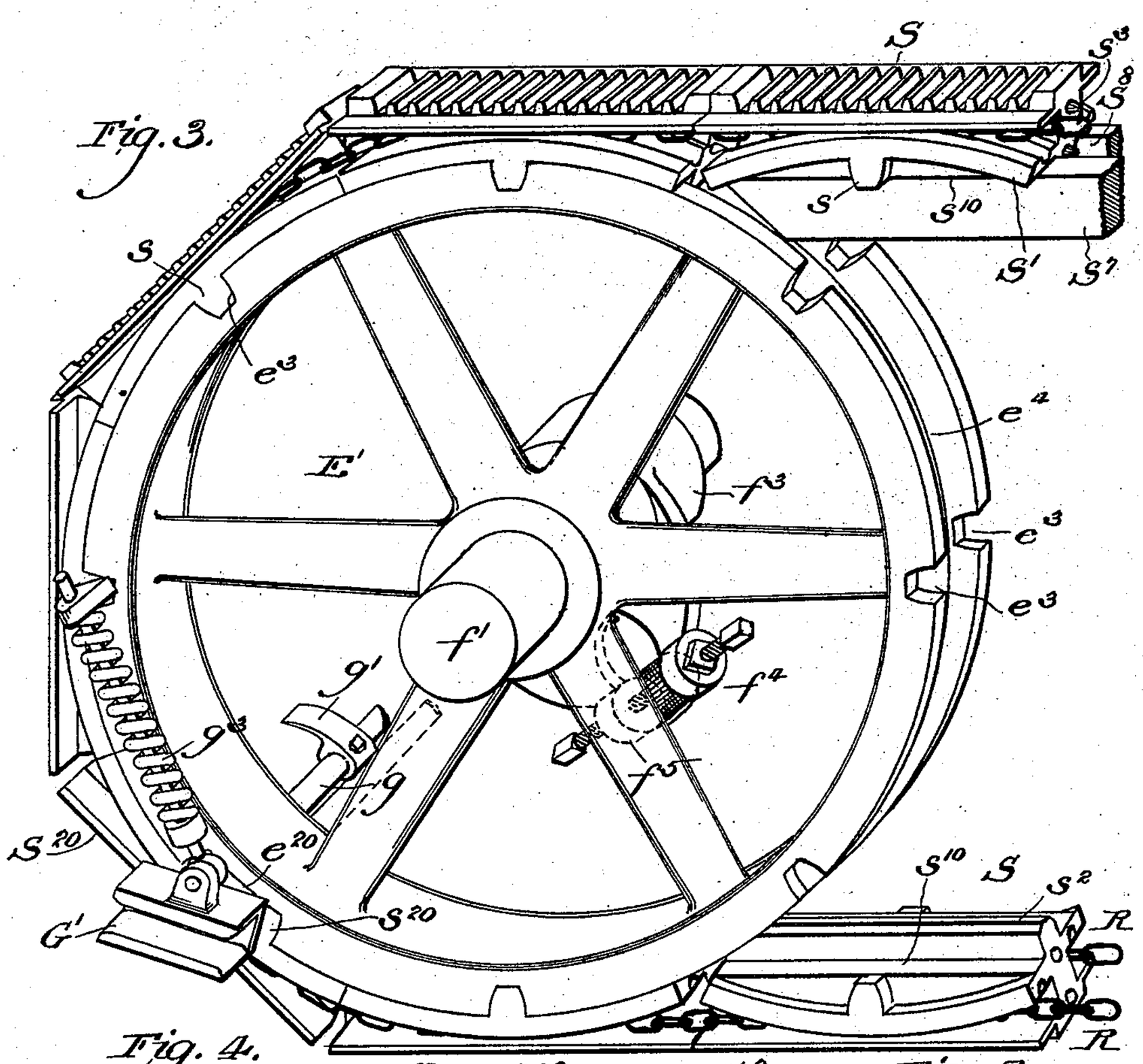


Fig. 4.

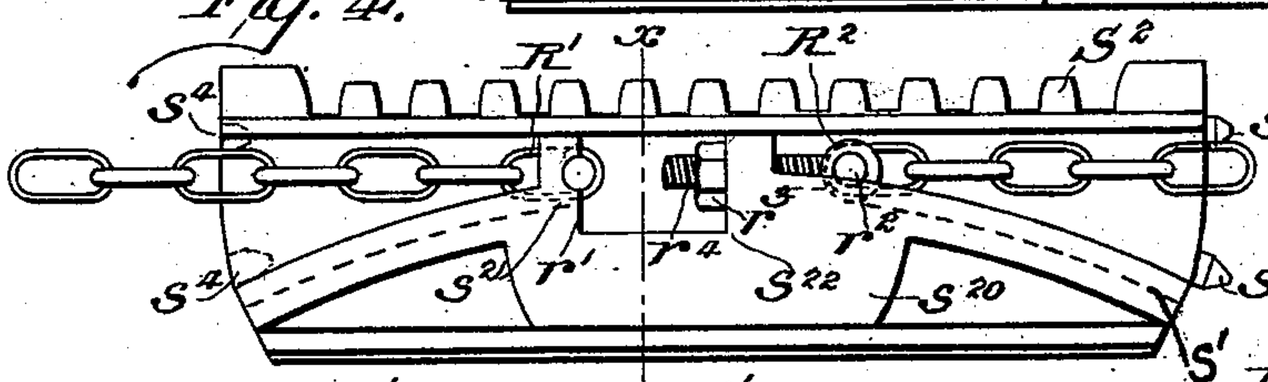


Fig. 5.

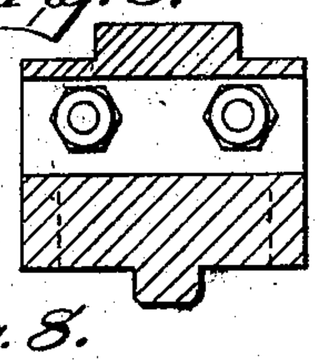
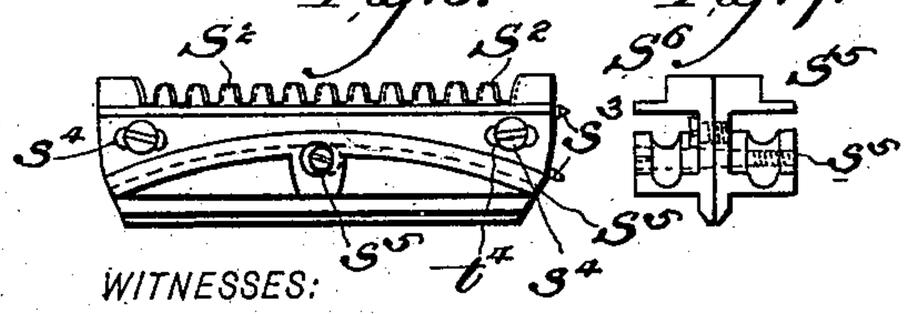


Fig. 6.



x Fig. 7. x

Fig. 8.

WITNESSES:

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UNITED STATES PATENT OFFICE.

WILLIAM H. R. TOYE, OF PHILADELPHIA, PENNSYLVANIA.

PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 534,298, dated February 19, 1895.

Application filed April 10, 1893. Serial No. 469,814. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. R. TOYE, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Printing-Machines, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to printing presses and especially to mechanism thereon designed to make perfect register and cause each sheet to receive its impression in an exactly corresponding position, and while applicable to all printing presses is particularly designed for use in presses adapted to print in several colors.

The effect of the processes necessary to print a multi-colored picture on a sheet of paper or other material is well known to those skilled in the art, as for instance, when passing between cylinders where it receives a heavy impression the sheet is apt to be retarded more than when passing between rolls where it receives but a light impression. Again, if the gripper fingers act sluggishly, a different width of margin is obtained from that desired, and if a flexible link carrier is used which is supported on a polygonal wheel the irregularity in the movement of this wheel causes corresponding irregularities in the movement of the sheet.

To overcome these and similar difficulties, my invention consists, first, in arranging a feed mechanism in the manner pointed out in the claims and so that it will always seize the sheet in the same position and will not be disturbed by any increase in the speed of the machine or sticking of the sheets, and secondly, to so arrange a flexible carrier for the gripper mechanism that it can be adjusted either to throw the whole gripper system slightly forward or retard it, and also to adjust the carrier so as to take up for wear, and to assist in correcting expansion or contractions due to changes of temperature; and it consists also in certain other improvements in the details of a printing press which will be pointed out hereinafter in the claims appended to this specification.

My invention may best be described in connection with the drawings in which it is illustrated, and in which—

Figure 1 is a side elevation of a printing press, here shown as adapted to print in several colors, embodying some of the important features of my invention. Fig. 2 is a plan view of the press shown in Fig. 1. Fig. 3 is a perspective view of one of the pulleys which support and drive the flexible gripper carrier. Fig. 4, is a view of one of the links showing a mode of securing binding chains on the side thereof. Fig. 5 is a cross section on the line *x*—*x* of Fig. 4. Fig. 6 is a side elevation of one of the adjustable links showing the means for longitudinal adjustment to take up wear. Fig. 7 is an end view of the link shown in Fig. 6, showing the preferred mode of dividing the link. Fig. 8 shows another mode of dividing the link for adjustment which is preferable in a link which has no teeth on its upper surface, and Fig. 9 shows a modified form of the adjusting devices for the pulley shown in Fig. 3.

A is the frame of the press on which the various shafts, levers and so on are arranged.

B, represents the driving shaft to which power is applied by means of a belt *b'* and a pulley *b*.

C C′ are plate or type cylinders shown driven from the shaft B by means of a spur gear b^2 on the shaft B and gear wheels *c c′* on the ends of the plate cylinders C C′ respectively, and additional gears *d′* d^2 pivoted at *e′* e^2 serve to rotate the gear wheels E^2 E^3 which are secured to studs *f f′* respectively.

W W′ are sets of inking rollers.

D D′ are impression cylinders shown supported on movable journals marked M M′, these journals being carried in a well known manner by two levers indicated at M^2 M^3 which form toggle joints and are raised and lowered by levers as K K′ operated by cams *k k′* on some rotating part of the machine and which serve to hold the cylinders D D′ at proper times, in contact with the plate cylinders C C′.

G indicates the main feed mechanism, which operates to seize the sheet and carry it between the rolls C D, C′ D′, &c., which together form a printing couple. This main feed mechanism consists essentially of a flexi-

ble carrier and suitable gripper mechanisms secured to said carrier which operate to seize and carry along the sheet to be printed. The flexible carrier may consist of a steel band, a chain, cable or other suitable device, but I prefer to form it of a series of links so formed and secured together that the carrier as a whole or each separate link may be capable of very careful adjustment.

On the outside of the link-carrier are secured suitable tumbler cams G′ which operate under the influence of suitable pins as shown at $p\ p'\ r^3\ r^4$ to raise the fingers at proper times to seize or drop a sheet, a spring at g^3 being used to hold the fingers tightly pressed on the sheet when not moved therefrom by means of the tumbler cams and pins. This construction of gripper mechanism is well known in the art and serves to seize a sheet from a state of rest on the front edge of a feed board as O′, and carry it around between the rolls of the plate and impression cylinders. The objection to the use of this gripper mechanism in work demanding exact register is, that if the gripper fingers act slugglishly or if there is a slight variation of the sheets, or if the speed of the press varies the impression on two successive sheets will not be in exactly the same place thus destroying register and margins. To remedy this defect I provide an auxiliary feed mechanism which operates to seize a sheet which is placed in a definite position on the feed board when both the sheet and the auxiliary feed mechanism are at rest, to carry the sheet forward from said state of rest until it is moving at a speed substantially the same as the speed of the main feed mechanism and then to deliver the sheet to the main feed mechanism. Such a device is indicated generally at H, Fig. 1. Here a plate h is arranged to slide along the top of the frame just under the front edge of the feed board O′. A link h' connects this plate to a rack m guided between side rails m' on the side of the frame. This rack is pivoted at h^3, which may also be the pivotal point of the link h', to a bar h^2. The bar h^2 has on the opposite end from that at which it is pivoted, a head h^5 with a slot h^6 therein and a projecting cam h^7, shown in dotted lines in Fig. 1. A pin as h^4 serves normally to support the bar h^2 in the position shown in Fig. 1. In order to slide the plate h evenly a link h^{11} similar to link h' and a rack m^{10} are preferably arranged on the other side of the frame as best seen in Fig. 2 and spur wheels $n\ n^{10}$ on a shaft n' serve to operate the two links simultaneously. A spring n^2 fastened at one end to the frame of the press and at the other end a block n^3 on the shaft n' is wound up as the shaft n' is rotated in the direction indicated by the arrow and tends to unwind and keep the racks $m\ m^{10}$ and the plate h and lever h^2 in the position shown in Fig. 1. On the front of the plate H are secured brackets H′ H″ and in these are journaled two shafts t, t' which between the brackets, as best seen in Fig. 2 are provided with a plate t^2 and fingers t^3 respectively. These shafts $t\ t'$ are provided respectively with cranks $t^4\ t^5$, to which are pivoted links $t^6\ t^7$ which are provided with rollers as shown adapted to read cams as T T′ on the rotating stud f of the pulley E and driving spur wheel E^2.

The fingers t^3 serve as stops to fix the position of a sheet when presented by the operator from the feed board. The plate t^2 serves to hold the sheet securely between itself and the plate h, and the advantage in using a plate instead of a set of fingers is, that if a sheet is presented to the plate in a crumpled condition or with edge slightly bent the plate t^3 coming down on the plate h will smooth the paper out and present it to the gripper fingers g' in a smooth condition. This plate may advantageously be made of some transparent material as glass, or may consist of a frame of the outline of the plate, so that the operator can see the edge of the paper as it is presented under the auxiliary feed mechanism. An arm G″ is also secured to and revolves with the stud f and has a pin g^4 secured therein at the same radial distance from the center of the stud as the pitch line of the gear teeth e in the spur wheel E. A pin g^5 is also secured to the frame substantially above the center of the stud f and projects as shown in the path of the cam h^7 on the head h^5 of the link h^6.

Before describing the operation of the auxiliary feed mechanism I would call attention to the construction of the flexible carrier for the feed mechanism. This flexible carrier is driven by the pulleys E E′ which are secured on the studs $f\ f'$ and consists preferably of a series of links connected together by chains or cables R, one of such chains being arranged on each side of the several links, as shown in Fig. 3. Each separate link S of the construction shown in Figs. 3 and 4 has curved flanges S′ extending from its sides of a curvature similar to that of the pulleys E E′ so that when carried thereby they may fit thereon neatly as indicated in Fig. 3. A flat flange or projection s^2 is also arranged preferably as shown, which fits in a groove S^8 of guides S^7 which are secured on the sides of the frame and serve to support the link carrier when it is traveling between the pulleys E E′. A groove e^4 is arranged in the pulleys E E′ to accommodate the flange s^2. The links are also provided with internal teeth s preferably one to each link and the pulleys are provided with recesses e^3 in which the teeth s fit and whereby the series of links is driven. Every eighth link, or one of any other convenient number of links, is arranged to carry a gripper bar and the rod carrying the gripper fingers, and also to have secured thereto the various lengths of chains or cables which secure the sets of links together. Such a link is shown in series at S^{20} in Fig. 3, and separated from the series in Fig. 4, and in this construction, as shown, a broad tooth s^{20} takes

the place of the tooth *s*, a corresponding recess e^{20} being provided therefor in the pulley. Two standards s^{21} and s^{22} serve for the support of the devices which secure the chain or cable. This broad tooth also provides ample space for the gripper bar and the finger bar as shown at *g* Fig. 3. The chain is conveniently secured by means of pins r' r^2 which pass through links R' R^2 of the chain, one of the pins r^2 being secured to a bolt *r* which is capable of adjustment by means of the nut r^3.

The horizontal rail or support S^7 above mentioned is arranged on a tangent line from the highest point of the rim of the pulleys or supporting wheels E E' and as the links have a curved bearing flange of the same curvature as the pulleys the links are taken from the slide S^7 on to the pulley without any of the up and down movement observed when polygonal wheels are used.

To preserve perfect alignment of the links, pins as s^3 adapted to fit in small sockets s^4 on the adjacent link can be advantageously used. The links S have been shown, some with external and internal teeth and some simply with internal teeth. The internal teeth serve to mesh with corresponding recesses in the pulleys E E' while the external teeth if used, mesh with teeth as d^{20} on gear wheels secured on the impression cylinders and serve as additional security for perfection of register.

In order to compensate for wear, I prefer to construct the links as shown in Figs. 6 to 8, so that an adjustment of each separate link can be made. As shown in Fig. 6 the link is divided into two parts S^5 S^6 which are secured together by bolts as s^4 which work through an elongated slot t^4 in one of the sections. A taper screw s^5 is screwed through the sections as shown and by loosening the screws s^4 and adjusting the taper screw s^5 a micrometric adjustment can be made of any or all of the links. It will be noticed that such adjustment would set one half of a tooth S^2 a little in advance of the other half thereof, and this serves to take up wear in the gear teeth. Where no external teeth are used, the division of the link may be conveniently made as shown in Fig. 8.

In order to set the whole carrier mechanism forward or retard it as may be necessary, I secure the supporting pulleys E E' to the shafts or studs *f f'* by an adjustable connection. In Fig. 3 a sleeve f^3 is secured to the stud *f'* and the pulley E' is adjustably secured thereto by means of a bolt f^4 one end of which screws into a bracket on the sleeve f^3 and the other end of which is secured to a projection f^5 on the pulley E'. In Fig. 9 another means of adjusting the pulleys is seen where screws working in elongated slots are shown by which the driving rim may be adjusted relatively to the hub. It is evident however, that various expedients may be used to adjust the pulleys with reference to their driving shafts without departing from the spirit of my invention.

It is often desirable, especially in color printing for the operator to be able to see both the front and back of the sheets as they are deposited on the receiving boards. It is also advantageous on some occasions to have two feed boards so that two operators can feed the press at the same time. Such an arrangement is contemplated in the construction shown in Fig. 1.

O', is the feed board already referred to and a second feed board is situated behind the first feed board as indicated in dotted lines at O^2. A second auxiliary feed mechanism may also be arranged in the same relation to the board O^2 as the auxiliary feed mechanism H is to the board O and a link h^{20} can be arranged as shown to cause the two devices to operate synchronously. Two receiving boards P P' are also arranged as shown, one inside, and the other outside of the travel of the carrier rack, so that sheets delivered on the board P will be impression side up and the sheets delivered on the board P' will be delivered blank side up and suitable mechanism operating in a well known fashion is arranged to operate tumbling mechanism so that the gripper fingers will open and close at proper times. Such a mechanism is shown in Figs. 1 and 2 where *a* is a small gear wheel on the stud *f'*. *a'* is a second gear wheel meshing with the gear *a* and carrying a cam a^2. A lever a^3 pivoted at a^4 is rocked by the cam a^2 and serves to reciprocate the pin *p'* into and out of the path of the tumbler cams G' on the gripper bars *g*. A second lever a^6 pivoted at a^7 and actuated by the lever a^3 serves to operate the pin *p* into and out of the path of the tumbler cams G' in such a way that one pin *p'* is in operative position when the other pin *p* is not. Operated by the same cam a^2 are two levers b^{10} b^{11} pivoted at b^{12} b^{13} respectively, and operating pins r^3 r^4. These pins serve to tumble the gripper cams as they come to the front of the feed boards so that the gripper fingers will operate to seize a sheet. By connecting the pins r^3 r^4 in the manner shown to the levers b^{10} b^{11} which are operated by the cam a^2 these pins are alternately put into and out of operative position so that every alternate gripper mechanism is tumbled as it passes by the front of each feed board.

The operation of the press is as follows: Power being applied and the carrier mechanism with its gripper fingers being driven by means of the gear wheels E^2 E^3 and pulleys E E' and the type and impression cylinders by their driving wheels the operator pushes a sheet on which an impression or picture is to be printed in position against the fingers t^3 on the shaft *t'*. Thereupon the auxiliary gripper fingers or plate t^2 on the shaft *t* operated by the link t^6 from the cam T' come down and seize the sheet, and hold it firmly against the edge of the plate *h* and while the sheet is so held, the stop fingers t^3 are moved out of the way by the link t^7 and the cam T. At this time the arm G' on the stud *f* has revolved to

the position seen in Fig. 1 and the pin g^4 thereon has just entered the slot h^6 in the head h^5 of the link h^2. As the arm G′ continues to rotate it carries with it the link h^2 and so moves the auxiliary feed mechanism and the sheet which has been caught thereby. When the arm G′ has rotated so far as to be perpendicular the auxiliary gripper mechanism is moving at substantially the same speed as the rack which constitutes the main carrier mechanism and at this point the gripper fingers g' of the main feed mechanism seize the sheet and the fingers t^2 which have held it thus far release it under the influence of the cam T′. The projecting cam h^7 on the head h^5 of the lever h^2 now engages with the pin g^5 and raises the lever h^2 disengaging the slot h^6 from the pin, thus permitting the lever and all the auxiliary mechanism under the influence of the spring n^2 to regain the position shown in Fig. 1 where it rests until again put in action as the pin g^4 comes around again. It will be noticed, that as the auxiliary feed mechanism seizes the sheet when the sheet and gripper mechanism are both at rest and delivers the sheet to the main feed mechanism when moving at the same speed therewith that there will be no sudden hitch whereby the predetermined position of the sheet will be disturbed. If two feed boards are to be used, the gears a a' and the levers a^3 a^4 operate in the manner described and each feeder feeds to every alternate gripper bar g. Any lack of register may be corrected by retarding or setting ahead the carrier as may be necessary, and individual links or the whole series may be adjusted to compensate for expansion and contraction. As will be noticed in Fig. 2 the supporting pulleys E E′ are driven by studs which do not extend across from one side of the press to the other which construction permits free access to the impression cylinders.

It is evident that various changes could be made in the arrangement of many of the parts of the press. For instance, the teeth marked s may be cut on the pulleys and corresponding recesses made in the several links, and various modes of adjustment may be substituted for the modes shown and changes made in the form of the link.

The auxiliary feeding device may be operated from any position of the machine other than the stud f as the main shaft B. If desired more than two printing couples may be used and various other changes may obviously be made in the arrangement of the parts which would not involve a departure from the spirit of my invention.

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

1. In a printing machine the combination with a printing couple and main feed mechanism having a continuous motion, and adapted to carry the sheet to be printed between the printing couple, of a feed board, a set of stops arranged in front of said feed board and adapted to limit the position of a sheet, an auxiliary feed mechanism adapted to seize a sheet from its position on the feed board as limited by the stops and when the sheet and auxiliary feed mechanism are at rest, means to move the stops out of the way, a connection between a moving part of the machine and the auxiliary feed mechanism adapted to move said auxiliary feed mechanism forward with gradually increasing speed till it is moving at substantially the same speed as the main feed mechanism, and means for transferring the sheet from the auxiliary to the main feed mechanism.

2. In a printing machine the combination with a printing couple and main feed mechanism having a continuous motion, and adapted to carry the sheet to be printed between the printing couple, of a feed board, a set of stops arranged in front of the feed board, and adapted to limit the position of a sheet, an auxiliary feed mechanism having two plates between which a sheet is adapted to be seized, at the position limited by the stops, when both the sheet and the auxiliary feeding mechanism are at rest, and carried forward from that position, a connection between an operative part of the machine and the auxiliary feed mechanism adapted to move said auxiliary feed mechanism forward with gradually increasing speed till it is moving at substantially the same rate as the main feed mechanism, and means for transferring the sheet from the auxiliary to the main feed mechanism.

3. In a printing machine the combination with a main feed mechanism of a crank G″ having a pin g^4 therein, an auxiliary feed mechanism adapted to transfer sheets to be printed from a feed board to the main feed mechanism, a link h^2 having a notch adapted to engage with the pin g^4 connected to the auxiliary feed mechanism and a pin g^5 adapted to disengage the link h^2 from the crank G″.

4. In a printing machine, the combination with a flexible rack having gripper mechanisms connected therewith and serving as a main feed mechanism, of supporting pulleys for said rack, a crank G″ connected with one of said pulleys and having a pin g^4 therein, an auxiliary feed mechanism adapted to transfer sheets to be printed from a feed board to the main feed mechanism, a link h^2 having a notch adapted to engage with the pin g^4 connected to the auxiliary feed mechanism, and a pin g^5 adapted to disengage the link h^2 from the crank G″.

5. In a printing machine, the combination with a printing couple, of main feed mechanism operating to carry the sheet between the rolls of the printing couple, an auxiliary feed mechanism, means for driving said auxiliary feed mechanism at gradually accelerated speed from a state of rest to a speed substantially equal to that of the main feed mechanism and means for disconnecting the auxiliary

feed mechanism from its driving motor and for returning it to its original position.

6. In a printing machine, the combination with a link *h* having a head provided with a notch, of a rotating arm G having a pin arranged to come in line with the notch and engage therewith, means for disengaging the link from the pin at a predetermined point of the travel of the arm G, means for restoring the link to its first position, and an auxiliary feed mechanism operated by the link.

7. In a printing machine the combination with a printing couple, of an endless flexible rack, supports for said rack, gripper mechanisms carried by said rack, two feed boards, two receiving boards, pins at the feed and receiving boards for actuating the gripper mechanisms, and means for actuating said pins that they will tumble every alternate gripper mechanism whereby sheets may be taken from each feed board and delivered to each receiving board.

8. In a printing machine the combination with a printing couple of an endless flexible rack carrying gripper mechanisms, supports for said rack, two feed boards and two auxiliary feed mechanisms operating to seize the sheets to be printed and deliver them to the main feed mechanism.

9. The combination in a printing machine of two or more printing couples, an endless flexible carrier for conveying sheets to be printed between the printing couples, a supporting and driving pulley for the carrier, a shaft or stud on which said pulley is mounted, and by which it is driven, said shaft or stud being connected by suitable gearing with the printing couples so that it revolves in a definite relation thereto, and means for adjusting the pulley circumferentially on the shaft so that the point at which a sheet is printed on may be varied.

10. An endless flexible carrier composed of links, certain of which are provided with relatively broad and the others with relatively narrow internal teeth, a support for said links having recesses as e^3 e^{20} arranged to fit the several teeth and gripper mechanism supported on the links with a broad tooth.

11. An endless flexible carrier composed of separate curved links, and circular supports for said carrier in combination with a chain or cable for connecting the links together and gripper mechanism carried at suitable intervals by the flexible carrier.

12. The combination with a printing couple of an endless flexible carrier composed of a series of separate curved links, an adjustable chain on each side of the series of links for holding the links together and gripper mechanism carried at suitable intervals by the flexible carrier.

13. In a printing machine the combination with a printing couple or couples, of gripper mechanisms, a flexible carrier on each side of the machine on which the gripper mechanisms are secured, said carrier operating to convey the sheet to be printed between the rolls of the printing couple, driving and supporting pulleys for the flexible carriers and studs secured to each side of the frame of the press for supporting the driving pulleys whereby free access may be had to the printing couple or couples.

14. In a printing machine, the combination with main feed mechanism of an auxiliary feed mechanism having plates *h* and t^2 between which the paper is held, and means for moving said auxiliary feed mechanism forward from a state of rest till it acquires practically the same speed as the main feed mechanisms, all substantially as specified, and so that the sheet may be delivered to the main feed mechanism in a smooth condition and exact register may be insured.

15. In a printing machine the combination with main feed mechanism, of an auxiliary feed mechanism having plates *h* and t^2 between which the paper is held and presented to the main feed mechanism, stops to limit the position of the paper before it is seized by the auxiliary feed mechanism *s*, means for moving the auxiliary feed mechanism in the manner specified, and means for transferring the sheet from the auxiliary to the main feed mechanism.

WILLIAM H. R. TOYE.

Witnesses:
ALF. H. FABER,
EDW. F. AYRES.