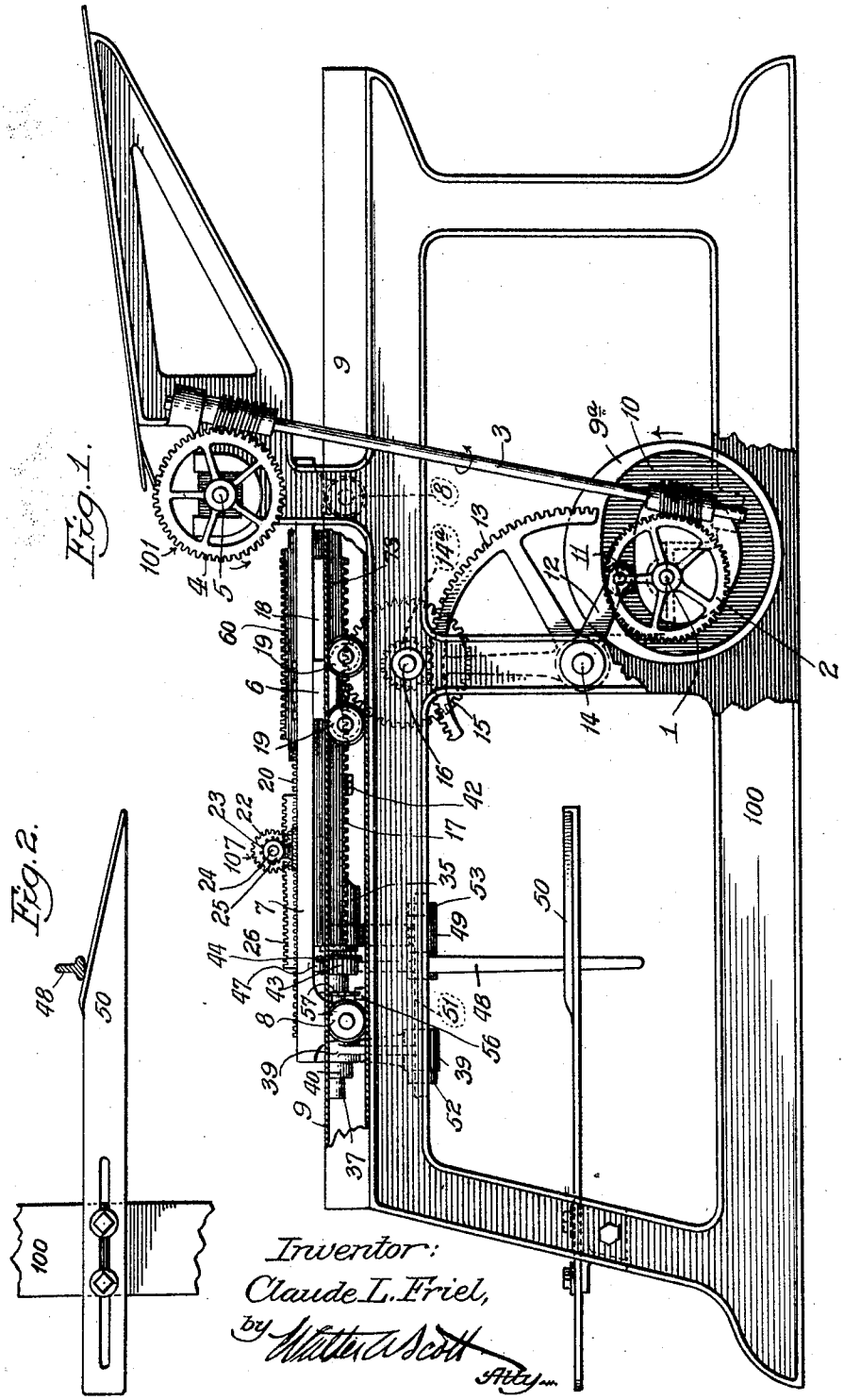
Aug. 11, 1925. 1,549,533

C. L. FRIEL

BED AND CYLINDER PRESS

Filed May 19, 1923 5 Sheets-Sheet 1



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C. L. FRIEL

BED AND CYLINDER PRESS

Filed May 19, 1923

5 Sheets-Sheet 2

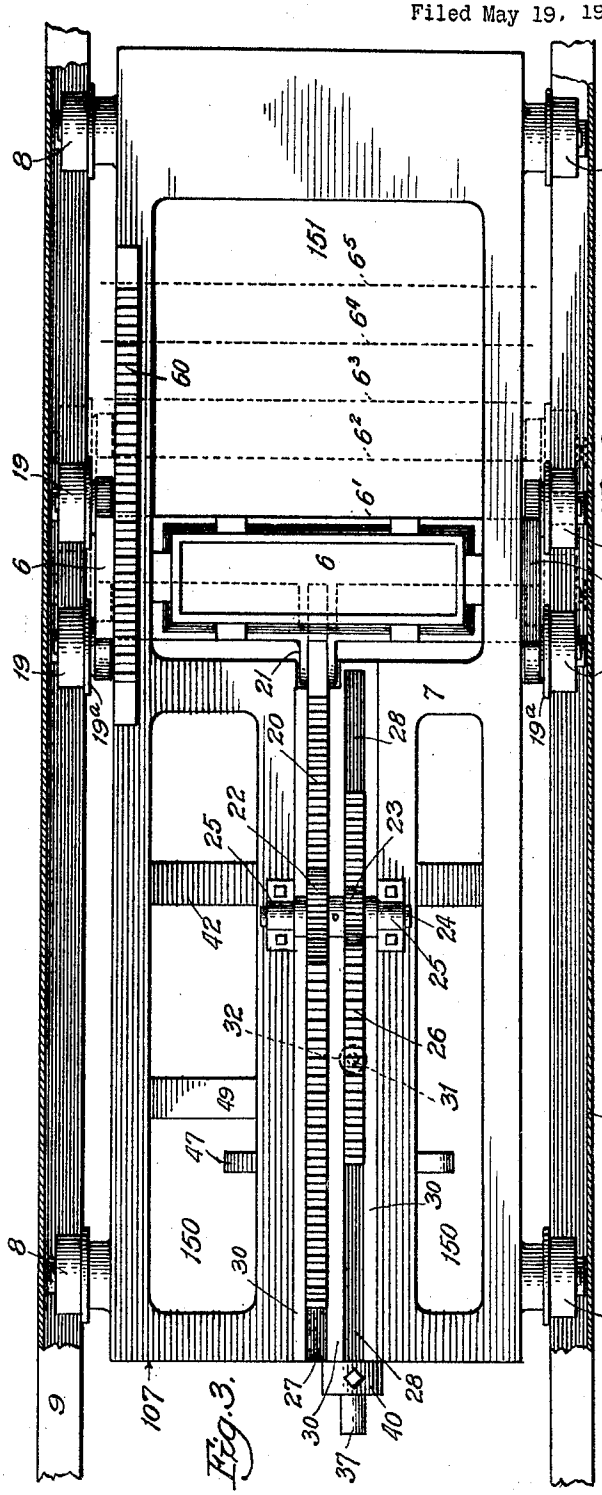


Fig. 3.

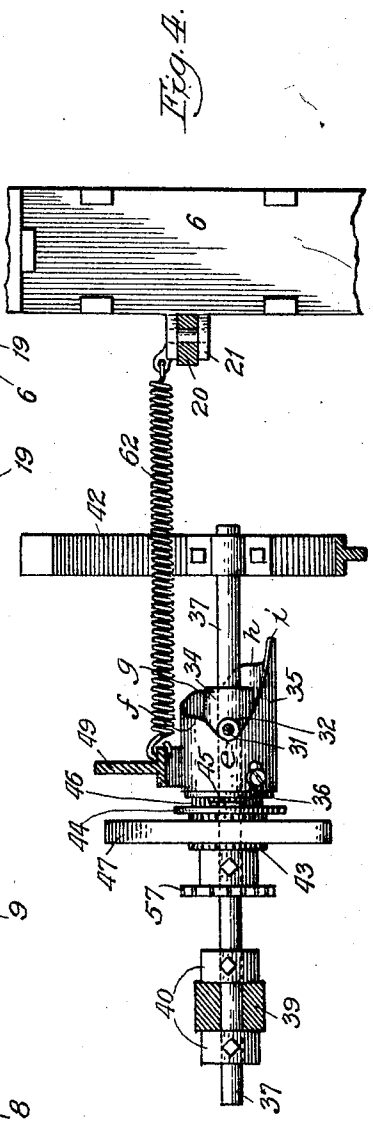


Fig. 4.

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BED AND CYLINDER PRESS

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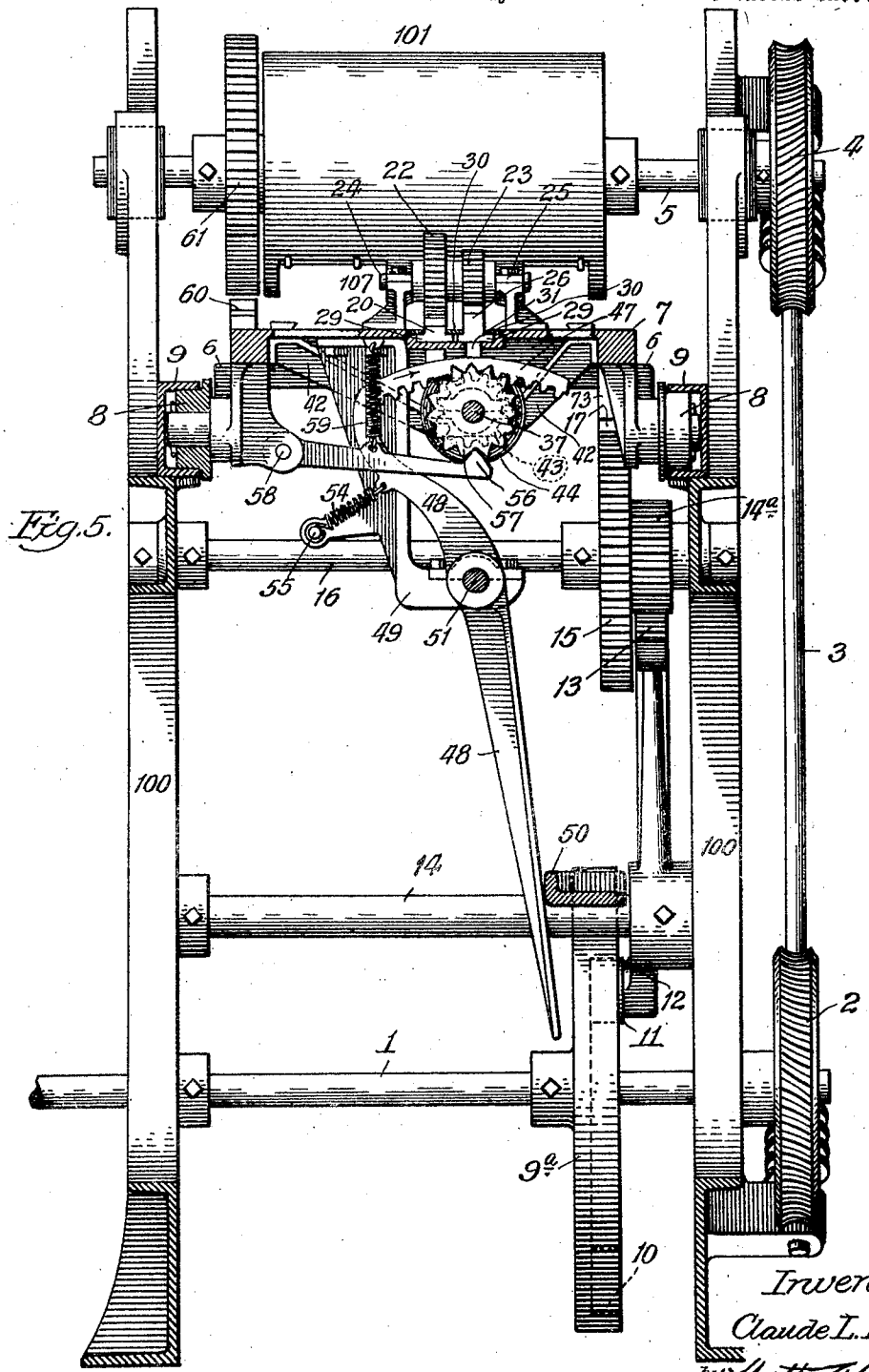


Fig. 5.

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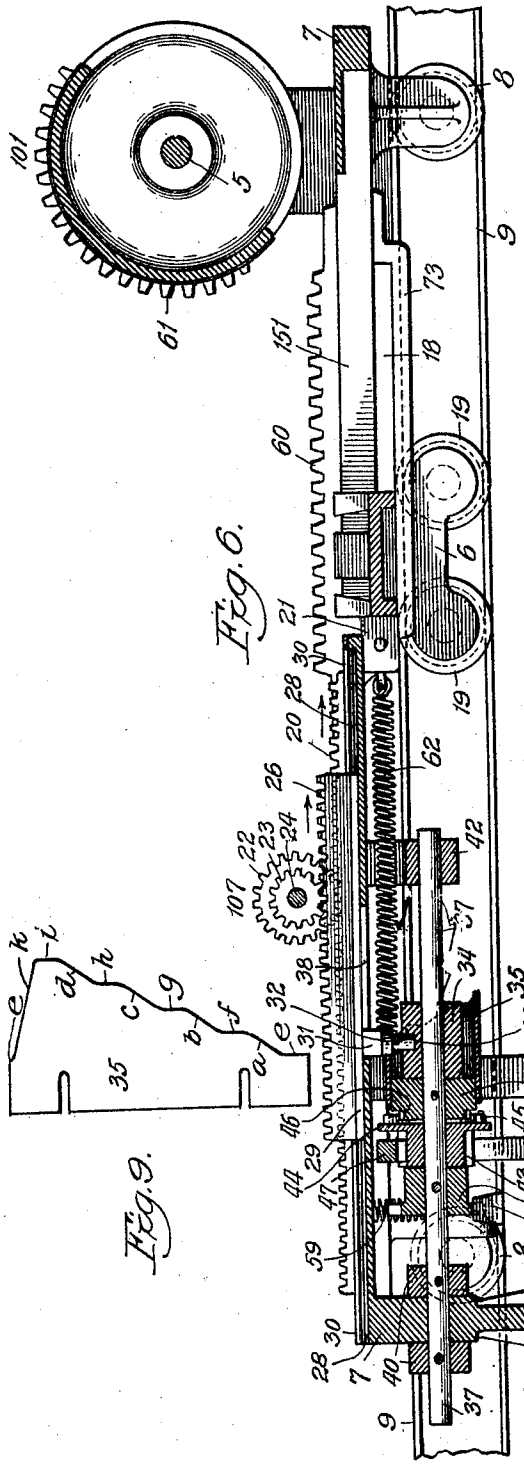


Fig. 6.

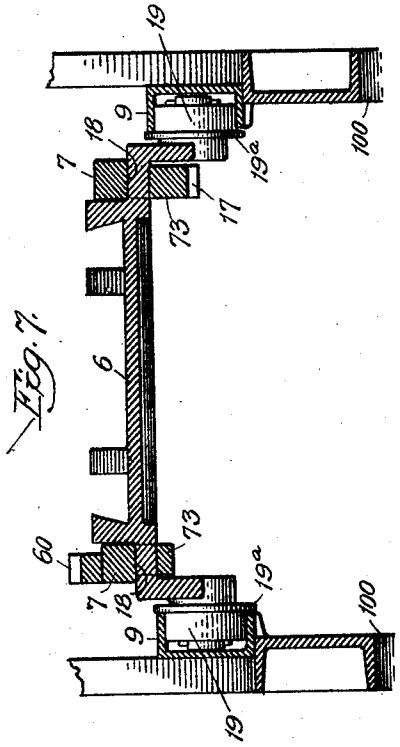


Fig. 7.

Fig. 9.

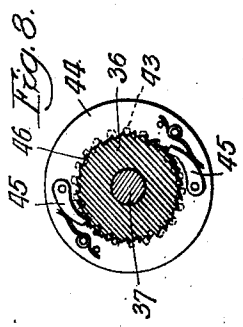


Fig. 8.

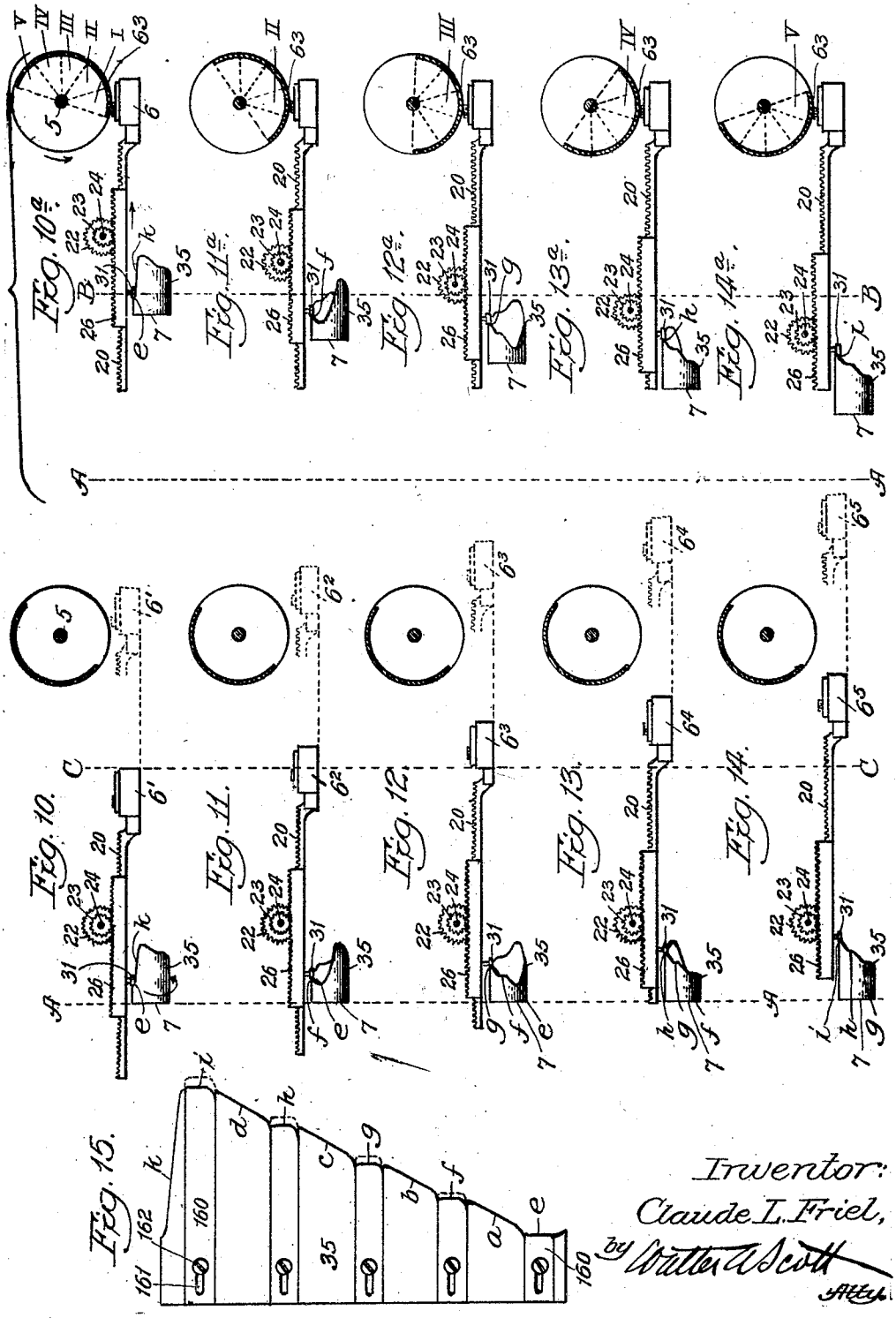
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Filed May 19, 1923 5 Sheets-Sheet 5



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Patented Aug. 11, 1925. 1,549,533

UNITED STATES PATENT OFFICE.

CLAUDE L. FRIEL, OF CHICAGO, ILLINOIS.

BED AND CYLINDER PRESS.

Application filed May 19, 1923. Serial No. 640,031.

To all whom it may concern:

Be it known that I, CLAUDE L. FRIEL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Bed and Cylinder Presses, of which the following is a specification.

The purpose of my invention is to so relate the rotation of the cylinder and reciprocation of the bed of a bed-and-cylinder press that successive impressions may be made from a single form in different positions circumferentially of the cylinder, a single sheet of paper being retained on the impression cylinder while the several impressions in different positions thereon are being made. An illustration of the utility of my invention is found in the lithographing of blank forms for bank checks and similar instruments. The impression area or blanket upon the cylinder of a bed-and-cylinder press is large enough to receive simultaneously an impression from as large a number of plates of this character as it is necessary to print on a single sheet, it being customary to print either three or five checks to a sheet, the sheets being subsequently bound in the form of the familiar bank check books. In printing a large number of checks with three or five or other desired number to a sheet a corresponding number of identical plates are made, assembled in a single form and each sheet printed with its plurality of blank forms by a single impression, and in the case of large orders for single checks the same procedure may be followed with subsequent cutting of the sheets into separate checks. But it is only when a comparatively large number of check or other blank forms are to be printed that a plurality of identical plates can be made without too greatly increasing the cost of the work. In the case of smaller orders it is more economical to use a single plate from which an impression is made on each sheet, then to alter the position of the plate on the bed and put all of the sheets through the press a second time, making a second impression in a different position, and repeating this procedure as many times as there are impressions to be made on each sheet. In the case of small orders it is more economical to put each sheet through the press as many times as there are blank forms to be printed on it than to prepare the necessary number of plates from which each sheet can be completely printed with one impression.

In my improved press I provide means whereby a plurality of impressions can be made in different positions on a sheet from a single plate and without removing the sheet from the press between impressions. I accomplish this result by imposing upon the bed a different movement upon each successive reciprocation during a cycle of impressions corresponding in number to the number of impressions to be made in different positions on each sheet, retaining each sheet upon the impression cylinder by proper actuation of the grippers during the successive reciprocations of the bed constituting the cycle of different movements. I have not shown the grippers in the drawings as any suitable form of gripper such as previously in use may be arranged to operate at the proper intervals. In bed-and-cylinder presses as ordinarily constructed and operated the bed and cylinder have a uniform movement between impressions and the form mounted on the bed therefore always cooperates with the same area on the cylinder, the result being that successive impressions if made on a single sheet would be superposed in registry one with the other. But it will be evident that when the form to be printed is smaller than the area that can be printed at a single impression proper variations in the movement of the bed will have the effect of causing successive impressions to be made in different positions on a sheet retained on the cylinder during such successive impressions. The utilization of this principle constitutes my invention. It will be apparent that the desired result is dependent only on a variation in the relation between the rotation of the cylinder and the reciprocation of the bed regardless of whether such variation is accomplished by modification of the reciprocation of the bed or of the rotation of the cylinder. In the embodiment of my invention herein illustrated and described I have effected the desired result by the introduction of means for successively varying the reciprocation of the bed. In the drawings—

Figure 1 is a side elevation of a bed-and-cylinder press embodying my invention.

Figure 2 is a detail view of a stationary

cam and operating arm which form part of the mechanism for producing the variations in the bed movement.

Figure 3 is a plan view of the press shown in Figure 1.

Figure 4 is a detail view of part of the mechanism by which the variable bed movement is produced.

Figure 5 is a transverse vertical sectional view of the press exhibiting the means for varying the successive reciprocations of the bed.

Figure 6 is a longitudinal sectional view showing the cylinder, bed, bed actuator and upper part of the frame of the press.

Figure 7 is a transverse sectional view through the upper part of the frame, the bed actuator carriage and bed.

Figure 8 is a detail view of a pawl and ratchet which form part of the mechanism mounted on the bed actuator carriage.

Figure 9 is a developed view of a cam which forms part of the actuating mechanism mounted on the actuator carriage.

Figures 10 to 14[a] are diagrammatic views of the bed and cooperating parts in the several positions occupied during the operation of the press.

Figure 15 is a developed view of the cam shown also in developed form in Figure 9 but modified by the addition of certain adjustable parts.

The press illustrated is in its general form similar to the bed-and-cylinder presses now in common use. A main power shaft, 1, is journalled in bearings mounted on the main frame, 100, and drives the impression cylinder, 101, by worm gearing consisting of screw threads on opposite ends of the shaft 3 which mesh with gears 2 and 4 fixed respectively to shaft 1 and shaft 5 of the impression cylinder. The bed actuator, designated generally by the numeral 107 comprises a carriage, 7, mounted upon flanged wheels, 8, which are embraced by the flanges of the channel track members, 9, the latter being fixedly mounted upon and in effect a part of the main frame of the press. The flanges of the wheels 8 abut against the edges of the flanges of the tracks 9. By the described relation of the wheels 8 and tracks 9 the bed actuator carriage 7 is restrained against any movement other than rectilinear reciprocation. In the operation of the press shown in the drawings the bed actuator carriage 7 has a uniform unvarying reciprocation which may be effected by gearing of the type heretofore used in bed-and-cylinder presses. The accomplishment of the purpose of my invention, however, is independent of the particular type of movement of the actuator carriage or other intermediate mechanism so long as the movement ultimately imposed upon the bed has the requisite cycle of variations. This uniform reciprocation is imparted to the bed actuator carriage by means of a cam, 9[a], fixed to shaft 1. The cam 9[a] takes the form of a disk having a groove or race 10 in one of its flat faces. Engaging the cam race is a roller, 11, mounted on the end of an arm 12 which is rigid with and may form part of a segmental gear 13 carried by shaft 14 which latter is mounted on the frame of the machine. Segmental gear 13 meshes with pinion 14[a], which together with spur gear 15 is fixed to shaft 16, the latter being rotatably mounted on the frame. Spur gear 15 meshes with rack 17 which forms an integral part of or is fixed to the bed actuator carriage 7. The race 10 of the cam 9 recedes from and approaches the center of shaft 1 once, thereby reciprocating the segmental gear once for each revolution of shaft 1 and through gears 14[a] and 15 and rack 17 imparting a forward and backward movement to the bed actuator carriage. The actuator carriage is shown in the drawings as comprising a base frame which may, as illustrated, take the form of a plate lightened by openings 150 and 151.

The bed 6, as clearly shown in Figures 1, 3 and 7, is provided with flanged wheels 19 which bear in the channel tracks 9 with the flanges, 19[a], of the wheels against the edges of the channels 9 thereby confining the bed to rectilinear movement. The ends of the bed 6 project through slots 18 in the downwardly extending side flanges 73 of the actuator carriage 7, the wheels 19 being outside of said flanges. The rectangular opening 151 in the actuator carriage permits movement and operation of the bed 6. The bed is thus supported directly upon the frame of the press, its only connection with the actuator carriage being that by which it is reciprocated.

The connection between the bed and bed actuator consists of a rack bar 20 slidably mounted on the base frame of the actuator carriage and attached at its forward end to a yoke 21 which projects rearwardly from and forms part of the bed. The rack 20 meshes with a gear wheel 22 which together with pinion 23 is fixed to shaft 24. Shaft 24 is mounted in bearings 25 on the base frame of the actuator carriage, and a second rack bar 26 also slidably mounted on bed actuator carriage 7 meshes with pinion 23. As shown in Figures 3, 5 and 6 the bed actuator carriage is provided with recessed parallel longitudinal guide-ways 27, 28 in which racks 20 and 26 have endwise movement. The racks are held against vertical displacement by longitudinal base flanges 29 over which lie cover plates 30 fixed to the base frame of the bed actuator carriage. When shaft 24 with the gears 22 and 23 mounted thereon is locked against rotation the rack 20 forms a rigid connection be-

tween the bed actuator carriage and bed, under which conditions the bed has the same movement as the actuator carriage. When shaft 24 is rotated by the means described below there is imposed upon the bed 6 a movement relative to the bed actuator carriage due to the travel of the connecting rack bar 20 in its guide-way 27 caused by the engagement of the gear 22 therewith. Rotation of the shaft 24 is effected by endwise movement of the rack bar 26.

For the purpose of imparting movement of the desired extent and at the proper times to rack bar 26 I provide the rack bar with a depending lug 31 which projects through a slot 38 in the bed actuator carriage. A roller 32 is mounted on lug 31 and coacts with the cam surface formed on the edge of the hollow cylindrical cam 35. The base of cam 35 takes the form of a disk 36 rigidly secured to the cylindrical shell of the cam (Figure 6), this base being rigidly secured to shaft 37. Slidably mounted on shaft 37 is a bearing block 34 in a cavity 33 in the upper side of which the lower end of stud 31 is seated. Shaft 37 rotates freely in block 34. Bearing block 34 serves to counteract any tendency of stud 31 and rack 26 to tilt from their respective vertical and horizontal positions under the pressure of cam 35 upon the stud. At its outer end shaft 37 is rotatably mounted in a hanger 39 which depends from and forms part of the bed actuator carriage. Collars 40 pinned to shaft 37 on opposite sides of hanger 39 restrain the shaft against endwise movement relative to the bed actuator carriage. The forward end of shaft 37 has a bearing in a hanger 42, the opposite ends of which incline upwardly and are secured to the under side of the bed actuator carriage as clearly shown in Figures 5 and 6.

Rotatably mounted on shaft 37 is a spur gear 43 with which there is integrally formed a flange 44. Spring pressed pawls 45 are pivotally mounted on flange 44 and engage ratchet teeth 46 formed on the circumference of the base 36 of cam 35 (Figures 6, 8 and 5). Rotation of gear 43 clockwise as viewed in Figure 5 is transmitted to cam 35 through the pawl and ratchet connection 45—46, and rotation of the gear 43 in the opposite direction is an idle movement during which pawls 45 ride over ratchet teeth 46 without transmitting rotation to cam 35.

Rotation is imparted to gear 43 by a gear segment 47 at the upper end of an actuating arm 48 mounted intermediate its ends on shaft 51 which is journaled in bearings in hanger 39 and another hanger 49 which depends from and forms part of the bed actuator carriage. The lower part of the actuator arm 48 cooperates with a stationary cam 50 (Figures 1, 2 and 5) fixedly mounted on the frame of the press. Shaft 51 is held against endwise movement by collars 52 and 53 pinned thereto. A spring 54 is secured at 55 to a projection formed on hanger 49 and at its opposite end is connected to actuator arm 48 thus serving to hold the lower end of the actuator arm in engagement with cam 50. It will be apparent that on the backward reciprocation of the bed actuator carriage, i. e. its movement toward the left as viewed in Figures 1 to 4 and 6 the engagement of arm 48 with cam 50 will rotate gear segment 47 at the upper end of arm 48 in clockwise direction as viewed in Figure 5, which rotation will be communicated through pawl and ratchet 45—46 to cam 35. In the embodiment of my invention illustrated the gradient of cam 50 is just sufficient to impart to gear segment 47 a circumferential movement equal to one fifth of the circumference of the gear wheel 43 which thereby causes the cam 35 to rotate 72 degrees—one fifth of a complete revolution. Upon reference to Figures 4 and 9, the latter view showing the cam developed, it will be observed that the cam has four successive equal inclines or rises, *a*, *b*, *c* and *d*, inclined to the plane of rotation of the cam, and five rests or neutral spaces, *e*, *f*, *g*, *h* and *i*, parallel to the plane of rotation of the cam, the highest neutral space, *i*, being connected to the lowest neutral space, *e*, by a single incline, *k*.

In Figure 4 of the drawing the stud 31 is shown in contact with the rest *e* of cam 35, the cam being accurately positioned by the engagement of detent 56 with star wheel 57. As shown in Figure 5 detent 56 is pivoted at 58 to the bed actuator carriage and, as indicated in Figure 6, star wheel 57 is pinned to shaft 37. A spring, 59, secured at its upper end to carriage 7 and at its lower end to detent 56 serves to hold the latter in yielding engagement with star wheel 57. The inclination of the faces of the detent and of the teeth of the star wheel is such that rotative force applied to the star wheel causes the detent to ride over the teeth of the star wheel, but when the cam 35 is at rest with stud 31 against one of its neutral faces the tension of detent spring 59 draws the detent to its limit of movement between two adjacent teeth of the star wheel thereby accurately positioning and holding the star wheel and with it shaft 37 and cam 35 in each of its successive adjustments. In the structure herein illustrated and described the number of teeth on the star wheel 57 should be either five or a multiple of five to correspond with the five positions of cam 35. When stud 31 is in contact with rest *e* of cam 35 rack 26 upon its last preceding movement has moved backward, i. e. to the left as viewed in Figures 1, 3 and 9, to the limit of its movement relative to the bed

actuator carriage 7, and this backward movement of rack 26 has been communicated to rack 20 through gears 23 and 22 whereby the rack 20 has also been brought to its extreme backward position relative to the bed actuator carriage. This position of the mechanism is shown in Figure 1, the bed 6 by reason of its connection with the rack 20 being in its extreme rearward position relative to the bed actuator carriage. This is the position of the bed just before the forward reciprocation for the printing of the first impression and at this time the cam 9^a begins to rotate the segment 13 counter-clockwise thereby moving the bed actuator carriage forward, and through the connection formed by the rack bar 20 the bed 6 is moved forward with the bed actuator carriage 7. As carriage 7 moves forward the rack 60 comes into mesh with the segmental gear 61 (Figures 5 and 6) on the impression cylinder to accurately coordinate the movement of the bed and cylinder during the time when the impression is being made.

During the forward movement the segmental gear 47 upon the actuator arm 48 moves counter-clockwise as viewed in Figure 5 while the lower end of the actuator arm rides against the receding face of cam 50 under the tension of spring 54, but during this movement the pawls 45 ride idly over the ratchet teeth 46 and no movement is transmitted to cam 35. Upon the succeeding rearward movement of the bed actuator carriage the engagement of the lower part of the actuator arm 48 with cam 50 imparts clockwise rotation to segmental gear 47 sufficient to impart one-fifth of a complete revolution to cam 35 through pawl and ratchet 45—46. The stud 31 is thus moved to its second position, i. e. to the rest *f* of cam 35, and the rack 26 which carries the stud 31 moves forward and imparts an increased forward movement to rack 20 and bed 6 through gear 23 and larger gear 22, thereby moving bed 6 to the position 6^2 shown in dotted line in Figure 3 just before the start of the second forward movement of the bed. The succeeding backward movements will rotate the cam 35 step by step and successively move the stud 31 to the cam rests *g*, *h* and *i* in each of which positions the cam will be accurately set and held by the engagement of detent 56 with star wheel 57. These successive movements of cam 35 will move the bed to the positions indicated by the dotted lines 6^3, 6^4 and 6^5, which lines indicate the positions successively occupied by the forward edge of the bed 6 at the beginning of its successive forward movements (Figure 3).

In bed-and-cylinder presses as ordinarily constructed the bed has a uniform movement with the result that the printing form always coacts with the same part of the impression cylinder and successive impressions made on a sheet of paper gripped to the cylinder would be superposed, each impression in registry with the others. The manner in which the successively varying movements imparted to the bed of my improved press operate to place successive impressions in different positions on a sheet is diagrammatically illustrated in Figures 10 to 14^a of the drawings. The cam 35 and gears 22, 23 shown in these views are mounted upon and have no movement relative to the bed actuator carriage other than their rotary movement. These parts, therefore, may be taken as representing the successive positions of the bed actuator carriage 7, and for convenience I have applied the reference numeral 7 to the base of cam 35 for the purpose of facilitating description of the operation of the mechanism by reference to the positions occupied by the bed actuator carriage. The line A—A (Figure 10 to 14 and 10^a to 14^a) marks the limit of the backward movement of the bed actuator carriage 7 and constitutes a fixed and invariable base to which the movements of the various elements may be referred. In each of Figures 10 to 14 inclusive the carriage 7 is shown at the limit of its backward movement just before starting forward toward the impression cylinder, and in each of these views the impression cylinder is shown in the same angular position which result is accomplished by the gear connections between shaft 1 and the impression cylinder and actuator carriage. In Figures 10^a to 14^a the line B—B marks the extreme forward limit of the movement of bed actuator carriage 7, the amplitude of movement of carriage 7 being the distance between the lines A—A and B—B of Figures 10^a to 14^a. In each of Figures 10 to 14 the left hand position of the bed, indicated by the numerals 6^1, 6^2, 6^3, 6^4 and 6^5, is that occupied by the bed relative to the actuator carriage and also relative to the impression cylinder at the beginning of the successive forward movements constituting the cycle for printing five impressions side by side on a single sheet, and in each of the same views the right-hand position of the bed, shown in fragmentary detached form, is the position occupied by the bed at the end of each of the forward movements of one complete cycle of five reciprocations. In Figures 10 to 14 the position of the impression cylinder is, as above stated, that occupied at the beginning of the forward movement of the bed, the rotative positions of the impression cylinder corresponding to the right-hand positions of the bed not being indicated in these views. The relation of the rotation of the impression cylinder to the movement of the bed is indicated in Figures 10^a to 14^a as explained below.

In Figures 10 and 10ª the stud 31 of rack 26 lies upon the rest *e* of the cam 35, this being the lowest rest, i. e., the one farthest to the left in the views referred to. The parts have been brought to this position by the tension of spring 62 (Figures 4 and 6) which draws the bed 6 to its extreme rear position relative to carriage 7 when cam 35, rotating in the direction of the arrow appearing in Figure 10, permits the stud 31 to ride down, i. e. backward or to the left, along incline *k*. The backward movement of bed 6 relative to carriage 7 causes backward movement of rack 26 and its stud 31 relative to carriage 7 by reason of the engagement of rack 20 with gear 22 and of gear 23 with rack 26. In Figure 10ª all of the parts are in the same relative position as in Figure 10 except for the fact that carriage 7 and with it the bed 6 have moved forward to a position where the form on the bed 6 is in contact with and making an impression upon the sheet 63 upon the impression cylinder, the bed not having quite completed its forward movement as indicated by the line B—B which marks the forward limit of the movement of the part of the actuator carriage 7 in the plane of the base of the cam 35. The relation of the bed and cylinder when stud 31 lies on rest *e* of cam 35, as illustrated in Figures 10 and 10ª, is such that the bed 6 does not engage the impression cylinder until four fifths of the width of the sheet 63 have passed the impression position thereby causing the first impression to be made upon the last fifth, designated I, of the width of the sheet to pass the impression position. As the width of the form mounted on the bed is not greater than one fifth of the width of the sheet space is left on the sheet for four more impressions, the gripper mechanism (not illustrated) being set to retain each sheet on the cylinder during five to-and-fro movements of the bed. In Figure 10ª the four fifths of the width of the sheet which have passed the impression position before the arrival of the bed are designated respectively II, III, IV and V, and the fifth of the width of the sheet receiving the impression is designated I.

Upon the succeeding backward movement of the bed and actuator carriage the actuator arm 48 is rotated clockwise, as viewed in Figure 5, by its engagement with stationary cam 50, whereby through segmental gear 47 and pawl and ratchet 45—46 cam 35 is rotated one fifth of a complete revolution to the position shown in Figures 11 and 11ª. By this movement of cam 35 stud 31 is forced forward along the incline between the rests *e* and *f* and the movement of the cam is accurately limited to one fifth of a revolution by the detent 56 and star wheel 57, thus leaving stud 31 temporarily upon rest *f* of the cam. The forward movement of stud 31 carries with it rack 26 thereby rotating gear 23, shaft 24 and larger gear 22, the latter imparting to rack 20 and bed 6 a greater movement relative to carriage 7 than that of rack 26. The advanced position so imparted to bed 6 relative to carriage 7 is indicated by the extent of its projection to the right beyond the reference line C—C in Figure 11. By reason of the advanced position occupied by the bed 6 upon the second reciprocation it will reach the impression position opposite the cylinder when the latter has revolved to an extent which carries three fifths of the sheet 63 beyond the impression position thereby causing the second impression to be made upon the second fifth of the width of the sheet, designated II in Figure 11ª. During the three succeeding reciprocations the bed will be advanced relative to the actuator carriage to the positions shown in Figures 12, 13 and 14, one fifth of a revolution being imparted to cam 35 upon each backward movement of the bed as above explained in connection with Figures 10 to 11ª, and the third, fourth and fifth impressions will be made respectively upon the three remaining fifths of the width of the sheet as indicated by the numerals III, IV and V in Figures 12ª, 13ª and 14ª. The sheet is then discharged from the cylinder. The next fifth of a revolution imparted to cam 35 carries it from the position shown in Figures 14 and 14ª to the position shown in Figures 10 and 10ª thereby permitting the stud 31 to ride rearward along incline *k* to rest *e* and the bed 6 to resume its initial position preparatory to repeating upon a new sheet the cycle of impressions just described. It will be apparent that any desired number of impressions may be made side by side on a single sheet by providing the cam 35 with the desired number of inclines and rests and adjusting the cam 50 to impart to the cam 35 upon each reciprocation rotation equal in extent to the angular distance between the successive cam rests.

In Figure 15 I have shown the rests *e*, *f*, *g*, *h* and *i* of cam 35 formed upon adjustable elements 160, slotted at 161, and adapted to be held in adjusted position by screws 162 passing through slots 161 and threaded into the body of cam 35. Such adjustable elements provide means for accurately regulating the movement of the bed and for taking up wear on the cam rests.

I claim:

1. In a bed and cylinder press, a rotary cylinder, a reciprocating bed and means for causing said bed to cooperate with different areas on said cylinder upon successive reciprocations thereby causing successive impressions to be made in different positions circumferentially of said cylinder.

2. In a bed and cylinder press, a rotary

cylinder and reciprocating bed, and means for successively varying the extent of reciprocation of said bed relative to said cylinder.

3. In a bed and cylinder press, a rotary cylinder and reciprocatory bed, means for imparting a greater movement to said bed in one direction than in the opposite direction in each of a predetermined number of reciprocations and for imparting to said bed in the next succeeding reciprocation a movement in said last-named direction greater than the movement in said first-named direction by an amount equal to the aggregate difference of movement in opposite directions during said preceding predetermined number of reciprocations.

4. In a bed and cylinder press, a rotary cylinder, a reciprocating bed, means for varying the relative extents of rotation of said cylinder and reciprocation of said bed between successive impressions, thereby causing successive impressions to be made in different positions circumferentially of said cylinder.

5. In a bed and cylinder press, a rotary cylinder, a reciprocating bed, and means for imparting different extents of rotation to said cylinder during the parts of the reciprocations of said bed between successive impressions, thereby causing successive impressions to be made in different positions circumferentially of said cylinder.

6. In a bed and cylinder press, a rotary cylinder, a reciprocating bed, means for imparting to said bed a cycle of non-uniform reciprocations comprising a predetermined number of reciprocations in each of which the movement in one direction is of less extent than the movement in the opposite direction and a reciprocation in which the movement of said bed in said first named direction is of greater extent than its movement in said opposite direction.

7. In a bed and cylinder press, a rotary cylinder, a reciprocating bed, means for imparting to said bed a cycle of reciprocations comprising a predetermined number of reciprocations in each of which the forward movement is of greater extent than the rearward movement and a reciprocation in which the rearward movement is of greater extent than the forward movement by an amount equal to the aggregate difference between said forward and rearward movements in said predetermined number of reciprocations.

8. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed and a bed actuator carriage, means for rotating said cylinder and for reciprocating said bed actuator carriage, means for transmitting reciprocatory movement from said carriage to said bed to an extent different from the extent of reciprocation of said carriage.

9. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed and a bed actuator carriage, means for rotating said cylinder and means for reciprocating said bed and carriage relative to said cylinder and relative to each other.

10. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed and a reciprocatory bed actuator carriage, means for rotating said cylinder, means for reciprocating said carriage and bed in unison during their movement in one direction and differentially in the opposite direction.

11. In a bed and cylinder press, a cylinder, a bed and a bed actuator, means to reciprocate said actuator uniformly in a fixed path and means controlled by said actuator for causing said bed to reciprocate in paths each of which is displaced longitudinally from the path of the preceding reciprocation.

12. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage, means for communicating reciprocatory movement from said actuator carriage to said bed, and means operated by the reciprocation of said actuator carriage for imparting to said bed an extent of reciprocation different from that of said actuator carriage.

13. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage operatively connected to said bed, means actuated by the reciprocation of said actuator carriage for moving said bed forward relative to said carriage during each of a predetermined number of reciprocations of said carriage and then returning said bed to its limit of movement rearward relative to said carriage.

14. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage operatively connected to said bed, means for rotating said cylinder and for reciprocating said actuator carriage, a cam mounted on said carriage, means actuated by the reciprocation of said carriage for actuating said cam, and means operated by said cam for changing the relative positions of said actuator carriage and bed.

15. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage operatively connected to said bed, means for rotating said cylinder and for reciprocating said actuator carriage, a stationary cam, a cam movably mounted on said actuator carriage, means actuated by the reciprocation of said actuator carriage and cooperating with said stationary cam to actuate said movably mounted cam, and means controlled by the last named cam for varying the relative positions of said actuator carriage and bed.

16. In a bed and cylinder press, a rotary

cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage operatively connected to said bed, means for rotating said cylinder and for reciprocating said actuator carriage, an arm movably mounted on said carriage, a stationary cam in the path traversed by said arm during reciprocation of said carriage, a cam movably mounted on said carriage, means actuated by said arm for imparting movement to said movably mounted cam, and means operated by said movably mounted cam for varying the relative positions of said actuator carriage and bed.

17. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage operatively connected to said bed, means for rotating said cylinder and for reciprocating said actuator carriage, an operating arm pivoted to said carriage and having gear teeth thereon, a stationary cam in the path traversed by said arm during reciprocation of said carriage, a spur gear mounted on said carriage and meshing with the gear teeth on said operating arm, a cam rotatably mounted on said carriage, means for transmitting rotation in one direction from said spur gear to said cam, and means operated by said rotatably mounted cam for varying the relative positions of said actuator carriage and bed.

18. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage operatively connected to said bed, means for rotating said cylinder and for reciprocating said actuator carriage, an operating arm pivoted to said carriage and having gear teeth thereon, a stationary cam in the path traversed by said arm during reciprocation of said carriage, a spur gear mounted on said carriage and meshing with the gear teeth on said operating arm, a cam rotatably mounted on said carriage, means for transmitting rotation in one direction from said spur gear to said cam, a rack longitudinally movable on said carriage and cooperating with said rotatably mounted cam, said bed being operatively connected to said rack.

19. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage operatively connected to said bed, means for rotating said cylinder and for reciprocating said actuator carriage, an operating arm pivoted to said carriage and having gear teeth thereon, a stationary cam in the path traversed by said arm during reciprocation of said carriage, a spur gear mounted on said carriage and meshing with the gear teeth on said operating arm, a cam rotatably mounted on said carriage, means for transmitting rotation in one direction from said spur gear to said cam, a rack longitudinally movable on said carriage and cooperating with said rotatably mounted cam, a second rack longitudinally movable on said carriage and geared to said first named rack, said second rack being connected to said bed.

20. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage operatively connected to said bed, means for rotating said cylinder and for reciprocating said actuator carriage, an operating arm pivoted to said carriage and having gear teeth thereon, a stationary cam in the path traversed by said arm during reciprocation of said carriage, a spur gear mounted on said carriage and meshing with the gear teeth on said operating arm, a cam pivotally mounted on said carriage, means for transmitting rotation in one direction from said spur gear to said cam, a rack longitudinally movable on said carriage and cooperating with said rotatably mounted cam, a spur gear fixed to a shaft rotatably mounted on said carriage and meshing with said rack, a larger spur gear fixed to said shaft, a second longitudinally movable rack meshing with said larger spur gear, said second rack being connected to said bed.

21. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage operatively connected to said bed, means for rotating said cylinder and for reciprocating said actuator carriage, an operating arm pivoted to said carriage and having gear teeth thereon, a stationary cam in the path traversed by said arm during reciprocation of said carriage, a spur gear mounted on said carriage and meshing with the gear teeth on said operating arm, a cam rotatably mounted on said carriage, means for transmitting rotation in one direction from said spur gear to said cam, said cam having a series of inclines and rests, each incline with the adjoining rest together extending over an angular distance equal to the extent of angular movement imparted to said cam by the movement of said arm during one reciprocation of said carriage.

22. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage, a connecting rod extending between said bed and carriage and longitudinally adjustable relative to one of said parts, and means actuated by reciprocation of one of said reciprocatory parts for effecting longitudinal adjustment of said connecting rod.

23. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a reciprocatory bed actuator carriage, a rack adjustably mounted on said carriage and connected to said bed and means actuated by reciprocation of said carriage for effecting longitudinal adjustment of said rack and bed relative to said carriage.

24. In a bed and cylinder press, a rotary cylinder, a reciprocatory bed, a constantly rotating shaft geared to said cylinder, means for driving said bed from said shaft comprising an actuator uniformly reciprocated by gearing driven by said shaft, said bed being adjustably connected to said actuator, and means operated by reciprocation of one of said reciprocating parts for effecting successive adjustments of the relative position of said actuator and bed.

In testimony whereof, I have subscribed my name.

CLAUDE L. FRIEL.