Jan. 5, 1937. R. STÜSSI 2,066,429

APPARATUS FOR OPERATING CYLINDER PRINTING PRESSES

Filed March 16, 1931 3 Sheets-Sheet 1

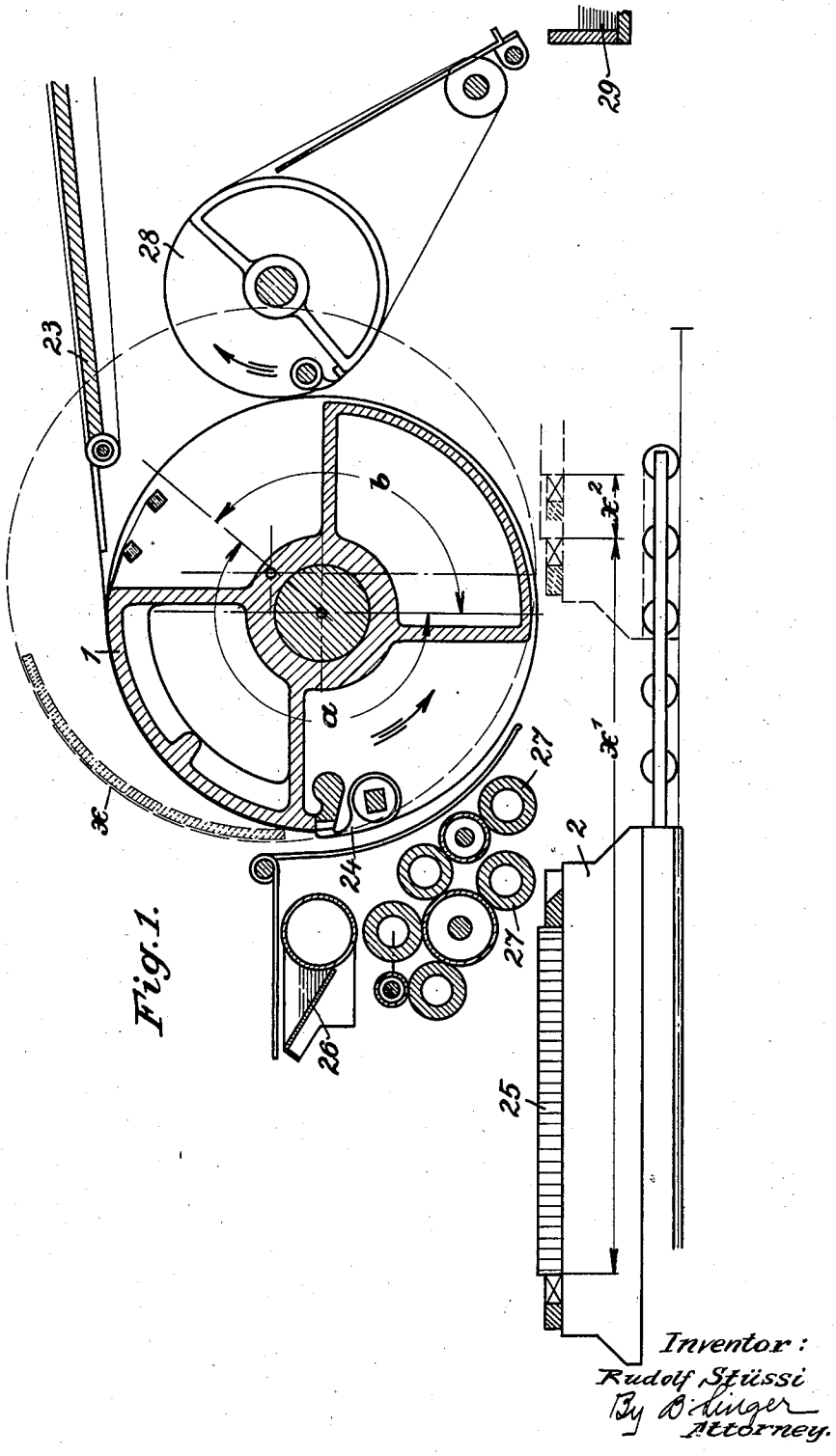


Fig. 1.

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Filed March 16, 1931 3 Sheets-Sheet 2

Fig. 2.

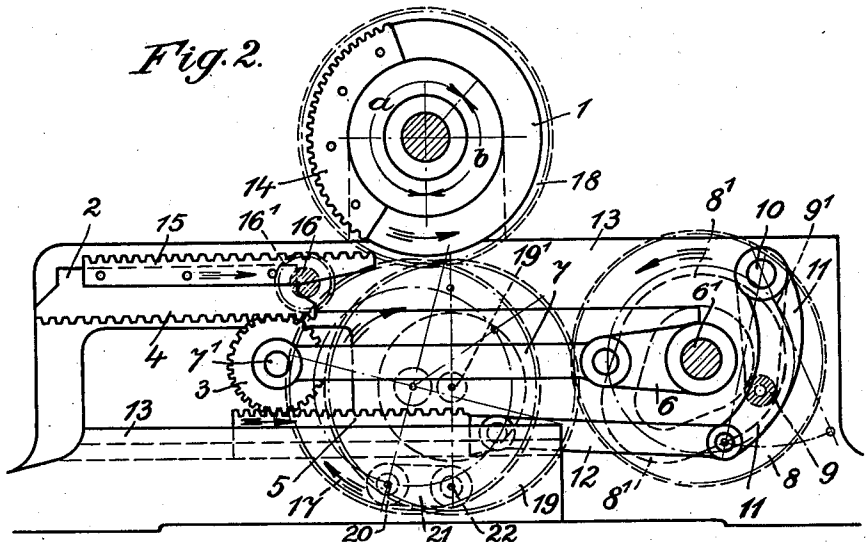


Fig. 3.

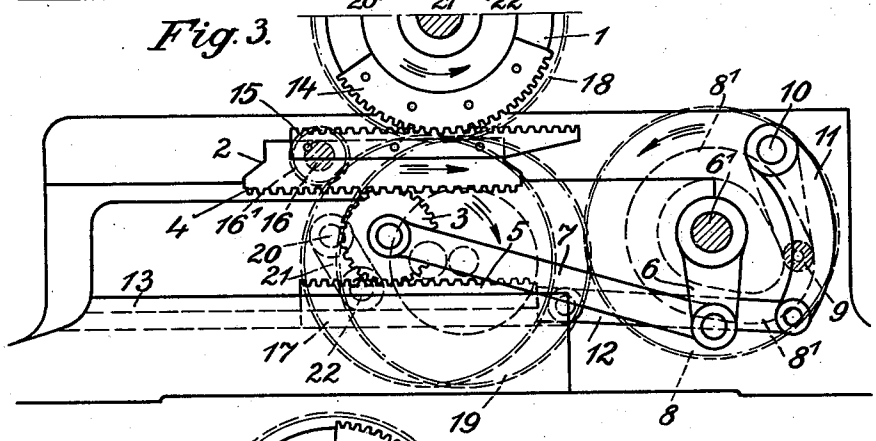
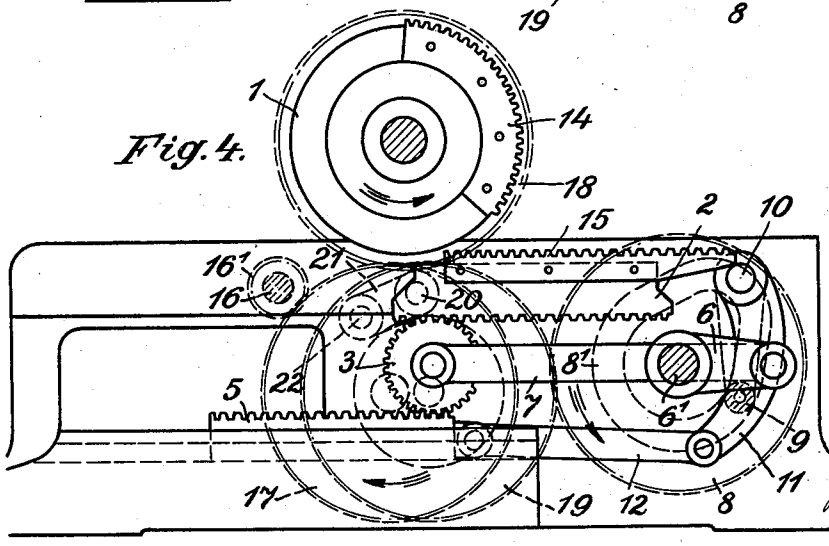


Fig. 4.



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Fig. 5.

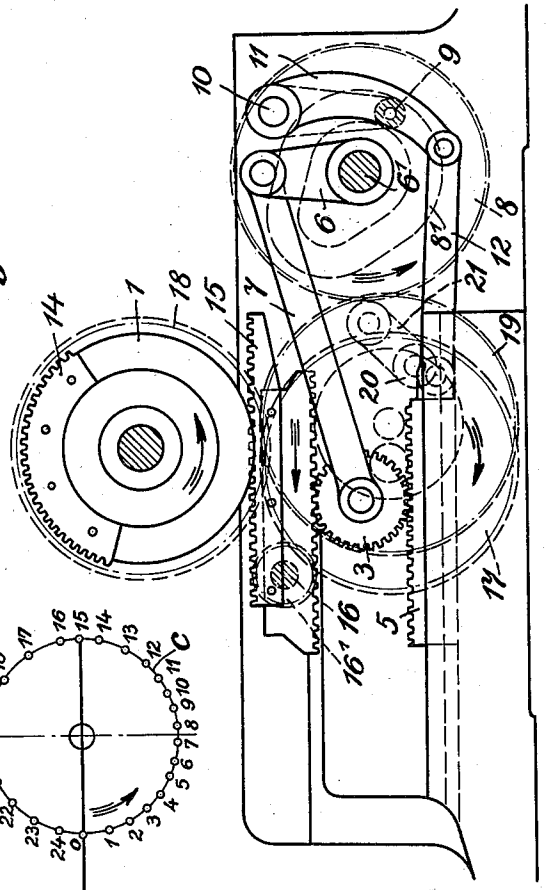
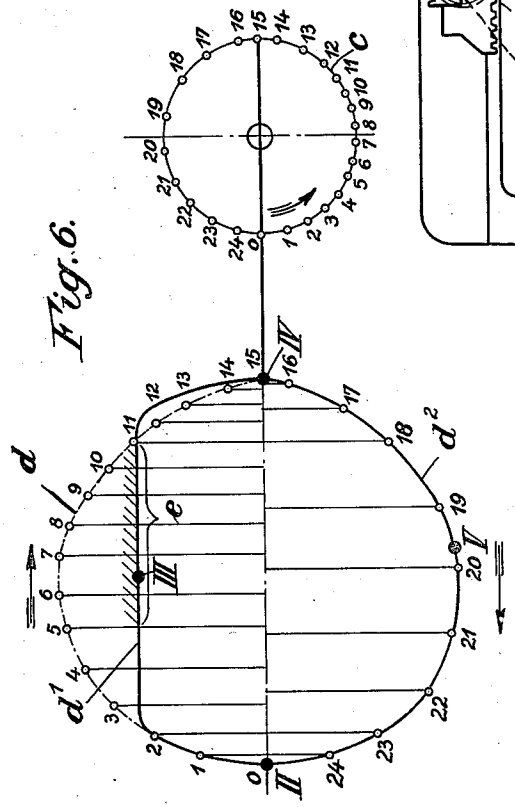


Fig. 6.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR OPERATING CYLINDER PRINTING PRESSES

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Application March 16, 1931, Serial No. 523,095
In Germany December 19, 1930

3 Claims. (Cl. 101—232)

This invention relates to improvements in cylinder printing presses with the impression cylinder revolving continuously in one direction.

In cylinder printing presses of this kind, the so-called single-revolution machines, and also two-revolution machines, the diameter of the impression cylinder is usually made as great as the length of travel of the form bed requires for this to-and-fro movement, including the reversal, the impression cylinder of the single revolution machines executing one complete revolution for each complete reciprocation of the form bed, whereas the impression cylinder of the two-revolution machines executes one complete revolution for each forward movement and for each return movement. In both cases the form bed is driven during the to-and-fro movement constantly at the speed of the cylinder.

Now it is known, however, that good printing work can only be produced up to a certain maximum speed. If this speed limit is exceeded, the inking of the form becomes defective, and the paper does not have time enough for the reception of the ink and the registering is bad, because the feeding of the sheet has to be effected to the impression cylinder revolving at a high speed. The machines mentioned were frequently capable of running at a rather high speed, but owing to the difficulties in printing technology the utilization of the full speed of the machines is not possible.

By the improvement according to the invention these disadvantages are obviated, and a subsequently higher printing output than has hitherto been attained with cylinder printing presses having a continuously revolving impression cylinder is reached, but the quality of the printing remains the same.

The invention consists essentially of the fact that by diminishing the diameter of the impression cylinder the peripheral speed of the impression cylinder is diminished, but maintaining constant the length of the impression receiving segment on the cylinder for a given size of sheet, and that the return of the form bed is effected by a greater speed.

Since in consequence of the diminution of the diameter of the impression cylinder, with a constant size of the impression receiving segment on the impression cylinder, the operations required in printing, such as taking over the sheet from the feeding table, inking the form before printing and the printing operation itself, extend over a larger portion of the cylinder periphery than hitherto, the form bed must according to the invention be moved at a higher speed during the return than during the printing stroke.

Since according to the invention the above-mentioned operations required during the printing stroke, and also the removal of the printed sheet, are effected at the reduced peripheral speed of the smaller impression cylinder, and therefore more favourable conditions are provided for these operations, an increase in the speed of revolution may at once be effected, and therefore an enhanced output in proportion to the diminution in the diameter of the impression cylinder, or, in other words, according to the method of this invention, definite printing work can still be carried out at substantially higher speeds of revolution of the cylinder than in machines of the kind hitherto known, but with the same quality of printing, or printing work can be carried out at a high speed of revolution of the cylinder which would only admit of being executed in machines of the kind hitherto known at substantially lower speeds.

Besides the increase in output directly attainable by diminishing the diameter of the impression cylinder, this increase being approximately proportional to the value of the decrease in diameter, a further increase in output is yielded with the method according to the invention owing to the fact that the form bed, in consequence of the diminution in the diameter of the impression cylinder, has a substantially shorter path to traverse for printing paper of the same length, and therefore can be returned earlier than in the machines hitherto known, as will hereinafter be shown.

The various speeds of the form bed may be for instance obtained from a crank drive in combination with a rack gear, in such a way that the form bed, owing to the control of a rack slidable in the machine frame, receives a uniform speed during the printing stroke, agreeing with the peripheral speed of the reduced impression cylinder, and receives a greater speed during the return stroke.

A cylinder printing press according to the invention is illustrated by way of example in the accompanying drawings, which relate to a single-revolution machine. In these drawings,

Figure 1 shows diagrammatically in longitudinal section through the upper part of the machine the parts of a single revolution machine that are concerned.

Figures 2–5 show the driving mechanism of the press illustrated in Fig. 1, these figures show-

ing various positions during the printing stroke and the return stroke of the form bed, and

Figure 6 shows a movement and speed diagram for the form bed.

The impression cylinder 1, which is supported in the usual manner above the form bed 2, is driven from a shaft 16, journalled in the machine frame. This shaft has for this purpose at each of its outer ends a pinion 16^1, which meshes with an intermediate wheel 17. The latter meshes with a toothed wheel 18 connected with the impression cylinder 1 and rotates the former at a constant speed.

The impression cylinder, as Figure 1 shows, is 20 per cent. smaller in diameter than the impression cylinder indicated in dotted lines in the drawings and marked x, such as would hitherto have been employed in single-revolution machines for paper of the same size. In consequence of the reduced diameter of the impression cylinder 1 the operations required for the printing stroke extend over a larger portion of the cylindrical surface than hitherto, that is, over more than 180°. On this ground the impression cylinder 1 must revolve during the printing stroke through angle a (Figure 1), as contrasted with the large impression cylinder hitherto used, which only executed half a revolution during the printing stroke.

In consequence of the diminution of 20 per cent., selected by way of example, in the diameter of the impression cylinder, the peripheral speed of the impression cylinder for the same angular velocity is 20 per cent. less. In order to provide the same relationships or working conditions as in the case of the large impression cylinder hitherto used, the speed of revolution of the impression cylinder may be increased by 20 per cent., whereby a 20 per cent. increase of output is obtained, with the same quality of printing as in the case of the large cylinder hitherto used.

The path that the form bed 2 has to traverse in the case of the impression cylinder 1 of reduced diameter during the printing stroke is marked x^1 in Figure 1. This path is shorter by the amount x^2 than the distance that the form bed would have had to traverse in the case of the large impression cylinder hitherto used for paper of the same format. The shortening amounts to about 10 per cent. of the total path and yields a corresponding diminution in the time occupied by the printing stroke and return stroke, which corresponds to a further increase in output of about 10 per cent.

In a two-revolution machine such a great shortening of the path is not possible in consequence of the impression cylinder being only half as large but the essential advantages of the diminished peripheral speed of the impression cylinder still come fully into play in the printing technology of two-revolution machines. In a two-revolution machine the impression cylinder would execute more than one revolution during the printing stroke, and the remainder of the second revolution would remain for the quicker return of the form bed.

In the single-revolution machine selected for the example of construction, the return of the form bed must take place during the remaining part b (Figure 1) of a complete revolution of the impression cylinder. The return speed of the form bed must therefore be correspondingly greater. For this purpose the following arrangement is made.

To the under side of the form bed 2 is secured a rack 4, with which a toothed wheel 3 meshes. The latter meshes at the same time with a rack 5 longitudinally displaceable in the machine frame 13. The toothed wheel 3 is freely rotatable upon the pivot 7^1, to which a connecting rod 7 is attached, the other end of which is pivoted to a crank 6, which is secured upon a shaft 6^1 journalled in the machine frame. During the revolution of the crank 6 the toothed wheel 3 is moved to and fro, and during this movement it rolls along the rack 5, the form bed traversing twice as great a path as the crank. For the driving of the crank shaft 6^1 there is secured to the latter outside the side wall of the machine frame 13 a toothed wheel 8, with which there meshes a toothed wheel 19. The latter is mounted upon a special shaft 19^1 and supported eccentrically to the intermediate wheel 17. The two toothed wheels 17 and 19 are however connected with one another for a purpose hereinafter described by means of a link 21, which is rotatably mounted at one end on a bolt 20 on the toothed wheel 17 and at the other end on a bolt 22 on the toothed wheel 19. The toothed wheels 8, 17, 18 and 19 may for example be of the same pitch diameter, so that to one revolution of the impression cylinder 1 there corresponds one complete revolution also of the crank shaft 6^1.

In consequence of the mutually eccentric position of the two adjacent toothed wheels 17 and 19, and of their connection by means of the link 21, the toothed wheel 19 participates in the rotation of the toothed wheel 17, but while the toothed wheel 17 is driven at a constant speed, the toothed wheel 19, in consequence of the above-mentioned connection, executes each revolution with a varying angular velocity. Since the toothed wheel 19 meshes with the toothed wheel 8, the crank 6 is also set in rotation in the same manner with varying angular velocity. The arrangement is such that while the toothed wheels 17 and 18 and therefore the impression cylinder 1 are executing during the printing stroke a rotation of the magnitude of the angle a (Figures 1 and 2) at the centre, that is, more than half a revolution, the toothed wheels 19 and 8, and therefore the crank 6, execute exactly half a revolution in the same time. This half revolution is executed at a diminished angular velocity. During the return of the form bed 2, however, the toothed wheels 17 and 18 and the impression cylinder 1 pass through the remaining angle b to complete the entire revolution. During this time the toothed wheels 19 and 8, and therefore the crank 6, execute the other half revolution at an accelerated angular velocity.

During the printing stroke the speed of the form bed 2 must of course completely agree with the constant speed of the impression cylinder 1. Since however the pivot 7^1 of the toothed wheel 3, which is permanently in mesh with the form bed 2, executes in consequence of the crank drive, 6, 7 non-uniform longitudinal movements, the movements must be harmonized during the printing stroke.

For this purpose there is provided in the toothed wheel 8 a cam groove 8^1, in which there engages a roller 9 rotatably mounted on a lever 9^1. The roller-lever 9^1 is secured to a shaft 10, journalled in the machine frame, upon which shaft, in about the longitudinal central axis of the machine, is secured a control lever 11, the lower end of which is connected by a link 12 with the rack 5.

The operations during one printing and one return stroke are as follows:—

The sheet lying upon the feeding table **23**, Figure 1, is seized during the rotation of the impression cylinder **1** in a known manner by the grippers **24** thereof and carried along with them. A start may here be made from the position of the parts indicated in Figure 2. The form bed **2** is in the position of reversal for the printing stroke. The crank **6** is rotating in the direction of the arrow in Figure 2. By this means the form bed **2** is moved in the direction of the printing stroke until the racks **15** fixedly arranged on the long sides of the form bed **2** come into engagement with the toothed segments **14** secured to the sides of the impression cylinder **1**. The rack **5** is displaced during the printing stroke, in consequence of the shape of the cam groove 8^1, in such a way that the rotary movement of the toothed wheel **3**, independently of the retarded longitudinal movement of its pivot 7^1, brings about a uniform movement of the form bed **2**, in harmony with the uniform rotary movement of the impression cylinder **1**.

During the printing stroke the form **25** that has been inked on the foregoing return stroke (Figure 1) is again inked by means of inking rollers **27** supplied from an ink trough **26** in a known manner and thereupon the printing is completed.

Figure 3 shows that position of the parts which they occupy at about the middle of the actual printing period. Since the rack **15** remains in mesh with the toothed segment **14** on the impression cylinder **1** for the duration of the uniform movement of the form bed **2**, an accurate agreement of the movements of the two printing organs during the printing operation is secured.

In the position of the parts according to Figure 4, the racks **15** are already out of engagement with the toothed segments **14** of the impression cylinder **1**, and the return of the form bed **2** is commencing.

During the reversing movements of the form bed **2** the racks **15** do not mesh with the segments **14**. The latter are therefore shorter than the part of the periphery of the impression cylinder which is needed during the printing stroke.

During the printing stroke the impression cylinder **1** has revolved through an angle corresponding to the angle *a* (Figures 1 and 2) at the centre, but the crank **6** has only rotated through 180°.

During the return of the form bed **2** the crank rotates through a further 180°. During this portion of the crank circle the form bed **2** is returned at a speed higher than the peripheral speed of the impression cylinder, the toothed wheel **3** rolling upon the rack **5**, which is now stationary.

Figure 5 shows the form bed **2** at about the middle of its return path. The racks **15** can run through underneath the impression cylinder without hindrance, since they do not come into engagement with the toothed segments **14**.

During the return of the form bed the impression cylinder **1** rotates through the angle *b* (Figure 1) in completing one entire revolution. In passing through this residual part of the complete revolution of the impression cylinder the printed sheet passes with the diminished peripheral speed of the impression cylinder in known manner over the discharge cylinder **28** (Fig. 1) on to the delivery pile **29**.

From the diagram of Figure 6 the variation in speed of the form bed will be seen. Upon the crank circle *c* traversed by the crank **6** the individual angles of rotation arising from the varying angular velocity are indicated by the numerals **0** to **24**, the numerals **0** to **15** corresponding to the printing stroke, and the numerals **15** to **24** corresponding to the return stroke of the form bed. The diagram *d*, representing the movement arising from the rotation of the crank and the acceleration is altered at the portion d^1 of the curve during the printing stroke by the displacement of the rack **5**. The actual speeds of the form bed are indicated in the diagram by full lines. It will be seen therefrom that during the printing stroke the form bed receives a uniform retarded motion, as represented in the upper portion d^1 of the curve, and during the return stroke is driven with a non-uniform and enhanced velocity represented by the lower part d^2 of the curve. The distance *e* in the upper portion d^1 of the curve corresponds to the part of the path of the form bed upon which the printing takes place. To the points II, III, IV and V of the curve there correspond the positions of the form bed according to Figures 2, 3, 4, and 5.

Owing to the small number of toothed wheels for driving the cylinder and the bed, and more particularly owing to the direct connection of the form bed during the printing stroke with the revolving impression cylinder through the toothed segments **14** and the racks **15**, disagreements in the development of these two members during the printing operation as a whole are precluded, so that even after lengthy operation no register differences arise.

The apparatus according to the invention may of course also be employed in printing presses in which the taking over of the sheet is not effected at the upper edge of the impression cylinder, as in the example of construction illustrated, but at its lower edge.

Furthermore the apparatus also admits of being employed in cylinder printing presses in which the form bed moves in a vertical direction.

What I claim as new is:—

1. In a cylinder printing press, the combination of a printing cylinder continuously rotating at uniform speed in the same direction, and a reciprocating form bed, said impression cylinder being reduced in diameter while retaining the arcuate length of the impression receiving segment as necessitated by the size of the sheet to be printed in such manner that the impression cylinder during the impression stroke of the said form bed is turned through a greater angle than during the return stroke of the form bed, a crank drive for reciprocating the form bed, and means for actuating the crank drive in such a manner that the crank in that period in which the impression cylinder travels through the greater angle passes through one-half revolution at reduced speed while the crank in that period in which the printing cylinder travels through the smaller angle makes a half revolution at accelerated speed.

2. In a cylinder printing press, the combination of an impression cylinder rotating continuously in the same direction at uniform speed, and a reciprocating form bed, said impression cylinder being reduced in diameter while retaining an arcuate length of the impression receiving segment as determined by the size of the sheet to be printed, so that the printing cylinder during the impression stroke of the form bed is rotated through a greater angle than during the return stroke of the form bed, a crank drive for reciprocating the form bed, a driving gear for

the said impression cylinder, and a second driving gear for the said crank drive, the two driving gears being disposed offset relatively to each other, a link connecting the two driving gears, a gear reciprocated by the crank drive, a rack bar mounted on the form bed into which said last named gear engages, another rack bar slidably disposed in the frame of the press and also engaged by said last named gear, and means for shifting the last named rack bar during the rotation of the crank.

3. In a cylinder printing press, the combination of an impression cylinder and a reciprocating form bed, said impression cylinder being reduced in diameter while retaining an arcuate length of the impression receiving segment as determined by the size of the sheet to be printed, so that the impression cylinder during the impression stroke of the form bed is rotated through a greater angle than during the return stroke of the form bed, a drive gearing for continuously rotating said impression cylinder at uniform speed in the same direction and for reciprocating said form bed, said drive gearing comprising toothed gears and being arranged in such a manner that one of said toothed gears, which actuates said form bed, in that period in which the impression cylinder travels through the greater angle passes through one half revolution at reduced speed while said toothed gear in that period in which the impression cylinder travels through the smaller angle makes a half revolution at accelerated speed.

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