July 4, 1939. G. C. WATERS 2,164,363

PRINTING PRESS

Filed Dec. 24, 1936 3 Sheets-Sheet 1

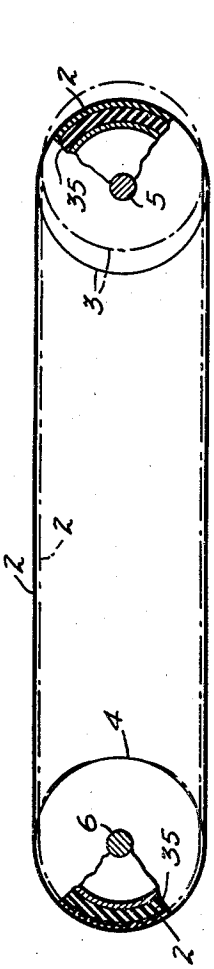


Fig. 2

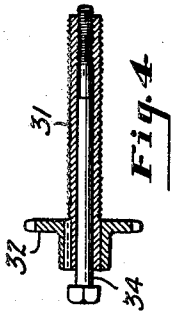


Fig. 4

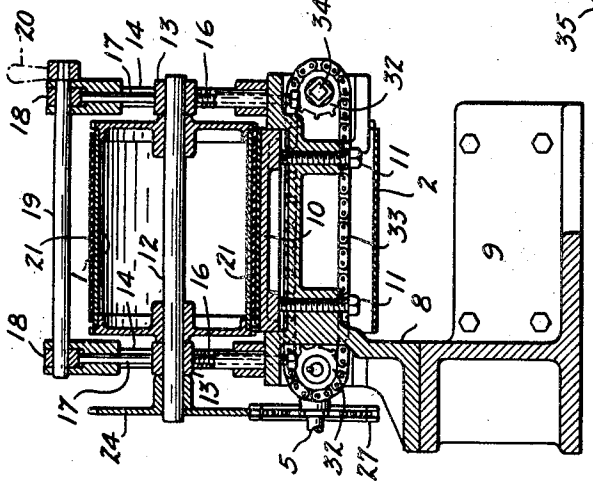


Fig. 3

Fig. 1

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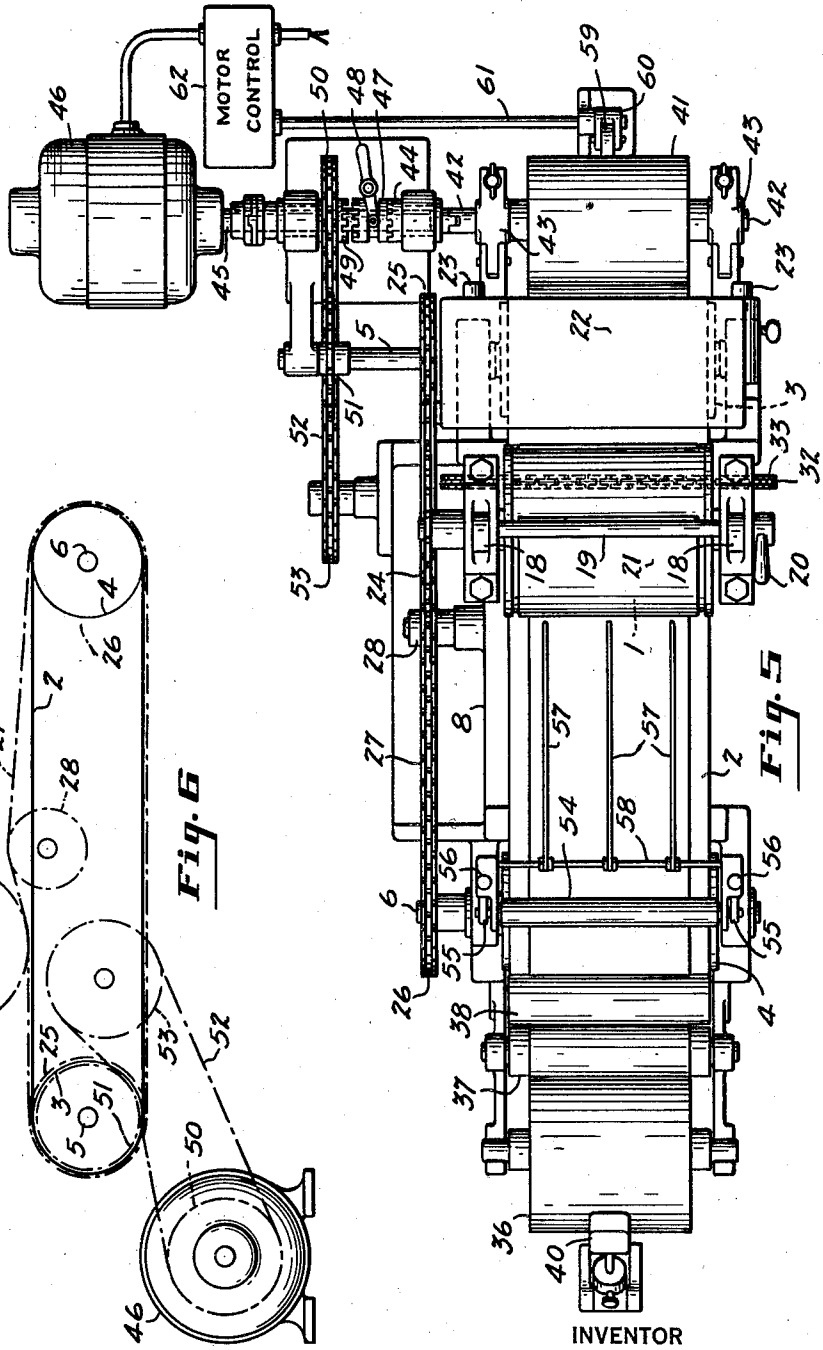


Fig. 5

Fig. 6

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Filed Dec. 24, 1936 3 Sheets-Sheet 3

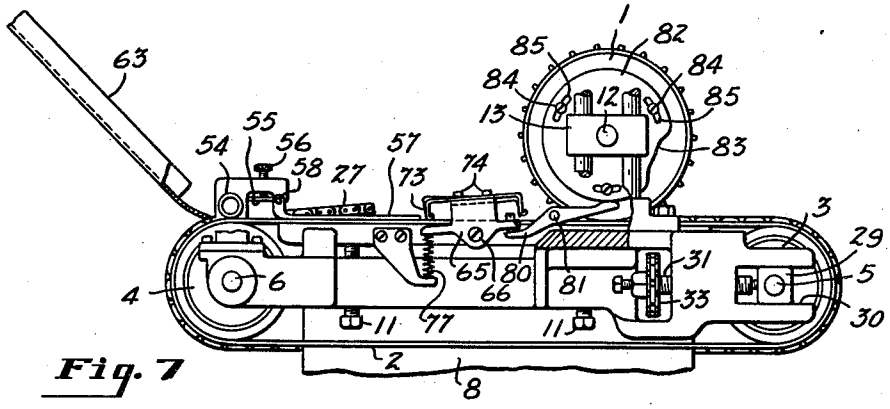


Fig. 7

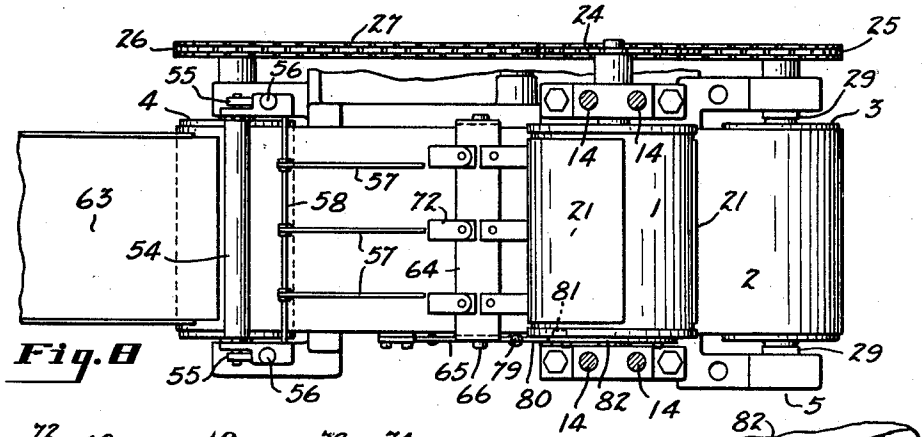


Fig. 8

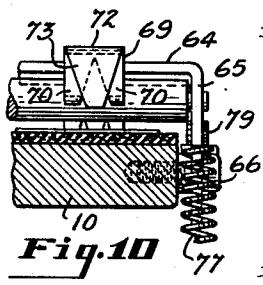


Fig. 10

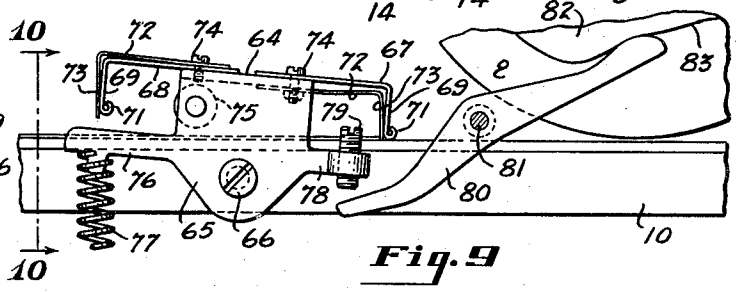


Fig. 9

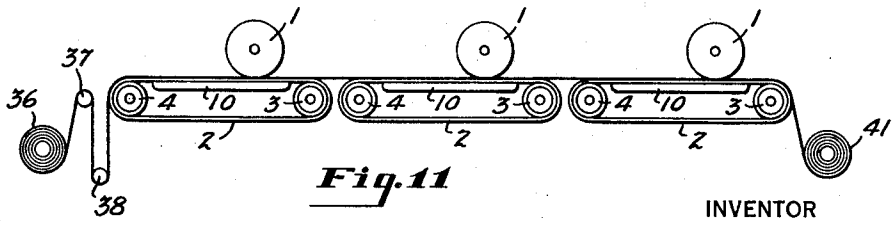


Fig. 11

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UNITED STATES PATENT OFFICE

2,164,363

PRINTING PRESS

Gilbert C. Waters, Rochester, N. Y.

Application December 24, 1936, Serial No. 117,439

15 Claims. (Cl. 101—212)

This invention relates to an improvement in printing presses. In its broader aspect it is adapted to all types of printing, letter press, gravure, and lithographic, and in each gives distinct advantage. It is peculiarly adapted to letter press printing from rubber, or other resilient type faces.

Printing from a resilient type face is now well known. It offers the only practical solution for printing certain types of work, but the usefulness of the process has been realized to a limited extent only because of the limitations of existing presses.

Perfect letter press printing can only be achieved if the type face meets the sheet and delivers its imprint along the true pitch line or plane in which the linear speed of the sheet is exactly equal to the peripheral speed of the printing surface. This holds true for both flat bed and rotary printing. But a true pitch line is never achieved. Slight but cumulative inaccuracies in the machining of the press; in the height of the type or plate, and in the application of forms or plates to the press always occur, and the printing surface never moves exactly in unison with the sheet being printed upon.

Thus the printer is driven to the "make-ready" operation which consists in building up under the type face or under the draw-sheet a laminated structure of bits of paper or fibre. He is forced to do this because of the inaccuracies which have crept into the press, the plate or the paper. But the "make ready" operation only approximates the desired result. The variations from true cylindrical form and the variations from the correct diameters bring the sheet surface out of the pitch plane common to the two cylinders with the result that there is slip between the sheet and printing cylinder.

In printing from metal, fairly satisfactory results are obtained for the reason that the metal pounds into the packing and establishes an impression bed, which although not in the true pitch plane and hence inaccurate, still gives fairly good results.

When, however, a flexible printing surface is used, the type, because it is resilient, is forced back and no static condition, as in the case of metal plates, ever is established. Instead, the packing is forced into the plate and the working pitch line is established somewhere below the actual working surface of the plate. Different kinds of surfaces on paper and other materials being printed upon require different pressures and different kinds of ink also require different pressures. Each different pressure establishes a plane of contact between the resilient cylindrical plate surface and the sheets being printed upon at different distances from the axis of the cylinder. While the variations in the speed of the cylinder and sheet may not be great enough to be apparent upon inspection of the printed sheet the slip between the rubber plate and sheet material being printed greatly shortens the life of the rubber plate.

It is believed that the inability to eliminate slip accounts for the great variation in the life of rubber printing plates run under what seem to be identical conditions, i. e., ink, paper, press speed and character of printed image. Sometimes the pressman has his press packed at exactly the correct cylinder diameter. More often he has not, since the long lived rubber plate is the exception and short runs are the rule.

An important object of the present invention is to provide a device by which variations in the effective diameter of the printing cylinder may be quickly and easily compensated for by effecting extremely minute variations in the ratio between the peripheral speed of the cylinder and the linear speed of the sheet material engaged by the cylinder.

Further objects of the invention are to provide a press of light construction capable of producing accurate work at high speeds and to provide a press having a wide range of usefulness and ready adaptability to the printing of continuous webs or individual sheets.

With the above and other objects in view the invention may be said to comprise the device as illustrated in the accompanying drawings, hereinafter described and particularly set forth in the appended claims together with such variations and adaptations thereof as will be readily apparent to those skilled in the art.

Reference should be had to the accompanying drawings forming a part of this specification, in which:

Figure 1 is a side elevation of a printing press embodying the invention;

Fig. 2 is a diagrammatic view illustrating the operation of the speed changing device associated with the sheet feeding belt which serves as the impression member;

Fig. 3 is a vertical section taken on the line indicated at **3—3** in Fig. 1;

Fig. 4 is a sectional detail view of the pulley adjusting device;

Fig. 5 is a top plan view of the machine;

Fig. 6 is a diagrammatic view showing the driving connections in side elevation;

Fig. 7 is a side elevation showing a device for regulating the feed of sheets to the printing cylinders;

Fig. 8 is a top plan view of the feed regulating device;

Fig. 9 is an enlarged side elevation showing the stop devices and means for actuating the same;

Fig. 10 is a section taken on the line indicated at **10—10** in Fig. 9;

Fig. 11 is a diagrammatic view showing the invention applied to a multi-cylinder press.

In the accompanying drawings the invention is shown applied to a printing press in which the printing member is in the form of a cylinder 1 and the impression member is in the form of an endless belt 2. The belt 2 runs over pulleys 3 and 4 mounted on shafts 5 and 6 at the ends of a rigid supporting frame 7 which supports both the cylinder and the belt and which is rigidly secured to a side plate 8 of a supporting frame 9. The frame 7 is attached at one side to the supporting frame 9 and is open at the other to facilitate the removal of the belt, cylinder and other parts of the press. The upper run of the belt which carries the sheet material to the printing cylinder is supported by a bed 10 which is mounted for vertical adjustment on the frame 7, suitable adjusting means such as screws 11 being provided for raising, lowering and leveling the bed.

The printing cylinder 1 is fixed to a shaft 12 which is journalled in bearing blocks 13 which are mounted for vertical adjustment on suitable guide posts 14 secured to the frame 7 and projecting upwardly therefrom. The bearing blocks 13 are resiliently supported by means of coil springs 15 interposed between the frame 7 and the bearing blocks and surrounding adjustable stop screws 16 which limit the movement of the cylinder toward the belt and determines the operative position of the cylinder. The bearing blocks 13 are held in engagement with the positioning screws 16 by means of vertical pins 17 which are interposed between the tops of bearing blocks and cams 18 carried by a cross shaft 19 above the cylinder to which is attached suitable handle 20. By means of the cams 18 the pins 17 are forced downwardly to press the bearing blocks against positioning screws 16 to hold the cylinder 1 in a fixed position. When the cams 18 are moved to a releasing position by means of a handle 20 the cylinder 1 is lifted by the springs 15 out of printing position.

A suitable printing plate such as rubber printing plate 21 is attached by suitable means to the periphery of the cylinder. Ink is supplied to this plate by a conventional inking mechanism 22 which is slidably mounted on ways 23 so that it can be backed away from the cylinder when desired.

A suitable driving connection is provided between the impression belt 2 and the printing cylinder 1, this driving connection being such that the peripheral surface of the printing plate and the top surface of the belt travel at exactly the same speed, assuming the belt and printing plate to be both uniform and of the correct predetermined thicknesses. Any suitable positive drive gearing may be employed which will maintain a constant speed ratio between the shafts 5 and 12. As herein shown, the drive is a chain and sprocket drive, the cylinder shaft 12 being provided with a sprocket 24, the shaft 5 and 6 of the belt pulleys being provided with sprockets 25 and 26. A sprocket chain 27 runs over the sprockets 25 and 26 and engages the under side of the sprocket 24, suitable means such as an idler 28 being provided for maintaining a positive driving engagement between the chain 27 and sprocket 24.

The positive driving connection between the belt pulley 3 and the cylinder 1 provides the correct speed ratio provided the printing plate is of exactly the correct thickness, and assuming that there is no distortion of the printing plate at the point of contact with the sheet material being printed upon. However, in actual practice the theoretically correct condition is not obtainable. The rubber printing plate may be two or three thousandths of an inch thinner or thicker than the thickness specified, and, as pointed out above, these plates, due to their resiliency, are flattened more or less by the pressure applied thereto during the printing operation. The variations in plate thickness and the variations in pressures applied to the plates during printing vary the distance of the printing surface from the axis of the cylinder with the result that the actual speed of travel of the cylinder at the point of contact with the work will vary slightly from the speed of the belt and this variation results in slip between the printing plate surface and the sheet material being printed upon. If the point of contact is, say, .001" above or below the true pitch line of the cylinder the amount of slip per revolution of the cylinder will be $2\pi \times .001''$. In the terms of speed ratio the variation is extremely minute. In terms of the amount of slip in a day's run the slippage becomes considerable and its effect upon the rubber printing plates is very deleterious.

The present invention provides a means for positively and accurately changing the speed ratio between the printing member and the impression member within the extremely minute range of variations in the effective diameter of the printing cylinder due to variations in thickness of the printing plate and variations in the pressure applied to the printing plate.

In the machine herein shown, changes in the speed ratio between the impression belt and printing cylinder are effected by changing the effective diameter of the belt pulley which is geared to the cylinder and the variations in pulley diameter are effected by changing the tension of the impression belt 2. In order to enable varying tensions to be applied to the belt the shaft 5 is mounted in sliding bearing blocks 29 which are mounted in slots 30 in the forward end of the frame 7, these bearing blocks being adjustable in the slots by means of longitudinal screws 31 threaded in the fixed portions of the frame and exerting thrust against the rear faces of the bearing blocks 29. Each of the two screws 31 has a sprocket 32 fixed thereto and a sprocket chain 33 runs over these sprockets which causes the screws to turn in unison to shift both bearings of the pulley shaft 5 simultaneously. For aligning the pulley with the belt, an additional screw 34 may be provided which extends through one of the screws 31, which is made hollow, and engages with the rear faces of one of the bearing blocks 29. By adjusting the screw 34 the pulley 3 may be adjusted to establish uniform pressure against the interior of the belt throughout the width of the belt.

The pulley 3 is covered with a layer 35 of rubber of uniform thickness which extends throughout the periphery of the pulley. The rubber covering 35 is composed of elastic rubber so that the thickness thereof in the portion of the pulley engaged by the belt will vary with the radial pressure exerted by the belt upon the pulley. As the pressure of the belt against the face of the pulley is increased the effective diameter of the pulley is slightly decreased. If the pressure of the belt on the pulley is lessened the effective diameter of the pulley is slightly increased. If the pulley is driven by the belt, a decrease in

the effective diameter of the pulley will increase the speed of rotation of the shaft 5 and of the cylinder 1 geared to the shaft 5. If the shaft 5 is driven, a decrease in the diameter of the pulley will decrease the speed of travel of the belt. The effect on the speed ratio between the impression belt and printing cylinder is the same in both cases. The variation in the effective diameter of the pulley 3 necessary to effect the corrections in the speed ratio to correspond substantially to the variations of the actual contact planes from the true pitch line of the cylinder established by the gearing connecting the pulley shaft 5 and the cylinder shaft 12, and, since these variations are measured in a very few thousandths of an inch, the variation in pulley diameter also need be only a very few thousandths of an inch. Within the narrow limits required for the corrections desired, the pulley diameter can be accurately varied by varying the tension of the belt. By providing a layer 35 of rubber of the proper thickness and of the proper degree of elasticity, very accurate control of belt speed may be obtained. The effect of variations in belt tension on the belt to cylinder speed ratio may be accurately determined by accurately measuring the differences in the travel of the belt for a given number of revolutions of the belt pulley 5 with various tensions applied to the belt. For example, a predetermined tension may be applied to the belt and a mark on the belt may be alined with a mark on the bed. A given number of revolutions may then be imparted to the pulley and a second mark be made on the bed opposite the mark on the belt. The tension of the belt may then be increased or decreased a predetermined amount, the belt adjusted to its original starting position and the same number of revolutions be imparted to the pulley. The distance of the mark on the belt from the first stopping point divided by the number of revolutions times 2π will be the change in effective pulley radius. The speed ratio changes effected by various tensions within the desired range may thus be accurately determined. The distance of the cylinder axis from the surface being printed upon may be accurately gauged for a series of pressures within the desired range and the proper adjustments of the pulley 5 may be made to compensate for variations in plate thickness and for variations in the pressure applied to the plates during the printing operation.

Where, as shown herein, the two belt pulleys are geared together, the pulley 4 is also preferably provided with an elastic covering 35 so that the effective diameters of both pulleys are simultaneously changed. The changes in speed ratio are, however, effected by the pulley geared to the cylinder and it is not essential that both pulleys be provided with an elastic covering.

In Figs. 1 and 5, of the drawings, the invention is shown applied to the printing of continuous webs of paper or similar material. The paper is taken from a roll 36 mounted in suitable bearings provided in the rear end of the frame 9, passes from the roll 36 over a fixed pulley 37 down under a movable take-up pulley 38 and upwardly over the pulley 4 onto the upper run of the belt 2. The pulley 38 compensates for variations in the rate of feed of paper from the roll and provides a yielding tension regulating device which prevents excessive tension on the web in starting the machine into operation. The pulley 38 travels in a vertical slot 39 provided in the frame which is of a length sufficient to allow the necessary play of the roller. In order to prevent overrunning of the unwinding roll 36 during the unwinding operation, a suitable braking device is applied to the roll 36. For convenience of illustration, an ordinary paddle brake 40 engaging the surface of the roll 36 is shown. At the forward end of the machine the paper is wound up on a reel 41 which is carried on a shaft 42 detachably mounted in suitable bearings 43 on the frame. One end of the shaft 42 is detachably keyed to a clutch member 44 which is rotatably mounted on the shaft 45 of an electric motor 46. A shiftable clutch member 47 is splined to the motor shaft 45 and is engageable with the clutch member 44 to cause the clutch member to rotate with the shaft and drive the wind-up reel. The splined clutch member 47 is moved by a suitable shift lever 48 between the clutch member 44 and the second clutch member 49 rotatably mounted on the shaft 45. The clutch member 49 carries a sprocket 50 and drives the shaft 5 through a sprocket 51 on the shaft 5 and a sprocket chain 52 which runs from the sprocket 50 to an idler 53 and bears against the under side of the sprocket 51 on the shaft 5. The motor 46 can be used to drive either the wind-up reel 41 or the belt pulley 3 as desired. In printing on continuous webs it is ordinarily preferable to drive the belt from the web. In order to maintain sufficient friction between the belt and the web the paper passes in a substantially vertical direction up to the pulley 4 and down from the pulley 3, so that the paper under tension has an effective frictional grip on the belt over a considerable arc of each of the pulleys. To provide additional friction between the paper and the belt surface, one or more pressure rollers 54 are provided which press the paper against the surface of the belt. The shaft of the roller 54 is engaged by pivoted spring arms 55 and the pressure of the roller against the paper may be adjusted by means of screws 56. Additional pressure may be exerted upon the paper by means of a series of metal rods 57 pivoted to cross bar 58 above the belt and lying upon the top surface of the paper passing over the belt.

In order to maintain a constant speed of travel of the paper web, a suitable motor control is provided for varying the speed of the motor to compensate for variations in the diameter of the roll of paper on the reel 31 as is common practice in the art. The control device includes a roller 59 which presses against the roll of paper on the reel 41, the roller 59 being carried by a controller arm 60 fixed to a shaft 61 which extends into a control box 62 which contains conventional current controlling devices for varying the speed of the motor proportionally to the movements of the controller arm.

When printing upon webs of material which is elastic or which does not have sufficient tensile strength to drive the printing mechanism, the belt 2 may be driven direct through the sprocket chain 52, and, when individual sheets are being printed the direct drive from the motor to the belt is utilized.

In Figs. 7 to 10 of the drawings, the press is shown adapted for the printing of individual sheets. The sheets are delivered one at a time to the impression belt 2 by a suitable chute 63 and are carried one at a time by the belt to the printing cylinder. In order to properly register the sheets with the printing plate on the cylinder a suitable stop device is provided in con-

nection with the belt 2 for stopping individual sheets and releasing them at intervals properly timed with respect to the rotation of the printing cylinder. The stop devices are carried by a rocker frame 64 which extends across the upper run of the belt and has downturned end portions 65 connected to the frame by horizontal pivots 66. Forwardly and rearwardly extending arms 67 and 68 are attached to the rocker frame 64. These arms have end portions 69 bent downwardly at right angles and have V-notches which provide spaced belt engaging fingers 70. The arms 67 and 68 are relatively rigid and the fingers 70 have rolled lower edges 71 which are adapted to rest upon the belt. The arms 67 and 68, each carry a spring metal stop member 72 which has an end portion 73 bent down at right angles and forming a stop finger. The stop fingers 73 are in front of and closely adjacent the downturned end portions 69 of the arms 67 and 68 so as to be held against deflection in the direction of the travel of the belt.

The stop fingers 73 are adapted to be adjusted by means of screws 74 to vary the distance which these stop fingers project below the rolled edges of the fingers 70 to thereby vary the pressure with which these stop fingers are pressed against the surface of the belt. The rocker frame 64 carries a pressure roller 75 which is brought into engagement with the paper when the frame is rocked rearwardly to bring the rear stop fingers into engagement with the belt. The rocker frame 64 is actuated at intervals timed with respect to the rotation of the cylinder 1, being provided with a rearwardly extending arm 76 which is engaged by a spring 77 which acts to normally hold the frame in a position in which the forward stop fingers engage the belt. The rocker frame 64 is also provided with a rearward extending arm 78 which carries an adjustable set screw 79 engaged by an actuating lever 80 which is pivoted intermediate its ends at 81 to the frame and which engages a cam 82 fixed to one end of the printing cylinder. The major portion of the cam 82 is circular and concentric with the cylinder, but, at a point corresponding to the position of the space between the ends of the printing plate on the cylinder, the cam has a recessed portion 83. Throughout a major portion of the rotation of the cylinder the cam 82 holds the rocker arm in the position in which the rear stop fingers are in engagement with the belt. Whenever the lever 80 comes into engagement with the recessed portion 83 of the cam the rocker frame is released and is moved by the spring 77 to a position in which the forward stop fingers engage the belt.

In operation a sheet of paper on the belt first engages the rear stop fingers 73 and is held against further movement with the belt until the recessed portion 83 of the cam engages the lever 80, whereupon the rocker frame is released and the rear stop fingers are lifted. The paper sheet held by the rear stop fingers is then released and moves forward into engagement with the forward stop fingers and is held by the forward stop fingers until the lever 80 rides out of the depression 83 of the cam, whereupon the sheet is released by the forward stop fingers and passes with the belt beneath the printing cylinder, the release of the forward stop fingers being so timed with respect to the movement of the cylinder that the sheet is properly registered with the printing plate. When the rocker frame is returned to the position in which the rear stop fingers are in operative position, these fingers may rest upon the top of the sheet previously stopped by forward stop fingers, but this engagement does not hinder the passage of this sheet to the cylinder. However, any additional sheet will be stopped even though it partially overlies the sheet being fed to the cylinder. The cam 82 is attached to one end of the cylinder by means of bolts 84 which pass through arcuate slots 85 in the cam so that the cam can be adjusted to proper angular position on the end of the cylinder.

The press herein shown may be a unit of a multi-cylinder press as shown in Fig. 11 of the drawings. By simply arranging the units end to end so that the paper is fed from one belt to the next the printing of successive cylinders may be registered. The belts may be continuously driven by means of a web of paper fed from a feed roll 36 to a wind-up reel 41 operating in exactly the same way as in Fig. 1 of the drawings. Each cylinder is provided with an individual impression belt so that the necessary changes in speed ratio may be made between each of the belts and its associated cylinder. Since the belts are all driven from one moving web the speed of the belts will be the same, but by changing the effective diameters of the pulleys 3 the speeds of rotation of the printing cylinders may be adjusted as desired to reduce slippage between the individual cylinders and the moving web of paper.

It will be apparent that the present invention provides a printing press of very light construction capable of operating at high speed, which requires but little power for its operation and which, by reason of its capability of minute speed adjustment is capable of very exact and uniform printing with very little wear on parts such as the printing plates.

Furthermore, it is to be understood that the particular form of apparatus shown and described, and the particular procedure set forth, are presented for purposes of explanation and illustration and that various modifications of said apparatus and procedure can be made without departing from my invention as defined in the appended claims.

What I claim is:

1. A printing press comprising an impression member and a printing member between which sheet material may be fed, means for driving said members in directions such that the surfaces thereof engaging the sheet material travel in the same direction and at speeds such that the opposed faces of said members in engagement with the sheet material travel at approximately the same speed, said driving means including a cylindrical driving pulley through which motion is transmitted to one of said members, and means for effecting minute increases or decreases in the effective diameter of said pulley to effect minute changes in the speed of the member driven by the pulley to equalize the speeds of the material-engaging surfaces of said members.

2. A printing press comprising a bed, an endless belt passing over said bed, a printing cylinder engageable with sheet material being carried over the bed by the belt, pulleys over which the belt passes, one of said pulleys being adjustable to vary the tension of the belt, and gearing connecting said cylinder with the adjustable pulley.

3. A printing press comprising a bed, an endless belt passing over said bed, a printing cylinder engageable with sheet material being carried over the bed by the belt, a pulley over which said belt passes, gearing connecting said cylinder with

said pulley, means for delivering a strip of sheet material to the belt, means independent of the cylinder for pressing the strip against the belt, and means for pulling the strip through the press whereby the belt and cylinder are driven by said strip.

4. A printing press comprising a bed, an endless belt passing over said bed, a printing cylinder engageable with sheet material being carried over the bed by the belt, a pulley over which said belt passes, gearing connecting said cylinder with said pulley, means for delivering a strip of sheet material to the belt, means independent of the cylinder for pressing the strip against the belt, means for pulling the strip through the press whereby the belt and cylinder are driven by said strip, a driving mechanism, and means for connecting said driving mechanism to said belt pulley or to said strip-pulling means.

5. A printing press comprising a bed, an endless belt passing over the bed, a printing cylinder engageable with sheet material being carried over the bed by the belt, means for driving the belt and cylinder, and means for effecting minute changes in the speed ratio to equalize the speeds of the material engaging surfaces of said members.

6. A printing press comprising a bed, an endless belt passing over the bed, a printing cylinder having a resilient printing plate engageable with sheet material being carried over the bed by the belt, means for effecting relative adjustments of the bed and cylinder to vary the pressure applied to the sheet material, means for driving the belt and cylinder, and means for effecting minute changes in the speed ratio to equalize the speeds of the material engaging surfaces of said members.

7. A printing press comprising a bed, an endless belt passing over said bed, a printing cylinder engageable with sheet material being carried over the bed by the belt, a pulley over which said belt passes, gearing connecting said cylinder with said pulley, and means independent of said gearing for varying the ratio between the linear speed of the belt and the peripheral speed of the cylinder.

8. A printing press comprising a bed, an endless belt passing over said bed, a printing cylinder engageable with sheet material being carried over the bed by the belt, a pulley over which said belt passes, gearing connecting said cylinder with said pulley, and means for varying the effective diameter of said pulley to vary the ratio between the linear speed of the belt and the peripheral speed of the cylinder.

9. A printing press comprising a bed, an endless belt passing over said bed, a printing cylinder engageable with sheet material being carried over the bed by the belt, a pulley over which said belt passes, said pulley having a layer of elastic compressible material upon its belt-engaging periphery, means for varying the tension of the belt to vary the pressure exerted by the belt on said elastic layer and change the effective diameter of said pulley, and gearing connecting said pulley and said cylinder.

10. A printing press comprising a bed, an endless belt passing over said bed, a printing cylinder engageable with sheet material being carried over the bed by the belt, a pulley over which said belt passes, said pulley having a layer of elastic rubber extending around its peripheral belt-engaging periphery, means for adjusting said pulley to vary the tension of the belt, thereby varying the pressure exerted by the belt on the elastic rubber covering of the pulley and varying the effective diameter of said pulley, and gearing connecting said pulley and said cylinder.

11. A printing press comprising a bed, an endless belt passing over said bed, a printing cylinder engageable with sheet material being carried over the bed by the belt, pulleys over which the belt passes, one of said pulleys having a layer of elastic rubber extending around its belt-engaging periphery, one of said pulleys being adjustable to vary the tension of the belt, and gearing connecting the rubber shod pulley with the printing cylinder.

12. A printing press comprising a bed, an endless belt passing over said bed, a printing cylinder engageable with sheet material being carried over the bed by the belt, a pulley over which said belt passes, gearing connecting said cylinder with said pulley, means for varying the tension of said belt, and means responsive to changes in belt tension for changing the ratio between the linear speed of the belt and the peripheral speed of the cylinder.

13. A printing press comprising a bed, an endless belt passing over said bed, a printing cylinder engageable with sheet material being carried over the bed by the belt, said cylinder having a resilient printing plate thereon, means for relatively adjusting the cylinder and bed for varying the pressure exerted on the sheet material between the bed and the cylinder, a driving connection between the belt and cylinder, and means for varying the speed ratio between the cylinder and belt to compensate for variations in the thickness of the printing plate and variations in the pressure to which the plate is subjected in printing.

14. A printing press comprising an impression member and a printing member between which sheet material may be fed, means for driving said members in directions such that the surfaces thereof engaging the sheet material travel in the same direction and at speeds such that the opposed faces of said members in engagement with the sheet material travel at approximately the same speed, and driving means including a pulley and belt, the surface of said pulley in engagement with said belt being substantially cylindrical, through which motion is transmitted to one of said members, and means for effecting minute increases or decreases in the effective diameter of said pulley to effect minute changes in the speed of the member driven by the pulley to equalize the speeds of the material-engaging surfaces of said members.

15. A printing press comprising a bed, an endless belt passing over said bed, a printing cylinder engageable with sheet material being carried over the bed by said belt, a pulley over which said belt passes, gearing connecting said cylinder with said pulley, means for delivering a strip of sheet material to the belt, means for tensioning said strip and for causing the strip to press against the belt, and means for pulling the strip through the press, whereby the belt and cylinder are driven by said strip.

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