United States Patent

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[72] Inventor **Roger H. Gartside**
Shaler Township, Allegheny County, Pennsylvania

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[73] Assignee **The Pannier Corporation**
a corporation of Pennsylvania

[54] **ROTARY PRINTER WITH PRINTING CYLINDER DRIVE WHEELS**
5 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **101/219,** 101/247, 101/349
[51] **Int. Cl.** **B41f 5/04,** B41f 13/40
[50] **Field of Search** ..... 101/216, 219, 247, 252, 250, 269, 282, 328—331, 349, 375, 376, 35

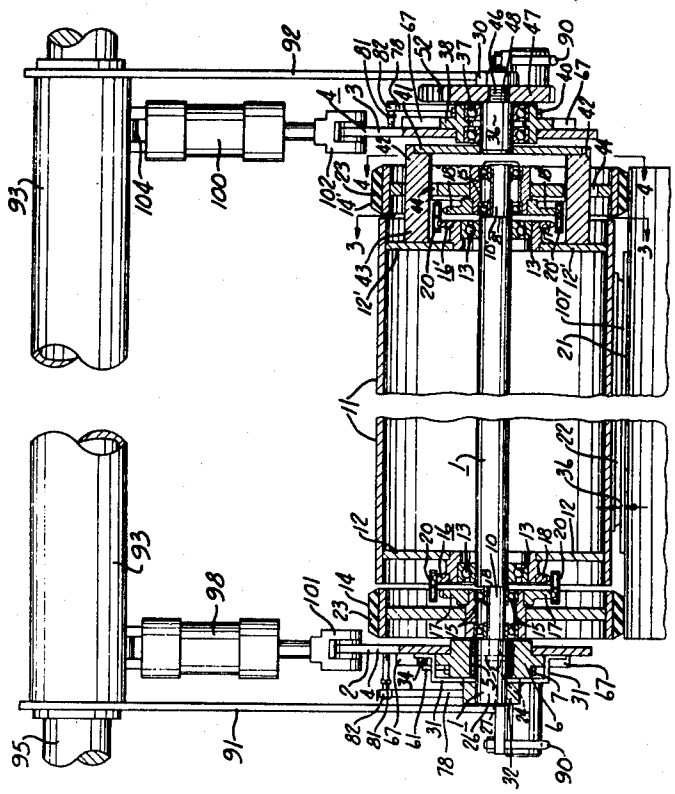
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Primary Examiner—Robert E. Pulfrey
Assistant Examiner—J. Reed Fisher
Attorney—Carothers and Carothers

ABSTRACT: A rotary printer having built-in means to adjust the printing clearance for the marking of materials of different thicknesses while maintaining the printing surface velocity of the printing die equal to the line speed. The printing drum with its applied die is mounted for rotation on a first shaft and adjacent a rotary coupled drive wheel mounted for rotation on a second shaft portion fixed in parallel with the first shaft and in driving engagement with a printing back-up surface. The driven wheel is provided with an outside engagement diameter equal to the outside printing diameter of the drum with its applied die. The shafts are supported from a frame and are provided with means to permit the axis of the shaft portion supporting the drive wheel to be rotated relative to the shaft supporting the printing drum until the desired printing clearance from the back-up surface is obtained and to then fix them against further surface is obtained and to then fix them against further rotation of one about the other.



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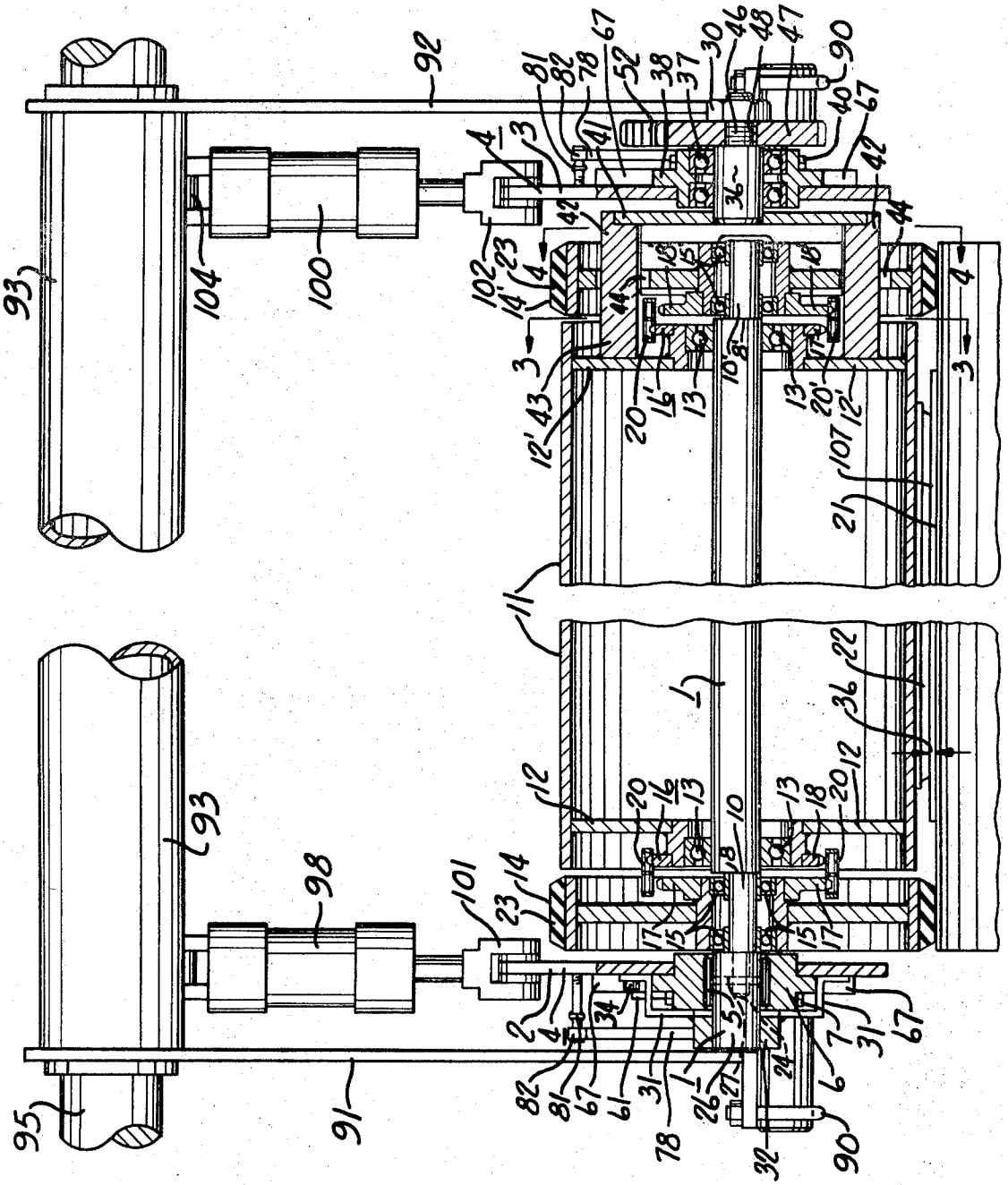
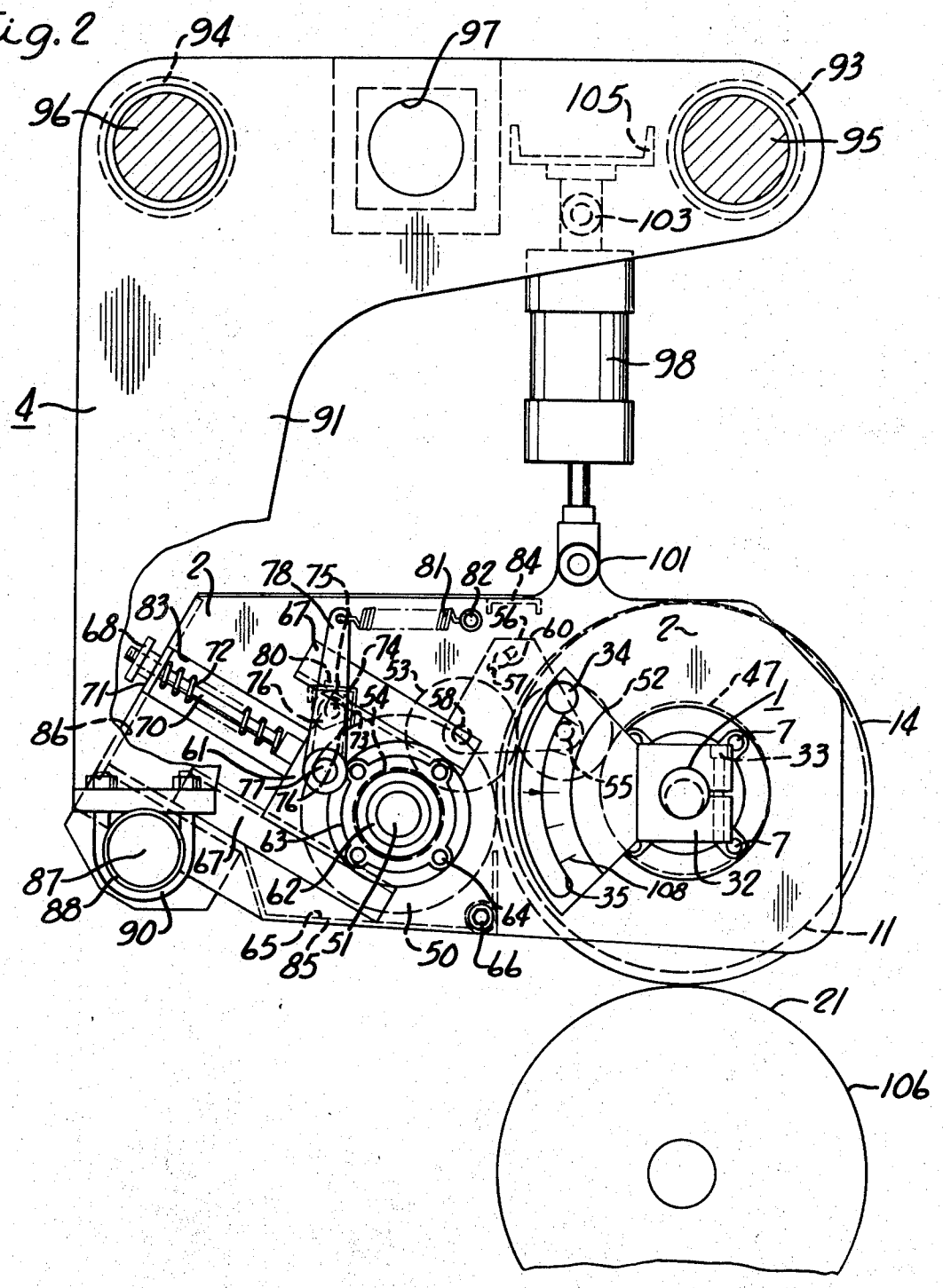


Fig. 1

INVENTOR.
ROGER H. GARTSIDE
BY,
CAROTHERS & CAROTHERS
HIS ATTORNEYS

Fig. 2



INVENTOR.
ROGER H. GARTSIDE

BY
CAROTHERS & CAROTHERS
HIS ATTORNEYS

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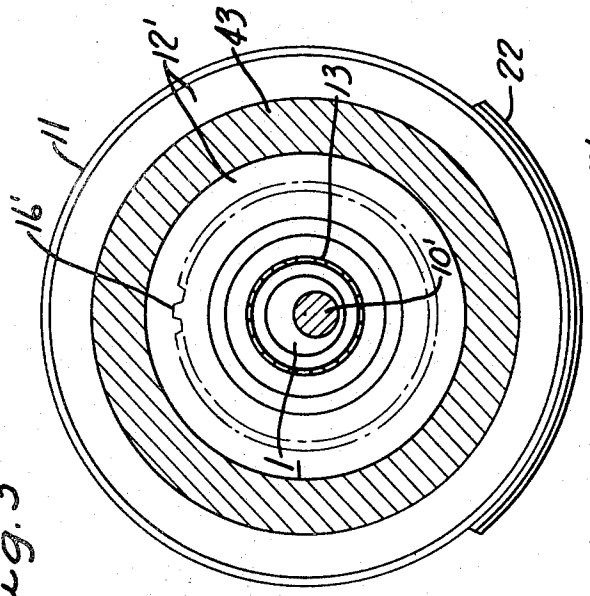


Fig. 3

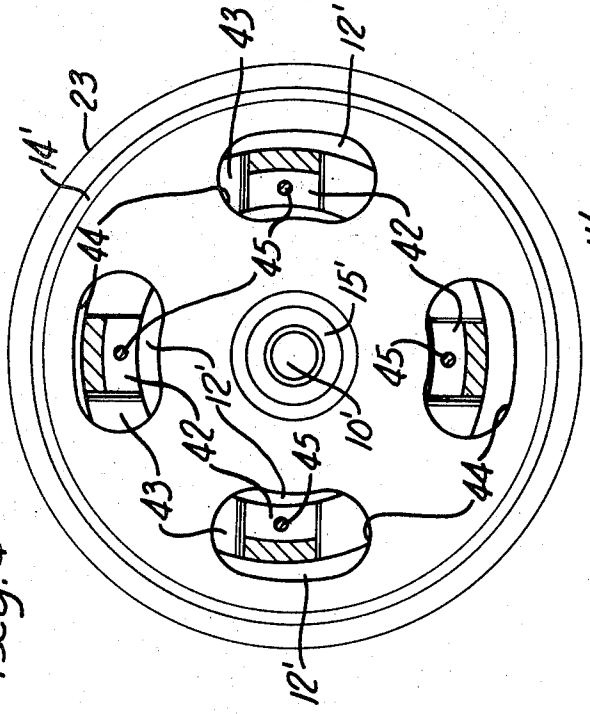


Fig. 4

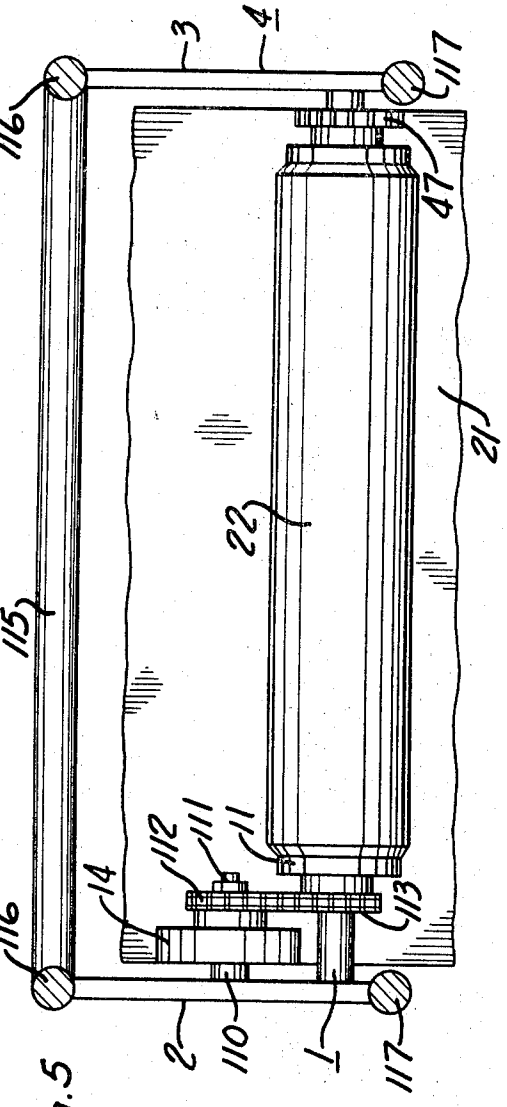


Fig. 5

INVENTOR.
ROGER H. GARTSIDE
BY
CAROTHERS & CAROTHERS
HIS ATTORNEYS

ROTARY PRINTER WITH PRINTING CYLINDER DRIVE WHEELS

BACKGROUND OF THE INVENTION

This invention relates generally to the art of printing an object as it passes a rotary press and more particularly to improvements in a rotary printer for continuously printing a series of objects or repeatedly printing a continuous sheet.

In printing a continuous sheet or a continuous series of objects, the sheet or objects are generally moved along a printing back-up surface driven at a selected line speed. A rotary press or printer having a printing drum or cylinder which is axially mounted between two friction drive wheels for rotation on a dead shaft supported between two end plates of a frame is positioned over and normal to the way of the back-up surface of the moving strip of material to be marked to impart rotational movement to the drum. A printing die is applied to the cylindrical surface of the drum and the outside diameter of the friction drive wheels is made equal to the outside printing diameter of the printing drum with the applied die to provide a printing surface speed to the die surface which is equal to the line speed. To permit variation in the outside diameter of the friction drive wheels in accordance with the thickness of different printing dies, tires are generally provided on the perimeter of the wheels which may be removed and replaced with tires of different thicknesses if so required.

Inking means are generally mounted on the frame supporting the printing drum and generally consists of an ink transfer roll which applies metered quantities of ink to the die on the drum from an ink source or well. The transfer roll is generally driven from the rotating printing cylinder or drum.

Several problems arise concerning the aforementioned rotary presses which render them both uneconomical and inconvenient to operate. First of all, the rotating printing drum with its applied die, continuously prints whether it be the desired object to be printed or the printing back-up surface or belt when no object to be printed underlies the printer. Thus, when a series of objects is being printed is finished but the succeeding strip is not yet fed to the press, the rotary printer will continue to print the back-up surface or belt between objects or strips. This not only wastes ink but leaves fresh ink marks on the belt or back-up surface which may undesirably transfer to the underside of a succeeding object to be marked.

Secondly, if the material strip to be printed is narrower than the spread of the friction drive wheels, the printing drum with its applied die alone will ride up onto the object and suspend the drive wheels. The excess pressure applied against a flexible die may readily give undesired printing results. Thus no means is provided to vary the printing pressure.

Thirdly, if the objects to be marked are to be permitted to travel along the line between the friction wheels such that the latter do not rest or ride on the material surface to be marked, no adequate means is provided to adjust the clearance between the die and the back-up surface in accordance with the material thickness.

SUMMARY OF THE PRESENT INVENTION

It is the principal object of the present invention to overcome these previously named disadvantages. The present invention provides a rotary printer or marking device having a first shaft fixed in parallel with a second shaft with a printing drum having a die applied thereto and mounted for axial rotation on one of the shafts and a drive wheel mounted for axial rotation on the other shaft for perimetal driving engagement with a marking back-up surface. The drive wheel is given the same outside engagement diameter as the outside printing diameter of the drum with the applied die and is coupled in rotary driving engagement with the drum. The shafts are rotatably supported from a frame and provided with adjustment means to permit parallel rotation of one of the axes of the shafts about the other and to fix them from further rotation.

By rotating the shafts one about the other the drive wheel axis and drum axis are vertically spread or brought closer together as viewed relative to one horizontal plane or as viewed in relation to the back-up surface. Thus the effect is that although the drive wheel may remain in resting engagement on the marking back-up surface, the drum will be raised or lowered in relation to the back-up surface to provide adjustable clearance between the printing die and the underlying back-up surface.

The two shafts fixed in parallel are preferably provided by a single crankshaft. Since the length of the crank arm need not be too great, the crank is readily supplied by providing a shaft with an eccentric restriction.

It is preferable to have two drive wheels on the printer, one at each end of the printing drum to engage the printing back-up surface at both ends of the rotary printer. Otherwise, the frame supporting the drum must be relied upon to maintain the drum axis parallel with the plane of the back-up surface. When two drive wheels are employed with the drum on a single shaft, the shaft is either provided with one double crank or end eccentric restriction or portion, or two spaced cranks or aligned eccentric end portions having their crankpins axially aligned. When two eccentric end portions are employed, the drum is mounted on the crankpin between the two end portions and the drive wheels are mounted to the end portions. With this arrangement the drive wheel axes always remain stationary with respect to the frame rotatably supporting the shaft and only the drum axis moves.

When two spaced double cranks or eccentric restrictions are employed on the shaft intermediate its ends, the printing drum is mounted for axial rotation on the main shaft between the spaced double cranks and the drive wheels are mounted for axial rotation on the crankpins or eccentric shaft restrictions of the double cranks. With this arrangement the drum axis remains stationary with respect to the frame and only the axes of the drive wheels is displaced by imparting rotational movement to the normally dead main shaft. This latter arrangement is preferred since the printing drum remains stationary when the shaft is rotated slightly to change the printing clearance and thus the ink transfer roll, which is in parallel engagement with the cylindrical printing surface of the drum with its applied die, does not have to be readjusted each time the adjustment means or lock means is employed to rotate the main shaft of the printing drum.

However, if this latter arrangement is employed, it is desirable to drive the ink transfer roll directly from the drum rather than from one of the drive wheels which would require an adjustment of the drive engagement means between the wheel and the transfer roll each time the main shaft was rotated to select a different printing clearance as the drive wheels then move with their crank pins relative to the frame and the transfer roll which is rotatably mounted to the same frame.

One means of driving the ink transfer roll from the drum is accomplished by providing a plurality of clearance ports in one of the drive wheels which in turn provide openings therethrough in the axial direction to pass a plurality of stud members which are secured at one end to the drum and at the other end to a short shaft axially aligned with the shaft carrying the drum and journaled in the frame. Drive engagement means are connected between the short shaft and the transfer roll to drive the latter such as a gear train with adjustable idler gears.

Due to the limited space provided between the drive wheels and the ends of the cylindrical printing drum, the rotary couplings connecting the wheels in driving engagement with the drum are preferably double chain and sprocket couplings which consist of a pair of sprockets mated face to face but in slight misalignment to match the displacement of the shafts and joined by a double chain having two more links than the number of sprockets on each sprocket wheel.

Other objects and advantages appear hereinafter in the following description and claims.

The accompanying drawings show, for the purpose of exemplification without limiting the invention or the claims thereto, certain practical embodiments illustrating the principles of this invention wherein:

FIG. 1 is a view in front elevation of the rotary printer of the present invention with the printing drum and drive wheels shown in longitudinal section.

FIG. 2 is an end view of the rotary printer shown in FIG. 1.

FIG. 3 is a sectional view taken along line 3—3 of the printing drum shown in FIG. 1.

FIG. 4 is a sectional view taken along line 4—4 of the printing drum shown in FIG. 1.

FIG. 5 is a diagrammatic plan view of a rotary printer illustrating another embodiment of the present invention.

Referring to FIGS. 1 and 2 of the drawings, the dead shaft 1 is rotatably mounted or supported from the end supports 2 and 3 of the frame 4 by means of the sleeve bearing 5 retained in the bearing housing 6 which is in turn secured to the end support 2 by means of the bolts 7 and indirectly through roller bearings 37 at end support 3 as explained hereinafter. The dead shaft 1 is provided with spaced cranks 8 and 8' which are in this instance provided by means of the eccentric restrictions 10 and 10' in the dead shaft 1. These eccentric restrictions 10 and 10' are axially aligned with eachother.

Printing drum 11 is provided with the circular end walls or plates 12 and 12' and is rotatably mounted on the dead shaft 1 between the spaced eccentric restrictions 10 by means of the ball bearing races 13.

Friction drive wheels 14 and 14' are mounted for axial rotation on the eccentric restrictions 10 and 10' by means of the ball bearing races 15 and 15'. A rotary coupling 16 connects friction drive wheel 14 in rotary driving engagement with the printing drum 11. This coupling consists of the two sprocket wheels 17 and 18 which are of equal pitch. The sprocket wheels 17 and 18 are secured together by means of the double chain 20 which is provided with two more links than the sprockets on each of the sprocket wheels 17 and 18 to make allowance for the parallel displacement.

Similarly the friction drive wheel 14' is provided with a rotary drive coupling 16' which connects the drive wheel in rotary driving engagement with the printing drum 11. The rotary coupling 16' again has identical sprocket wheels 17' and 18' which are joined by means of the double chain 20'.

It is readily seen that one of the axially aligned eccentric restrictions or crank pins 10 or 10' together with the dead shaft 1 interposed between the spaced cranks 8 and 8' provide a first and second shaft which are fixed in parallel with each other. Thus if the dead shaft 1 is given a slight clockwise or counterclockwise rotation such that the axes of the eccentric restrictions 10 are permitted to rotate about the axes of the dead shaft 1, that the drive wheels 14 and 14' will either raise or lower in unison to permit the printing drum to either lower or raise relative to the printing back-up surface 21.

The printing drum 11 has a printing die 22 which is applied to the outside cylindrical surface of the printing drum 11. The outside printing surface diameter of this drum 11 with its applied die 22 is equal to the outside diameters of the friction drive wheels 14 and 14' including their friction tires 23 which are mounted about their periphery for surface engagement with the marking or printing back-up surface 21 which is driven at the desired line speed.

For assembly purposes the dead shaft 1 is made in two sections at its left and as seen in FIG. 1 such that eccentric restriction 10 is provided with an extension 24 (providing altogether a double crank) which is slidably received within a cooperative bore in the short shaft section 26 to permit mounting of the drive wheel 14. Extension 24 is permanently secured with the short shaft 26 by means of the pin 27 which penetrates the bores in the section 25 and extension 24 when they are properly aligned such that the axes of short shaft 26 is axially aligned with the remainder of dead shaft 1.

To provide adjustment means which will permit the parallel rotation of the eccentric restrictions 10 and 10' about the axes of dead shaft 1, and adjustment arm 31 is tightly secured to the exposed end of the short shaft 26 by means of the clamp 32 which is secured to the shaft by tightening the bolt 33. Arm 31 is in turn adjustably secured to end plate 2 of the frame 4 by means of the bolt 34 which is threadably received in the end support 2 and passes through the slot 35 in the outer end of arm 31. Thus when the bolt 34 is drawn up tight, it grasps the arm 31 thereby fixing the axes of dead shaft 1 and crank pins 10 and 10' from further rotation.

When it is desired to change the printing clearance 36 between the surface of the printing die 22 and the printing back up surface 21, one merely backs off bolt 34 and moves arm 31 up or down to rotate dead shaft 1. When the desired clearance 36 is maintained, the bolt 35 is then retightened to maintain this clearance.

The opposite end of the printing drum 11 is rotatably supported from end support 3 of frame 4 by means of the short shaft 36 which is journaled in the bearing 37 having the housing 38 which is in turn secured to the end support 3 by means of the bolts 40.

Unlike dead shaft 1, short shaft 36 rotates continuously with the printing drum 11 and is secured directly to the end wall 12' of drum 11 by means of the circular plate 41 and the projections 42 which project from and are integral with the sleeve 43 through the openings 44 in the drive wheel 14'. The sleeve 43 is welded to the end plate 12' and the circular plate 41 is secured to the projections 42 by means of bolts 45.

The ports or openings 44 provide sufficient clearance to the studs or projections 42. Since the axis of the friction drive wheel 14' is in permanent fixed displacement relative to the axis of dead shaft 1 which rotatably supports the printing drum 11, sufficient clearance must be provided for the relative movement between the studs 42 and the side walls of the clearance openings 44. This is readily observed by viewing FIG. 4 which illustrates how the studs 42 move relative to the side walls of the identical clearance openings or bolts 44.

Short shaft 36 has a threaded extension 46 to receive the drive gear 47 thereon which is secured from rotation by means of the key and keyway arrangement 48 and retained by lock nut 30.

Drive gear 47 is provided to drive the inking transfer roll 50 which is mounted for axial rotation from the end supports 2 and 3 of the frame 4.

The reason that the drive gear 47 is driven directly from the drum 11 rather than friction drive wheel 14' is that the axis of dead shaft 1 always remains stationary with respect to shaft 51 of the inking transfer roll 50 whereas the axis of the crank pin or eccentric restriction 10' does not. Thus if the transfer roll were driven from the drive wheel 14' rather than from the printing drum 11, the drive engagement means between the gear 47 and the transfer roll 50 would have to be constantly adjusted to make engagement each time the dead shaft 1 was rotated to permit relative rotation of the dead shaft and crank pin shaft axes.

The drive gear 47 is placing in driving engagement with the transfer roll 50 by means of the gear train provided by the gears 52, 53 and 54. Driven gear 54 is permanently secured with the transfer roll 50. Idler gear 52 is rotatably mounted on a dead stud 55 which is threadably received by the end support 3 and passes through the triangular shaped bracket 56 which it pivotally supports before receiving the gear 52 for rotation on the end thereof.

Idler gear 53 is mounted for rotation on a shaft 58 which is threadably received or welded to the bracket 56. Bracket 56 is provided with the arcuate slot 57, the center line of which is a circular section as taken about the center of dead shaft 55. Bolt 60 passes through arcuate slot 57 and is threadably received in the end support 3 of the frame. Thus when transfer roll 50 is for some reason adjusted such that it is moved either further away from or toward drum 11, bolt 60 may be loosened to permit the bracket 56 to be rotated about the axis of stud 55 to permit gear 53 to once again mesh with gear 54 which is secured to transfer roll 50 and shaft 51.

Transfer roll **50** is securely mounted to shaft **51** as is driven gear **54** and shaft **51** is rotatably received or journaled in the end blocks **61** by means of the ball bearing races **62** which are housed in the bearing housings **63**. Bearing housings **63** are in turn secured to the blocks **61** by bolts **64**.

An inkwell is provided immediately subjacent to transfer roll **50** as indicated at **65** to permit the transfer of ink to transfer roll **50** and in turn to the printing surface of die **22**. A drain plug **66** is provided at the lowest point in the inkwell **65** to permit drainage of the ink supply when the press is shut down.

Block **61** is slidably received and guided by the guides **67** which are mounted to the end plates **2** and **3**. The blocks **61** on either end of the transfer roll shaft **51** are moved or adjusted along the guides **67** at each end by means of the hand adjustment nuts **68** which are threadably engaged with the stud **70** having its lower end secured to the block **61**. Stud **70** projects through the small projection **71** extending outwardly from each of the end supports **2** and **3**. Compression spring **72** surrounds the stud **70** intermediate the blocks **61** and the projections **71** to constantly urge the block **61** toward the printing drum **11**.

The ink quantity retained by the transfer roll **50** and eventually transferred to the printing surface of the die **22** is metered by the blade **73** which extends along the full longitudinal length of the transfer roll **50** and has a rearward channel portion **74** which overlies the tie member **75**. The tie member **75** is secured at each end to an arm **76** which is in turn rigidly secured to the pins **77**. Pins **77** are pivotally mounted in and extend through the end supports **2** and **3**. Lever arms **78** are rigidly secured to the outer end of pin **77** which extend out of the end supports **2** and **3**.

The metering blade **73** is mounted to the die member **75** by means of the bolts **80**.

The free ends of the lever arm **78** are secured to stretch springs **81** which have their opposite ends hooked about the hanger bolts **82** which are secured to the end supports **2** and **3**. Thus tension or stretch springs **81** constantly apply resilient metering pressure of the inking blade **73** against the transfer roll surface **50**.

The slots **83** provided in the end supports **2** and **3** permit the passage of the outside ends of shaft **51** and also permit the blocks **61** to slide along guide **67** with shaft **51**.

The end supports **2** and **3** are maintained in rigid alignment by means of the respective shafts extending therebetween and further by the tie member **84** and the bottom pan **85** of the inkwell **65** and the back plate **86**.

The end plates **2** and **3** together with their respective tie means are permitted to rotate as a unit about axis **87** of the tubular tie member **88** which is clamped at both ends by means of U bolts **90** to the upright end supports **91** and **92**. End supports **91** and **92** are maintained in fixed spaced relationship by means of the tubular tie members **93** and **94** which slidably receive mounting columns or rods **95** and **96** respectively.

Threaded nuts or openings **97** in each end of the upright supports **91** and **92** threadably receive a threaded traversing rod which extends between said end supports and therethrough in threaded engagement with the nuts **97**. Thus when the threaded traversing column or rod is axially pivoted the entire printing press or assembly may be adjusted to the right or left to properly locate the same over the printing back up surface.

Air cylinders **98** and **100** are pivotally secured to end plates **2** and **3**, respectively, by means of the pin and clevis points as indicated at **101** and **102**. The upper end of the air cylinders **98** and **100** are similarly secured with pin and clevis connections **103** and **104** to tie member **105** which is an upside down channel secured to the upright end plates **91** and **92**.

The air cylinders **98** and **100** may be activated to either raise the drive wheels up and away from the printing back up surface **21** or to lower the same in engagement.

The back up surface **21** is here indicated as the cylindrical surface of a back up roll **106** which is driven such that the surface velocity thereof is the desired line speed. However it is obvious that the back up surface may be a belt or such other means disposed between the back up roll **106** and the printing drum **11** with its drive wheels **14** and **14'**.

OPERATION

Once the thickness of the continuous strip or plates **107** is known the bolt **34** which is threadably secured in end plate **2** is loosened and the arm **31** is either moved upwardly or downwardly to adjust the clearance between the outside printing diameter of the die **22** with the back up printing surface **21**. The indices **108** provided on the arm **31** permit accurate adjustment of the printing clearance **36** without actually viewing the material **107** to be marked as it lies under the printing drum **11** and over the printing back up surface **21** while the adjustment is being made.

If necessary, adjustments are also made to the hand nut **68** to adjust the contact of the transfer roll surface with the die surface. When this is completed the rotary printer is lowered to engage the driven back up roll **106** by means of the air cylinders **98** and **100** such that the friction drive wheels engage the back up roll **21**.

The back up roll therefore drives the drive wheels **14** and **14'** which in turn impart rotational movement to the printing drum **11**. Due to the fact that the outside diameter of the printing tires **23** is equal to the outside printing diameter of the die **22**, the printing surface speed of the die **22** will be equal to the printing line speed as provided by the driven back up roll **106**. Thus it may be seen that the printing clearance may be readily changed without varying the printing surface speed of the printing cylinder with the back up surface.

It should be pointed out that two separate shafts connected to the same end plate (one for the drum and one for a drive wheel) may be provided to serve the same function as the dead shaft or crank shaft **1**. What is important is that there be at least two shafts fixed in parallel misalignment with each other and that there is an adjustment means to permit relative parallel rotation of these shafts such that a drive wheel and the printing drum which are each mounted on one of the shafts are permitted to raise and lower relative to each other. The diagrammatic sketch of FIG. **5** illustrates another manner in which the teachings of the present invention may be carried out or practiced.

In FIG. **5** the inking means as provided by the inking transfer roll and inkwell with their associated parts have been excluded for simplicity sake. Here the end supports **2** and **3** have secured therebetween the dead shaft **1**. Dead shaft **110** is rigidly secured and extends inwardly from end plate **2** and is in fixed parallel misalignment with dead shaft **1**.

Dead shaft or stud **110** is provided with a restricted portion **111** which is threaded at its outer end and receives friction drive wheel **14** for axial rotation thereon. The restriction **111** prevents the drive wheel **14** from shifting to the left on dead shaft **110**.

Printing drum **11** is mounted for axial rotation on dead shaft **1** and has applied thereto the printing die **22**. Identical sprockets **112** and **113** are provided on and rigidly secured with the end of drive wheel **14** and the end of printing drum **11** respectively. Chain **114** engages sprockets **112** and **113** in rotary engagement such that when friction drive wheel **14** is rotated by means of the driven back up surface **21**, printing drum **11** is imparted with rotational movement by means of the rotary coupling means provided by the two sprockets with their mutual chain.

As only one drive wheel **14** is provided in this illustration, the drive gear **47** is directly secured to the end of the printing drum **11**. This supplies a much simpler arrangement but is somewhat undesirable as compared with the structure illustrated in FIGS. **1** through **4**. It is preferable to have two drive wheels, one at each end in engagement with the driven back up surface to uniformly support the printing drum. The apparatus of FIG. **5** applies all the weight of the frame and drum to its single drive wheel **14** and its respective bearings.

As explained previously in connection with the foregoing figures drive gear **47** is similarly employed to drive the transfer inking roll.

A tubular tie member **115** is provided at the rearward end of the rotary printer to tie the rearward ends of the supports **2** and **3** together to form a rigid construction.

Two sets or pairs of air cylinders **117** and **116** are provided to raise or lower the front or rear respectively of the rotary printer to provide relative parallel rotation of the axes of shafts **1** and **110** and thereafter fix them from further relative rotation. The air cylinders **116** work in unison as do the pair of air cylinders **117** such that the front of the rotary printer may be raised or lowered in relation to the rear of the rotary printer or vice versa.

These air cylinders **116** and **117** are preferably supported from an overhead frame somewhat similar to that provided by the end supports **91** and **92** with their respective tie means as shown in the foregoing figures.

It should also be realized that the drive engagement between the printing back up surface **21** and the drive wheels **14** and **14'** need not necessarily be a friction drive. Any other suitable engagement means such as a rack and pinion or circular gears would be sufficient.

I claim:

1. A continuous rotary printer comprising a frame having spaced end supports, a shaft rotatably supported from and between said end supports and having a spaced pair of axially aligned eccentric restrictions, lock means to lock said shaft from rotation relative to said end supports, a drive wheel mounted for axial rotation on each of said restrictions, a printing drum mounted for axial rotation on said shaft between said spaced restrictions, a rotary drive coupling connecting each of said drive wheels with said drum to drive the same, a printing die on said drum, inking means mounted on said frame to ink said die, said drum with said applied die having a printing outside diameter equal to the outside diameter of said drive wheels, a plurality of clearance ports in one of said drive wheels providing openings therethrough in the axial direction, a plurality of stud members passing through said ports and secured at one end to said drum and at the other end to a second shaft axially aligned with said first shaft and journaled in one of said end supports for rotation, and drive engagement means connecting said second shaft in driving engagement with said inking means to continually ink said die.

2. A rotary printer comprising a frame having spaced end supports, a shaft supported from and between said end supports, a printing drum mounted for axial rotation on said shaft, a pair of axially aligned driving wheels mounted for rotation on opposite sides of said printing drum on shaft portions secured in parallel with and eccentric to said shaft, a rotary drive coupling connecting each of said drive wheels in driving engagement with said drum, an inking roll mounted on said frame between said end supports for rotation about an axis parallel to the axis of said shaft to ink a die to be applied to said drum, drive means coupling said inking roll in rotary driving engagement with said drum, and means to rotate said aligned shaft portions about said shaft and to thereafter lock said shaft portions from further rotation relative thereto.

3. The rotary printer of claim **2** characterized in that the outside driving diameter of said drive wheels is equal to the printing outside diameter of said drum with an applied die.

4. The rotary printer of claim **3** characterized in that one of said wheels is spoked to provide clearance ports therethrough in the axial direction, a plurality of stud members poking through said ports and secured at one end to said drum and at the other end to a second shaft axially aligned with said first shaft and journaled in one of said end supports for rotation, said drive means connected in driving engagement with said second shaft.

5. The rotary printer of claim **4** wherein said rotary couplings are double chain and sprocket couplings each consisting of a pair of sprocket wheels of equal pitch joined together in driving engagement by a double chain of two more links than the number of sprockets on each of said sprocket wheels.