

Oct. 8, 1940.

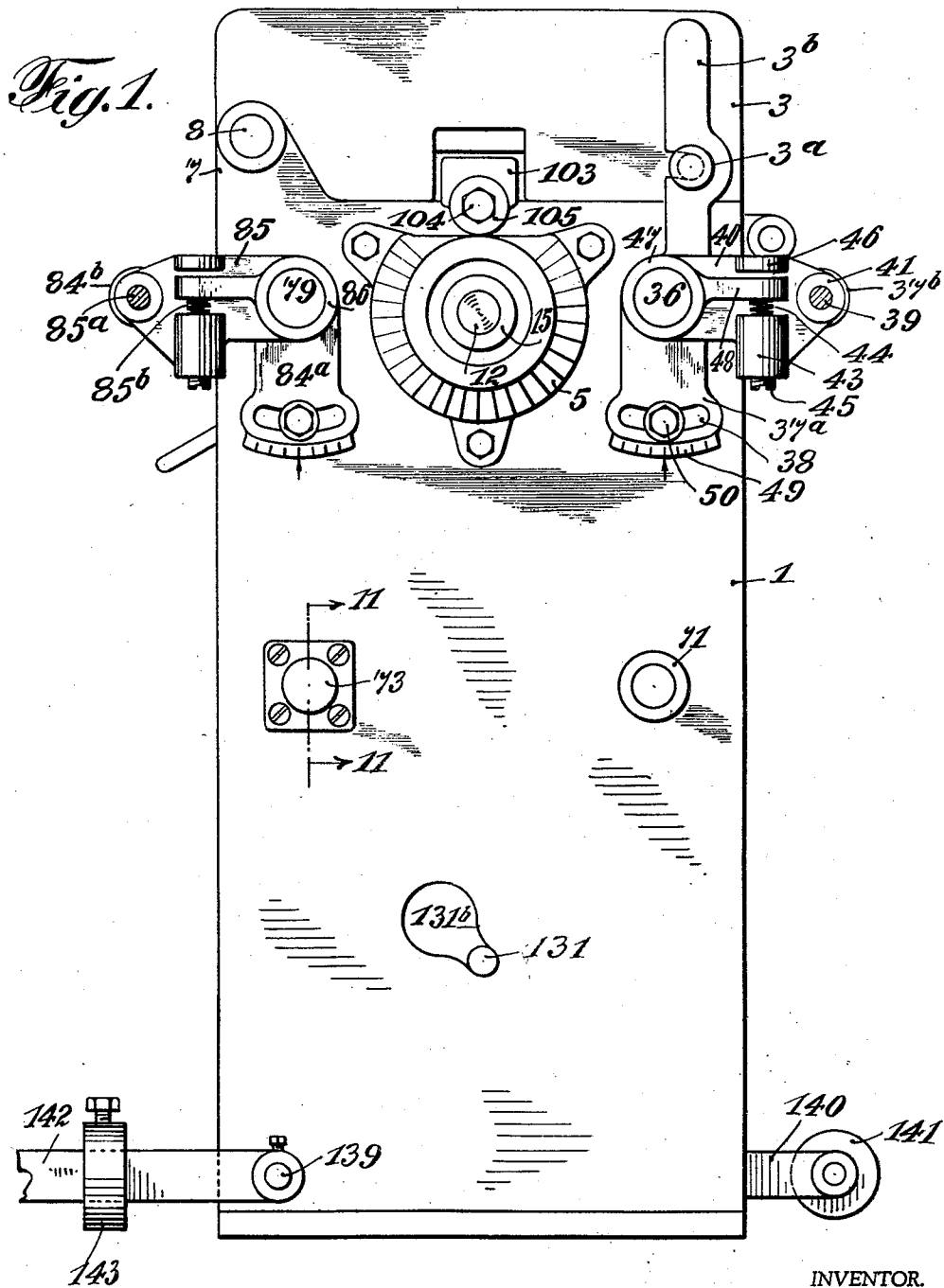
A. WEISS

2,217,191

PRINTING MACHINERY

Filed June 2, 1938

10 Sheets-Sheet 1



INVENTOR.

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Oct. 8, 1940.

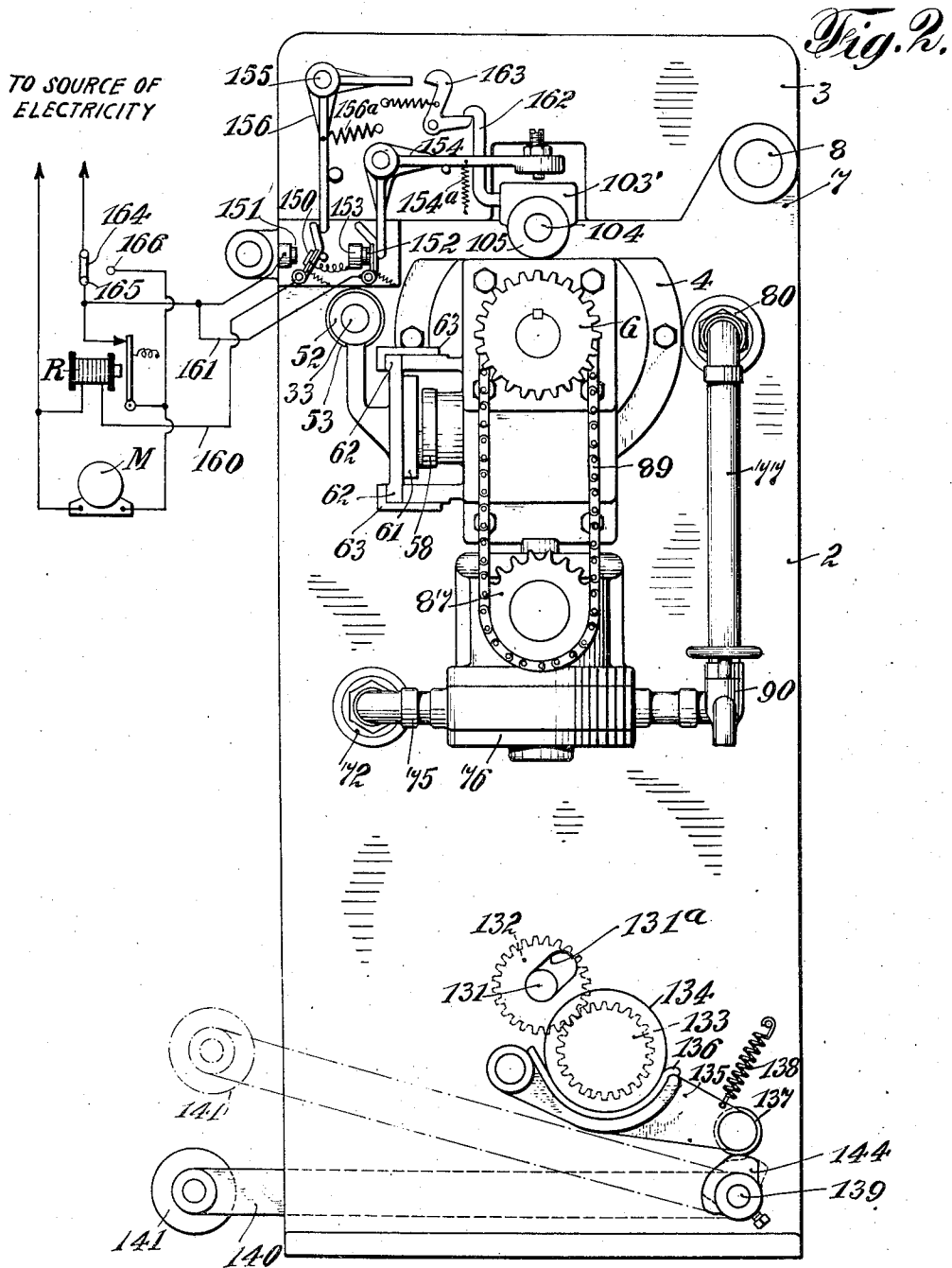
A. WEISS

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10 Sheets-Sheet 2



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PRINTING MACHINERY

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10 Sheets-Sheet 3

Fig. 3a.

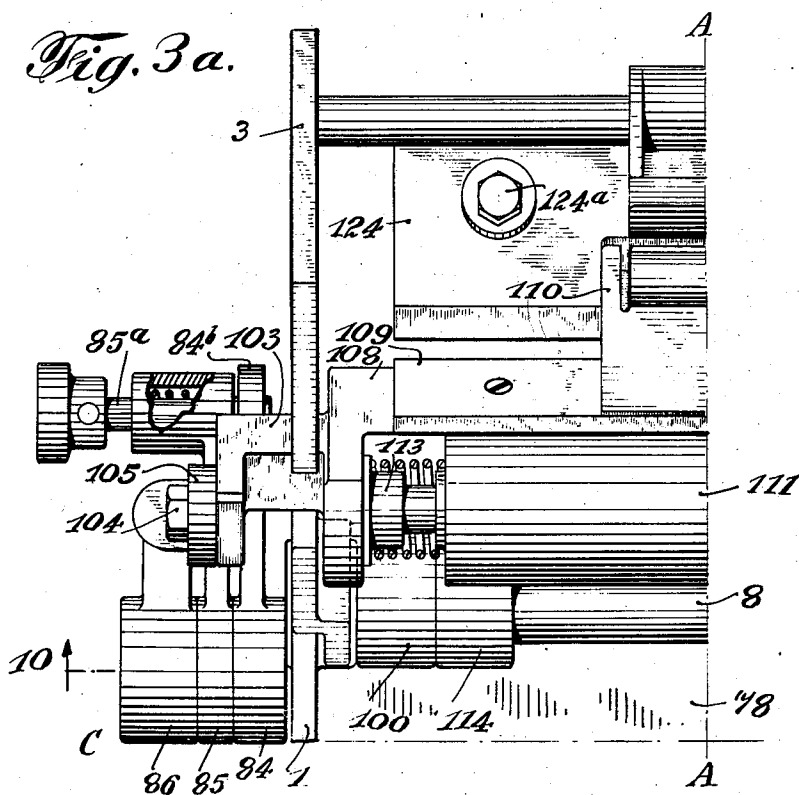
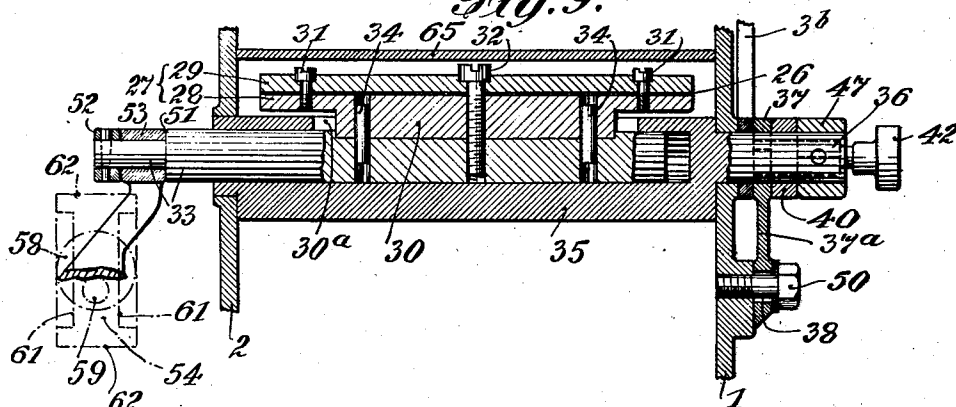


Fig. 9.



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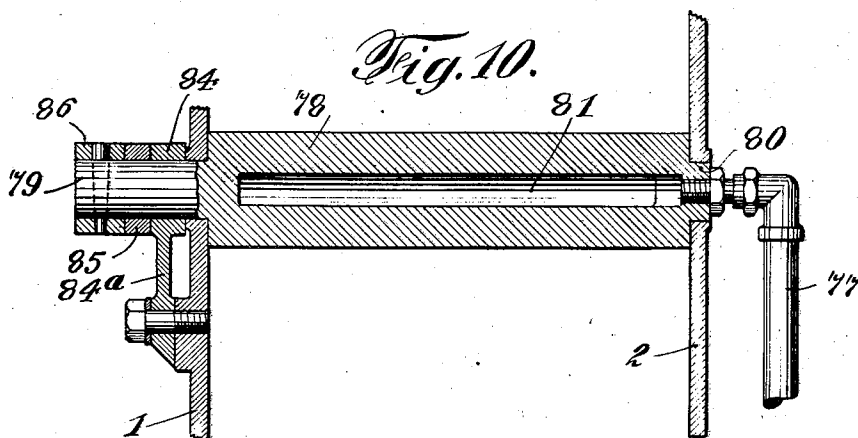
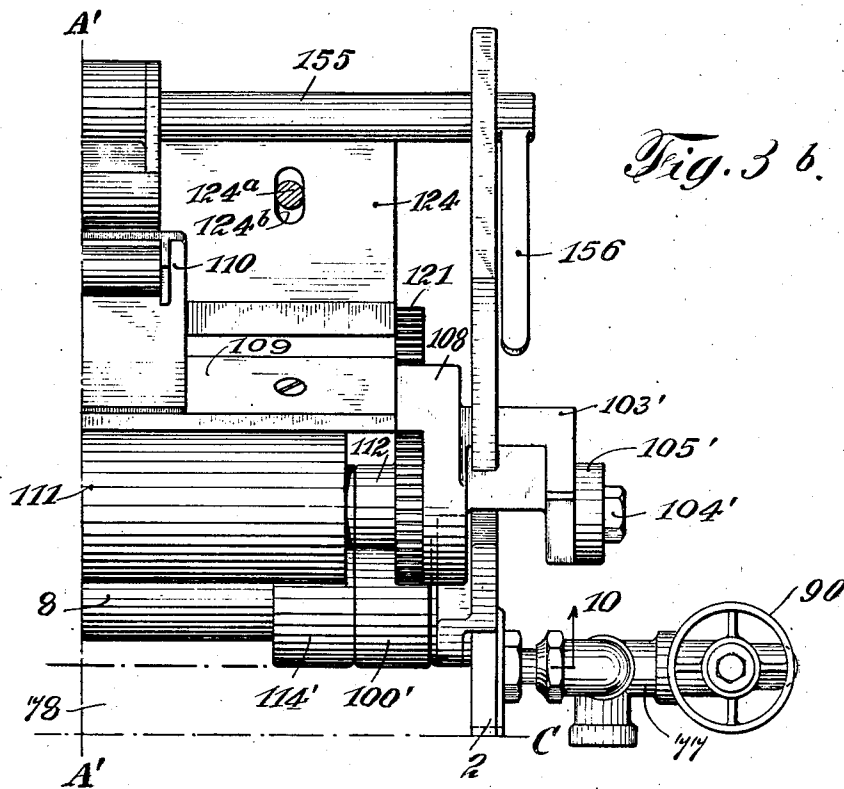
A. WEISS

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10 Sheets-Sheet 4



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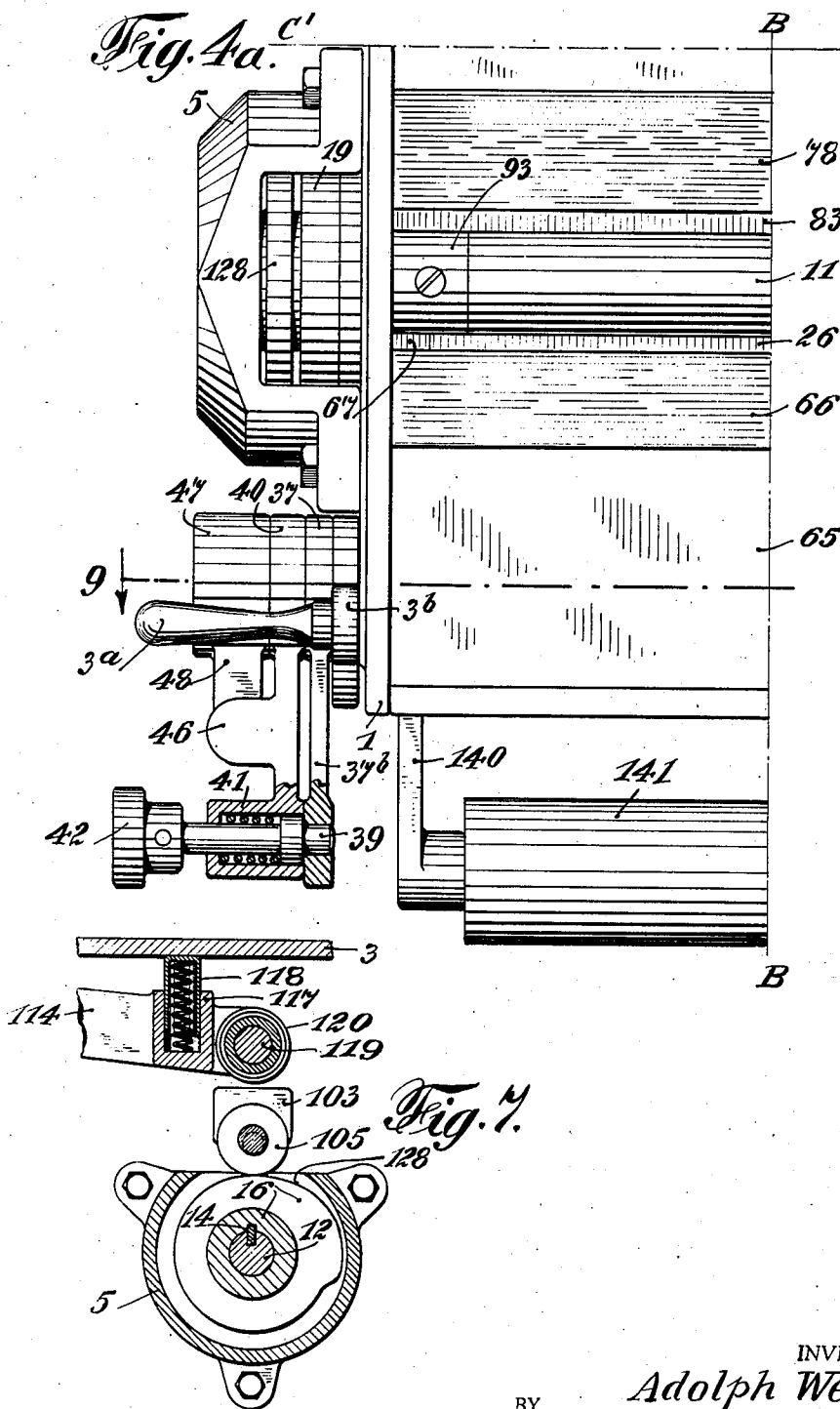
A. WEISS

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10 Sheets-Sheet 5



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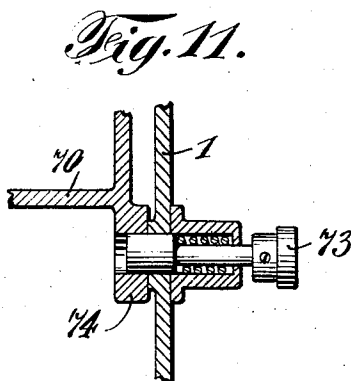
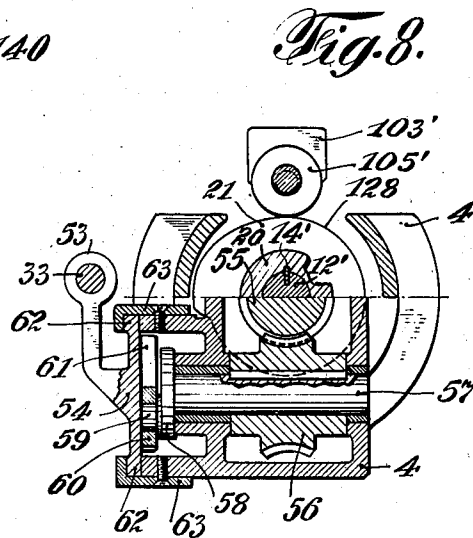
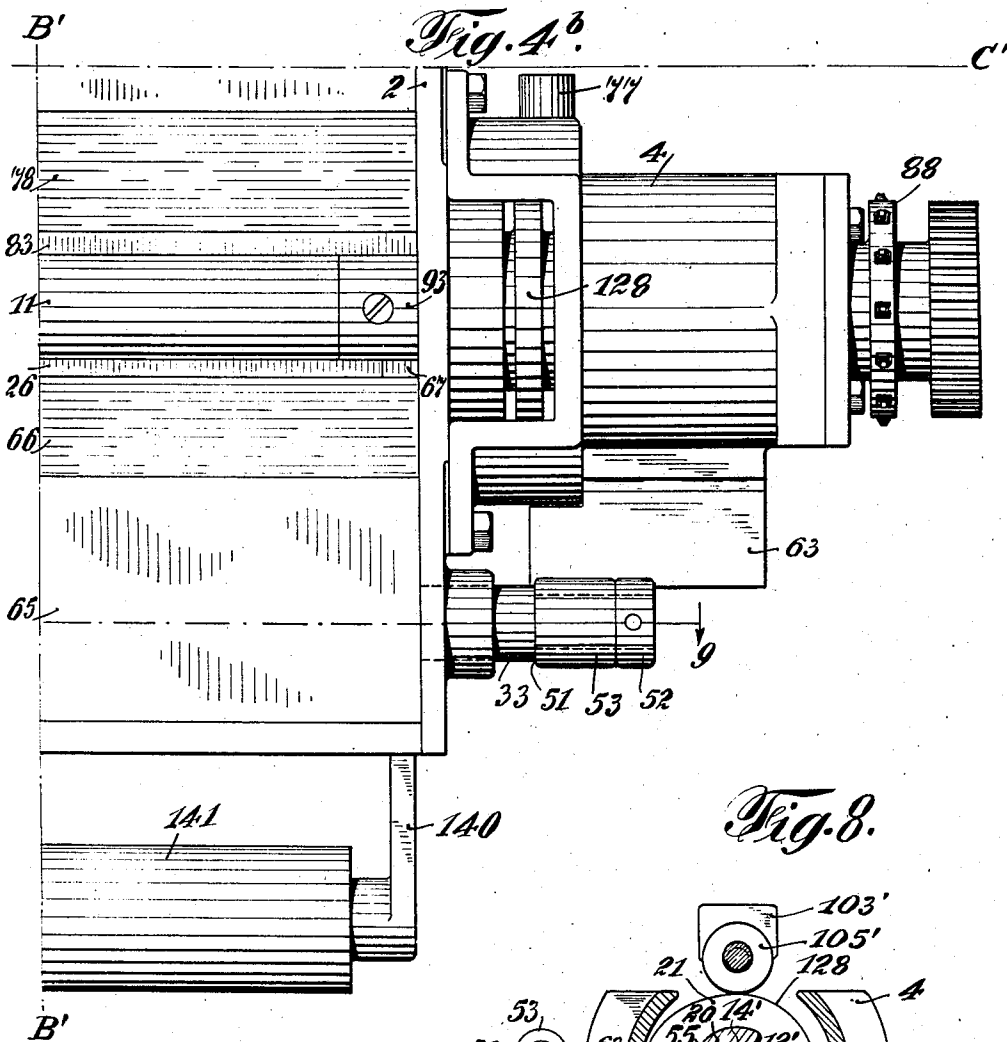
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10 Sheets-Sheet 6



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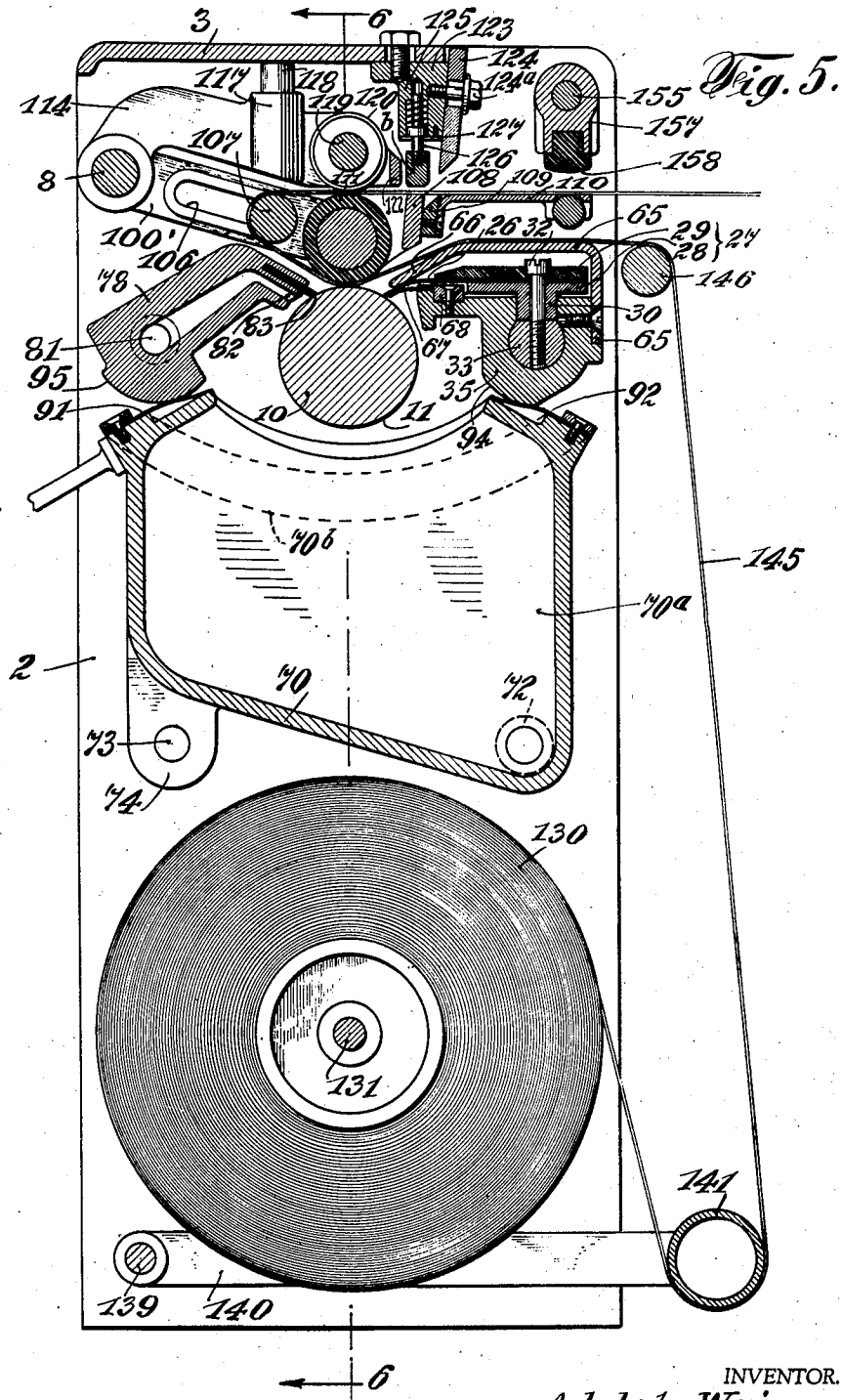
A. WEISS

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10 Sheets-Sheet 7



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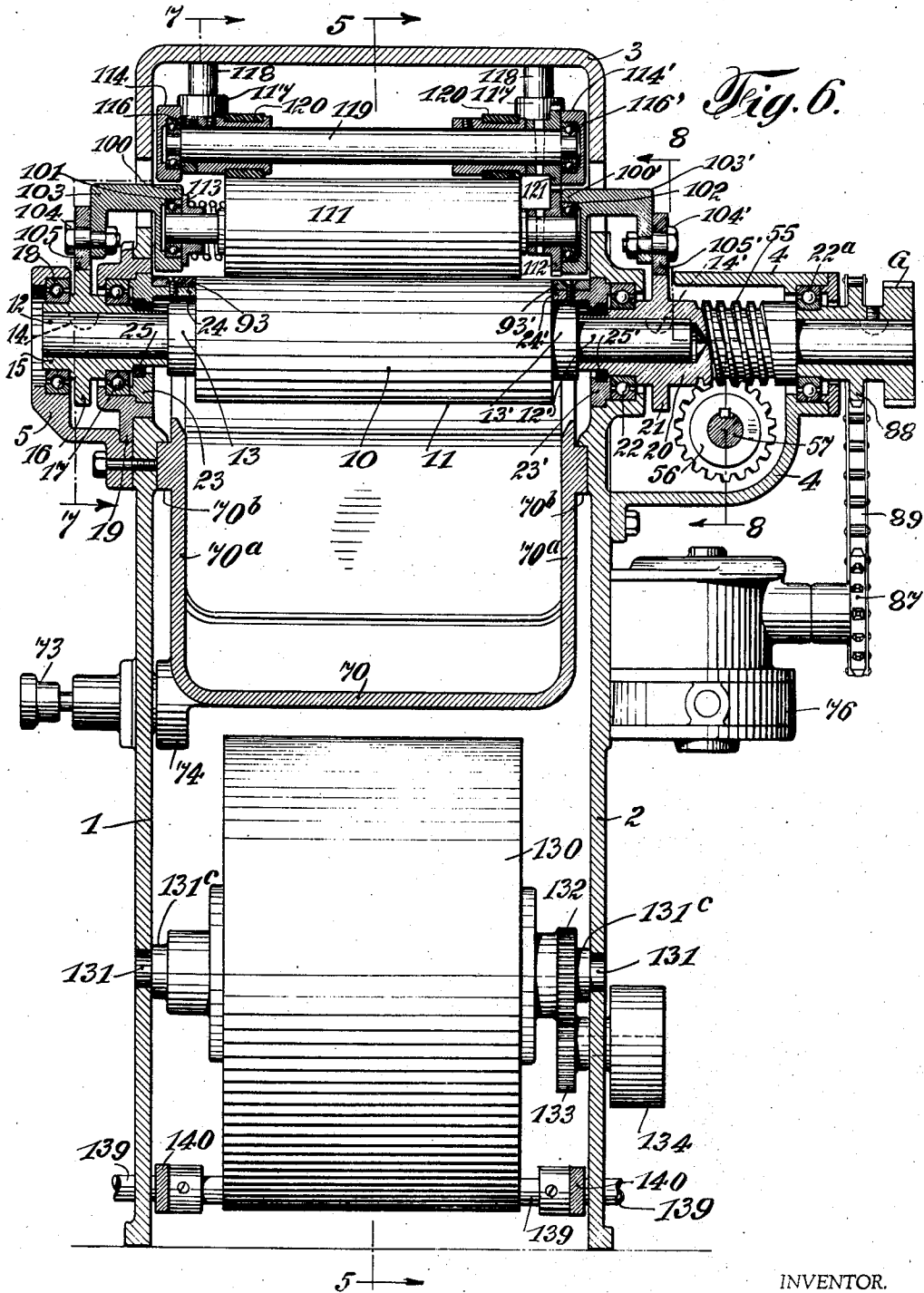
A. WEISS

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PRINTING MACHINERY

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10 Sheets-Sheet 8



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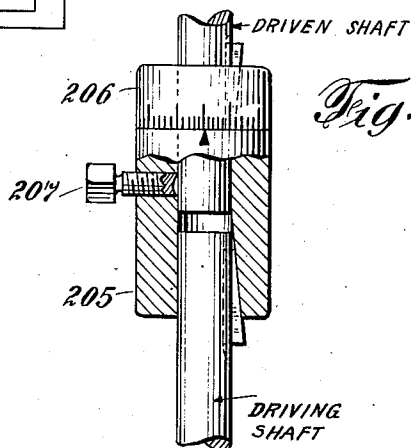
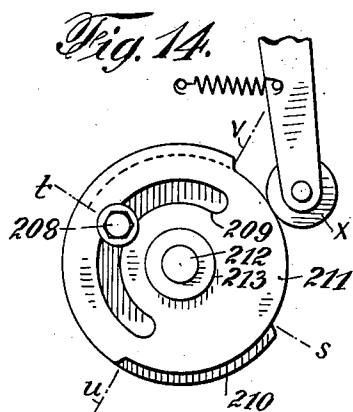
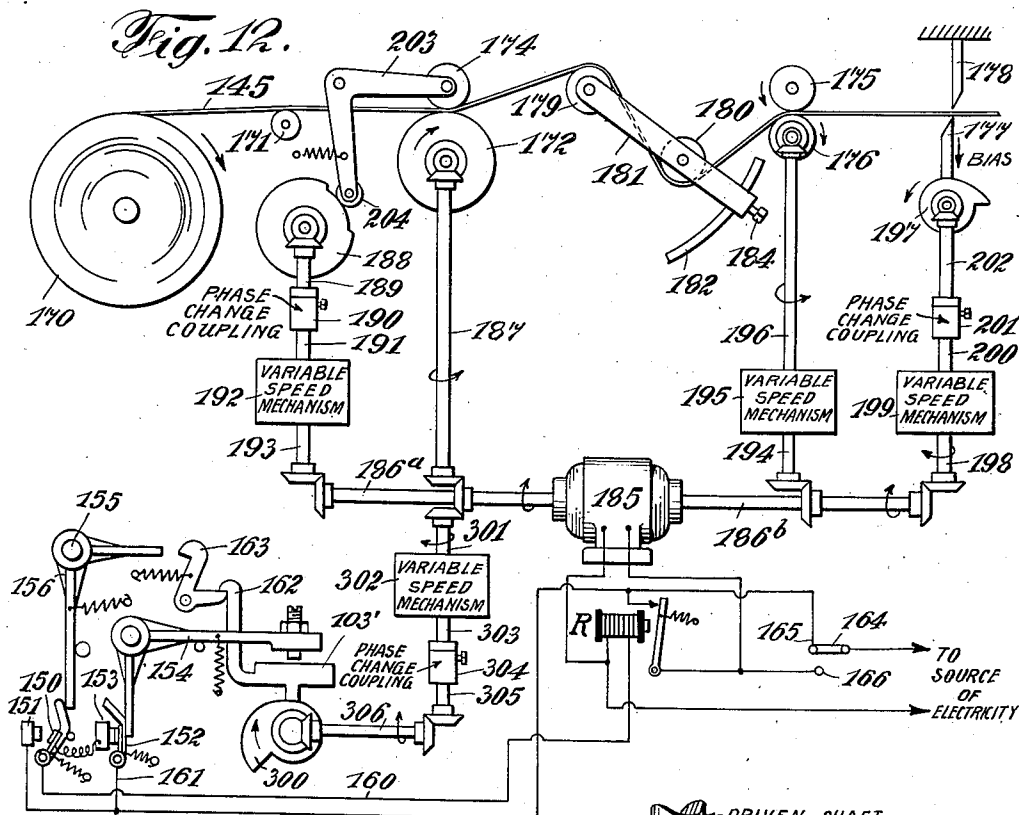
A. WEISS

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PRINTING MACHINERY

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10 Sheets-Sheet 9



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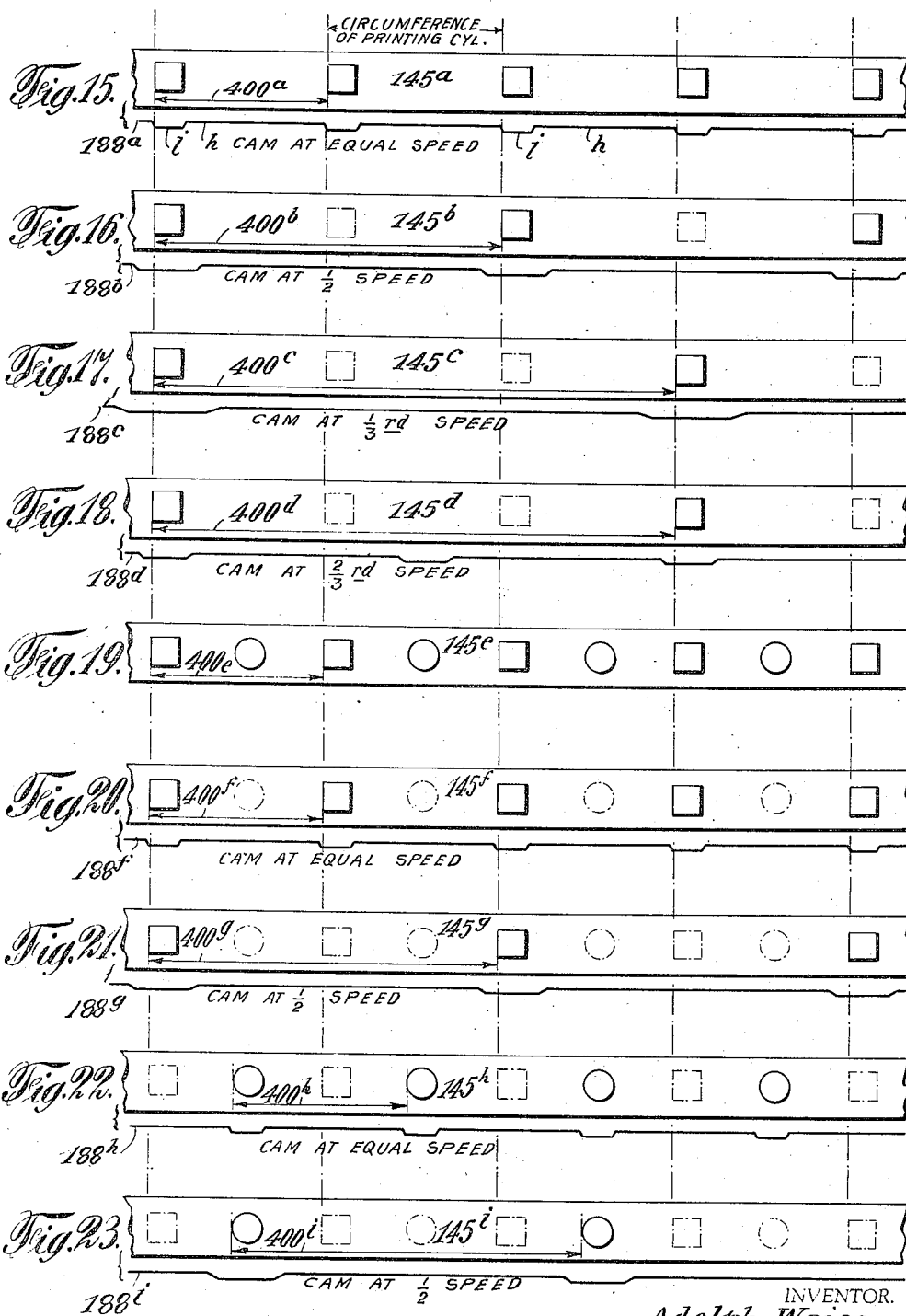
A. WEISS

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PRINTING MACHINERY

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10 Sheets-Sheet 10



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UNITED STATES PATENT OFFICE

2,217,191

PRINTING MACHINERY

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Application June 2, 1938, Serial No. 211,325

18 Claims. (Cl. 101—157)

This invention relates to rotary intaglio print-
ing machines, and particularly to improvements
in such machines of the character disclosed in
my Patents Nos. Re. 18,856, 2,014,303, 2,055,272,
2,115,376 and 2,133,881.

Among the general objects of this invention
are to provide a simplified structure and to pro-
vide improved coordination of the sealing, ink-
ing, and cylinder-wiping mechanisms.

Additional objects are to provide wiping and
inking mechanisms of simplified structure.

Additional and important objects are to pro-
vide means whereby the length of an impres-
sion on a web being printed may be varied with-
out varying the diameter of the printing cylin-
der.

Another object is to provide a simple press
structure which permits easy and convenient
threading of the web, while providing accessibil-
ity of the press mechanism.

A further object is to provide a simple combi-
nation of pressure roller, web-feeding means, and
web-cutting mechanism, which enables these ele-
ments to perform dual functions.

Various additional objects will become evident
from the following disclosure of illustrative em-
bodiments of the invention.

Fig. 1 of the drawings is a partially diagram-
matic elevation of a rotary intaglio printing
press embodying the present invention, the view
being from the front (i. e. operator's side) of the
machine.

Fig. 2 is a partially diagrammatic elevation, the
view being from the rear (i. e. drive side) of the
machine.

Figs. 3a and 3b, when matched together by
superimposing line A—A on line A'—A', consti-
tute a plan view of a portion of the mechanism
in press-opened position. The view shows the
pressure roller, the web-feeding mechanism, and
the web-cutting mechanism, all swung up and
back from the printing cylinder.

Figs. 4a and 4b, when matched together by
superimposing line B—B on line B'—B', consti-
tute a plan view of the printing roller and
associated parts as they would appear after re-
moval of the pressure roller, the web-feeding
mechanism, and the web-cutting mechanism.

When the composite of views 3a, 3b is matched
to the composite of views 4a, 4b by superimpos-
ing line C—C on line C'—C', there is formed a
plan view of the machine with the cover, pres-
sure roller, web-feeding mechanism, and web-
cutting mechanism swung into press-opened po-
sition.

Fig. 5 is a vertical section of the machine in
press-closed position, taken in a plane perpen-
dicular to the printing roller. The direction or
view and the general plane of the section is in-
dicated by line 5—5 of Fig. 6.

Fig. 6 is a vertical section of the machine in
press-closed position, taken in general on line
6—6 of Fig. 5.

Fig. 7 is a detail section taken approximately
on line 7—7 of Fig. 6.

Fig. 8 is a detail section taken approximately
on line 8—8 of Fig. 6.

Fig. 9 is a vertical detail section taken in gen-
eral on line 9—9 of Figs. 4a and 4b, the view
being supplemented with a dot-dash elevation of
certain associated parts that are in front of the
plane of the section.

Fig. 10 is a vertical detail section taken in gen-
eral on line 10—10 of Figs. 3a and 3b.

Fig. 11 is a vertical detail section taken in gen-
eral on line 11—11 of Fig. 1.

Fig. 12 is a diagrammatic view illustrating var-
ious modifications and extensions of the inven-
tion.

Fig. 13 is an enlarged scale elevation, partially
in section, of a phase change coupling shown in
Fig. 12. While this is a structural type of view,
the figure is supplementary to diagrammatic Fig.
12. Accordingly the illustration of the coupling
may be considered as diagrammatic in its rela-
tion to the invention as a whole.

Fig. 14 is a partially diagrammatic elevation
of an adjustable cam that may be utilized in
presses of the present invention.

Figs. 15 to 23, inclusive, are diagrammatic
views illustrating some of the variations in print-
ing results that can be achieved with presses
embodying the present invention.

General organization

This is best seen in Figs. 1, 2, and 6. Front
and back plate-like members 1 and 2 are rigidly
tied together and held in parallelism by any
suitable means. These members serve as stand-
ards which support the various elements of the
machine. At the top, standards 1 and 2 are pro-
vided with extensions 7, 7 in which is mounted
a cross shaft 8. Hinged to shaft 8 is a cover
3. This cover swings down over the printing
roller; and mounted inside of the cover, for
swinging movement, are the pressure roller, the
web-feeding mechanism, and the web-cutting
mechanism.

Removably bolted to the front standard 1 is
a cam housing 5. Removably bolted to the rear

standard 2 is a gear housing 4. Also attached to rear standard 2 is a pump 76 for pumping the ink from the ink reservoir 70 and applying it to the printing cylinder. At the bottom of the machine there is mounted the web supply roller 130.

Printing cylinder assembly

This is best seen in Fig. 6. The printing cylinder 10, which has a printing surface 11, is provided with journal extensions 12 and 12', having shoulders 13 and 13'. Sleeve 15 of cam 16 (which will be discussed later) is fitted to extension 12 and splined thereto by a spline 14. Ball-bearing units 17 and 18 are arranged as shown to rotatably support the sleeve 15 without end play.

Bearing unit 17 is secured in a bearing cap 19 by means of a retainer ring 23 which may (optionally) make a holding friction fit with the bearing cap 19. Carried by the retainer ring 23 is a sealing gland 25 which embraces the periphery of the sleeve 15. Also, the retainer ring 23 is provided with an integral arcuate extension 24 which projects inwardly adjacent to the end of the printing cylinder proper.

The bearing cap 19 is fitted into an aperture in the frame standard 1; and it is held in place by the coaxially positioned cam housing 5, which is bolted to the standard 1 and which carries bearing unit 18. Thus, the bearing units 17 and 18 are coaxially arranged and are removably secured to the frame standard 1.

At the opposite end of the printing cylinder there is a cam 21 (referred to later) having a sleeve portion 20 which is fitted to journal extension 12' and splined thereto by a spline 14'. Ball bearing units 22 and 22a are positioned coaxially with bearing units 17 and 18, and they rotatably support the sleeve 20 without end play.

Frame standard 2 is provided with a seat which receives the bearing unit 22, and a retainer ring 23' holds the bearing in place in the same manner that retainer 23 holds bearing 17 in place. Integral with retainer 23' is an arcuate flange 24' which projects inwardly adjacent to the end of the printing cylinder proper. Carried by the retainer 23' is a sealing gland 25' which embraces the periphery of sleeve 20. Bearing unit 22a is suitably secured in gear housing 4 which is bolted to frame standard 2. Attached to, or integral with, the sleeve 20 is a worm 55, which will be referred to later.

End play of the printing cylinder is prevented by engagement of shoulders 13 and 13' with the inner ends of sleeves 15 and 20 respectively, operating clearance being allowed for the free rotation of the printing cylinder. The printing cylinder may be removed by unbolting cam housing 5, removing sleeve 15 and its bearings, and then withdrawing the printing cylinder from sleeve 20.

Wiping mechanism

The general organization of the wiping mechanism is best shown in Figs. 5 and 9.

The surface 11 of the printing cylinder is wiped by a spring steel doctor knife 26 mounted in a holder 27. This holder comprises lower and upper knife-clamping plates 28 and 29, urged together by screws 31, 31 and 32. Depending from the lower plate 28 is an integral longitudinal flange 30 which slidably fits into a longitudinal recess 30a in a support 35. Support 35 extends between frame standards 1 and 2 and is journaled in them for rocking movement that

will be referred to later. Beneath recess 30a the support 35 is provided with a longitudinal bore which contains a reciprocable shaft 33. Shaft 33 has a flat seat which receives the lower face of flange 30; and the blade holder 27 is fixed to shaft 33, being located by dowels 34, 34, and being secured by screw 32.

Rockable support 35 is provided with an end extension 36 (Figs. 9 and 1) which projects through frame standard 1 to the operator's side of the machine. Associated with this extension are means for setting the support 35 in different angular positions, for the purpose of thereby positioning doctor knife 26 for engagement with different sizes of printing cylinders 10. Also associated with extension 36 are means for biasing the doctor knife 26 against the surface of the printing cylinder with the requisite wiping pressure. These means will now be described.

Pivoted on extension 36 is an adjustment link 37 (Figs. 9, 1 and 4a) having a depending arm 37a and a generally horizontal arm 37b. Arm 37a has an arcuate slot 38 (Fig. 1), pierced by a clamping cap screw 50 which is threaded into frame standard 1. On the lower end of arm 37a is a scale 49 which cooperates with a stationary index mark on frame standard 1. The graduations on scale 49 may indicate desired graduations in the sizes of printing cylinders 10; thus, link 37 can be readily located in the angular position corresponding to a selected size of printing cylinder, and be clamped by screw 50 in the selected position. The setting of arm 37a directly determines the setting of arm 37b which is provided with a hole to receive a pin 39 that is instrumental in positioning the doctor knife 26.

Also pivoted on extension 36 is a plunger link 40. At the end of link 40 there is a boss 41 (Figs. 4a and 1) which slidably supports the plunger pin 39. Pin 39 may be biased toward link arm 37b by any suitable means, as by a helical spring within boss 41. Also plunger pin 39 may be provided with a head 42 (Figs. 4a and 9) for manual withdrawal of the pin from link arm 37b. It will be seen that with plunger pin 39 in engagement with link arm 37b, link 40 is angularly positioned in accordance with the setting that has been given to link 37.

Keyed or pinned to the outer end of extension 36 is a pressure link 47 having a horizontal arm 48 (Figs. 1 and 4a). This arm is biased upwardly by a helical spring 44 which projects from a well 43 that is integral with plunger link 40. An adjustment screw 45 serves to adjust the pressure applied by spring 44. Above arm 48 is a lip 46 which is integral with plunger link 40. When plunger arm 40 is manually moved clockwise (Fig. 1) lip 46 engages arm 48, thereby imparting corresponding movement to support 35 and withdrawing the doctor knife 26 from the printing cylinder 10. When the plunger link 40 is moved in the reverse direction to insert plunger pin 39 into the aperture in link arm 37b, the doctor knife 26 is swung against the surface of the printing cylinder 10. Before the link 40 has reached the position where pin 39 can be inserted, the doctor knife has already engaged the surface 11 of the printing cylinder 10, so that the final counterclockwise movement (Fig. 1) of link 40 compresses spring 44. Thus, spring 44 biases the doctor knife 26 against the printing surface 11 with the requisite wiping pressure.

The arrangement provides ready access to the printing surface, and provides for easy adjustment of the doctor knife when a printing cylinder

der of different size is to be installed in the machine. After other parts have been moved out of the way (as described later), the doctor knife and knife holder may be moved out of the way by merely withdrawing knob 42 and swinging it downwardly. By simple reverse manipulation of knob 42 the doctor knife is restored to the printing surface with the previous wiping pressure. If a printing cylinder of different size has been installed in the meantime, it is only necessary to appropriately set link arm 37a by means of scale 49 before the knob 42 is swung upwardly and pin 39 inserted in the socket in link arm 37b.

When the machine is in operation, the doctor knife 26 is reciprocated longitudinally of the printing cylinder. This reciprocation is effected by imparting a corresponding back-and-forth longitudinal movement to shaft 33. The mechanism for reciprocating shaft 33 is seen in Figs. 9, 4b, 2, and 8.

A reciprocatory slide 54 (Fig. 8) has an arm 53 which is attached at right angles to shaft 33. This attachment (Figs. 9 and 4b) is made at the end portion of shaft 33, which projects beyond frame standard 2. This end portion of the shaft 33 pierces arm 53, and is reduced in diameter to provide a shoulder 51 which abuts against one face of arm 53. Against the opposite face of arm 53 is a collar 52 which is pinned to shaft 33.

Slide 54 has guideway bearing portions 62, 62 (Fig. 8) which are reciprocable in guideways that are formed by angles 63, 63 in cooperation with wall portions of gear housing 4. The back of slide 54 is formed with spaced vertical faces 61, 61 (see also Fig. 9) between which is a roller 60 that is mounted on a stud 59. Stud 59 is eccentrically located on a disc 58, so that as the disc rotates, a reciprocatory motion is imparted to slide 54. The reciprocatory motion of slide 54 is, of course, imparted to shaft 33, and thence to the doctor knife 26.

Disc 58 receives its rotation from shaft 57 to which it is attached. Splined to shaft 57 is a worm gear 56 (see also Fig. 6) which is driven by the worm 55 of sleeve 20, which receives the rotation of the printing cylinder 10. Thus, rotation of the printing cylinder effects reciprocation of the doctor knife 26. It will also be noted that the reciprocation of shaft 33 in no way interferes with the rocking of support 35 by movement of knob 42, and vice versa.

As shown in Figs. 5, 4a, 4b, and 9, the support 35 carries a removable pressure apron 65 which has a bent nose portion 66 in engagement with the upper surface of doctor knife 26. This nose 66 deflects the doctor knife downwardly from its unstressed position, as more fully explained in my United States Patent No. 2,014,303, issued September 10, 1935. In that patent the pressure apron reciprocates with the doctor knife, but in the construction herein shown it does not. Accordingly the apron 65, or the nose thereof, is preferably made of bronze or other suitable bearing material; and the same applies to strip 67. As shown in Fig. 9, the apron 65 extends from frame standard 1 to frame standard 2, except that sufficient clearance is allowed for the apron to move between the standards when support 35 is rocked.

On the forward edge of support 35 (Fig. 5) is a sealing blade 67 secured by a clamp 68. A similar sealing blade is shown and fully explained in my United States Patent No. 2,055,272, issued September 22, 1936.

Ink system

An ink reservoir 70 (Figs. 5 and 6) is pivotally attached to frame standard 1 at 71 (Fig. 1) and to frame standard 2 at 72 (Figs. 2 and 5). Integral with the reservoir is a perforated lug 74 (Figs. 11, 5 and 6) which is pierced by a spring pressed plunger 73 to hold the reservoir in the operating position shown in the drawings. By withdrawing plunger 73, the reservoir 70 can be readily swung downwardly to give access to its interior, e. g. for cleaning.

The pivotal connection at 72 is made hollow to permit the passage of the ink through a swivelly connected conduit 75 (Fig. 2) to the intake port of a circulating pump 76. The discharge port of the pump is connected by a pipe 77 to an inking manifold 78, from which the ink is discharged through an elongated port 82 onto the printing surface 11. The pump is driven through sprocket 87, connected by chain 89 to sprocket 88 (Fig. 6) which rotates with the printing cylinder 10.

The inking manifold 78 is in sealing engagement with the frame standards 1 and 2; and it is pivotally mounted so that it can be rocked away from the printing cylinder, in much the same way that the doctor knife 26 is rocked back. Above the discharge port 82, the manifold is provided with a long sealing strip 83 which is in sealing engagement with the printing cylinder 10 when the manifold is in operating position.

As best seen in Fig. 10, the inking manifold has a hollow pivot stud 80 which pierces frame standard 2. From this stud a swivel joint pipe connection is made to conduit 77, so that the ink can pass to the manifold bore 81 while permitting the manifold to be rocked in its pivots. At the other end the manifold has an extension 79 which projects through frame standard 1.

Associated with extension 79 are parts (a) by which the manifold is biased to spring press sealing strip 82 against the surface of the printing cylinder, (b) by which adjustment is made for different sizes of printing cylinders, and (c) by which the manifold can be rocked back away from the printing cylinder. These parts are similar to those for correspondingly adjusting the doctor knife, and they operate in the same way. Link 84 (Figs. 10 and 3a), which has perpendicular arms 84a and 84b (Figs. 3a and 1) corresponds to link 37 with its perpendicular arms 37a and 37b; and link 84 may be set in the different positions required for different sizes of printing cylinders. Plunger link 85 corresponds to plunger link 40; and by withdrawing spring pressed plunger 85a (Figs. 3a and 1) and swinging it downwardly, the inking manifold is rocked back from the printing cylinder. Pressure link 86 corresponds to pressure link 47; and link 86 is rotatively biased by spring 85b to press the sealing strip 83 (Fig. 5) against the printing cylinder.

In operation ink is drawn from reservoir 70 by pump 76 and forced to the inking manifold 78 from which it is continuously delivered through nozzle 82 in the form of a ribbon which extends the length of the printing surface 11. Except for the depressed areas in surface 11 which hold the ink that is to be applied to the web, the entire surface 11 of the printing cylinder is wiped clean by doctor knife 26; and the surplus ink falls back into reservoir 70. When it is desired to drain the ink reservoir, drain cock 90 (Fig. 2) is opened with the pump 76 in operation.

Sealing system

To prevent any substantial evaporation of the volatile ingredients of the printing ink, the ink is kept in a sealed system from which only such ink is removed as is to be applied to the web being printed. In accordance with certain objects of the invention, various operating parts of the press also act as portions of the sealed inclosure for the ink. The boundaries of the sealed system will be explained by first tracing the boundary in a plane perpendicular to the printing roller, and then showing the boundaries in directions lengthwise of the printing cylinder.

Referring to Fig. 5, the boundary of the sealed system will be traced in a clockwise direction, starting with printing cylinder 10. The doctor knife 26 seals the printing cylinder to strip 67, which in turn carries the seal to support 35. Upwardly bowed springy strip 92 seals support 35 to one edge of ink reservoir 70. The other edge of the ink reservoir is sealed by bowed springy strip 91 to inking manifold 78. And the inking manifold is sealed to the printing cylinder by strip 83. Since support 35 and manifold 78 are swung into different positions for different sizes of printing cylinders, they are provided with arcuate surfaces 94 and 95 concentric with their respective pivotal axes, which, in the different positions, appropriately engage sealing strips 92 and 91, respectively.

Each of the elements referred to in the preceding paragraph is sealed endwise to the frame standards 1 and 2, as will now be described.

The endwise sealing of the printing roller to standard 1 is a substantial duplication of its endwise sealing to standard 2. Accordingly, only the sealing to standard 1 will be described, reference being had primarily to Fig. 6.

The arcuate flange 24 of retainer 23 has its outer surface at a radius equal to the radius of the smallest printing cylinder for which the machine is designed. Thus, the outer surface of flange 24 constitutes a stationary extension of printing surface 11 when the smallest printing cylinder is being used. For larger printing cylinders, the outer surface of flange 24 is, in effect, appropriately increased in radius by a removable segment 93. The arcuate length of flange 24 (and segment 93) is sufficient to extend beyond sealing strips 67 and 83 (Fig. 5) so that those strips make sealing engagement with the outer surface of flange 24 (or segment 93). The doctor knife 26 also makes sealing engagement with the surface of flange 24 (or segment 93), and in reciprocating it does not completely leave the flange (or segment). Thus, sealing strip 67 can have its edge relieved throughout the axial length of printing surface 11, so that it does not engage the printing surface, which is sealed by the doctor knife 26.

The end of the printing cylinder 10, and the free end of flange 24 (and segment 93) are accurately ground so that the flange 24 (and segment 93) make a sealing fit with the end of the printing cylinder. Frame standard 1 is in sealing engagement with bearing cap 19, which in turn, is in sealing engagement with the periphery of retainer 23. The inner surface of retainer 23 is sealed by gland 25 to sleeve 15; and sleeve 15 is in sealing engagement with journal extension 12. Thus, it will be seen that the printing cylinder is sealed endwise to frame standard 1; and it is correspondingly sealed to frame standard 2.

The ends of sealing strips 67, 83, 91, and 92 are all accurately fitted against flat-ground sur-

faces of standards 1 and 2, so as to make sealing fits therewith while permitting sliding movement of the strip ends with respect to the standards 1 and 2. The ends of support 35 and manifold 78 are likewise fitted and sealed to standards 1 and 2. The end walls 70a, 70b (Figs. 5 and 6) of the ink reservoir 70 have curved bosses 70b, 70b which make sealing engagement with standards 1 and 2. Each of these bosses has a flat ground face, so engaging a flat face on the standard as to permit the pivotal downward movement of the reservoir for cleaning.

It will be seen that various operating parts of the machine have been utilized as part of the sealing system without impairing their primary functions. This has been accomplished with convenience and simplicity; and the sealed system has been adapted for various applicational needs, some of which will be discussed later.

Web supply mechanism

This is best seen in Figs. 1, 2, 5, and 6. A shaft 131 carries a roll of web 130, which roll is telescoped onto the shaft and clamped thereto in any suitable manner. One end of the shaft 131 is journaled in the bottom of an inclined slot 131a (Fig. 2) in frame standard 2. The other end of shaft 131 is journaled in the bottom of an inclined slot 131b (Fig. 1) in frame standard 1. As shown in Fig. 6 the shaft 131 is provided adjacent to its ends with shoulders 131c, 131c which prevent excessive end play of the shaft. The upper end of slot 131b is enlarged as shown so that, when the shaft is lifted upwardly, one shoulder 131c can be pushed into the enlargement and the shaft cantled and removed for replacement of roll 130.

Keyed to shaft 131 is a gear 132 which, when the shaft is in place, meshes with a gear 133. Gear 133 is fixed on a stub shaft to which is also fixed a brake drum 134 located outside of standard 2. Pivoted to standard 2 is a brake 135 (Fig. 2) having a lining 136 which is urged against the brake drum by spring 138.

A shaft 139 is journaled in frame standards 1 and 2 and extends outside of each of them. Affixed to this shaft, just inside of standards 1 and 2 are links 140, 140. These links carry a weight roller 141 under which the web 145 passes, as shown in Fig. 5. When the web is pulled to set it in motion, the inertia of supply roll 130 does not have to be instantaneously overcome, as roller 141 rises thereby making a certain length of the web available to the printing mechanism. Continued pulling of the web, or the weight of roll 141, or both, act to pull the web from the supply roll. As this happens, roll 141 descends and moves shaft 139 counterclockwise as viewed in Fig. 2. Such movement of shaft 139 causes cam 144 to engage, and increasingly apply pressure to, roller 137. This increases the retarding pressure of brake 135 until the downward movement of roller 141 is checked by a balanced condition having been reached.

Affixed to shaft 139 on the operator's side of the machine is a link 142, provided with an adjustable counterweight 143 by which the weight action of roller 141 may be modified.

The supply mechanism disclosed makes the web available to the printing mechanism at substantially constant tension as the diameter of the supply roll diminishes. Counterweight 143 is so set that, at the smallest diameter of the supply roll, the tension produced by weight roller 141 is sufficient to overcome the action of brake

135 when set by spring 138 alone. Supplementary braking pressure that is particularly needed on larger supply-roller diameters is supplied by cam 144. Thus, the effective weight of roller 141 determines the tension at which the web is delivered to the printing mechanism.

Pressure roller, and guiding and feeding mechanisms

10 These parts are compactly arranged inside of the hinged cover 3. With the cover open, all of these elements may be readily moved out of the way to give access to the printing cylinder, inking manifold, and doctor knife assembly; and restoration is accomplished by simply swinging the parts into operating position and closing and latching the cover.

With conventional rotary intaglio printing presses, the length of the printing cylinder impression is equal to the peripheral length of the printing cylinder. "Length of the printing cylinder impression" or "length of the impression," means the length of web which passes the printing cylinder during one complete printing cycle, without regard to whether or not the printed design occupies the entire length of the "impression," and without regard to whether the printing cycle involves one, more than one, or less than one revolution of the printing cylinder. As previously pointed out herein, my invention provides for the insertion of printing cylinders of different sizes to vary the length of the printing cylinder impression. Additionally, I provide means (referred to later) whereby impressions of different lengths may be made from the same printing cylinder; and this has important industrial applications.

Pressure roller 111 (Figs. 5 and 6) is journaled in ball bearing units 101 and 102. These bearings are mounted respectively in similar links 100 and 101' (see also Figs. 3a and 3b) which are pivoted to shaft 8 that also forms the pivot for cover 3. The free ends of links 100 and 101' are tied together by bridge 109 (Figs. 5, 3a and 3b) so that the alignment of bearings 101 and 102 is maintained. In operating position the axis of the pressure roller is located approximately directly above the axis of the printing cylinder, as shown in Fig. 5.

Links 100 and 100' are provided respectively with L-shaped extension lugs 103 and 103' (Fig. 6), to which are affixed studs 104 and 104' for rollers 105 and 105'. These rollers are adapted to cooperate respectively with cams 16 and 21 that are driven synchronously with the printing cylinder. When it is desired to produce printing cylinder impressions corresponding in length to the peripheral length of the printing cylinder, cams 16 and 21 are so made or set as to not affect the links 100 and 100' on which the pressure roller is mounted. When it is desired to produce printing cylinder impressions of lengths less than the peripheral length of printing cylinder 10, cams 16 and 21 are provided with active sectors corresponding to that portion of the periphery of printing cylinder 10 which is to be omitted from the length of the impression. Thus, the web is fed and printed throughout the inactive zone of cams 16 and 21; but in the active zone of the cams, pressure roller 111 and the web are elevated and the printing cylinder 10 rotates idly without the web being advanced.

In operation the printing cylinder 10 is power driven. While the web is being advanced by the printing cylinder, the pressure roller 111 is frictionally driven through its pressure contact with the moving web. When cams 16 and 21 elevate the pressure roller, its rotation is stopped by a spring pressed brake 113 (Fig. 6).

A guide and spacing roller 107 (Fig. 5) is also rotatably supported by links 100 and 100'. The bearings (not shown) for roller 107 are in blocks which may be clamped in different positions along slots 106 in the links, to shift the position of roller 107 for a purpose to be described later. If desired the bearing blocks for roller 107 may each be provided with an index, while each of links 100 and 100' is provided with a cooperating scale, to facilitate alignment of roller 107.

Also pivoted to shaft 8 is a second pair of links 114 and 114' (Figs. 5, 6, 3a and 3b) which are positioned higher than links 100 and 100'. As shown in Fig. 6, links 114 and 114' carry bearings 116 and 116', respectively, which rotatably support a feed roller shaft 119. A bridge 122 (Fig. 5) ties together the free ends of links 114 and 114', thereby maintaining the alignment of bearings 116 and 116'. Adjustably fixed on shaft 119 are yielding feed roller members 120, 120 which engage the edge portions of the web as it passes over pressure roller 111.

Shaft 119 and pressure roller 111 are geared together by gears 112 and 121 (Fig. 6). So long as the pressure roller is being frictionally driven by the moving web, feed rollers 120, 120 are, therefore, driven to advance the web from the bottom of pressure roller 111 over guide and spacing roller 107, to feed rollers 120, 120. The advancing of the web from supply roll 130 to the bottom of the pressure roller 111 is effected by the rotation of the printing cylinder 10. The peripheral speed of feed rollers 120, 120 may be equal to the peripheral speed of the printing cylinder. However, to insure that the web will be kept taut over roller 107, the peripheral speed of feed rollers 120, 120 may be somewhat in excess of the peripheral speed of the printing cylinder.

Links 114 and 114' are provided with bosses 117, 117 (Figs. 7 and 6) from which spring pressed plungers 118, 118 project upwardly. When the cover 3 is forced closed by handle 3a and latched by latch 3b (Figs. 1 and 4a) the plungers 118, 118 are engaged by the cover and yieldingly depress yielding feed rollers 120, 120.

When rollers 120, 120 are unstressed they preferably have a diameter larger than the pitch diameter of gear 121, while pressure roller 111 preferably has approximately the same diameter as the pitch diameter of gear 112. Thus before plungers 118, 118 are depressed, gears 112 and 121 loosely mesh with their pitch circles out of contact with one another. Depression of plungers 118, 118 (with resultant yielding of feed rollers 120, 120) brings the pitch circles of gears 112 and 121 into contact, or nearly so. Links 100, 100' and 114, 114' are provided with abutting projections which arrest the movement of shaft 119 toward pressure roller 111 when the pitch circle of gear 121 has been brought tangent to the pitch circle of gear 112. The final closing movement of the cover causes pressure to be transmitted through these abutting projections to yieldingly press the bottom of the pressure roller 111 against the web and toward the printing cylinder 10. When the pressure roller 111 (and associated parts) are elevated by the action of cams 16 and 21, the springs within plungers 118, 118 yield as required to permit the movement.

Cutting mechanism

The cutting mechanism is best seen in Fig. 5, but parts of it also appear in Figs. 3a and 3b.

Extending across the top 3, and parallel to the axis of the printing cylinder, is an angular bracket 123. A cutting knife 124 is secured to bracket 123 by cap screws 124a; and the knife is made vertically adjustable by any suitable means, such as slots 124b (Fig. 3b) in the knife.

Along the bracket 123 are several boss portions 125 (one shown) which accommodate spring-pressed plungers 126 that support a clamping bar b of yielding material. Secured to the bottom of bracket 123 are retainers 127 (one shown) which so limit the downward movement of plungers 127 as to establish a predetermined normal spacing between the lower face of clamping bar b and the top of bridge 108. Secured to bridge 108 is a second cutting knife 109, and also a platform 110. The parts are so adjusted that, when bridge 108 is elevated sufficiently, cutting knives 109 and 124 make shearing engagement and sever the web.

When the machine is so operated that the length (or spacing) of the printed impression is less than the peripheral length of the printing cylinder, bridge 108 (among other things) is elevated by cams 16 and 21 (Fig. 6) while the printing cylinder turns idly. If it is desired to sever the printed web (e. g. for making printed slips or package wrappers) the cams 16 and 21 are so arranged that cutting knife 109 will be elevated sufficiently to sever the web. In this elevating movement the web is first clamped between bridge 108 and clamping bar b; then the web is severed by cutting knives 109 and 124. The cut slip falls onto platform 110, from which it may be removed by hand or by suitable mechanical means. The position of the line of severance with respect to the printing is governed by the position of roller 107. This roller may be shifted along slots 106, as previously described, to vary such position of the line of severance.

If repeat printing of the web is desired, without severance into slips (or the like), cams 16 and 21 are so arranged that any elevation of bridge 108 to permit idle rotation of the printing cylinder is insufficient to bring the cutting knives 109 and 124 into shearing engagement.

Threading the machine

The web 145 (Fig. 5) passes from the supply roll 130, under weight roller 141, over guide roller 146, between the printing cylinder 10 and pressure roller 111, over guide roller 107, between pressure roller 111 and feed rollers 120, 120, between bridge 108 and clamping barb, between the cutting knives 109 and 124, and over platform 110.

To thread the web, the cover 3 is opened and links 100, 100' and 114, 114' are swung back to the position shown in Figs. 3a and 3b. This moves the cutting mechanism and rollers 111, 107, and 120, away from the printing cylinder. The leading edge of the web is drawn under roller 141, over roller 146 and beyond the printing cylinder 10. Then the links 100, 100' are swung down, bringing rollers 107 and 111 to the position shown in Fig. 5. The leading edge of the web is next drawn around roller 107 and over roller 111 to a position beyond platform 110. Then links 114, 114' are swung down, meshing gears 112 and 121 (Fig. 6) and bringing feed rollers 120, 120 to the position

shown in Fig. 5. Finally cover 3 is closed and latched, which brings cutting knife 124 to the position shown in Fig. 5.

Drive and electrical controls

As previously described, the machine includes such mechanical connections that all driven parts will be actuated in coordination if rotation be imparted to sleeve 20 (Fig. 6). In keyed relation to this sleeve is a drive gear, or sprocket, G (see also Fig. 2) to receive driving power from an electric motor M (Fig. 2) that is mechanically suitably connected to the gear G to drive the same. Thus, all elements of the press are operated by a single driving connection to a source of motive power.

For certain uses, I may provide the press with automatic controls which cause it to stop after each printing cycle. This makes it possible to print single slips, one at a time as required. Also I may provide for semi-automatic operation of the press in printing such slips, the removal of one printed slip being utilized to initiate the printing of the next slip.

Suitably insulated and mounted on the frame standard 2 (Fig. 2) are movable contacts 150 and 152 which are spring biased away from stationary contacts 151 and 153 respectively. Pivoted to cover 3 is a bell crank lever 154 having a vertical leg adapted to engage contact 152. A spring 154a biases bell crank lever 154 with sufficient strength to overcome the bias of contact 152 and close the same when lever 154 is free to move. A shaft 155 extends across cover 3; and keyed or pinned to the end of the shaft is a bell crank lever 156. This lever is movable to close contact 150, but is biased in the opposite direction by spring 156a.

Inside of cover 3 (Fig. 5) shaft 155 is provided with a fixed arm 157 having a yielding friction pad 158. Extension 103' (Figs. 2 and 3b) of link 100' is adapted to engage the adjustment screw of bell crank lever 154 when roller 105 is moved up by its cam (as previously described) to suspend the advance of the web.

Assume that the machine is in operation, with the printing cycle in progress. The electrical contacts are then in the positions shown in Fig. 2, the circuit to the motor M being maintained by relay R. The holding circuit for relay R is through connection 160, contact 150, contacts 153 and 152, and connection 161 and switch 164 to the line. At the end of the printing cycle roller 105 is raised by cam 21 (Fig. 6) and printing is suspended. Cam 21 is so arranged that as the end of the complete machine cycle is approached, roller 105 will be given a final upward movement beyond that required for severing of the web by the cutting knives 109 and 124 (Fig. 4). In this final movement, extension 103' moves bell crank lever 154 and permits contacts 153, 152 to open. This breaks the holding circuit of relay R, allowing the relay to open and stopping driving motor M. Thus the press stops with the bridge 108 (Fig. 5) in its uppermost position.

Attached to extension 103' is a latch-engaging hook 162 which moves upwardly with extension 103', allowing latch 163 to advance so that its upper portion engages the end of the horizontal arm of bell crank lever 156.

With the bridge 108 in its uppermost position, the severed slip on shelf 110 (Fig. 5) is clamped against the friction pad 158. When the slip is withdrawn, the pad moves with it, rotating shaft 155, thereby moving bell crank lever 156 clockwise as viewed in Fig. 2. This closes contacts 150, 151 which complete the circuit to relay R, so that

the relay operates and starts the driving motor M. Latch 163 is arranged to hold bell crank lever 156 in its operated position, thereby maintaining contacts 150, 151 closed as the press starts to operate. The initial movement of the press causes extension 103' to descend, which allows bell crank lever 154 to rotate clockwise and close contacts 152, 153. This restores the original holding circuit for relay R, through connection 160, contact 150, contacts 153 and 152, and connection 161. After contacts 152, 153 are closed, hook 162 retracts latch 163 and permits bell crank lever 156 to return to its initial position and contacts 150, 151 to open.

When the machine cycle is completed, contacts 152, 153 are again opened and the machine stopped. If it is desired to operate the press continuously, switch 164 is shifted from contact 165 to contact 166, thus connecting the motor M for continuous operation. For continuous operation friction pad 158 may be removed, and table 110 be inclined downwardly so that the slips will drop onto a conveyor (if slips are being printed). If the web is not being severed into slips, the printed web may be appropriately handled as it leaves the machine.

If desired, the machine may be arranged to operate automatically through a series of cycles when it is started by extracting a printed slip. In such case, the machine would function to automatically print a definite number of slips and then stop. In this case bell crank lever 154, instead of being elevated by extension 103' could be elevated by a machine part operating on a reduced gear ratio. For example, if it were desired to print three slips in a series, bell crank lever 154 could be operated by a machine part arranged to rise once in three revolutions of the printing cylinder. This modification is illustrated in connection with Fig. 12.

Characteristics and adaptations of the press

The inventor provides a printing press which can be readily adapted for various types of operations, and for various industrial applications. The parts are simply constructed and compactly arranged. A complete machine, including paper supply, may be arranged to have all operating parts actuated in coordination from a single source of motive power.

Substitution of printing cylinders of different sizes is readily effected. Also, printing cylinder impressions of different lengths may be made from a single printing cylinder. The ink supply may be so well sealed that the machine can stand idle over considerable periods of time and remain always ready for immediate use. This is very desirable for the printing of individual slips. For such use the engraving on the printing cylinder is so arranged that the machine stops with all of the engraving within the sealed ink housing. This means that in stopped position, the exposed portion of the printing cylinder (the short arc in Fig. 5 between the doctor knife 26 and sealing strip 83), is a plain cylindrical surface that has been wiped clean by the doctor knife. Thus, no ink coated parts are left exposed.

Several different prints may be selectively made from a single cylinder by providing the engravings therefor on one cylinder and selectively printing from that cylinder. The selection may be made by substituting different sets of cams 16 and 21 (Fig. 5) which have their inactive sectors in different angular positions with respect to the printing cylinder 10. To select any one engraving for printing it is only necessary

to install a set of cams 16 and 21 having active sectors covering that arc of the printing cylinder which is to be rendered inactive or non-printing. Such selection may similarly be made by arranging the cams 16 and 21 to be rotatively adjustable with respect to the printing cylinder. In this connection, it should be noted that (with sufficiently rigid construction), the web is lifted from the printing cylinder if an active sector of either cam 16 or 21 is in engagement with its roller (105 or 105'). Thus, cam 16 may be made to render the printing cylinder inactive throughout one sector, while cam 21 continues the printing cylinder inactivity throughout a succeeding sector.

By the use of different sets of cams 16 and 21, a wide variety of operating characteristics can be achieved. The sectors of activity of the cams may be varied in length, as well as angular location. Also the amount and rate of life imparted to roller 105 and 105' may be varied. I also contemplate that the same results can be achieved by replaceable and/or adjustable segments which actuate the rollers 105 and 105' and which can be shifted to vary the angle of the active sectors of the cams, as well as the rotative locations of the sectors and the amount and rate of lift imparted to rollers 105 and 105'.

These various modifications and adaptations of the press are illustrated diagrammatically in Figs. 12, 13, and 14 of the drawings.

Figs. 12, 13 and 14

The web 145 passes from supply roll 170 over guide roller 171 and between printing cylinder 172 and pressure roller 174. Subsequent to the printing, the web passes between feed rollers 175 and 176, and is delivered between the blades 177 and 178 of cutting shears. Between the printing cylinder 172 and feed rollers 175, 176, the web may pass over two rollers 179 and 180, which are so arranged as to vary the distance which the web must travel in moving from the printing cylinder to the cutting shears. The axis of roller 179 is stationary, but roller 180 is rotatably mounted on a swinging frame 181 which is pivoted coaxially with roller 179. By swinging the frame 181 and locking it to a sector 182 by set screw 184, the adjustment is made to vary the length of the travel of the web between the printing cylinder 172 and the cutting shears. This adjustment permits severing of the web at any selected point in the printing cylinder impression.

The various driven elements of the press are mechanically connected together to be actuated from a single source of power indicated as an electric motor 185. To permit a clear and convenient diagrammatic showing of the operating relationships of the different parts, bevelled gears have been indicated in Fig. 12 of the drawings. However, in actual machine construction, it is preferable to so arrange the parts as to permit the use of spur gears or the like. As shown in the drawings, the motor drives shafts 186a and 186b, which are in effect a single shaft. By means of shaft 187, power is transmitted to the printing cylinder 172 to rotate it at predetermined speed, which may be the speed of the motor. A cam 188 (to be referred to later) is driven in coordination with the printing cylinder 172 by power transmitted to it through shaft 189, phase-change coupling 190, shaft 191, variable speed mechanism 192, and shaft 193, which is geared to the drive shaft. At least one of feed rollers

175 and 176 is driven in coordination with the printing cylinder 172, the driving power being transmitted from the drive shaft 186b through shaft 194, variable speed mechanism 195, and shaft 196. The movable blade 177 of the web cutting shears is adapted to be actuated by cam 197, which is also driven in coordination with the printing cylinder 172. The power for driving the cam 197 is derived from the power shaft 186b through shaft 198, variable speed mechanism 199, shaft 200, phase-changing coupling 201, and shaft 202.

Pressure roller 174 is rotatably mounted on a pivoted frame 203, which is adapted to be rocked by cam 188. When the inactive (or low) zone of cam 188 is in contact with roller 204, the pressure roller 174 holds the web 145 in contact with the printing cylinder 172. Accordingly, throughout the inactive zone of cam 188 the web is printed with any design which passes the printing zone of the printing cylinder 172. However, during the active (or high) zone of cam 188, the pressure roller 174 is elevated, with the result that the web is out of contact with the printing cylinder and no printing takes place.

While the web is out of contact with the printing cylinder, it is, nevertheless, advanced by feed rollers 175, 176, which may be driven at the same peripheral speed as the speed of the printing cylinder 172. By means of variable speed mechanism 195, the peripheral speed of feed rollers 175, 176 may be adjusted to conform with the peripheral speed of different sizes of printing cylinders 172 which may be inserted into the machine. Variable speed mechanism 199 provides an adjustment so that the cutting shears may be set to operate at any desired frequency in relation to the cyclic operation of the machine; for example, the web may be severed into lengths corresponding to one, less than one, or more than one revolution of printing cylinder 172. Phase-change coupling 201 provides a means whereby the point of severance may be located on the web, though a similar location may be effected by adjusting the position of roller 180. Variable speed mechanism 192 permits the control cam 188 to be rotated at various cyclic rates in relation to the rotation of the printing cylinder 172. Also phase-change coupling 190 permits any inactive sector of cam 188 to be located in coordination with any selected peripheral zone of the printing cylinder 172.

The press may be so controlled that upon being set in operation, it automatically stops after one or more printing cycles (e. g. after printing and cutting one or more slips). This control may be the same as that previously described in connection with Figs. 2 and 5; and it is so illustrated in Fig. 12.

A cam 300 is shown as driven from drive shaft 186a through shaft 301, variable speed mechanism 302, shaft 303, phase change coupling 304, shaft 305, and shaft 306. Thus cam 300 may be set at any phase with respect to the printing cylinder; and for each revolution of the printing cylinder, this cam may make one, more than one, or less than one revolution. Once each revolution, cam 300 elevates member 310 and stops the press. The starting and stopping of the press is effected by controlling motor 185 with a mechanical and electrical system associated with member 310. In Fig. 12 such mechanical and electrical system is identical with

that shown in Fig. 2 and previously described; and in Fig. 12 the same reference characters are used to designate the respective parts duplicated from Fig. 2.

Fig. 13 shows more clearly the diagrammatic phase-change couplings 190, 201, and 301. The driving shaft of the coupling is keyed to a collar 205 and the driven shaft is keyed to an abutting collar 206. Set screw 207 secures collar 205 to the driven shaft for the transmission of power. By loosening the set screw, the driven shaft can be rotated with respect to the driving shaft to change the operating phase of the part actuated from the driven shaft. To aid in making the adjustment, the contiguous ends of collars 205 and 206 may be provided with a scale and co-operating index as shown in the drawings.

As referred to in connection with Figs. 1 to 11 of the drawings, the control cam for elevating and depressing the pressure roller may be of a suitable adjustable type. One of such type of adjustable cam is shown in Fig. 14. Affixed to the cam shaft is a cam element 210 having an active (or high) zone which extends clockwise from the line *s* to the line *t*. Rotatably mounted on the cam shaft is a replaceable and adjustable cam element 211 having an active zone extending clockwise from the line *u* to the line *v*. Attached to cam shaft 212 is a collar 213 which holds the adjustable cam element 211 against the main cam element 210. A bolt 208 passes through an arcuate slot 209 in the adjustable cam element and is threaded into the main cam element. The cam roller *x* has a face wide enough to engage both the edge of the main cam element 210 and the adjustable cam element 211. By setting the adjustable cam element to effect various degrees of overlap of the active zones of elements 210 and 211, the effective active and inactive zones of the cam are varied.

Figs. 15 to 23

These figures show a few of the many printing effects that may be produced by a press such as illustrated in Fig. 12 of the drawings. The webs shown in these figures represent the web after it has been acted upon by the printing cylinder. For the sake of illustration, the printing cylinder is assumed to be engraved with either a square design, or a circular design, or both. Each design printed on the web is illustrated in full lines. Where a design on the printing cylinder passes the printing zone without being printed (due to pressure roller 174, Fig. 12 being elevated), the location of such design with respect to the web is indicated in dot-dash lines in Figs. 15 to 23.

For each of Figs. 15 to 23 the printing cylinder is the same size and cam 188 is the same, though rotated at various speeds relative to the printing cylinder. In each of these figures, one printing cylinder revolution corresponds to the web length between consecutive of the vertical dot-dash lines. However, the location of these lines has nothing to do with the beginning and end of the printed slips (if such are being made) as the web may be so severed as to place the design on any selected part of the slip.

For Fig. 15, the control cam (188 in Fig. 12) rotates synchronously with the printing cylinder which has one square engraving. The cam action graph 188a indicates that the web is in contact with the printing cylinder during intervals I (five shown) and out of contact during intervening

intervals h . Accordingly, web 145a is printed as shown, with one rectangle per printing cylinder revolution; and the length of the printing cylinder impression is equal to arrow 400a, which is the peripheral length of the printing cylinder.

To print the web 145b shown in Fig. 16 it is only necessary to so adjust the speed of cam 188 that it makes one revolution for each two revolutions of the printing cylinder. In other words, the cam runs at half the angular speed of the printing cylinder. As indicated by cam graph 188b, the design is printed only every second revolution of the printing cylinder, so that the printing cylinder impression is twice the peripheral length of the printing cylinder, as indicated by the length of arrow 400b.

Fig. 17 shows the effect of reducing the angular speed of the cam 188 to one third that of the printing cylinder as indicated by graph 188c. The design is printed on web 145c only once every third revolution of the printing cylinder; and the printing cylinder impression has a length equal to arrow 400c.

In Fig. 18 the web 145d is printed the same as the web in Fig. 17. The printing cylinder impression has the same length as indicated by arrow 400d. However, the result is obtained by rotating the control cam at two-thirds the angular speed of the printing cylinder, the cam action being indicated by graph 188d.

For Figures 19 to 23, the printing cylinder has both square and circular engravings. Operated in continuous contact with the web, it would print the web 145e shown in Fig. 19, the length of the printing cylinder impression being indicated by arrow 400e.

If this two design cylinder is used with the cam 188 operating as for Fig. 15, it prints a web 145f as shown in Fig. 20. This is the same as web 145a, the circular design being blanked out by the cam action indicated by graph 188f. The length of the impression is that of arrow 400f.

By cutting the cam speed in half as indicated by graph 188g, Fig. 21, the web 145g is printed. This is the same as web 145b, Fig. 16, the length of the printing cylinder impression being that of arrow 400g.

For Fig. 22, the cam is operated synchronously with the printing cylinder as indicated by graph 188h. However, the phase of the cam is shifted 180 degrees from the condition indicated in Fig. 20. Thus, the web 145h is printed with the circular design instead of the square design. Arrow 400h indicates the length of the impression, which is equal to the peripheral length of the printing cylinder.

For Fig. 23, the cam 188 is slowed to half speed as indicated by graph 188i. The result is that the length of the impression is doubled as indicated by the length of arrow 400i; and web 145i is printed with the circular design every second revolution of the printing cylinder.

From these examples, it will be apparent that a variety of effects may be produced by suitably correlating the angular speeds of the control cam and printing cylinders. These may be related after the manner of ratios used in hunting tooth gear sets. Thus even with a cam speed near to the cylinder speed, the length of the impression may be made several (or even many) times the peripheral length of the printing cylinder. Also, the same cylinder may have various designs which may be printed selectively or in various chosen combinations.

In compliance with the patent statutes, I have disclosed the best forms in which I have con-

templated applying my invention. However, it will be understood that the disclosures are illustrative and not limiting.

What I claim is:

1. In a rotary intaglio printing press including a printing cylinder and a fountain housing having means for wiping the cylinder to condition it for printing, the improvement which comprises: an ink reservoir, a pivotally mounted support for the wiping means, and a sealing element, all three included in the fountain housing, said support having a curved face extending lengthwise of the printing cylinder, and said sealing element being in sealing engagement with said curved face and also in sealing engagement with a wall of said ink reservoir.

2. In a rotary intaglio printing press adapted to accommodate printing cylinders of different diameters and including a fountain housing having means for wiping the cylinder to condition it for printing, the improvement which comprises: an ink reservoir, a support for the wiping means pivotally mounted for cooperation with different sizes of printing cylinders, and a sealing element, said reservoir, support, and sealing element being included in the fountain housing, said support having a curved face concentric with the pivotal axis of the support, and said sealing element being attached to a side wall of said reservoir and making sliding sealing engagement with said curved face, whereby said side wall is in sealed connection with said support when the support is in the different positions corresponding to the different sizes of printing cylinders.

3. A rotary intaglio printing press comprising: a printing cylinder; a fountain housing; frame standards having portions thereof included in the fountain housing; a doctor knife in engagement with the cylinder to wipe the cylinder preparatory to printing, the doctor knife approaching the cylinder in a direction that is nearer to being tangential than it is to being radial; means to reciprocate the doctor knife lengthwise of the printing cylinder; and a non-reciprocating curving member deflecting the wiping edge of the doctor knife, the direction of deflection being away from a plane tangent to said cylinder and toward a plane radial to said cylinder, and the ends of the curving member being in engagement with said frame standards to aid in sealing the fountain housing.

4. A rotary intaglio printing press comprising: a printing cylinder, a support pivoted on an axis parallel to the axis of said cylinder; a doctor knife reciprocally supported by said support, adjustment means operable to swing said support on its pivotal axis and thereby move said doctor knife out of and into wiping engagement with said cylinder, and means to yieldingly bias said doctor knife into wiping engagement with said cylinder whereby the wiping pressure is maintained as the wiping edge of the doctor knife wears back.

5. In a rotary intaglio printing press adapted to accommodate printing cylinders of different diameters, the improvement which comprises: a doctor knife for wiping the printing cylinder; a support for the doctor knife pivoted on an axis parallel to the axis of the printing cylinder; and mechanism for both rotatively adjusting said support to locate the doctor knife for engagement with printing cylinders of different sizes and for rotatively biasing the support to establish wiping pressure, said mechanism comprising a first arm pivoted coaxially with said support, means to secure said arm in different angular

positions, a second arm also pivoted coaxially with said support, means to releasably lock said two arms together, a third arm fixedly secured to said support, and spring means to rotatively bias said third arm with respect to said second arm.

6. In a rotary intaglio printing press adapted to accommodate printing cylinders of different diameters, the improvement which comprises: a doctor knife for wiping the printing cylinder; a support for the doctor knife pivoted on an axis parallel to the axis of the printing cylinder; and mechanism for both rotatively adjusting said support to locate the doctor knife for engagement with printing cylinders of different sizes and for rotatively biasing the support to establish wiping pressure, said mechanism comprising a pressure-receiving arm connected with said support to transmit rotative movement and pressure to the support, spring means engaging said pressure-receiving arm to rotatively bias the same, means to sustain the reactive force of said spring means, and means to fix said sustaining means in different angular positions with respect to rotative position about the axis of said doctor knife support.

7. For a rotary intaglio printing press, the combination of: a doctor knife support having a longitudinal bore and a guide slot extending outwardly from the bore, a reciprocatory shaft positioned in said bore, and a doctor knife holder having a longitudinally extending key portion fitted into said slot and attached to said shaft.

8. In a rotary intaglio printing press, the combination of a pivotally mounted doctor knife support having a longitudinal bore and a guide slot extending outwardly from the bore, a reciprocatory shaft positioned in said bore and extending beyond at least one end of the bore, and a doctor knife holder having a longitudinally extending key portion slidably fitted into said slot and attached to said shaft.

9. In a rotary intaglio printing press, the combination of a pivotally mounted doctor knife support having a longitudinal bore concentric with its pivot and also having a guide slot extending outwardly from the bore, a reciprocatory shaft positioned in said bore and extending beyond at least one end of the bore, a doctor knife holder having a longitudinally extending key portion slidably fitted into said slot and attached to said shaft, and means in engagement with the extending portion of said shaft to reciprocate said shaft and thereby reciprocate said doctor knife holder.

10. In a rotary intaglio printing press adapted to accommodate printing cylinders of different diameters and including a fountain housing having means for wiping the cylinder to condition it for printing, the improvement which comprises: an ink reservoir, a pivotally mounted support, a doctor knife supported by the support, and a sealing element, said reservoir, support, doctor knife and sealing element being all included in the fountain housing, means to place said support in different pivotal positions to locate said doctor knife for cooperation with printing cylinders of different diameters, said sealing element being effective to seal said support to a wall of said reservoir when the support is in the different pivotal positions, and means to reciprocate said doctor knife, said reciprocating means including a reciprocatory element concentric with the pivotal axis of said support.

11. A rotary intaglio printing press comprising:

a printing cylinder having journal extensions, a drive sleeve fitted to one of said extensions to support the same and rotate the printing cylinder, said sleeve having a worm portion, a reciprocatory doctor knife, and mechanism for reciprocating said doctor knife, said mechanism being driven from said worm portion of the drive sleeve, the driving connection including a gear meshing with said worm portion.

12. Means for inking the printing cylinder of a rotary intaglio printing press, said means comprising: an ink reservoir, a pivotally mounted inking manifold movable into different pivotal positions to cooperate with printing cylinders of different diameters, said manifold having a passage through its pivot and having an elongated discharge port in communication with said passage, said discharge port being adjacent to the printing cylinder, and pump and conduit means to convey ink from said reservoir to said manifold through said passage in said pivot.

13. In a rotary intaglio printing press including a printing cylinder and a fountain housing having means for inking said cylinder, the improvement which comprises, an ink reservoir, a pivotally mounted inking manifold, and a sealing element, all three included in the fountain housing, said manifold having a curved face extending lengthwise of the printing cylinder, and said sealing element being in sealing engagement with said curved face and also in sealing engagement with a wall of said ink reservoir.

14. A rotary intaglio printing press comprising: a printing cylinder, and a fountain housing, said housing including devices on opposite sides of the printing cylinder, one of said devices being an inking manifold and the other being a doctor knife support, said fountain housing also including an ink reservoir beneath the printing cylinder, and sealing means, the ink reservoir being pivoted for movement from operating position to a lowered cleaning position, and said sealing means including a sealing element attached to one wall of the ink reservoir and operable to make sealing engagement with one of said devices when the reservoir is in operating position.

15. In a rotary intaglio printing press including a frame, a printing cylinder, and means for inking the cylinder, the improvement which comprises: an ink reservoir pivoted to the frame for movement from operating position to a lowered cleaning position, the reservoir having a port passing through its pivot; and pump and conduit means connected to withdraw ink through said port and deliver it to the printing cylinder.

16. A rotary intaglio printing press comprising: a printing cylinder, and a fountain housing, said housing including an inking manifold on one side of the printing cylinder, a doctor knife support on the opposite side of the printing cylinder, an ink reservoir beneath the printing cylinder, and sealing means, the ink reservoir being movable from operating position to a lowered position, and said sealing means including sealing elements operable to seal the reservoir to both said manifold and said support when the reservoir is in operating position.

17. A rotary intaglio printing press comprising: a printing cylinder, an inking manifold having a discharge port adjacent to the surface of the printing cylinder, a resilient sealing member secured to the manifold alongside of said port and adapted to project into sealing engagement with the surface of said cylinder, means to move the discharge port of said manifold toward and

away from the printing cylinder, and means to bias the manifold to yieldingly urge said sealing member against the surface of the printing cylinder and automatically compensate for wear in the sealing member.

5 18. A rotary intaglio printing press comprising: a printing cylinder, an inking manifold having a discharge port adjacent to the surface of the printing cylinder, a resilient sealing member
10 secured to the manifold and adapted to project into sealing engagement with the surface of said

cylinder, means to adjust and set the manifold in different nominal positions for cooperation with printing cylinders of different diameters, and means operative in the different nominal positions to yieldingly urge the manifold toward the printing cylinder to maintain sealing engagement between said sealing member and the cylinder as the sealing member wears in operation of the press.

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