Oct. 7, 1930. F. J. CONNOLLY 1,777,785

PRINTING APPARATUS

Filed Nov. 24, 1928 2 Sheets-Sheet 1

Fig. 1.

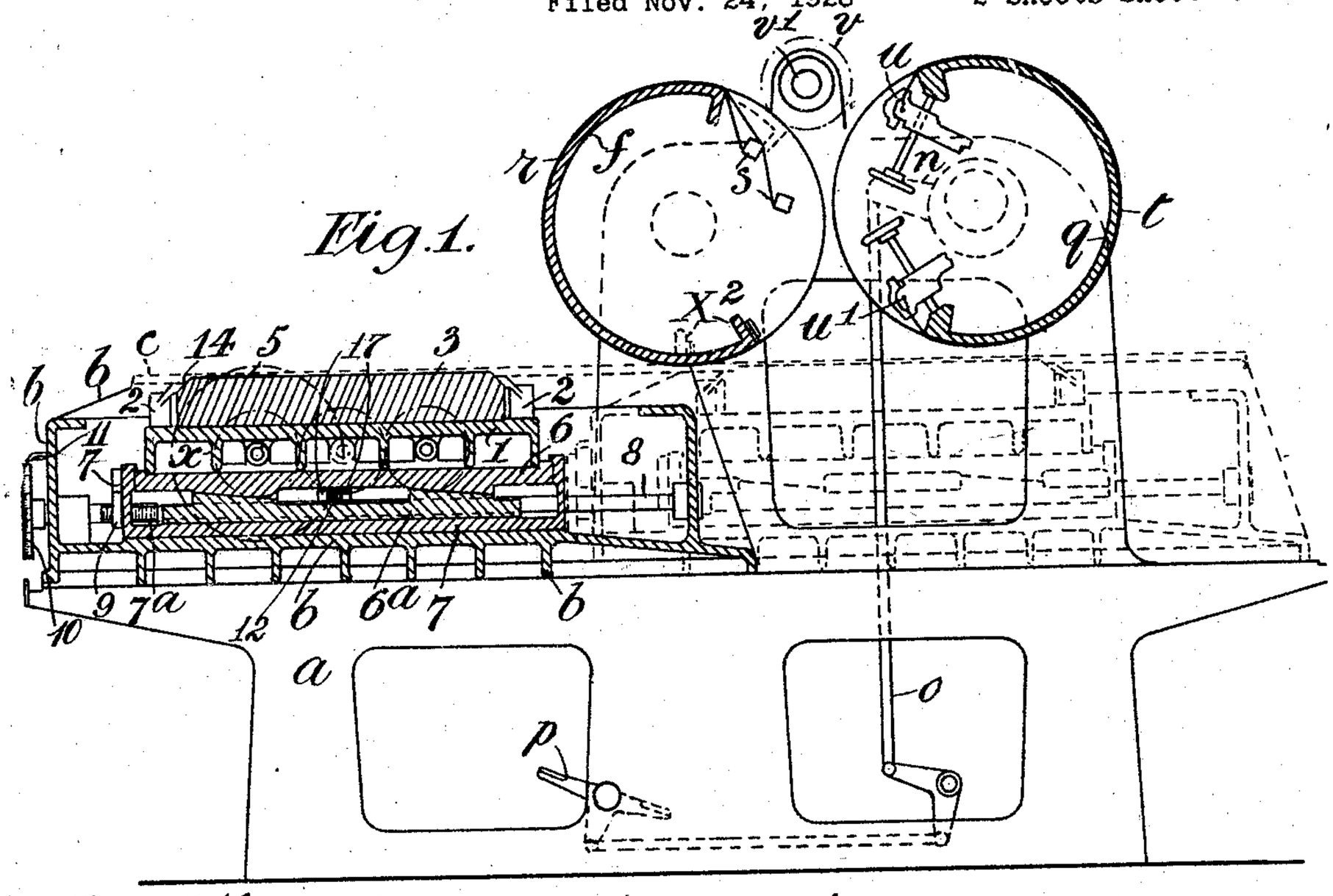

Fig. 5.

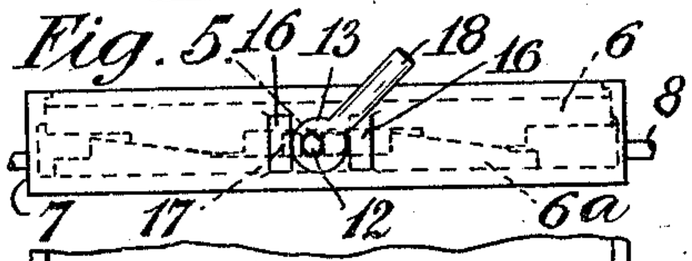

Fig. 6.

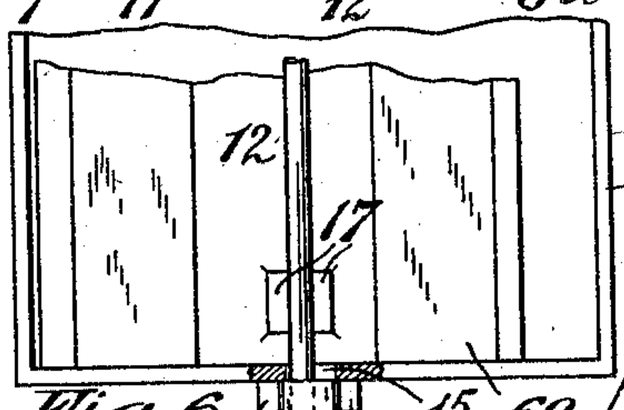

Fig. 3.

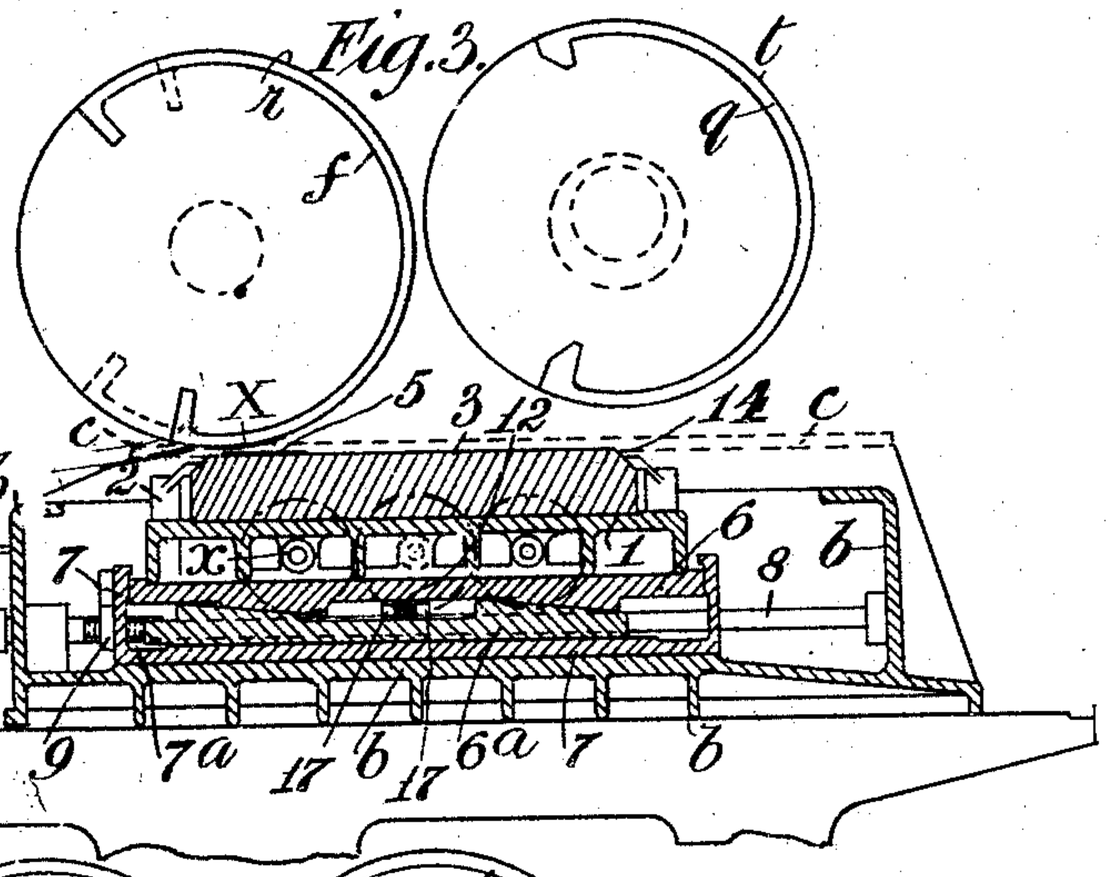

Fig. 4.

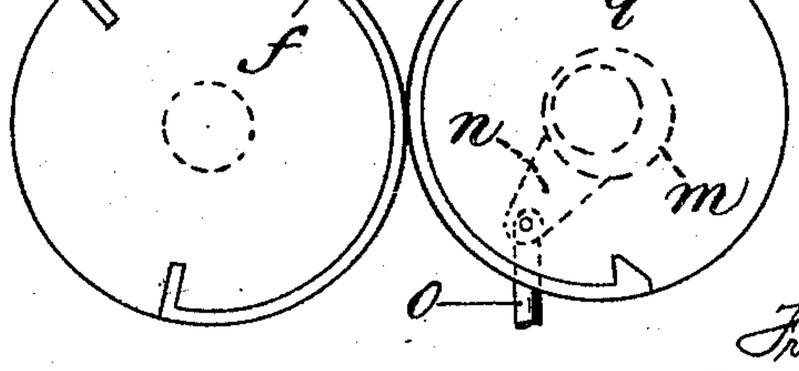

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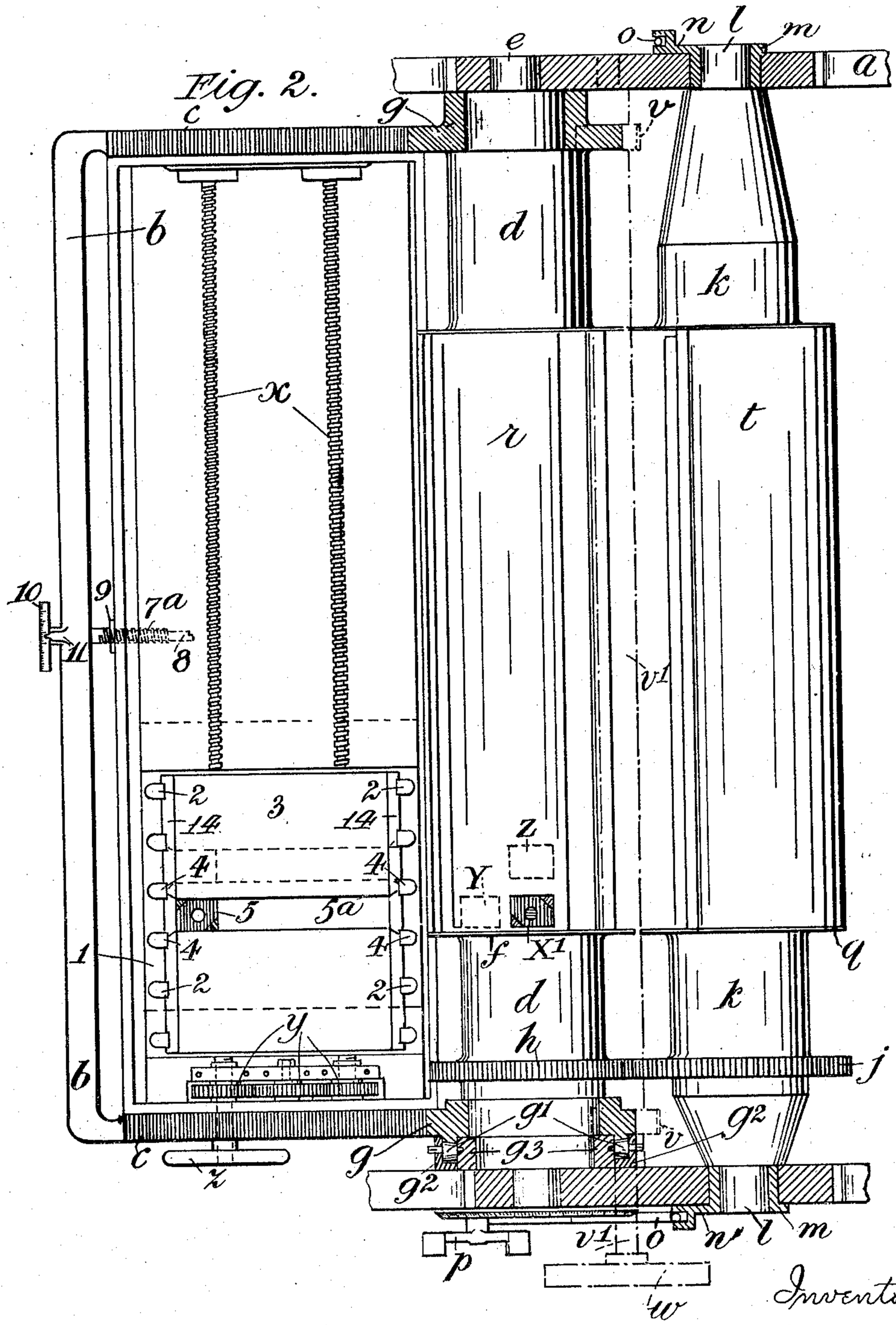
Fig. 2.



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UNITED STATES PATENT OFFICE

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PRINTING APPARATUS

Application filed November 24, 1928, Serial No. 321,724, and in Great Britain November 25, 1927.

This invention comprises improvements in printing apparatus and is primarily concerned with means whereby large numbers of copies of an original are produced by the aid of a number of reproductions of the original on one plate. Heretofore, it has been the common practice to adopt one of two methods. According to one of these methods, a number of lithographic impressions were taken from the original upon transfer paper and were attached in suitable disposition to a suitable backing or carrier by the aid of which they were transferred to a larger plate of the desired size, which plate was mounted upon a printing cylinder or flat bed. According to the other of these methods, a number of photolitho impressions of the original were produced upon a zinc plate which was mounted upon the printing cylinder. By these methods, a number of prints were obtained per revolution of the printing cylinder, so that the speed of production was greatly accelerated. These methods, however, were attended with certain defects and difficulties. For example, in one case accurate setting or registering of the several printing plates or surfaces was demanded owing to the position of each unit having been determined by hand and eye and not mechanically. The accurate setting or registering of such surfaces is all-important where colour printing is concerned, for it is essential that all copies should be properly spaced and that in the case of more than one colour appearing each colour should fall into its correct position. In the other case, special photographic plant had to be installed and a skilled photographer was required for operating it.

Proposals have been made to produce large numbers of identical copies by the aid of a number of reproductions obtained from the original by the off-set process. This process enables methods of precision to be adopted, whereby all reproductions from the original are not only identical in every respect but are registered or set with mathematical accuracy and with greater fidelity to the original. The reproductions are much sharper than from a transfer on transfer paper and the plates produced are more easily prepared for printing from owing to the absence of "dirt" which always "rolls up" from a paper transfer. The said proposals have included the taking up of a number of impressions of the original by an off-set or transfer cylinder, such impressions being subsequently transferred to a printing plate supported upon a flat bed and the printing plate being then available for the printing of a number of reproductions at every operation. The object of the present invention is to improve upon these off-set methods and to avoid defects which it is believed have heretofore been responsible for the failure of such methods to become a practical success.

According to this invention, the original is mounted upon a saddle or carrier which is mounted with micrometer or fine adjustment upon a bed geared with a rotary off-set or blanket cylinder so that relative reciprocatory motion can take place simultaneously with the revolution of the off-set cylinder, and a plate cylinder is geared with the off-set cylinder and is adapted for the mounting of a printing plate which receives from the offset cylinder and can subsequently be used, or developed for use, as printing surfaces. A trip mechanism may be operative upon the plate cylinder for intermittently throwing it into and out of pressure relation with the off-set or blanket cylinder, but so that the plate cylinder never loses its original angular or circumferential setting relatively to the blanket cylinder. The employment of a plate cylinder in the combination is important from the point of view of obtaining reproductions which are all faithful to the original and alike in all respects. If the off-set cylinder is employed for transferring its impressions to a flat printing plate, defects or infidelities may develop due to the pressure contact of the off-set roller upon a plane surface, and further defects and infidelities may develop when such flat plate is bent and possibly distorted in order to mount it upon a printing cylinder. By the employment of a plate cylinder, simple mechanism can be used for effecting a co-operative working of the parts, the transfer operation is accurately and smoothly performed, and the printing plate

receiving the impressions is already in the cylindrical form in which it is ultimately to be used in the printing machine. The blanket cylinder may be rotatively adjustable in relation to its gear in order to enable a fresh segment of its surface to be brought into contact with the original.

Finally, as considerable pressure may be required, in some cases, between the plate cylinder and blanket cylinder, it may be desirable to substitute for the rubber blanket which is ordinarily used a blanket composed of a harder or more resistant material such as vulcanized rubber or vulcanite, celluloid or casein.

In order to enable the invention to be readily understood, reference is made to the accompanying drawing illustrating an example of an off-set machine embodying these improvements, in which drawing:—

Figure 1 is a longitudinal sectional elevation.

Figure 2 is a plan.

Figure 3 is a view showing part of Figure 1 in a different working position.

Figure 4 is a diagrammatic side elevation illustrating a trip mechanism for the plate cylinder.

Figure 5 shows in side elevation the platen carrier and means for raising and lowering the platen and

Figure 6 is a sectional part plan of Figure 5, the upper wedge plate being removed.

Referring to the drawings. *a* is the framing of the machine having suitable guideways for supporting a sliding saddle or bed *b*, the latter being fitted with side racks *c*. A cylindrical body *d*, journalled at *e* in suitable parts of the framing, is fitted with an off-set cylinder *f* and revolubly supports toothed gears *g* for meshing with the racks *c*. The body *d* is also fitted with a toothed gear *h* for meshing with a similar gear *j* carried by a cylindrical body *k*. The last named is journalled at *l* in revolubly adjustable eccentric bushes or sleeves *m* in the framing, the said eccentric bushes being formed with arms *n* which are pivotally connected with rods *o*. Arms or the like on the shaft of a double pedal *p* are adapted for lifting or lowering the rods *o* to effect adjustment of the bushes *m* for the purpose hereinafter described. The cylindrical body *k* is fitted with a plate cylinder *q*. The off-set cylinder *f* has a rubber or other off-set blanket *r* wrapped around it and is fitted with blanket stretching means diagrammatically indicated at *s*.

The plate cylinder *q* has a printing plate *t*, wrapped around it and is fitted with plate stretching means *u* and *u'* of any suitable construction. Toothed pinions *v* mesh with the toothed gears *g*, the shaft *v'* (shown by broken lines in Figure 1) of these pinions *v* being fitted with a driving pulley or hand wheel *w* shown by chain lines in Figure 2.

Upon the sliding bed *b* is a frame 7 by which is carried a vertically movable platform 6, having wedge shaped under surfaces adapted to be engaged by a wedge plate 6ª also carried in the frame 7 and adjustable forwards and rearwards therein. This wedge plate 6ª when moved forwardly allows the platform 6 to descend so as to lower a platen 3 carried by the said platform and when moved rearwardly raises the said platform and platen. Movement of the wedge plate 6ª is effected by a rock shaft 12 having an eccentric 13 on one or both of its ends which ends pass through horizontal guide slots 15 in the side members of the frame 7, each said eccentric 13 being revoluble between lugs 16 forming a vertical guide on the frame 7.

The rock shaft 12 which, by the eccentrics, is moved in the slots 15 in a direction at right angles to its axis engages between vertical lugs 17 on the wedge plate 6ª. A lever 18 adapted to be operated by hand or by a suitable tappet on the machine frame, is suitably connected to the eccentric 13 whereby the eccentric is turned so as to move the rock shaft in its guides 15 and so through its engagement with the lugs 17 on the wedge plate 6ª cause the latter to be moved either forwardly or rearwardly according to the direction of rotation of the eccentric. On the platform 6, a plate 1 having depending flanges is supported. A number of clips 2 are carried by the plate 1, which engage the platen 3. An original design 5, for reproduction is attached to the platen 3. The original design in the example shown is formed at one end of a narrow strip 5ª secured to the platen as by means of the clips 4. In its rearwardly adjusted position as shown in Figure 1 the wedge plate 6ª has elevated the platform 6, plate 1 and platen 3 to a position in which the original 5, will make pressure contact with the blanket *r* of the off set cylinder *f* when the bed *b* is moved beneath the said cylinder. In its forwardly adjusted position as seen in Figure 3 and in dotted lines in Figure 5 the wedge plate 6ª has permitted the platform 6 and the parts carried thereby to descend a little so that the original 5 on the platen 3 will not make contact with the off-set cylinder when the bed *b* performs return stroke as it is about to do in Figure 3. A fine adjustment of the platen 3 relatively to the racks *c* and therefore the relation of the platen to the off-set cylinder may be effected by the screw 7ª on a longitudinal spindle 8 which revolubly engages the end cross members of the frame *b*, see Figure 1, and which screw works in a nut 9 in the rear end wall of the frame 7.

The screw 7ª can be turned by a hand wheel 10 having a suitable scale on its periphery so that the amount of adjustment can be de-

termined with accuracy by the aid of the pointer 11 fixedly mounted on the rear cross-member of the frame of the bed *b*.

The plate 1 is adjustable transversely on the platform 6 by means of transversely extending screws *x* rotatably carried by the platform and engaging suitable nuts on the undersurface of the plate 1. The screws *x* are geared together by means of pinions *y* one of these screws being revoluble by means of a hand wheel *z* the spindle supporting the same extending through a stop in the frame of the bed *b*.

As aforesaid, the gears *g* are not keyed to the cylindrical body *d* but are free to revolve on the journals or bearings formed thereon but between the gear *g* on the operator's side of the machine and the cylindrical body *d* there is a mechanism which can be operated for revolubly adjusting the cylindrical body *d* and off-set cylinder *f* in relation to the gears *g*.

In order to effect this adjustment, the gear *g* on the operator's side of the machine and which is freely supported on the cylindrical body *d*, is formed with lateral gear teeth which are engaged by pinions *g'* revolubly supported in a carrier comprising an outer and an inner ring g^2 and g^3 respectively, non revolubly connected to the body *d*. The arbors or spindles of the said pinions extend beyond the periphery of the outer ring g^2 and are formed with a squared or other suitably formed outer end by means of which they may be rotated in order thereby to rotate the body *d* in respect to the gears *g* and so adjust the off-set cylinder so that a desired portion thereof shall receive an impression from the original 5, in a position different from that in which a previous impression was received.

The operation is as follows:

With the parts in the position seen in Figures 1 and 2, the original 5 is inked up or otherwise prepared for the transfer operation. The wheel or pulley *w* is then revolved clockwise so that the gears *g* are revolved anti-clockwise and feed the racks *c* rightwardly in order to carry the platen 3 on the bed *b* beneath the off-set cylinder *f* to the position indicated by dotted lines in Figure 1. As the platen 3 passes under the cylinder *f* its surface makes pressure contact with the blanket *r* and an impression of the original design is transferred to such blanket as indicated by the thick line over the arc X Figure 3. In Figure 3, the transfer has just been effected and the wedge plate has been pushed forwardly by rocking the lever 18 to the right as shown in full lines in Figure 5 to lower the plate 1 and platen 3 so that the surface of the latter shall not make contact with the off-set cylinder *f* during the return stroke of the bed *b* which is effected by reversely revolving the wheel or pulley *w*. When the bed *b* returns to the position seen in Figures 1 and 2, the wedge plate 6^a is by rocking the lever 18 to the leftward position indicated in Figure 5 pushed to its rearward position for again elevating the plate 1 and platen 3. When the parts have returned to the position seen in Figures 1 and 2, the transfer which was made on to the blanket around the arc X in Figure 3, now appears at the position X' in Figure 2. It is now desired to make a second transfer on to the area enclosed by the dotted rectangle Y in Figure 2, and for this purpose the off-set cylinder *f* must be revolubly adjusted through an appropriate number of degrees. This is accomplished by operating the adjustable clutch mechanism to turn the off-set cylinder *f* clockwise in relation to its gears *g* and consequently in relation to the racks *c* and bed *b*. Such revoluble adjustment turns the cylinder *f* through the arc indicated by X^2 in Figure 1. The wheel or pulley *w* is now again revolved for moving the bed *b* forwards to the position seen in Figure 3, and at the end of this movement a transfer will be made on to the blanket over an arc similar to the arc X but displaced therefrom to the extent of the revoluble adjustment of the off-set cylinder, the dotted position of the cylinder being that in which it will receive the second transfer from the original 5. The wedge plate 6^a is pushed back and the bed *b* is returned to the position seen in Figures 1 and 2, whereupon the second transfer will be found in the position Y, Figure 2, relatively to the transfer X'. These operations are continued until a number of transfers have been made on to the blanket from the position X' at one end of the blanket to the last position at the opposite end of the blanket. Thereupon, the adjustable clutch mechanism is operated to revolve the off-set cylinder reversely so that it is restored to the original relative position which is the position seen in Figures 1 and 2. The handwheel *z* is then operated to adjust the plate 1 laterally for shifting the platen 3 into the dotted position shown in Figure 2, and a repetition of the operations above described will produce a transfer on to the area Z, Figure 2 and further transfers in alignment therewith around the cylinder *f*. The surface of the blanket *r* is thus progressively covered with transfers all identical in character and spaced apart, both axially and circumferentially of the cylinder *f*, with a high degree of accuracy rendered possible by the nature of the adjustments provided. When the blanket *r* is full, or has received the appropriate number of transfers, the rod *o* is operated by the pedal *p* for turning the bushes *m* in the direction for adjusting the plate cylinder *q* towards the off-set cylinder *f* so that the plate *t* will make pressure contact with the blanket *r* during the next revolution of the cylinders as indicated in Figure 4. For this transfer operation, the wedge plate

6ª is adjusted by the hand lever 18 before the platen 3 comes beneath the off-set cylinder *f* so that it makes no contact therewith. The wheel or pulley *w* is then turned for revolving the cylinders *f* and *q* and the blanket *r* transfers its impressions to the plate *t* which is then ready for use, or ready for development for use in a printing machine.

It will be noted that the platen 3 is formed with sharply bevelled ends 14 and it is important that the edge of the original design 5 should coincide with the angle between the horizontal top face and the end bevel face of the platen 3. By comparing Figures 1 and 3 it will be seen that when a transfer has been made upon an area of the blanket *r* no further contact takes place between such area and the platen 3. As soon as the cylinder *f* has rolled over the original 5 it ceases to make contact therewith owing to the bevel, and the platen 3 is thereupon lowered for the return movements. The revoluble adjustment of the off-set cylinder *f* to the new position has the result that at the end of the next forward movement of the bed *b* that portion of the blanket upon which a transfer has been made fails to reach the position in which contact can be made with the original 5, as will be clear from the dotted position Figure 3. Thus, the impressions or transfers on the blanket *r* are never brought into possibly harmful contact with the platen 3 and remain intact until the moment arrives for their transfer to the plate *t*.

If desired, impressions when produced on the plate may be covered with lithographic gum solution in order to protect them against the blanket during contact periods occurring when further impressions are being taken.

Instead of rotatively adjusting the cylinder *f q* as above described, a similar result may be obtained by longitudinal adjustment of the bed *b* in relation to its rack *c*, or in relation to the cylinder *f*.

In order to take full advantage of the possibility of economizing space and of getting as many impressions as possible on a printing plate *t*, the width of the bed *b* is made greater than the length of the cylinders *f* and *q* so that the sides of the bed *b* are beyond the respective cylinder ends as seen in Figure 2. Thus, when the original copy is narrower in width than the plate 1, as is the case with the copy 5 in the example illustrated, the said copy may be arranged centrally on such plate 1, and the latter be laterally adjusted to one side so that one of its unoccupied side or marginal portions is beyond the ends of the cylinders at that side. Thus, the first row of impressions may be made upon the cylinder close to the edge thereof, as shown in Figure 2, so that no space is wasted and so that there may even be room for an additional circumferential row which may be impressed close to the opposite edge of the said cylinder.

The laterally adjusting mechanism for the plate 1 may comprise a coarse adjustment for quickly shifting the said plate and a micrometer adjustment for finally adjusting it with precision in the desired lateral position. Means may be provided so that when required any given side of the original may be placed in a true parallel position in relation to the edge of the transferring blanket and/or at a true right angle, and that any given position in relation to the cylinder may be definitely and exactly re-occupied subsequently.

It is to be understood that the press may be used as a transfer press for originals either of planographic, relief, or intaglio character, and that the plate cylinder may carry material other than metal for receiving the off-set impression, such as textiles, ivorine, or celluloid.

I claim:—

1. Off-set printing machine for carrying out a method of the kind described, comprising a block or platen adapted for supporting the original, a reciprocatory bed, a transverse adjustment operative for shifting the platen laterally of said bed, an off-set cylinder, gearing between said cylinder and the reciprocatory bed, an adjustment operative for turning said cylinder through predetermined angles in relation to said gearing, and a plate cylinder geared with the off-set cylinder substantially as described.

2. Off-set printing machine for carrying out a method of the kind described, comprising a block or platen adapted for supporting the original, a mechanism operative on said platen for elevating or lowering the latter into and out of pressure contact relation with the off-set cylinder, a reciprocatory bed, a transverse adjustment operative for shifting the platen laterally of said bed, an off-set cylinder, gearing between said cylinder and said bed, an adjustment operative for turning said cylinder through pre-determined angles in relation to said gearing, and a plate cylinder geared with the off-set cylinder substantially as set forth.

3. Off-set printing machine for carrying out a method of the kind described, comprising a platen, adjustable into and out of pressure contact relation with an off-set cylinder, a reciprocatory bed supporting said platen and geared with the off-set cylinder, a clutch mechanism adjustable for altering the angular relation between the off-set cylinder and its gear, a plate cylinder constantly geared with the off-set cylinder, and a trip mechanism operative for putting said plate cylinder into and out of pressure contact relation with the off-set cylinder.

4. Off-set printing machine for carrying out a method of the kind described comprising a platen having a bevelled edge at one end

and adapted for the mounting of the original with an edge of such original coinciding with the commencement of the bevel, an adjustment for altering the elevation of said platen, a reciprocatory bed supporting said platen and geared with the off-set cylinder, a mechanism adjustable for altering the angular relation between the off-set cylinder and its gear and a plate cylinder geared with the off-set cylinder substantially as set forth.

5. Off-set printing machine for carrying out a method of the kind described, comprising a platen, a reciprocatory bed supporting same, an adjustment operative between said bed and said platen for altering the elevation of the latter, an off-set cylinder, toothed gearing between said cylinder and said bed, and toothed clutch mechanism operative for turning said cylinder in relation to said gearing substantially as set forth.

6. Off-set printing machine for carrying out a method of the kind described, comprising a platen, a reciprocatory bed, precision adjustments operative upon said platen for altering the longitudinal and lateral positions, an adjustment operative between said bed and said platen, for altering the elevation of said platen, an off-set cylinder, toothed gearing between said bed and said cylinder, and adjustable clutch mechanism operative for turning said cylinder in relation to said gearing substantially as set forth.

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