

L. J. R. HOLST.
MACHINE FOR BUILDING UP DESIGNS ON CYLINDRICAL PRINTING SURFACES.
APPLICATION FILED FEB. 25, 1913.

1,107,520.

Patented Aug. 18, 1914.

4 SHEETS—SHEET 1.

FIG. 3 -

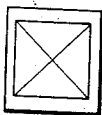


FIG. 6 -

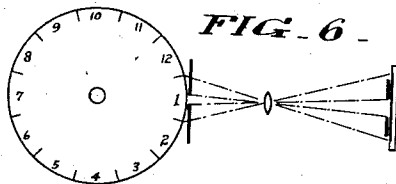


FIG. 4 -

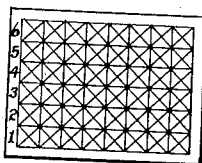
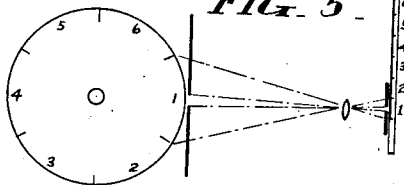
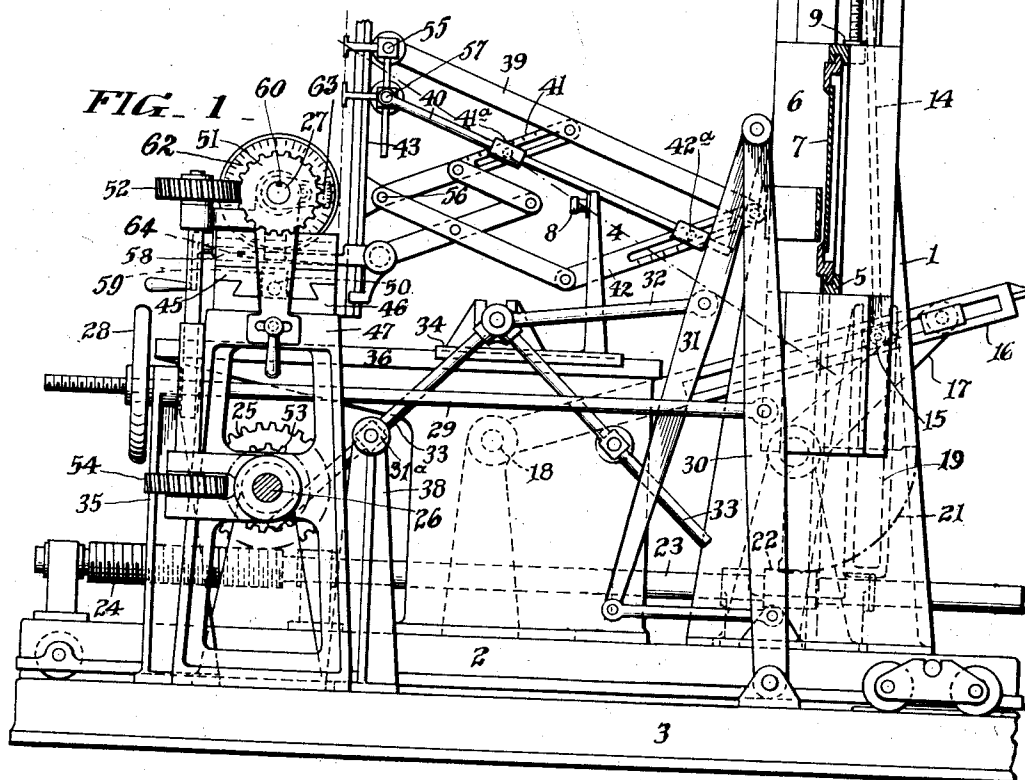


FIG. 5 -



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By

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4 SHEETS-SHEET 2.

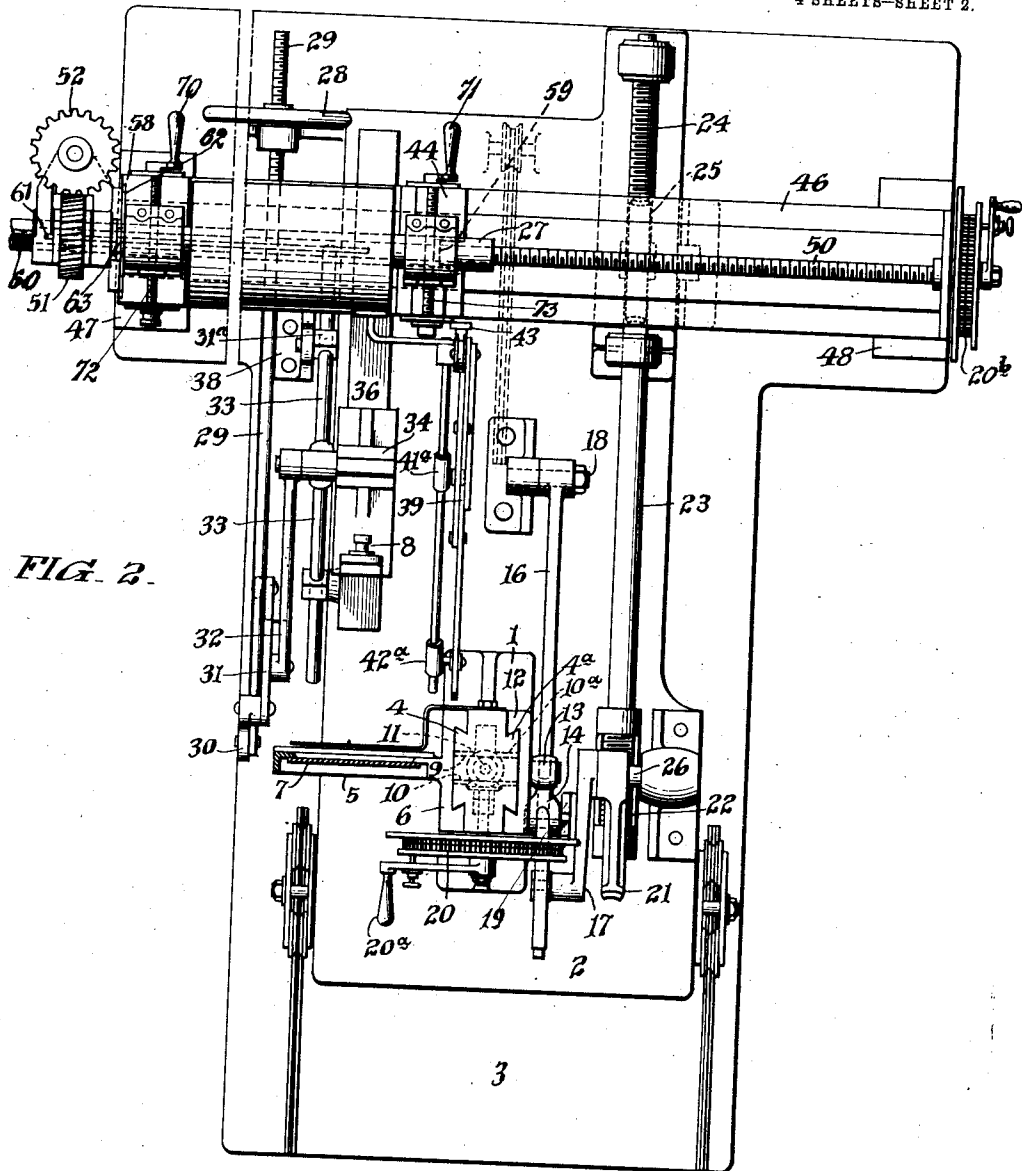


FIG. 2.

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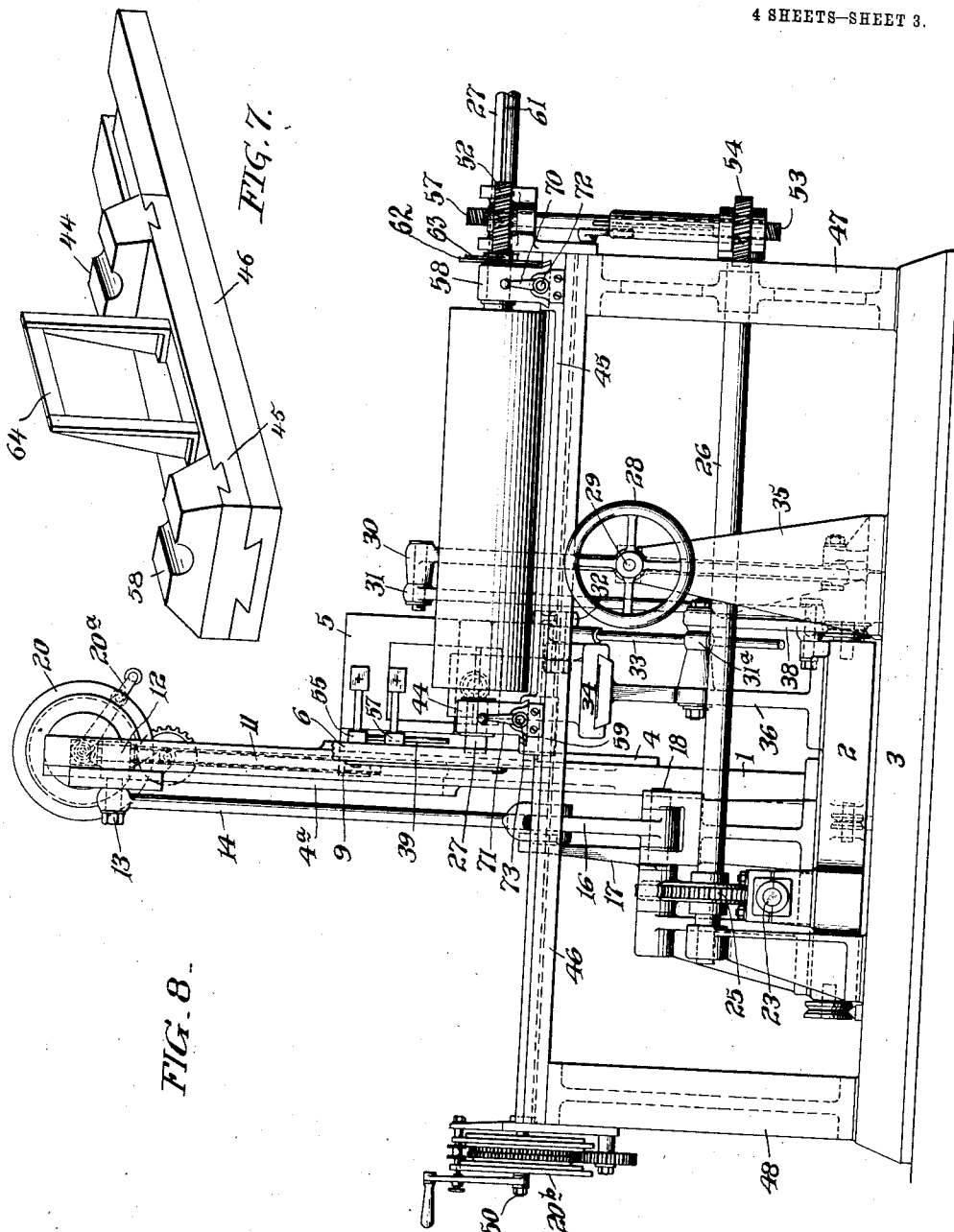


FIG. 8.

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 4 SHEETS—SHEET 4.

1,107,520.

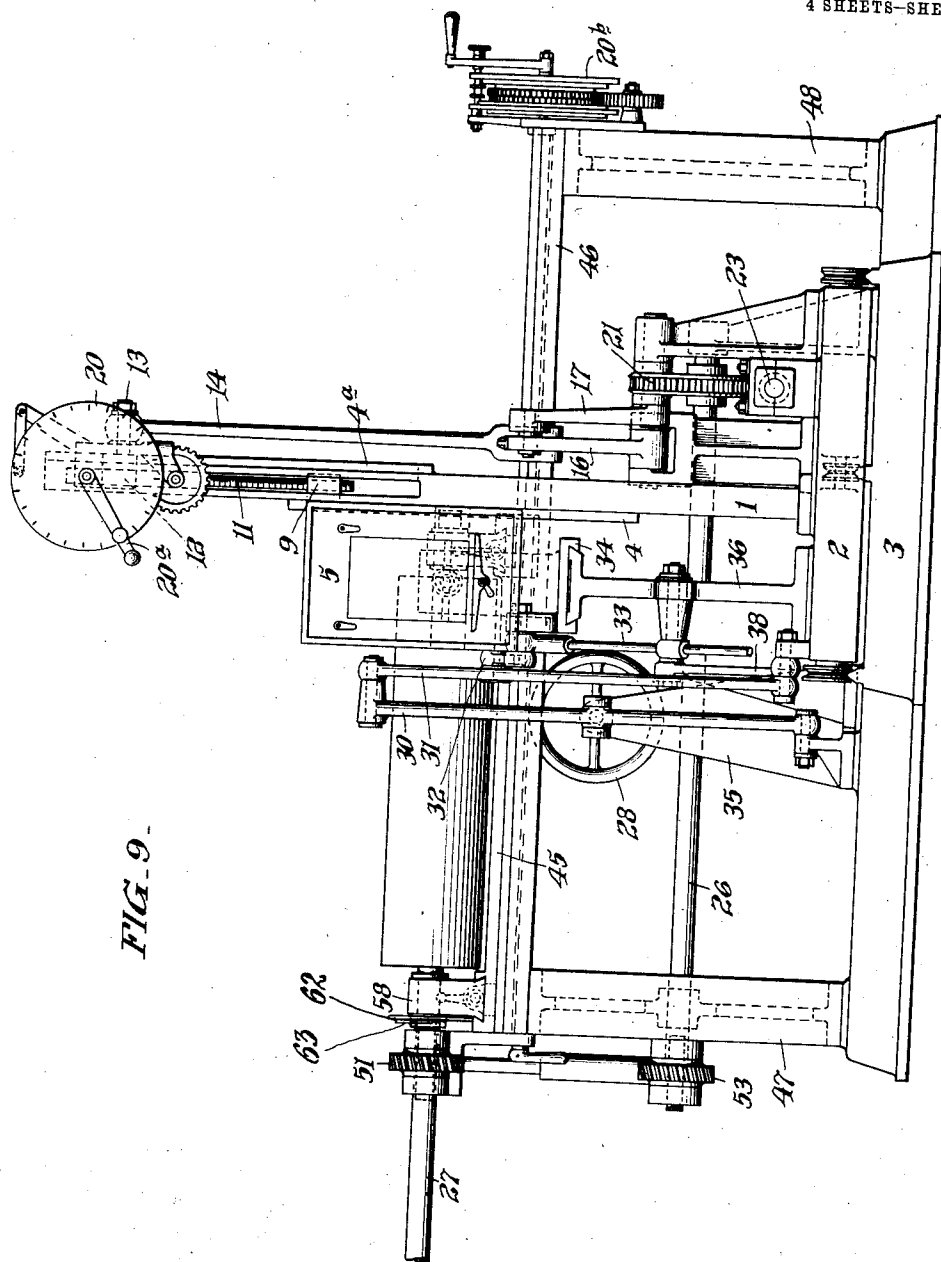


FIG. 9.

WITNESSES
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UNITED STATES PATENT OFFICE.

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MACHINE FOR BUILDING UP DESIGNS ON CYLINDRICAL PRINTING-SURFACES.

1,107,520.

Specification of Letters Patent.

Patented Aug. 18, 1914.

Application filed February 25, 1913. Serial No. 750,481.

To all whom it may concern:

Be it known that I, LODEWYK JAN RUTGER HOLST, a citizen of the United States, residing at Lansdowne, in the county of Delaware and State of Pennsylvania, have invented certain new and useful Improvements in Machines for Building Up Designs on Cylindrical Printing-Surfaces, of which the following is a specification.

10 The principal object of my present invention is to provide means for the photographic production of printing rollers containing a repeated design, such for instance, as used in printing textile materials, wall-
15 papers and other printed goods suitable for production by means of such rollers.

My United States Patent No. 1,051,997, issued February 4th, 1913, describes and claims means with which any design contained on a flat surface can be photo-
20 mechanically reproduced on the surface of a sensitized cylindrical roller. It will thus be evident that when this flat design consists of the repetition of a unit design, for instance, a so-called step and repeat plate, the
25 purpose of my present invention may be accomplished by means of the devices described in my said patent. This, however, pre-supposes the possession of this so-called
30 step and repeat plate, for the production of which separate machinery is required.

In the present invention means are disclosed whereby mechanism, in general principle similar to that in my before mentioned
35 United States Patent No. 1,051,997, may be modified and completed, so that the need of producing a flat plate containing all the units of the design destined to be placed on the roller is obviated, and whereby the entire
40 printing surface of the sensitized roller may be covered with the repetition of an original design, by directly projecting said design from a flat plate and successively impressing the same on adjoining sections of
45 the cylindrical surface.

For the better understanding of my present invention, reference is made to the annexed drawings in connection with the following description, in which drawings—

50 Figure 1, is a view in side-elevation of a machine, embodying the features of my present invention. Fig. 2, is a plan view of said

machine. Fig. 3, represents a plate containing a unit image. Fig. 4, represents a step and repeat negative plate. Fig. 5, shows a
55 diagram of a roller and the step and repeat plate, the design of which is to be reproduced on the roller. Fig. 6, shows a diagram of a roller and a single unit image to be repeatedly reproduced thereon. Fig. 7, is
60 a perspective view of the transverse slide for the roller, in this instance for an object-support being placed thereon and held by the same and illustrating thereby a modified
65 arrangement of that of Figs. 1 and 2. Fig. 8, is an end elevation of the machine from the side of the roller; and Fig. 9, is an end elevation of the machine from the side of the object-plate.

In these drawings corresponding parts
70 have been indicated by the same letters and numerals.

The machinery now to be described, consists mainly in the combination of four distinct groups of mechanism, as follows:—1st.
75 Mechanism for the restilinear displacement of the unit design. 2d. Mechanism for the simultaneous proportional rotation of the cylindrical surface. 3d. Automatic focusing
80 mechanism for the adjustment of the required enlargement, reduction or copying of the unit design, operating in conjunction with mechanism to determine the actual size
85 of the unit-impression to be produced on the roller. 4th. Mechanism for the automatic
90 regulation of the stepping adjustment of the unit-plate and of the repeating adjustment of the reproduced image. Each of these
95 separate groups of devices form either a part or the entire subject-matter of United States Patents already granted to me, the novelty of the present invention being the particular combination of these devices, or their mechanical equivalents, in such a manner that an original flat unit design may be
100 stepped and repeated directly on a cylindrical surface, suitably sensitized to receive impressions of such unit design through a photographic lens.

The vertical displacement of the unit design is obtained by means of the standard 1, securely bolted to a carriage 2, constructed so as to be readily adjustable over the bed-plate 3. The standard 1, is provided with ver-

tical guideways 4 and 4^a, on both sides, as clearly shown in Fig. 2. The guideways 4, on the front of the standard guide the plate-carrying frame 5, which projects transversely from its foot 6, (see Fig. 2), and is placed accurately at right angles to the face of the standard, to insure the correct rectangular position of the unit-image plate 7, with relation to the optical axis of the lens 8. Through a slot 10, in the face of the standard 1, a rearward extension 9, of the foot 6, of the plate-carrying frame projects inside of the standard 1, and this extension forms a nut for the screw-shaft 11, the upper end of which is rotatably secured in a rearward extension of the slide 12, which is mounted on the guideway 4^a, of the rear-face of the standard 1, between which guideways a slot 10^a, similar to the slot 10, is provided. A pivot 13, extends transversely from the face of the slide 12, and supports the upper end of the connector 14, the forked lower end whereof engages a pin traversing the slide-block 15, adapted to travel in the slot of the slide-bar 16, which is pivoted on the pin 18, and forms with the crank 17, and the horizontally adjustable vertical guide 19, for the pin of the slide-block 15, in all respects the equivalent for the adjustable plate-moving mechanism, fully described and claimed in my United States Patent No. 1,051,997, of February 4th, 1913. The mechanism so far described, allows thus to impart to a unit-image plate 7, secured in the plate-carrying frame 5, the total amount of vertical displacement required to reproduce it around the circumference of the cylinder to be placed in the machine, just as if instead of a plate containing only a single image, like Fig. 3, a step and repeat plate containing the full required number of images, such as shown in Fig. 4, were secured in the plate-carrying frame 5.

Referring now to Fig. 5, it will be observed that when the design is to be repeated six times around the cylinder, which number is chosen only by the way of example, a step and repeat plate, Fig. 4, from which to produce said cylinder should have six rows of unit-images, whereas the number of images in each row depends on the length of the cylinder. Furthermore, the lens reproducing these images should be placed so as to enlarge each individual unit-image to the size corresponding with one-sixth of the circumference of the roller. When so adjusted, the successive images Nos. 1, 2, 3, 4, 5 and 6, will be impressed upon the successively adjoining sections, Nos. 1, 2, 3, 4, 5 and 6, of the roller, said section being indicated on a corresponding division-plate 62, over which a pointer 63, attached to a spindle 27, of the roller 1, moves. As however, image No. 2, is in every respect the

same as image No. 1, it will be seen that the arrangement diagrammatically illustrated in Fig. 6, will produce the same results when the single image on the flat plate, Fig. 3, be moved through its own height in the same period of time required to rotate the roller through the angle embraced by the reproduction of said image on its cylindrical surface. If on completion of this movement the exposure be interrupted, and while the roller and all the remaining mechanism remain at rest, the image be raised to the original position in which the exposure began, and again, the same relative movement be imparted to both the image and the roller, the second operation will of necessity result in the impression of section No. 2, of the cylinder, with the same image, as already impressed on section No. 1. The repetition of this cycle of operation will thus result in building up a band of images completely encircling the roller. If finally on completion of a band of images, either the object-plate or the roller be transversely displaced through the width of the image contained on either, successive bands will be produced side by side, in adjoining relation to each other, and thereby cover the entire printing surface of the roller with a repetition of properly joined unit-images.

The screw-shaft 11, Figs. 1 and 2, constitutes the connection between the slide 12, and plate-carrying slide 6. This screw-shaft can be rotated by means of the crank-handle 20^a, of an automatic index and locking device 20, of the type as fully described and claimed in my United States Letters Patent No. 1,048,968, dated December 31st 1912. This index device allows thus of raising the slide 6, with the unit-image plate 7, by means of the screw-shaft 11, exactly through the height of the image contained on that plate, after said image has been lowered that much by the previously described means, in conjunction with the simultaneous rotation of the roller through the corresponding angle embraced by the projected image. As furthermore, the index mechanism 20, can be operated while the entire mechanism for rotating the roller remains at rest, it will be seen that after this readjustment of the unit-image has taken place, it has assumed the same relative position as image No. 2, of the step and repeat plate, illustrated in Fig. 5, with relation to the roller, and that on starting the machine section No. 2, of the roller, will receive its impression exactly as section No. 1, did in the first instance.

Fig. 1, shows how by means of the worm-sector 21, the worm 22, the shaft 23, the worm 24, and worm-wheel 25, the rotary movement of the crank 17, is communicated to the transverse shaft 26. This shaft is supported by suitable bearings resting on 130

the base plate 3, and is thus stationary with relation to the roller-shaft 27, and parallel therewith. As for the purpose of regulating the size of the reproduced image, the before described unit-plate is moved back and forth, with all its operating gear, on the carriage 2, the worm 24, has been made long enough to remain in operative contact with the worm-wheel 25, and acts like a tooth-rack on the latter, when the carriage is shifted for focusing purposes. Figs. 1 and 2, show this carriage in its position of nearest approach to the roller. Its proper distance from the roller is regulated by means of the hand-wheel 28, which is rotatably mounted in the standard 35, which standard is firmly bolted to the bed-plate 3. The handwheel 28, when rotated, will thus force the partly screw-threaded shaft 29, to rock the lever 30, and thereby bring into operation the lever system, 30, 31 and 32, the rectangle-levers 33, and the lens-slide 34. This latter-slide is laterally movable over the bed 36, which is bolted to the carriage 2. This lens and plate adjusting mechanism is an adaptation of the kinematically corresponding device, fully described and claimed in my United States Patent No. 1,029,297 of June 11th 1912, differing only from the construction illustrated therein, that on account of the much greater weight of the plate carriage in the machine forming the subject of this invention, the lens movement is derived from the plate movement instead of vice versa, but in this case like in the devices shown in my said patent, the oscillating fulcrum-slide 31^a, of the rectangle lever 33, is held stationary with relation to the image, by being pivoted in the standard 38, which is bolted to the bed-plate 3, as clearly illustrated in Figs. 1 and 2.

The required degree of magnification or reduction, or the equal sized reproduction of the unit-plate, is ascertained by means of the pantograph 39, in a manner similar to that described in my already before mentioned United States Patent No. 1,051,997, of February 4th 1913. As, however, in the present instance, it is required to ascertain the actual length of a part of the circumference, instead of the entire circumference, special provision is made to meet this requirement. The number of images to be placed around the roller varies in practice between two and ten, and is of necessity always a whole number. It is thus necessary to measure accurately the length of $1/2$; $1/3$; $1/4$; $1/5$; $1/6$; $1/7$; $1/8$; $1/9$; or $1/10$, of this circumference as the case may be, and this result is obtained by means of the bar 40. The arms 41 and 42, of the pantograph system are slotted and carry in their slots movable pivots 41^a and 42^a. These pivots can be clamped at points dividing these arms, in the before mentioned frac-

tions, and assuming for the sake of example, that they be adjusted at points marked 6, on both arms, the distance between the free end of the arm 39, and the bar 40, will also be $1/6$, of the entire distance between the free ends of the arms 39 and 42, if the latter had been continued to the same length as the arm 39, and consequently $1/6$ of the circumference of the roller, one-half of which circumference is indicated by the distance between the points 55 and 56. The pivot 56 in the free end of the arm 39, and the pivot 57 of the bar 40, carry suitable pieces of glass, with horizontal scratches coinciding in position with the centers of said pivots, and indicate thus the required length of the projected image of the unit-plate. The focusing mechanism already described is then adjusted accordingly, for which purpose the object-image on the plate 7, is lowered as far below the axis of the lens as is required to make its reproduction appear on the ground of the plates, as adjusted. This position of the object-image is readily obtained by moving the crank 17, downward until said reproduced image appears in the right place.

The brackets 58 and 44, are laterally adjustable over the transversely adjustable slide 45 by means of the crank handles 70 and 71, and the screw-spindles 72 and 73, as clearly shown in Figs. 2, 8 and 9. This permits of adjusting rollers of different diameters so that always the vertical plane passing through both focusing glasses will be tangent to the roller surface, whereby this surface is brought in the correct focus, as previously established. The transverse slide 45, is movable over a support 46, which itself is firmly bolted on top of the frames 47 and 48, secured to the bed-plate 3.

The partially screw-threaded shaft 50, engages a nut 59 attached to the transverse slide 45. This shaft is rotatable under the control of an automatically locking index-device 20^b, in all respects similar to the one already described. The operation of this shaft will thus cause the roller to be moved transversely to the axis of the lens, as plainly illustrated in Fig. 2, and thereby provides means to place a series of image bands in adjoining relationship to each other over the full printing width of the roller. For the purpose of this adjustment, the roller spindle 27, projects for a suitable distance beyond the bracket 58, and is provided with a key-way 61, any part of which will engage the key 60 in the spiral-gear 51. The latter receives its rotation through the action of the train of gears 52, 54 and 53, the latter of which is permanently keyed to the shaft 26, of the worm-wheel 25. Motive power of any suitable nature is applied to the shaft 23, the rotation whereof causes in the manner explained in my previously men-

tioned United States Patent No. 1,051,997 of February 4th 1913, the proper relative movement to the unit-plate 7, and to the roller. The transverse movement of the slide 45, may further be utilized for the production of an image-plate containing side by side, two or more images of the original design. To this end the design is placed in a suitable support 64 on the transverse slide 45, as illustrated in Fig. 7, and exposures made of it on a sensitive plate placed for that purpose in the position of the image-plate 7. The required horizontal displacement of the design between successive exposures is obtained by means of the index-device 20^a, controlling the screw-shaft 50. It will be evident that when desired, the vertical adjustment of the plate-slide 6, by means of the screw-shaft 11, and the index-device 20, may equally be utilized for the purpose of obtaining more than one horizontal row of exposures. This method of operation provides thus means for the production of a multiple unit-image plate, which when used to impress images on the roller, reduces the number of return-movements of the image-plate in direct proportion as the number of the horizontal rows of unit-images, and reduces the number of the required transverse adjustments of the roller in direct proportion of the number of unit-images in each row. This manner of utilizing the machine is especially desirable when the unit design is small, and would therefore require a large number of repeated exposures on the roller.

Having now completed the description of the mechanism of my present invention, I will describe its operation for which purpose it will be assumed, that an image-plate such as shown in Fig. 3, must be transferred to a roller of 6 inches diameter, and that each image must occur 12 times around the circumference and 4 times along the length of the roller. I begin by placing the image-plate in the holder 5, when it will assume the position as indicated by 7, the image surface of the plate being placed toward the lens 8. The lower edge of the design, or a suitable register-mark on said design, is placed exactly in line with the lower edge of the exposure slit in front of the plate, by raising or lowering the plate itself, as required, in the holder 5. The index-device 20, is set to zero, and the roller upon which the design is to be transferred is then placed in position. This having been done, the worm-shaft 24, is rotated until the cylinder has made 1/12 of a revolution or $360/12 = 30^\circ$, which is ascertained by reading the initial and the final position of the index-pointer 63, with relation to the graduated disk 60. This movement has caused the design to descend, and should now place the latter so that its upper edge, or a suitable upper register-mark has come exactly in line

with the lower edge of the exposure slit. Most likely it is not in the correct position at the first trial, and in that case, the pivot pin 15, of the slide block in the lower end of the connector 14, is adjusted in the required direction, that is toward the fulcrum 18, of the slide-bar 16, if the plate has descended too far, or oppositely if not far enough, until said upper register-mark does properly coincide with the lower edge of the exposure slit. This having been accomplished, I next unlatch the locking-device 20, and turn the handle 20^a, as far as required to again raise the design to its original position, that is with the lower register-mark coinciding with the lower edge of the exposure slit. The division on the index ring will then indicate how many complete turns were required to do this and the position of the handle 20^a, relative to the index-plate will indicate if, and what additional fractional revolution is necessary to return the image to its starting point. The index-device is then adjusted so as to limit the movement of the handle 20^a, to this required amount of rotation and the entire index-device replaced in the zero position. This completes the necessary adjustments of the plate movement, all of which have been accomplished as will be observed, without any reference as to the relative size of the design, and the image to be produced by it, but merely in accordance with the required number of images to be placed along the circumference of the roller. Consequently 1/12 of a revolution of this roller, no matter what its diameter may be, will be coinciding with the descent of the plate 7, through the height of the design placed thereon. It remains thus to now regulate the focusing mechanism so that the image, the lens will project in a tangent plane to the roller will be exactly of a size to occupy the 1/12 part of the circumference of the said roller. To this end, I proceed, as follows:—The bar 40, of the pantograph-mechanism, is adjusted by means of the guides 41^a and 42^a, until it coincides with the points marked 12, on the pantograph arms 41 and 42, and firmly clamped to these arms in that position. The arm 39, is then lifted upward until the forwardly extending arm 64, of the pantograph touches against the lower surface of the said roller. This causes the points 55 and 57, of the pantograph levers to come to a distance exactly equal to 1/12 of the circumference of the roller, and hence the horizontal hair-line marks on the ground glass screens carried by these points will indicate the height of the required projected image. By again turning the shaft 24, the plate 7, is lowered as much as is required, to show the lower register-mark on the upper ground glass, and the upper register-mark on the lower ground glass. They will not as yet coincide

with the hairline marks on these ground glasses, but are made to do so by rotating the wheel 28, of the focusing mechanism, until the image assumes the required height.

5 Inasmuch as the mechanical focusing mechanism can readily be constructed so as to yield projected images ranging from $1/3$ to 3 times the lateral size of the design, the actual size of the original is immaterial, so
10 long as its size does not exceed these limits in relation to the ultimate projected image. The roller is now to be sensitized and replaced in the machine, which in the meanwhile has been returned to its starting position as shown in Fig. 1, when the position
15 of the index-pointer b^3 , is carefully read off or placed back to the zero position. The exposure can now begin, and the worm-shaft 24, simultaneously placed in rotation. At
20 the exact instant the pointer 63, shows 30° , rotation, the exposure is halted and the machine is stopped; the necessarily slow rotation permitting of the instant stopping of the entire mechanism, and while everything
25 is at rest, the index-device 20, is operated, until it locks. This has lifted the plate 7, back to its first starting position and the machine is now ready to begin the second exposure and the second 30° , rotation. The
30 same operations are repeated until the 360° , of rotation have been completed. By means of the self-locking index-device 20^b, attached to the screw-shaft 50, the roller is now horizontally shifted to the position for the next
35 ring of exposures. The actual amount of displacement required, having been previously established in an analogous manner, by means of the projected image on the ground glass and the vertical hairlines
40 thereon, which are compared with the horizontal repeat-marks provided for that purpose on the object-plate 7. The entire operation is then repeated as described until the desired number of exposures have been
45 obtained.

Having now fully described the object of my present invention and means, whereby the same may be accomplished, it should be well understood that I do not limit myself
50 to the various details of design as described and illustrated, but may vary the same within the scope of the claims, and that

What I claim as new and desire to secure by Letters Patent is:—

55 1. In a machine for building up designs on a cylindrical surface, the combination of an image-plate, a sensitized roller, means for projecting the image contained on said plate upon said sensitized roller, means to
60 cause rotary movement of said roller in unison with rectilinear movement of said image-plate and means for the independent return movement of said image-plate.

2. In a machine for building up designs
65 on a cylindrical surface, the combination of

an image-plate, a sensitized roller, means for ascertaining the length of even fractions of the circumference of said roller and means for projecting upon said roller the image contained on said image-plate either
70 in reduced, equal or enlarged size, to correspond with the lengths of said even fractions.

3. In a machine for building up designs on a cylindrical surface, the combination of
75 an image-plate, a sensitized roller, automatic focusing means to project the image contained on said plate upon said sensitized roller, means to cause rotary movement of said roller in unison with rectilinear move-
80 ment of said image-plate and means for the independent return movement of said image-plate.

4. In a machine for building up designs on a cylindrical surface, the combination of
85 an image-plate, a sensitized roller, means for ascertaining the length of even fractions of the circumference of said roller and automatic focusing means for projecting the image contained on said image-plate upon
90 the even fractions of the circumference of said roller.

5. In a machine for building up designs on a cylindrical surface, the combination of
95 an image-plate, a sensitized roller, means for projecting the image contained on said plate upon said sensitized roller, means to cause rotary movement of said roller in unison with rectilinear movement of said
100 image-plate and means for the independent transverse movement of said roller.

6. In a machine for building up designs on a cylindrical surface, the combination of
105 an image-plate, a sensitized roller, means for projecting the image contained on said plate upon said sensitized roller, means to cause rotary movement of said roller in unison with rectilinear movement of said
110 image-plate, means for the independent return movement of said image-plate and means for the independent transverse movement of said roller.

7. In a machine for building up designs on a cylindrical surface, the combination of
115 an image-plate, a sensitized roller, means to ascertain the lengths of even fractions of the circumference of said roller, automatically focusing means to project the image contained on said image-plate upon said
120 even fractions of the circumference of said roller, means to cause rotary movement of said roller in unison with rectilinear movement of said image-plate and means for the independent return movement of said
125 image-plate and for the independent transverse movement of said roller.

8. In a machine for building up designs on a cylindrical roller, the combination of
a vertically movable support for an image-plate, a transversely movable support for a
130

roller, said latter support also adapted to hold a design supporting member and mechanically operated focusing means adapted to produce equal sized, reduced or enlarged images of said design in the plane of said image-plate.

In witness whereof, I have hereunto set

my signature in the presence of the two subscribing witnesses hereto.

LODEWYK JAN RUTGER HOLST.

Witnesses:

THOMAS M. SMITH,
HELEN F. MILLER.