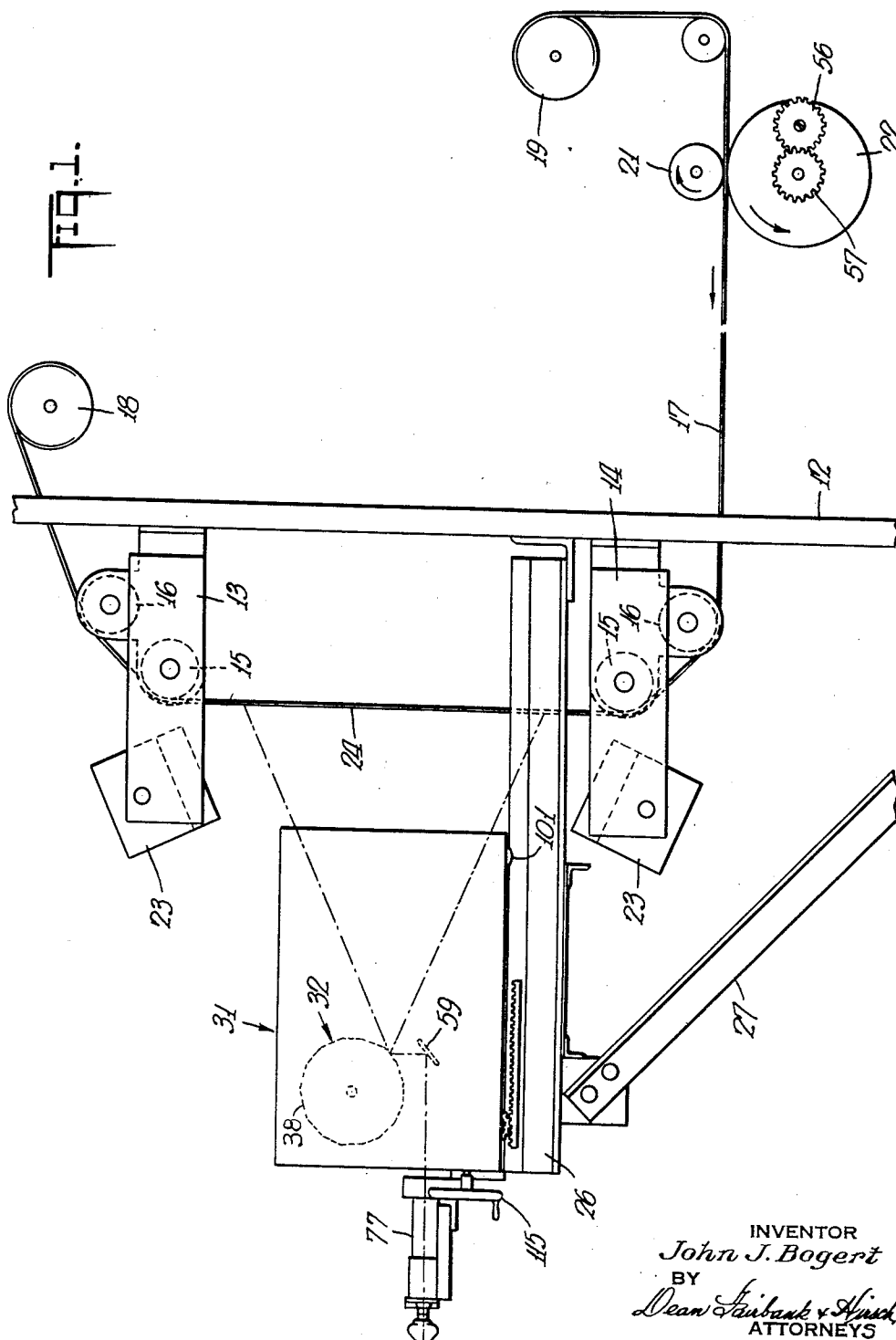


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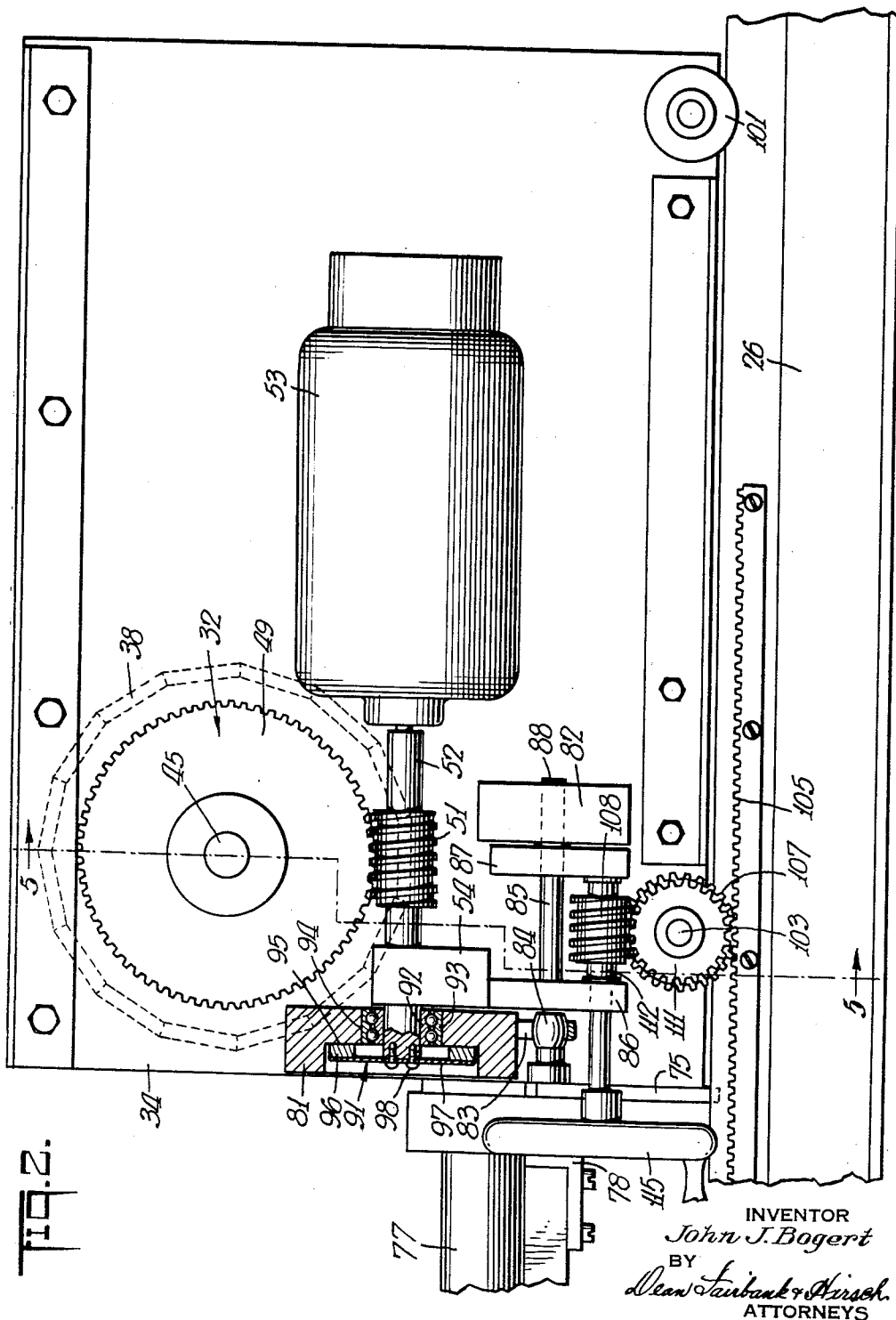


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MEANS FOR CHECKING SUPERPOSED
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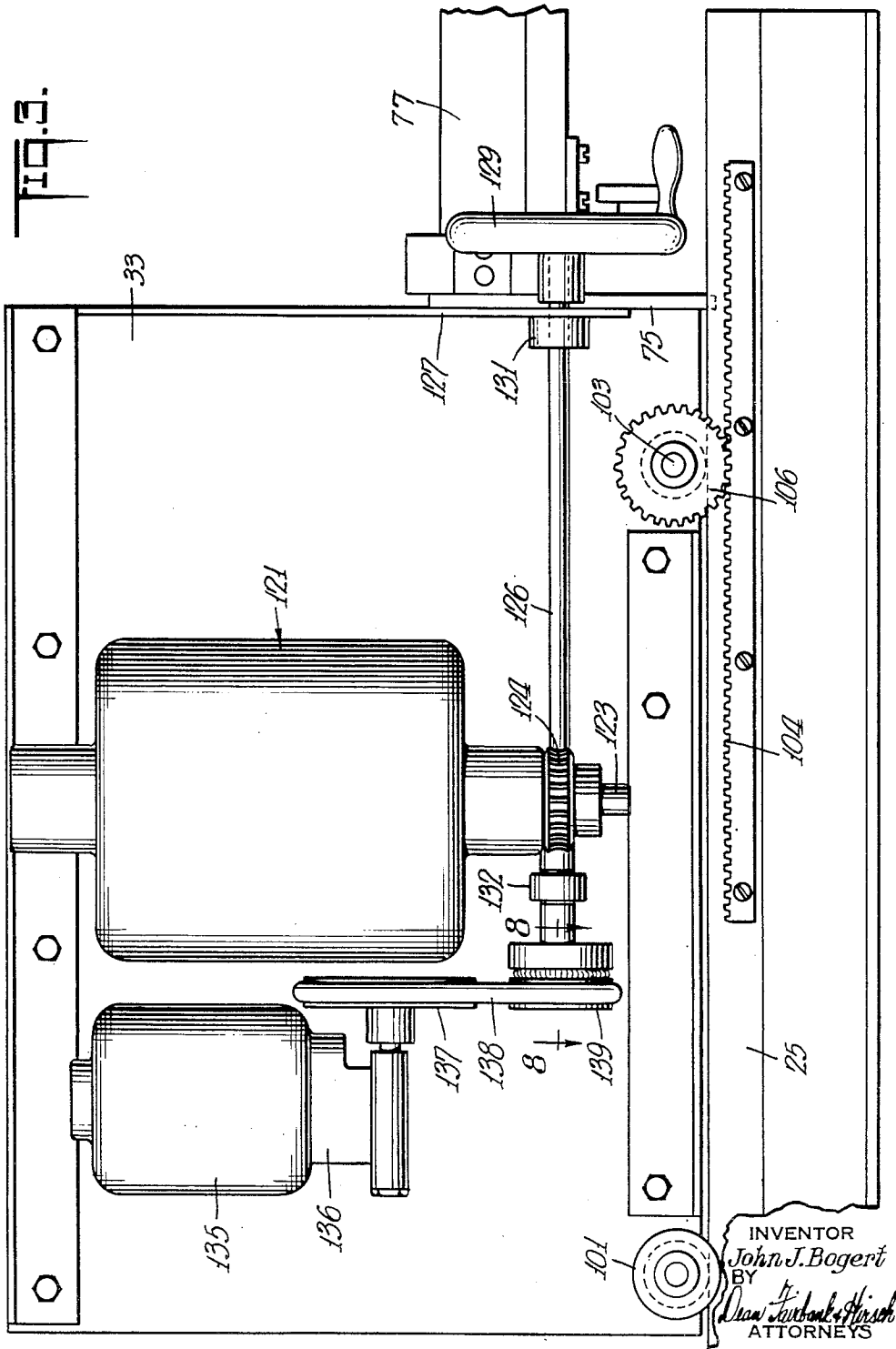
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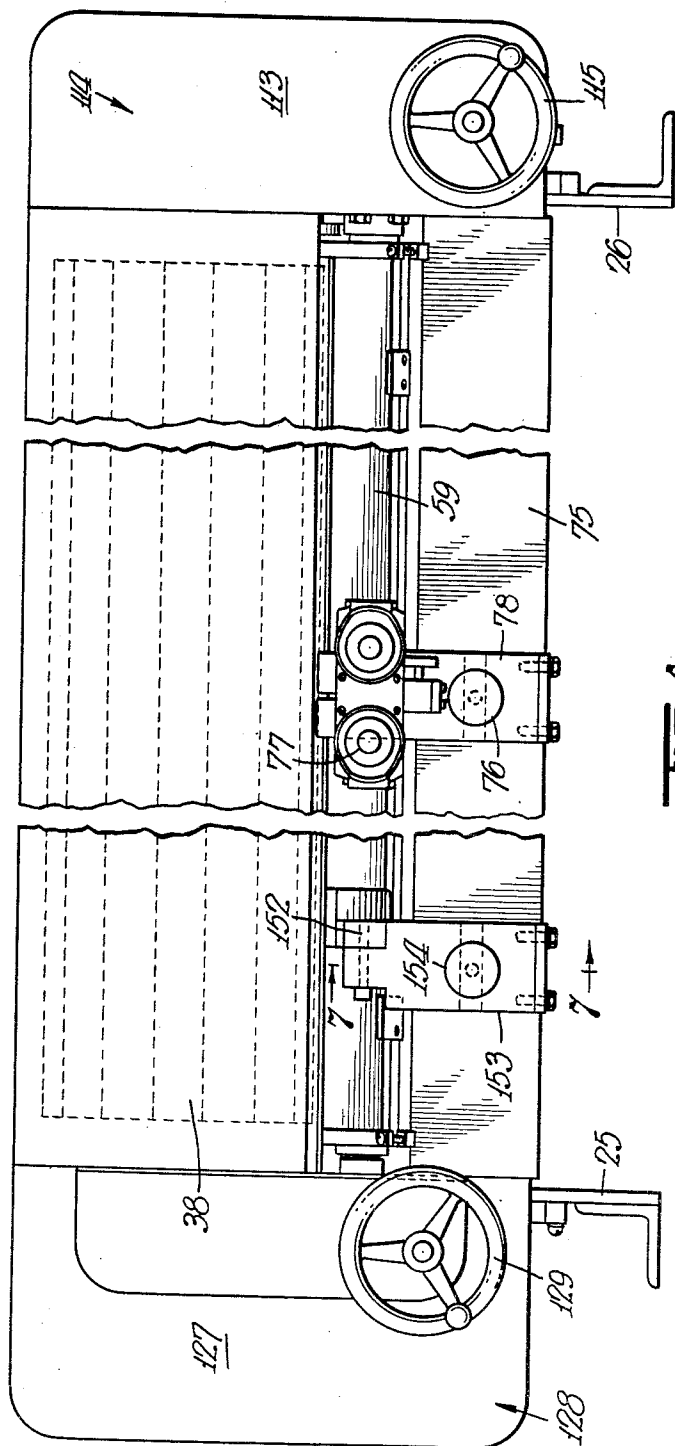


Fig. 4.

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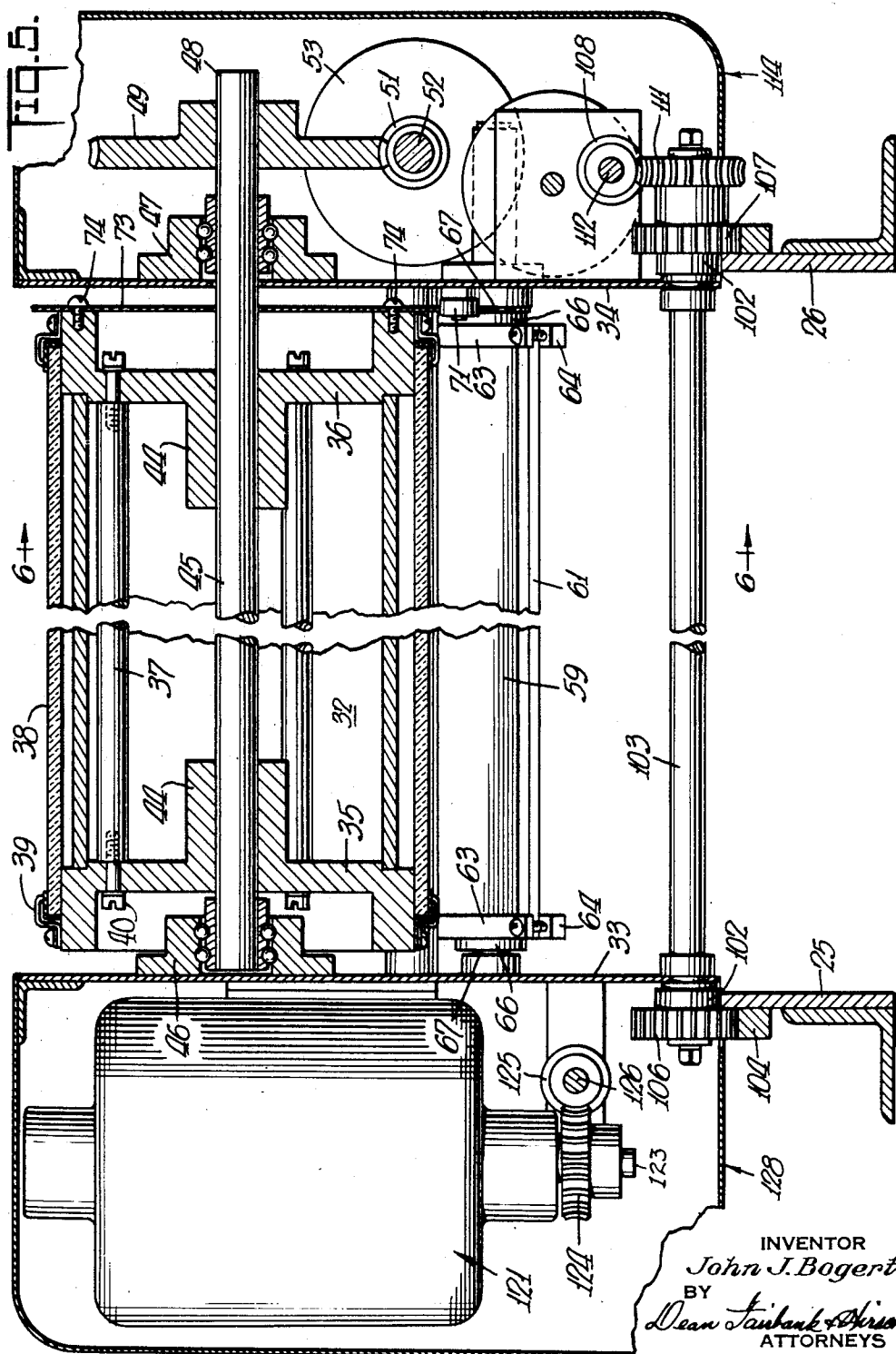
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IMPRESSIONS ON A MOVING WEB

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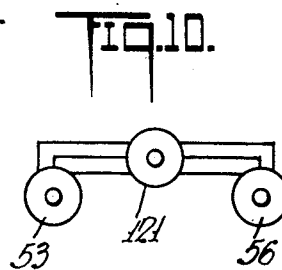
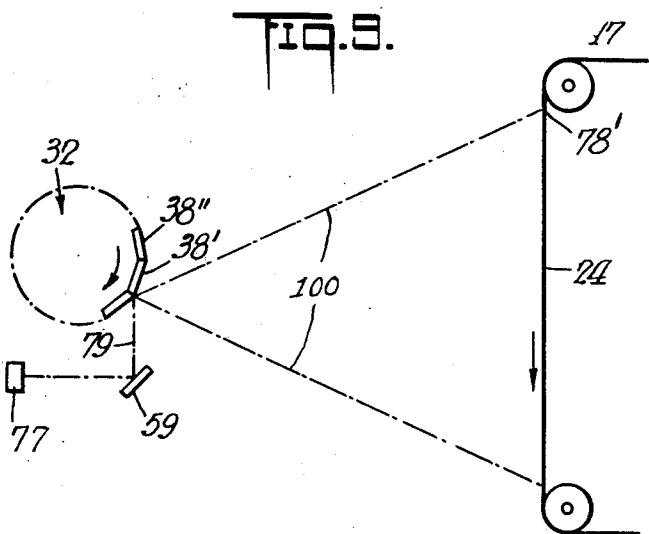
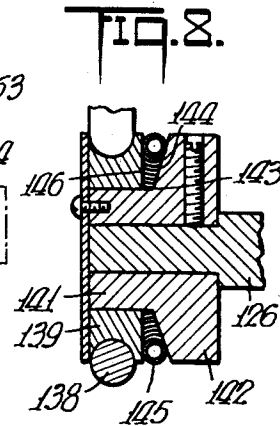
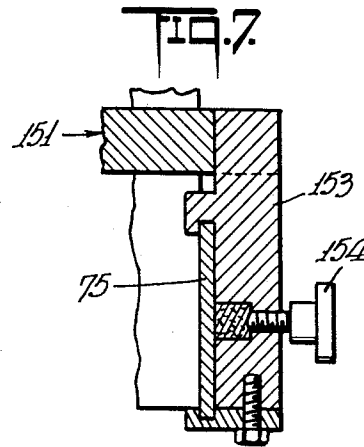
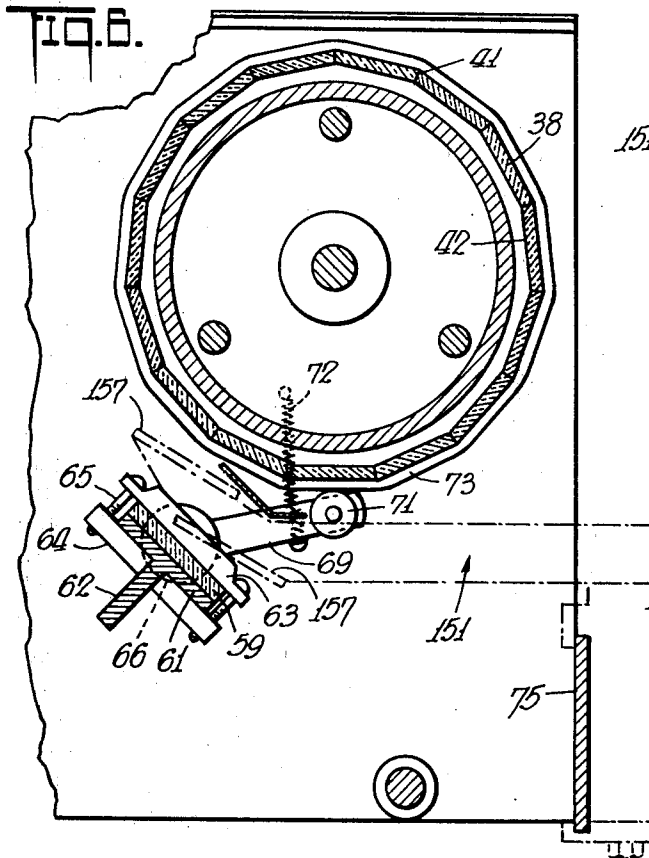
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J. J. BOGERT
MEANS FOR CHECKING SUPERPOSED
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Application August 1, 1950, Serial No. 177,003

5 Claims. (Cl. 88—14)

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This invention relates to an apparatus for observing repeated patterns or designs on a moving web and more particularly for inspecting the registration, quality and color of a plurality of superposed printed impressions which form the design.

As conducive to an understanding of the invention, it is noted that in the printing of repeated multi-colored designs on a continuous web, the different color impressions which form the final design are printed successively in superposed relation from a number of printing rollers.

In order to provide high grade printing it is necessary that the various impressions forming each design be in registry and properly aligned. It is therefore desirable that an inspection be made of the alignment and registration of the printed impressions in order that defective designs will not be produced. As the web is moving at a relatively high speed, such inspection by direct observation of the printed web is impossible and mechanism is provided, which may be of the type shown in the patents to Horton Nos. 2,140,402 and 2,155,013, whereby successive identical areas on the printed, moving web are reflected for a period of time by a suitable reflecting member which is moved in synchronization with the running web so that the printed impressions on such areas will appear stationary and thereby permit close inspection thereof.

Where the design to be inspected is relatively large in size, the area viewed at any one time may only be a portion of the entire design and it is desirable that means be provided to permit any portion of the design to be inspected.

Where a mirror is rotated in synchronization with the movement of the web, such as by means of a worm and worm gear drive and the relative position of the worm with respect to the worm gear is changed to advance or retard the mirror slightly with respect to the synchronous speed of the web and the mirror, although inspection of the entire design is afforded, it has been found that the errors in lead inherent in the gears cause objectionable errors in tracking that result in an apparent jiggling of the reflected area.

As the superposed impressions in such reflected area may be small in size, the jiggling may make it impossible to determine if such impressions are in registry and hence no accurate inspection can be made without stopping the movement of the web which would cause an objectionable slowing of the output of the printing machine.

It is accordingly among the objects of the in-

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vention to provide a viewing apparatus which is simple to operate and install and has but relatively few parts, none of which is likely to become out of order, and with which device an observer may view the reflected image of any selected portion of a design formed by means of a plurality of superposed printed impressions on a web or scan the entire design at any selected rate of speed with substantially no jiggling in the reflected image of such design, regardless of the area being viewed, so that even the smallest impression may be minutely checked, and which device when once adjusted for maximum accuracy does not become out of adjustment.

Where the mirror used in the scanning apparatus is rotated by means of a Selsyn motor coupled in conventional manner to a second Selsyn motor driven in synchronization with the printing rollers, an element of oscillation or hunting is inherent in the operation of the first mentioned Selsyn motor with the result that the reflected image swings back and forth over a given point rendering it difficult to inspect.

It is accordingly another object to provide a Selsyn motor drive in a viewing apparatus of the above type in which there is a minimum of hunting in the driven Selsyn motor with resultant steadiness of the image.

As it is essential with Selsyn motors that they maintain synchronization even during acceleration, the use of a relatively heavy flywheel is desirable, but the inertia of such flywheel on the driven Selsyn motor may result in stalling before it can accelerate to full speed unless Selsyn motors so large are used as excessively to increase the cost and bulk of the apparatus.

It is accordingly still another object to provide an apparatus of the above type in which the flywheel mass is applied to the shaft of the driven Selsyn motor in such manner as not to overload the latter.

According to the invention, a substantially cylindrical drum is provided having a plurality of identical longitudinally extending mirrors on the periphery thereof the lengths of which extend across the web and desirably form a regular polygon in transverse cross section. The drum is desirably rotated by a gear transmission, preferably one of the worm gear type driven by a Selsyn motor which in turn is preferably driven by a driving Selsyn motor that is coupled to the printing rollers, so that the two Selsyn motors may be driven in synchronization with the printed web, a differential Selsyn motor being interposed between said two Selsyn motors to

change the movement of the driven Selsyn motor in a predetermined manner relative to that of the driving Selsyn motor so that any selected area of the design on the web may be viewed or, if desired, the entire design may be scanned.

Desirably the driven Selsyn motor has a flywheel thereon to reduce the hunting inherent in Selsyn motor systems and such flywheel is desirably coupled to the Selsyn motor shaft in such manner as to preclude excessive load and possible stalling in the course of bringing such driven Selsyn motor up to speed.

In the accompanying drawings in which are shown one or more of various possible embodiments of the several features of the invention,

Fig. 1 is a diagrammatic side elevational view of the apparatus,

Fig. 2 is a fragmentary side elevational view similar to Fig. 1 on a larger scale partly in cross section and with parts broken away,

Fig. 3 is a fragmentary side elevational view of the opposite side of the apparatus to that shown in Fig. 2,

Fig. 4 is a fragmentary front elevational view of the apparatus with parts broken away,

Fig. 5 is a fragmentary transverse sectional view of the apparatus with parts broken away taken along line 5—5 of Fig. 2,

Fig. 6 is a fragmentary longitudinal sectional view of the apparatus taken along line 6—6 of Fig. 5,

Fig. 7 is a detail sectional view on a larger scale taken along line 7—7 of Fig. 4,

Fig. 8 is a sectional view on a larger scale taken along line 8—8 of Fig. 3,

Fig. 9 is a diagrammatic view illustrating the operation of the apparatus, and

Fig. 10 is a diagrammatic circuit diagram of the Selsyn motors.

Referring now to the drawings, in Fig. 1 is shown a diagrammatic side elevational view of the apparatus which desirably comprises a supporting frame which may include a pair of spaced parallel uprights or beams 12 mounting transversely aligned pairs of laterally extending brackets 13 and 14.

Rotatably mounted on each pair of brackets 13 and 14 are transverse guide rollers 15 and 16 around which the printed web 17 passes. As shown in Fig. 1, one end of the web is wound around a roll 18 to be collected thereon and the other end of the web 17 is fed from a supply roll 19 and passes between a plurality of pairs of printing rollers 21 and 22, only one of which is shown, the pairs of rollers successively printing the impressions which form the completed design. Desirably each of the pairs of brackets 13 and 14 carries a lamp 23 thereon to illuminate the vertical portion 24 of such web which is stretched between rollers 15.

Also mounted on the beams 12 between brackets 13 and 14 are a pair of spaced parallel, horizontal tracks 25 and 26 supported adjacent their ends by braces 27, and which serve as the mount for a housing 31 containing the scanning mechanism for viewing the web 17.

Although the scanning mechanism may be of any suitable type, it desirably comprises a drum 32 extending transversely of the housing 31 and rotatably mounted therein between the spaced upright side plates 33 and 34.

As shown in Fig. 5, the drum may comprise a pair of hubs 35 and 36 retained in spaced parallel relation by separator bars 37 held against the hubs by screws 40. The drum 32 desirably car-

ries a plurality of light reflecting surfaces or mirrors 38 which are desirably elongated flat strips of uniform length and width affixed at their ends by brackets 39 to the periphery of hubs 35 and 36.

As shown in Fig. 6, the adjacent longitudinal edges 41 of the mirrors 38 are desirably beveled and are retained in edge to edge abutment preferably of their thickness. The peripheries of hubs 35 and 36 desirably have a plurality of flats 42 thereon against which the associated ends of the mirrors may rest, the mirrors 38 thereby forming a regular polygon in cross section.

Although the mirrors 38 could be of any suitable type, it is preferred to have them coated on the front surface thereof. Such mirrors are advantageous in that they eliminate the double reflection inherent in conventional rear surface mirrors which prevents clear definition of the impressions to be viewed and in addition as the physical mounting of the flat mirror strips upon a drum necessitates a joint at the adjacent mirrors, the visual effect of these joints is minimized, for if back surface mirrors should be employed, the rays of light would have to pass through the glass and return, with resultant loss of definition at each joint due to parasitic reflections.

Means are desirably provided to rotate the drum 32 in synchronization with the rotation of the printing rollers 21 and 22 and the movement of the web 17. To this end, each of the hubs 35 and 36 desirably has an axial hub bearing 44 affixed as by set screws (not shown) to a transverse shaft 45 which extends therethrough. The shaft 45 is desirably journaled at one end in a bearing block 46 affixed to the inner surface of plate 33 and near its other end in a bearing block 47 affixed to the outer surface of plate 34.

The end 48 of shaft 45 which extends through bearing block 47 desirably has a worm gear 49 affixed thereon which meshes with the worm 51 affixed on the drive shaft 52 of a Selsyn motor 53 mounted on the outer surface of plate 34, said shaft 52 being journaled in a laterally extending bearing block 54 affixed on plate 34.

The Selsyn motor 53 is electrically connected in conventional manner to a driving Selsyn motor 56 to be driven thereby, said Selsyn motor 56 being driven through gearing 57 (Fig. 1) from the printing roller 22, the Selsyn motors functioning in the manner well known in the art, so that upon rotation of the rotor of the driving Selsyn motor the rotor of the driven Selsyn motor will be rotated a corresponding amount.

In order to view the impressions reflected from the vertical portion 24 of web 17 to the mirrors 38 in the manner hereinafter to be described, a mirror 59 is desirably provided which, as shown in Figs. 5 and 6, is desirably an elongated strip extending parallel to drum 32 and mounted between plates 33 and 34 so as to oscillate or rock back and forth to maintain unaltered the optical relationship between the moving web area being viewed and the reflected image projected to the observer.

As shown in Fig. 6, the mirror 59 is clamped to a rigid strip 61 preferably of metal, having a longitudinal reinforcing rib 62 on the undersurface thereof. The clamping is desirably effected by means of clamp bars 63 and 64 extending transversely across the mirror 59 at its ends, said clamp bars being retained together by screws 65. Each of the clamp bars 63 desirably has a hub 66 affixed thereto on the outer surface

thereof so that the axis of each of the hubs is aligned with the top surface of the mirror 59 midway between its side edges. The mirror 59 is mounted between the side plate 33 and 34 by means of bearing pins 61 rigidly affixed to said plates and extending laterally inward therefrom through the hubs 66 of the clamp bars 63 and is desirably rocked by a lever 69 (Fig. 6) one end of which is affixed to hub 66 while the other end carries a cam roller 71 resiliently retained as by a coil spring 72 in engagement with the periphery of a cam 73 affixed by screws 74 to hub 36.

As both the mirrors 33 on the drum 32 and the oscillating mirror 59 extend the entire width of the web 17, it is apparent that a design that extends over such entire width will be reflected so that it may be seen by an observer viewing mirror 59.

In order to permit minute inspection of such design, magnifying means may desirably be provided which may comprise a pair of binoculars 77 mounted on a carrier 78 movable transversely between side plates 33 and 34 on a transverse guide rail 75. When any portion of the web is to be observed, the carrier 78 is moved to the selected position on guide rail 75 and fixed in place by set screw 76 and the binoculars 77 may be focused as desired.

With the construction thus described, it is apparent that the drum 32 at a predetermined distance from the vertical portion 24 of the moving web 17, as shown in Fig. 9, one of the mirrors, i. e. mirror 38', will reflect the area on the web portion 24 indicated by the point 78'. The image from point 78' will be reflected from mirror 38' to mirror 59 so that it can be seen by the observer through binoculars 77.

As the drum 32 rotates in a clockwise direction and the web 17 moves in the direction of the arrow, the mirror 38' will follow point 78' until such mirror 38' moves past the line of sight 79 of the binoculars 77 at which time the beginning of the next mirror 38'' comes into the line of sight 79 of the binoculars 77.

As successive identical patterns on the web are equi-distantly spaced thereon by an amount which will bring one pattern into sight immediately after the preceding observed pattern passes out of sight, the observer will see what is apparently a stationary object.

Inasmuch as an element of hunting or oscillation is inevitable in Selsyn motors connected as above described, such hunting of the Selsyn motor 53 would cause the image seen to swing back and forth about a fixed point thereby rendering minute inspection thereof difficult.

It is therefore desirable to add mass to the shaft 52 of the driven Selsyn motor 53 to act as a flywheel for substantially constant speed rotation without hunting. Because of space limitation, a single flywheel of large size has been found to be impractical and it has been found desirable, in order to achieve the desired mass with a minimum of size, to provide a pair of relatively small flywheels 81 and 82. As shown in Fig. 2 flywheel 81 is mounted on shaft 52 and desirably has an encompassing pulley belt 83 which drives a pulley 84 affixed on countershaft 85 journaled in laterally extending brackets 86 and 87 affixed to plate 34, the end 88 of shaft 85 having said flywheel 82 affixed thereon. Preferably the pulley 84 has a much smaller diameter than flywheel 81 so that flywheel 82 will rotate at a greater speed than flywheel 81.

As the inertia of flywheels 81 and 82 is rela-

tively high, it would require the application of considerable torque in order that the Selsyn motor 53 may accelerate to the speed of the driving Selsyn motor 56, and consequently the Selsyn motor 53 would have to be of relatively large size, which in addition to being very expensive would occupy considerable space.

In order to use a moderately sized Selsyn motor, yet with the required flywheel mass to prevent hunting, means are desirably provided to permit the Selsyn motor 53 to attain substantially its running speed before the full mass of the flywheels 81 and 82 is applied thereto. To this end as shown in Fig. 2, a friction clutch 91 is desirably interposed between shaft 52 and flywheel 81. The clutch may comprise an inner bearing race 92 affixed on the end of shaft 52 and coacting with an outer race 93 affixed to the wall of an axial bore 94 in the flywheel 81. The end face 95 of the flywheel 81 desirably has a friction ring 96 urged thereagainst by a resilient plate 97 affixed at its axis as by screws 98 threaded into the end of shaft 52.

Thus, upon initial rotation of shaft 52, due to the inertia of flywheels 81 and 82, plate 97 will slide on ring 96 applying but little driving torque thereto, and hence flywheels 81 and 82 will initially rotate very slowly with but little load being applied to shaft 52. As shaft 52 and flywheels 81 and 82 continue rotating, the flywheels will gradually build up to their normal running speed with their load being gradually applied to shaft 52 so that Selsyn motor 53 may come up to the speed of the driving Selsyn motor 56 without stalling, which might occur if the load of the flywheels was suddenly applied. Thus, the two Selsyn motors 53 and 56 will remain in synchronization.

It is to be noted that the vertical range of coverage of the web by the reflecting mirrors 38 on drum 32, depends upon the distance of said mirrors from the web, for the angle embraced between the upper and lower dot and dash lines 100 in Fig. 9 is determined by the number of mirror faces on drum 32 and does not change. Consequently the mirrors 38 must be spaced a predetermined distance from the web in order that identical areas on the successive identical printed designs on the web may be viewed.

Where the printing cylinder 22 carries one design about its periphery, the mirrors 38 and the web must be spaced by a certain amount. Where the cylinder 22 has two identical designs in sequence about its periphery each extending half way around, the impressions will occur on the web at twice the frequency they would occur if but one design extended around the cylinder. In such latter case it is desirable to reduce the distance between the mirrors 38 and the web 17 so that but a single design will be reflected to the mirrors 38 and as the web 17 will be closer to the observer the design may be more closely inspected. To afford such movement, the housing 31 desirably has one pair of transversely aligned rollers 101 rotatably mounted near the rear edge of each of the upright plates 33 and 34 riding on tracks 25 and 26 respectively, and a second pair of transversely aligned rollers 102 rotatably mounted on the protruding ends of a transverse shaft 103 extending through the plates 33 and 34 near the front lower edge thereof, said rollers 102 also riding on rails 25 and 26 respectively.

Each of the tracks has a rack 104, 105 affixed on its outer surface and extending longitudinal-

ly thereof, which racks are engaged by pinions 106, 107 respectively affixed to the ends of shaft 103 and riding on said racks.

In order to rotate said shaft 103 to effect movement of the housing 31, a worm 108 is desirably provided which meshes with a worm gear 111 affixed on the end of the shaft 103 adjacent pinion 107. Worm 108 is preferably affixed on a shaft 112 journaled in brackets 86 and 87 and having a handwheel 115 affixed on the forward end thereof extending through the front wall 113 of protective housing 114. Thus, upon rotation of the handwheel 115 in either a clockwise or counterclockwise direction, the housing 31 may be moved back or forth as desired.

Since as previously pointed out and as diagrammatically shown in Fig. 9, only a relatively small area lengthwise of the web can be viewed by the observer, it is desirable to permit inspection of any portion of the design especially where the design covers a considerable portion of the length of the web. To this end means are provided to change the phase of the driven Selsyn motor 53 with respect to the driving Selsyn motor 56 either momentarily or continuously so that the position of the mirror 38 on drum 32 rotated by Selsyn motor 53 with respect to the moving web may be changed, thereby to bring another area of successive designs on the moving web into view or to continuously scan the designs.

To accomplish such result, in the embodiment herein shown, a differential Selsyn motor 121, electrically connected in conventional manner as diagrammatically shown in Fig. 10, is interposed between the driven Selsyn motor 53 and the driving Selsyn motor 56. The differential Selsyn motor shaft 123 desirably has a worm gear 124 thereon which meshes with a worm 125 affixed on a shaft 126 extending parallel to side plate 33. Shaft 126 which extends through front wall 127 of a protective housing 128 is manually rotated by a handwheel 129 and desirably is journaled in a bearing block 131 on wall 127 and in a bearing block 132 extending laterally outward from plate 33.

With the above construction, a viewer by merely rotating the handwheel 129 will turn the rotor of the differential Selsyn motor 121, which functions in conventional manner, to cause the rotor of the driven Selsyn motor 53 to be advanced or retarded with respect to the rotor of the driving Selsyn motor 56 depending upon the direction of rotation of the hand wheel 129. As a result, the angle of the mirrors 38 on the rotating drum with respect to the web will be changed to permit any area of the design to be inspected.

Means are also desirably provided automatically to rotate shaft 126 to provide for continuous scanning of the entire design.

For this purpose a motor 135 is desirably provided as shown in Fig. 3, affixed to plate 33 and which, through a reduction gear drive 136 rotates a pulley 137. By means of a pulley belt 138 the pulley rotates a clutch ring 139 shown in Fig. 8, rotatably mounted on the reduced end 141 of a complementing clutch member 142 which is rigidly affixed to the end of shaft 126. The shoulder 143 formed by the reduced end of clutch member 142 is desirably beveled as at 144 and a resilient friction ring 145 encompasses said clutch member being seated on said beveled portion 144 and resting against the adjacent face 146 of ring 139.

Thus, upon rotation of shaft 126 by handwheel

129, the gear transmission 136 will provide sufficient load on clutch ring 139 so that by reason of the slipping friction ring 145, shaft 126 may turn freely. However, upon rotation of the clutch ring 139 by motor 135, the ring 145 will provide sufficient frictional engagement to drive clutch member 142 thereby to rotate shaft 126 and through the gear transmission previously described to rotate the differential Selsyn motor 121.

With the apparatus thus described, an optically stationary image of the moving web is attained, which may readily be inspected. It is apparent that if a stationary image of a sample of material is brought visually adjacent the web, a means of comparison is achieved.

To this end a color comparator is provided comprising an arm 151 which extends longitudinally between side plate 33 and 34. The front end of the arm 151 is affixed as at 152 in Fig. 4 to a carrier 153 slidably mounted on transverse guide rail 75, said carrier being retained in any position of adjustment by a set screw 154. The arm 151, as shown in Fig. 6, desirably has reflecting mirrors 157 mounted thereon adjacent the oscillatory reflecting mirror 59, said mirrors 157 being positioned so as to reflect rays of light, desirably to the binoculars 77, from a sample of material which may be positioned adjacent the moving web in any suitable manner.

As the two reflecting surfaces of the drum and the oscillatory mirror tend to discriminate slightly between light rays of different wave length, thereby creating a slight color change, in order to compensate for this color change so that an accurate comparison may be made of the sample of material and the impression on the web, two reflecting mirrors 157 are utilized, desirably of the same type as the reflecting surfaces of the drum and the oscillating mirror. Thus if the printed impression and the sample are identical they will so appear when viewed through the mirrors of the comparator, whereas if no reflecting mirrors 157 were used, even though the sample of material and the printed design should be identical in color, the color change caused by the mirrors 38 and 59 would prevent accurate comparison.

Thus, it is a relatively simple matter for the observer, when he desires to compare the sample of material with the printed impression, to move the carrier 153 along transverse guide rail 75 to any desired position so that the sample will be positioned adjacent the portion of the impression to be compared. By then looking through the binoculars 77, the apparently stationary impression on the web may be readily compared with the stationary sample.

With the construction thus described, a highly efficient viewing apparatus is provided whereby any portion of a repeated design on a moving web may be maintained in apparently stationary position with substantially no jiggling or other movement, thereby facilitating minute inspection thereof.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

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1. An apparatus for observing successive printed designs equi-distantly spaced on a moving web, comprising a rotary reflecting member having a plurality of light reflecting surfaces extending across such web, observing means positioned to view said reflecting member, a first Selsyn motor to drive said rotary member successively to present said light reflecting surfaces by its rotary movement to receive and reflect successive light rays from the moving designs, a second Selsyn motor electrically connected to said first Selsyn motor, means to rotate said second Selsyn motor in synchronization with the movement of said web thereby to rotate said first Selsyn motor in synchronization with the movement of said web, a differential Selsyn motor electrically connected between said first and second Selsyn motors, means to rotate the rotor of said differential Selsyn motor to change the phase of said first Selsyn motor in predetermined manner with respect to the phase of said second Selsyn motor thereby to adjust the relative position of said light reflecting surfaces with respect to said web, means to move a portion of such printed web in a straight observable path and means to observe an area adjacent the portion of such web moving in a straight observable path, said means comprising an arm, a pair of inclined reflecting mirrors on said arm, one of said mirrors having its reflecting surface directed towards such area adjacent the web to reflect rays of lights therefrom onto said second mirror, and said second mirror having its reflecting surface directed toward said observing means to reflect the rays of light thereto.

2. An apparatus for observing successive printed designs equi-distantly spaced on a moving web, comprising a rotary reflecting member having a plurality of light reflecting surfaces extending across such web, a first Selsyn motor to drive said rotary member successively to present said light reflecting surfaces by its rotary movement to receive and reflect successive light rays from the moving designs, a second Selsyn motor electrically connected to said first Selsyn motor, means to rotate said second Selsyn motor in synchronization with the movement of said web thereby to rotate said first Selsyn motor in synchronization with the movement of said web, a differential Selsyn motor electrically connected between said first and second Selsyn motors and means to rotate the rotor of said differential Selsyn motor to change the phase of said first Selsyn motor in predetermined manner with respect to the phase of said second Selsyn motor thereby to adjust the relative position of said light reflecting surfaces with respect to said web, said means comprising a control shaft, means operatively connecting said control shaft to the rotor shaft of said differential Selsyn motor, a hand wheel at one end of said control shaft to rotate the latter, a clutch at the other end of said control shaft and a drive motor operatively connected to said clutch to rotate said control

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shaft, whereby when said drive motor is de-energized said control shaft may be freely rotated by said hand wheel independently of said motor and when said drive motor is energized said control shaft will be rotated.

3. The combination set forth in claim 2 in which said clutch is of the friction type comprising a member affixed to said drive shaft and having a reduced nose portion forming a beveled shoulder, a friction ring encompassing said reduced nose, and a complementary clutch ring rotatably mounted on said reduced nose portion, said friction ring engaging said beveled shoulder and the opposed face of said clutch ring, the latter being rotatable by said drive motor.

4. An apparatus for observing printed impressions on a moving web, comprising a rotary reflecting member, a worm wheel operably connected to said member, a first Selsyn motor having a drive shaft, a worm affixed on said shaft in mesh with said worm wheel, a second Selsyn motor electrically connected to said first Selsyn motor, means to rotate said second Selsyn motor in synchronization with the movement of such web thereby to rotate said first Selsyn motor in synchronization with the movement of such web, a flywheel associated with the drive shaft of said first Selsyn motor to prevent hunting thereof with respect to said second Selsyn motor, a friction clutch interposed between said drive shaft and said flywheel, a second flywheel associated with said first flywheel and driven thereby, and means interposed between said flywheels to drive said second flywheel at a greater speed than said first flywheel.

5. The combination set forth in claim 4 in which said rotary reflecting member comprises an elongated drum extending across the moving web, and said light reflecting surfaces comprise a plurality of reflecting strips affixed on said drum and forming a regular polygon thereon, said strips being successively presented by the rotary movement of the drum to receive and reflect in succession light rays from the impressions on the moving web, each of said reflecting strips comprising a mirror having a reflecting coating on the front surface thereof.

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