May 18, 1937. E. W. STONE 2,080,974

PANTOGRAPH

Filed July 28, 1936 3 Sheets-Sheet 1

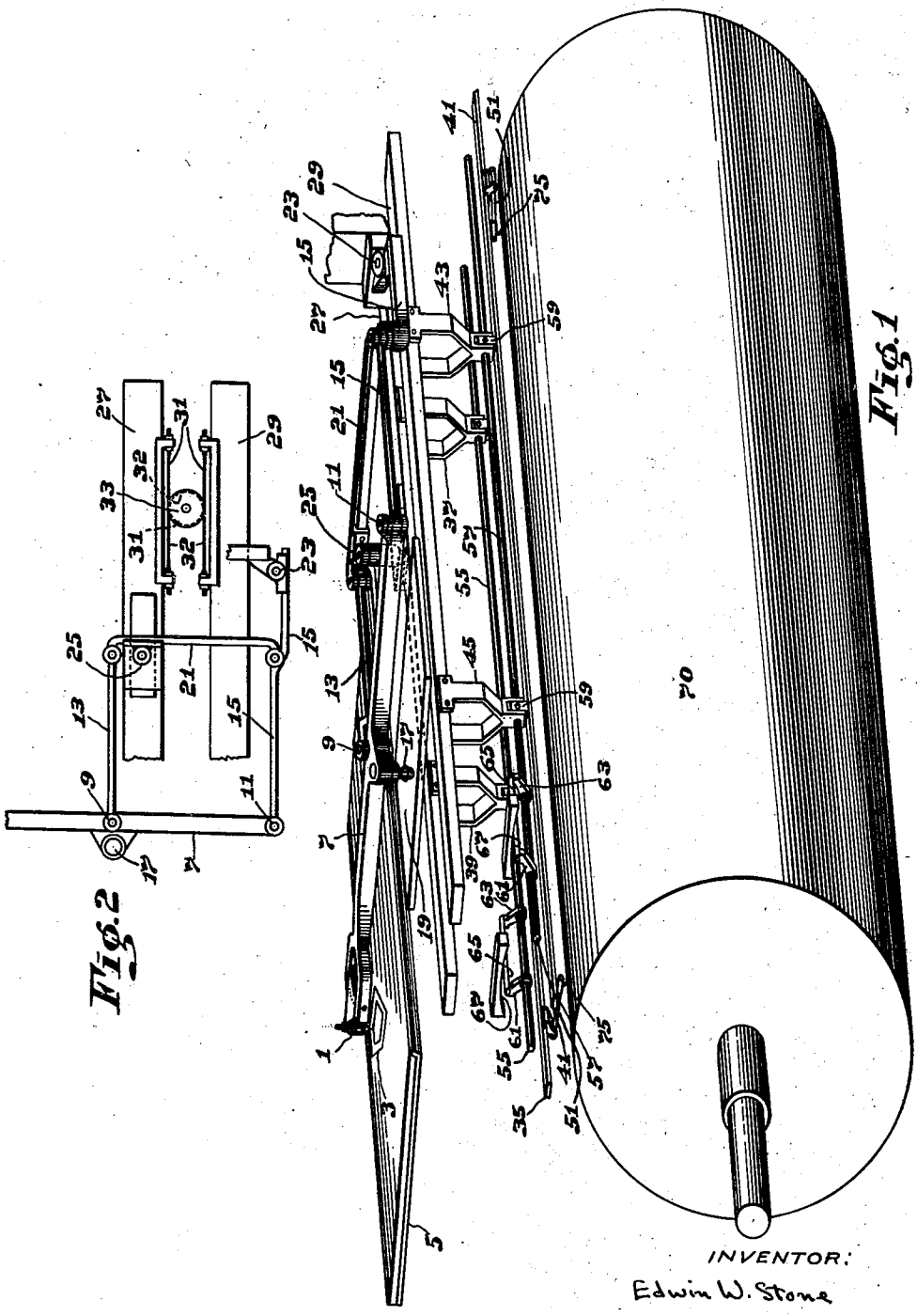


Fig. 1

Fig. 2

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Fig. 3

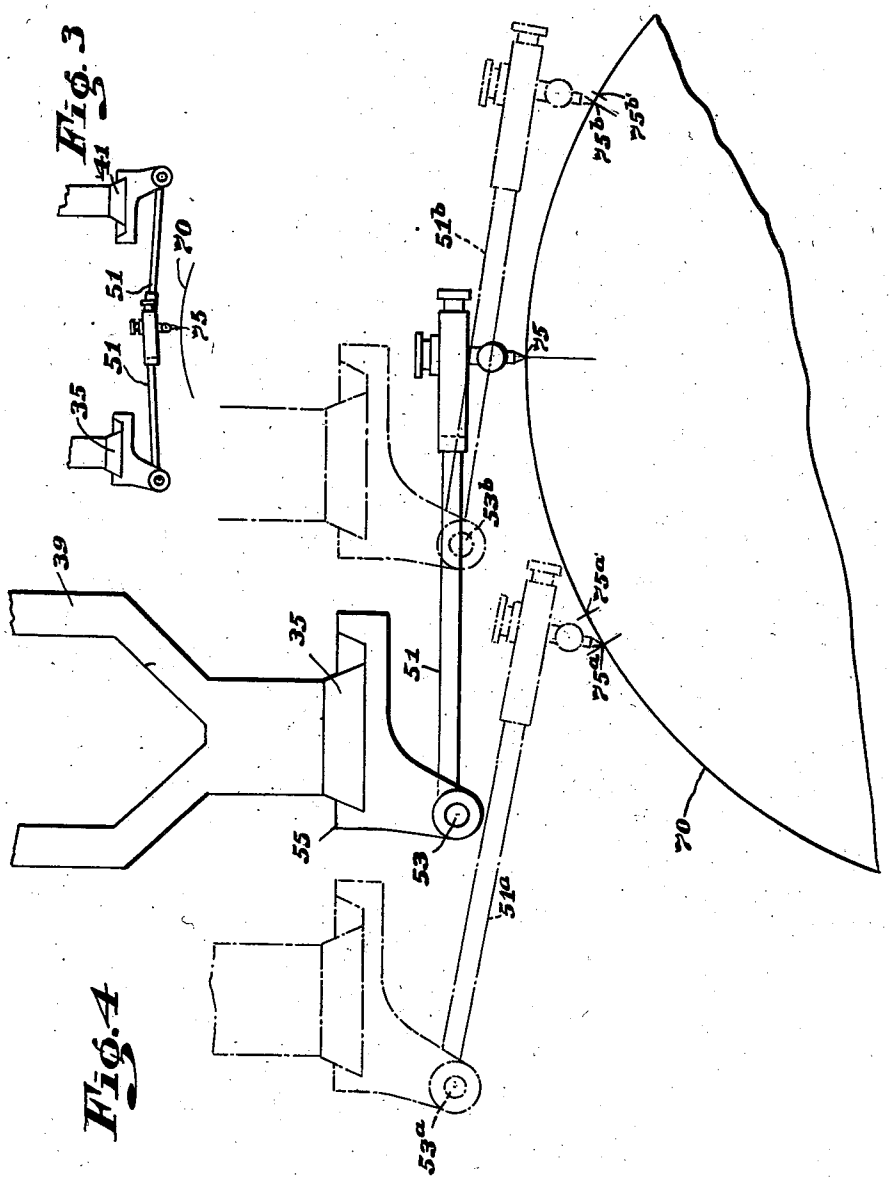


Fig. 4

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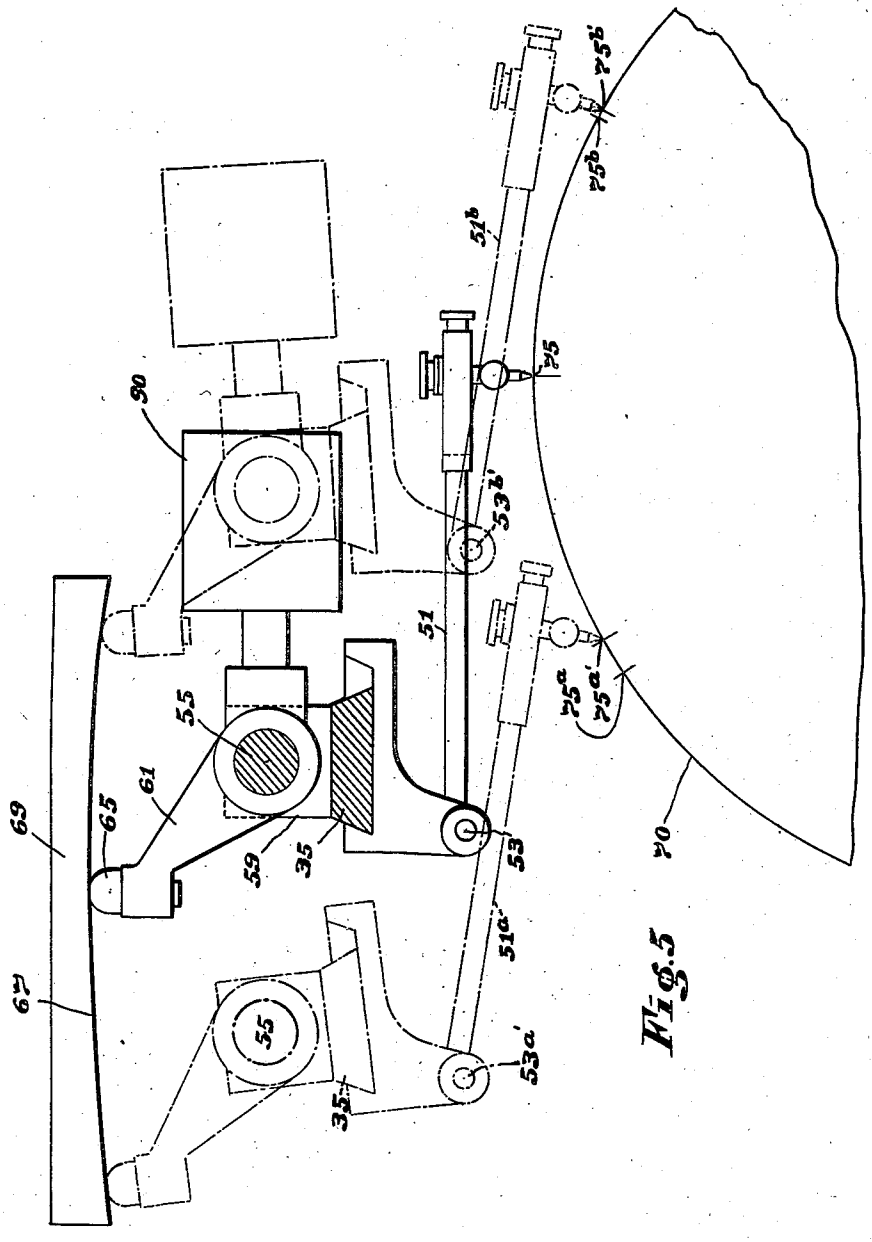


Fig. 5

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2,080,974

PANTOGRAPH

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Application July 28, 1936, Serial No. 93,000

7 Claims. (Cl. 33—21)

This invention relates to pantographs of the type employed for transcribing a design from a pattern presenting a plane surface, to an object presenting a curved surface to receive the design, and particularly to novel mechanism for use in such pantographs for compensating for the errors in transference resulting from differences in the movement of the tracer point, traversing the plane of the pattern, and of the scribing point which follows the curved surface of the object.

It has been common heretofore to use such pantographs for marking designs on the surfaces of cylindrical rolls, which, after treatment with acid, are used to print various types of fabrics, including rugs, and in using, for that purpose, one common type of pantograph, the cylinder, usually lying on its side, is held motionless while a small portion of the design is reproduced on a limited area of the uppermost portion of the cylinder surface, after which the cylinder is rotated to move the next adjacent area of the cylinder uppermost and the pantographic transference is continued.

The plane surface of the pattern results in a movement of the tracer point over the pattern entirely within a single horizontal plane. The scribing or marking point or points of the pantograph, on the other hand, rise and fall vertically with the arched surface of the cylinder as they follow the tracer point movement. As a result of these differences in movement, all lines on the plane surface of the pattern which are parallel to the axis of the cylinder, and hence do not produce any vertical movement in the scribing point, will be reproduced on the cylinder without distortion, but all other lines, which do involve varying amounts of vertical movement of the scribing point, will be distorted in varying amounts depending chiefly upon the amount of such vertical movement.

It is the object of my invention to correct such distortions, and I have found that they may be entirely eliminated by incorporating into the pantograph, mechanism adapted to impart to the linkage holding each scribing point, a slight movement in addition to that imparted to it by the tracer point movement, so that the scribing point moves a greater or lesser distance than normal, depending upon the error to be corrected.

These and further objects and advantages of my invention will appear from a more detailed describing thereof, taken in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view showing the skeleton outline of a common type of pantograph apparatus, but with my compensating apparatus incorporated therein;

Fig. 2 is a detail plan view of the pantograph showing the customary parallelogram linkage;

Fig. 3 is a detail end elevation view showing the two opposite rails;

Fig. 4 is a view taken in a plane perpendicular to the axis of the cylinder showing various positions of a scribing point in a machine not provided with my compensating mechanism to indicate the errors to be corrected; and

Fig. 5 is a view similar to Fig. 4, indicating the mode of operation of my corrective mechanism.

Referring to Figs. 1 and 2 of the drawings, the pantograph illustrated has a tracer point 1 adapted to traverse a plane surfaced pattern indicated diagrammatically at 3, disposed on a suitable platform 5. The tracer point 1 is mounted on the usual arm 7, pivoted at 9 and 11 to arms 13 and 15 respectively, and supported by roller 17 traversing the plate 19 adapted to bear the weight of the pantograph parallelogram. The arms 13 and 15 are pivoted to the closing arm 21 of the parallelogram. The arm 15 extends beyond the arm 21, and is adjustably pivoted at 23 to the framework of the machine.

A post 25 is secured to the arm 21 to depend downwardly therefrom, and it is secured at its lower end to the horizontally disposed bar 27. A companion bar 29, extending parallel to the bar 27, is linked with the bar 27 by bands 31 and 32 passing around pulley 33, whereby when the bar 27 is moved longitudinally in one direction, the bar 29 is moved longitudinally either in the same direction or in the opposite direction, as desired, and depending upon whether the pulley 33 is locked or free to rotate. Such mechanism is well known and is employed for effecting opposite directions of motion of different scribing points to make reverse designs on opposite ends of the cylinder.

The linkage connecting the bars 27 and 29 with the different scribing points 75 engaging the surface of cylinder 70, is only diagrammatically illustrated in Fig. 1, except in so far as the apparatus of my invention is concerned, but in general the bar 27 is connected to a rail 35 by yokes 37 and 39, and the bar 29 is similarly connected to a rail 41 by yokes 43 and 45. As indicated in Fig. 3, the rails 35 and 41, when in central position, are spaced slightly above and at equal distances to opposite sides of the uppermost line of tangency of the cylinder 70. The rails 35 and 41 support arms 51 carrying the scribing points 75

and I have illustrated in Fig. 1, one arm 51 as attached to rail 35 at the left hand end of the cylinder and another arm 51 attached to the rail 41 at the opposite end of the cylinder, which is a customary arrangement for marking designs simultaneously on opposite ends of the cylinder. With that arrangement the reversing mechanism at 33 would usually be made operative to effect reverse markings on the two ends of the cylinder. It will be noted from Fig. 3 that the arms 51 carried by the rail 35 and the arms 51 carried by the rail 41 extend inwardly from opposite directions to bring their scribing points 75 in alignment with each other on the upper line of tangency of the cylinder.

With the exception of the connections, hereinafter to be described in detail, between the scribing points 75 and the yokes supporting the rails 35 and 41, all of the foregoing mechanism is old and well known in the art and accordingly need not be further described. It is obvious that as the tracer point 1 traverses the pattern 3, post 25 will follow the movement of the tracer point in the same scale or in a larger or in a smaller scale, depending upon the adjustment of the various pivot points of the parallelogram, and that the bars 27 and 29 will follow the movement of the post 25 moving in the same or opposite directions longitudinally of the cylinder, depending upon the adjustment of the reversing mechanism, but, in any event, moving together in directions around the cylinder. The yokes supporting the rails 35 and 41 will impart a similar movement to those rails and thence through the arms 51 will move the scribing points 75.

I have indicated in Fig. 4 the usual connections between the yokes and the scribing points and the errors in transference which arose from the use of pantographs so constructed. Whereas I have shown the connections through only one rail, it will be understood that the same principle applies to the opposite connections. As indicated, each arm 51, carrying a scribing point 75, is pivoted at 53 to a grooved bracket 55, slidably mounted on the rail 35 shaped in cross-section as indicated. Each arm 51 is mounted on its individual bracket 55 and the slidable connection between the brackets 55 and the rail 35 is for the purpose of readily adding or eliminating one or more scribing points and for adjusting them in different positions lengthwise of the rail, to position the design as desired on the cylinder. In prior devices of this nature, the rails have been secured directly to the yokes, as by being bolted thereto, and with this construction the pivot point 53 will move in all directions, in a single plane, precisely the distance desired for the scribing point to move relative to the movement of the tracer point and depending upon the scale reduction or increase for which the machine is adjusted.

To indicate the errors arising from transference to a cylindrical surface, let us assume that the scribing point is to move only in a plane which is perpendicular to the axis of the cylinder, as indicated in Fig. 4, for it is with such movements that the errors are greatest. Let us also assume that the maximum movement of the pivot point is from position 53*a*, on one side of the central position indicated at 53, to position 53*b* on the other side. In moving between these two extreme positions the scribing point will move between the extreme positions indicated at 75*a* and 75*b*. As stated, the pivot point 53 moves precisely the distance desired for the scribing point 75 to move and if the distance from 53 to 53*b* be measured off around the surface of the cylinder in the direction of the point 75*b*, where the scribing point actually came to rest, it will be found that the point desired falls at 75*b'*, or an appreciable distance greater than the distance actually inscribed.

The chief factor giving rise to this error is that in moving from the point 75 to the point 75*b*, the arm 51 gradually rotated from approximately a horizontal position to the inclined position 51*b*, and this rotation caused the point 75 to traverse a distance less than was desired.

On the left hand side of the cylinder, the error is much larger than on the right hand side, with the mechanism illustrated, and in this case the error is one which causes the scribing point to traverse a distance greater than was desired, rather than a lesser distance, as was the case on the right hand side. If the distance 53 to 53*a*, the correct distance desired, be measured on the surface of the cylinder from the point 75 toward the point 75*a*, it will be found that the correct distance terminates at the point 75*a'*, a distance considerably less than that actually reached by the scribing point. It will be observed that in this case, as the pivot point 53 was on the same side of the cylinder as that traversed by the scribing point, the arm 51 rotated through a greater angle and that that angle tended to increase the length transcribed as illustrated.

Referring now to Figs. 1 and 5, I will describe the mechanism I have devised for compensating for these errors. Instead of mounting the rails 35 and 41 rigidly to the yokes 37, 39, 43 and 45, according to the prior practice and as indicated in Fig. 4, I rotatably secure through the lowermost extensions of the yokes, the shafts 55 and 57, which shafts, though rotatable in the yokes, are secured against longitudinal movement in the yokes by blocks 59 secured to the shafts 55 and 57, and fitting between the forked lower ends of the yokes. The rails 35 and 41 are now rigidly secured to the blocks 59 thus secured to the rotatable shafts and by this arrangement the rails move with the yokes but also may rotate about the axis of the shafts 55 and 57.

Each shaft carries secured to it a pair of spaced arms 61 and 63, connected at their upper extremities by a rod 65, riding on a curved cam surface 67 (Fig. 5) of a bar 69, suitably secured to the framework of the machine. A counterweight 99 (Fig. 5) maintains the rod 65 against cam surface 67.

As indicated in Fig. 5, as the pivot point 53 now moves to the point 53*a'* or 53*b'*, the rod 65 traverses the cam surface 67, and imparts rotative movement to the shaft 55, which gives the desired correction to compensate for the curvature of the surface of cylinder 70. Thus, as the pivot point 53 moves to the point 53*a'*, that point will be rotated slightly about the axis of shaft 55 in a counterclockwise direction to cause the scribing point 75 to move a lesser distance than it would have moved without such rotation of the pivot point, with the result that the scribing point 75 will now move to the desired point 75*a'* rather than to the point 75*a* as before. The cam surface 67 is properly designed not only to produce the precise amount of rotation necessary to produce the desired correction, but also to impart that corrective rotation in gradual increments, proper for the curvature of cylinder 70, so that the correct distance is traversed regard-

less of how extensive. The cam is of course designed to give the proper corrective movement when the scribing point 75 moves in the *b* direction.

I have described above a particular type of pantograph and a specific manner of curing certain errors inherent in the construction illustrated. It is obvious that the particular amount and kind of error is immaterial, so far as my method of correcting it is concerned, because different sorts of error can be corrected by appropriately designing the cam surface 67 and this surface may vary upon a mere change in the radius of the cylinder being marked.

Under some working conditions it may be necessary to provide only an approximate correction of the error incident to the curvilinear surface and in that event the cam may take the form of one or more straight edges set at the proper angles necessary for the correction desired. When using such straight edges, compensation for cylinders of different radii may be effected by merely changing the inclination of the straight edge cams. Furthermore, corrections for curvilinear surfaces of all types are within the scope of my invention and I do not wish to limit myself to the use of correcting mechanism merely for cylindrical surfaces.

Also some types of pantograph may not employ the pivoted arm giving rise to the error above discussed, but, in such machines an error may arise chiefly from the difference between the arc traversed by the scribing point and the chord subtending that arc. All such errors may be eliminated by imparting to the linkage an additional corrective movement and my invention is not to be limited to such details except as indicated in the appended claims.

I claim:

1. In a pantograph for transcribing a design from a pattern to a surface which does not lie in a plane parallel to the face of the pattern, the combination of a pattern-following tracer point, scribing means for marking the surface, linkage connected at one end to the said tracer point and at its other end to the scribing means adapted to move the scribing means over the surface upon movement of the tracer point over the pattern and means adapted to impart movement to the said linkage independent of the movement imparted to it by movement of the tracer point, to correct distortions arising from the movement of the scribing means in following said surface.

2. In a pantograph for transcribing a design to a curved surface, the combination of a pattern-following tracer point, scribing means for marking the curved surface, follower mechanism connected to the tracer point and having a member movable, by said connections, in paths geometrically similar to the movement of the tracer point, linkage connected at one end to the said member to move therewith in said paths and at its other end to the scribing means to move the latter over said curved surface and means adapted to impart movement to the said linkage independent of the movement imparted to it by said member to correct distortions arising from the curvilinear movement of the scribing means in following said surface.

3. In a pantograph for transcribing a design to a curved surface, the combination of a pattern-following tracer point, scribing means for marking the curved surface, follower mechanism connected to the tracer point and having a member movable, by said connections, in paths geometrically similar to the movement of the tracer point, linkage pivotally connected at one end to the said member to move therewith in said paths and connected at its other end to the scribing means to move the latter over said curved surface, and means adapted to swing the said linkage about said pivot to impart movement to the said linkage independent of the movement imparted to it by said member, to correct distortions arising from the curvilinear movement of the scribing means in following said surface.

4. In a pantograph for transcribing a design to a curved surface, the combination of a pattern-following tracer point, scribing means for marking the curved surface, linkage connecting the tracer point and the scribing means adapted to move the scribing means over the curved surface upon movement of the tracer point over the pattern, a cam and cam following means engaging said cam and connected to said linkage, the said cam following means co-operating with said cam to vary the movement imparted to the scribing means by the tracer point to correct distortions arising from the curvilinear movement of the scribing means in following said surface.

5. In a pantograph for transcribing a design to a curved surface, the combination of a pattern-following tracer point, scribing means for marking the curved surface, follower mechanism connected to the tracer point and having a member movable, by said connections, in paths geometrically similar to the movement of the tracer point, linkage pivotally connected at one end to the said member to move therewith in said paths and connected at its other end to the scribing means to move the latter over said curved surface, a stationary cam, and cam follower means engaging said cam and connected to said linkage to be moved over the surface of said cam by movement of the linkage, the said cam surface being designed to impart movement to the said linkage independent of the movement imparted to it by the said member to correct distortions arising from the curvilinear movement of the scribing means in following said surface.

6. In a pantograph for transcribing a design to the surface of a cylinder, the combination of scribing means for marking the cylinder, a pattern-following tracer point connected to the scribing means to move the latter to any point desired within an area on the surface of the cylinder extending a limited distance lengthwise of the cylinder and limited equal distances on opposite sides of a line in the surface of the cylinder parallel to the axis thereof, a cam, and cam-following means engaging the cam and connected to the scribing means to control the movement imparted to the scribing means by the tracer point, the said cam having a cam surface designed to correct the extent of movement of the scribing means in all directions not parallel to the said line whereby to correct errors in transference incident to the curvature of said cylinder.

7. In a pantograph for transcribing a design to the surface of a cylinder, the combination of scribing means for marking the cylinder, a pattern-following tracer point connected to the scribing means to move the latter to any point desired within an area on the surface of the cylinder extending a limited distance lengthwise of the cylinder and limited equal distances on opposite sides of a line in the surface of the cylinder parallel to the axis thereof, a cam, and cam-following means engaging the cam and connected to the scribing means to control the movement im-

parted to the scribing means by the tracer point, the said cam having one surface portion designed to increase the extent of movement of the scribing means over that imparted to it by the tracer point when the scribing means moves on one side of the said line in any direction not parallel thereto and another cam portion designed to decrease the extent of such movement on the other side of said line whereby to correct errors in transference incident to the curvature of said cylinder.

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