

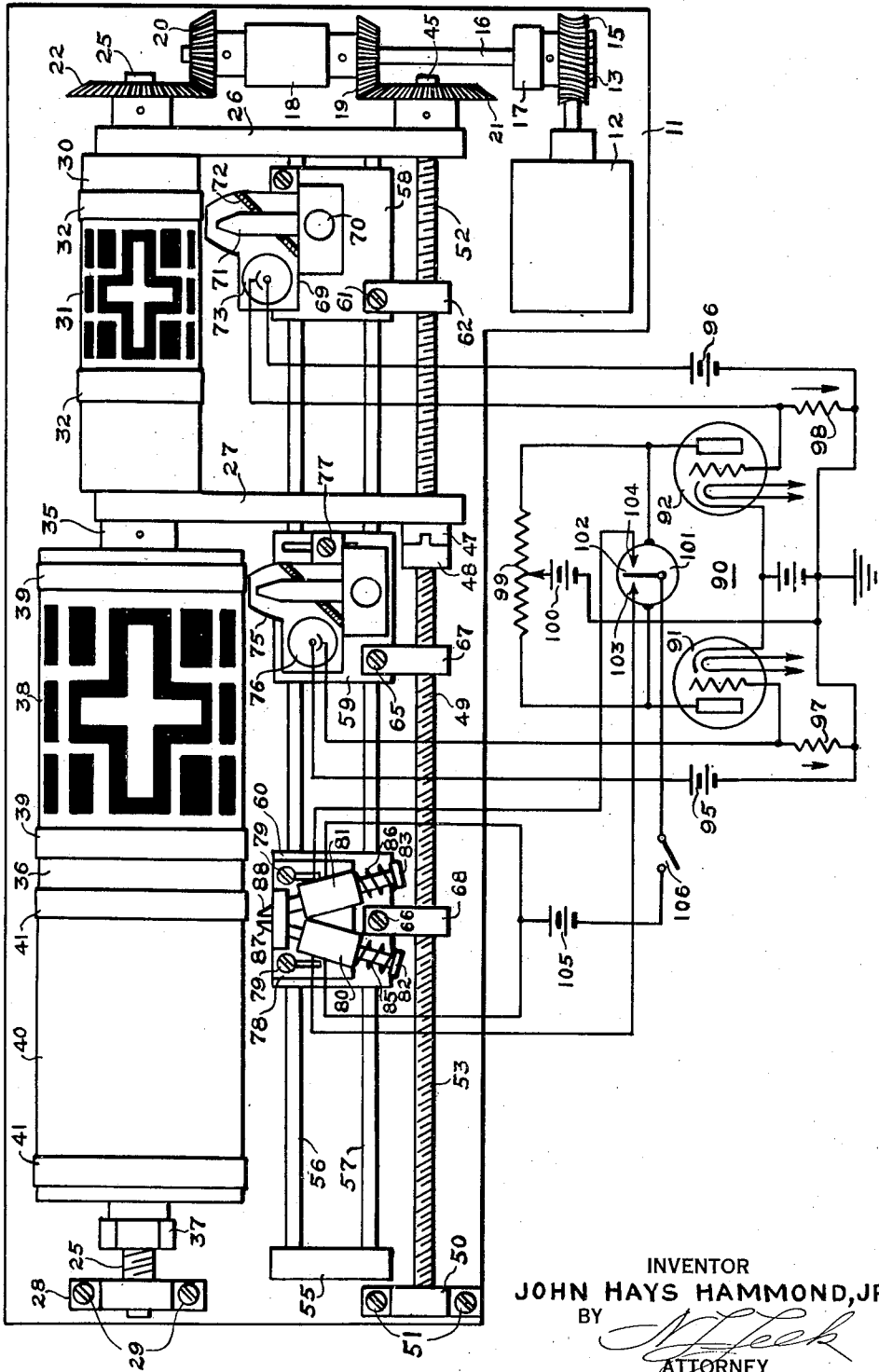
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SCANNING COMPARATOR

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SCANNING COMPARATOR

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This invention relates to comparators for comparing an original and a facsimile and more particularly to means for comparing representations on two surfaces by simultaneously scanning the original and the facsimile and comparing one with the other point by point.

The invention also provides a balanced bridge system for comparing the outputs of the scanning devices.

The invention further provides automatic means for making a record of any differences which may exist between the original and the facsimile.

The invention also provides for comparing originals with enlargements and for making a record of the same and the term "facsimile" is used herein to include enlargements and reductions as well as copies of the same size.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization, may be better understood by referring to the following description, taken in connection with the accompanying drawing forming a part thereof, in which the figure illustrates diagrammatically the system as applied to the comparing of an original and an enlargement thereof together with a means for making a record of the same.

In the following description and in the claims parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring to the accompanying drawing a base 11 is provided, upon which is mounted an electric motor 12 driven from any suitable source not shown. Secured to the shaft of the motor 12 is a worm 13 which meshes with a worm wheel 15, which is secured to a shaft 16 rotatably mounted in bearings 17 and 18 which are supported on the base 11. Secured to the shaft 16 are two beveled gears 19 and 20 which mesh with two beveled gears 21 and 22 respectively.

The beveled gear 22 is secured to the end of a shaft 25 which is rotatably mounted in brackets 26, 27, and 28 which are mounted on the base 11, the bracket 28 being secured thereto by means of screws 29. Secured to the shaft 25 is a drum 30 upon which is mounted the original

drawing 31, this being secured to the drum by means of suitable clamps 32. Secured to the shaft 25 is a collar 35. Slidably mounted on the shaft 25 is a drum 36 which is held tightly against the collar 35 by means of a nut 37, which is screwed upon a threaded part of the shaft 25. In this case the drum 36 is twice the diameter of the drum 30. Mounted upon the drum 36 is a double sized copy 38 of the drawing 31, this copy being secured to the drum 36 by means of suitable clamps 39. Wrapped upon the drum 36 is a sheet of transparent material 40 which is secured to the drum by means of suitable clamps 41.

The beveled gear 21 is secured to a shaft 45 which is rotatably mounted in the brackets 26 and 27. Secured to the end of the shaft 45 is a female coupling 47 which is engaged by a corresponding male coupling 48, which, in turn, is secured to a shaft 49 which is rotatably mounted in a bracket 50 secured to the base 11 by screws 51. The shaft 45 is provided with threads 52 and the shaft 49 is provided with threads 53. The relative pitches of the threads 52 and 53 are in the same proportion as the relative lengths of the drums 30 and 36.

Mounted in brackets 26, 27, and 55 are two rods 56 and 57. Slidably mounted upon the rods 56 and 57 are three carriers 58, 59, and 60. Secured to the carrier 58 by means of a screw 61 is a bracket 62 which is tapped to engage the threads 52 of the shaft 45. Secured to the carriers 59 and 60 by means of screws 65 and 66 are two brackets 67 and 68 which are tapped to engage the shaft 49. Mounted on the carrier 58 is a photo-electric pick-up system 69 which is provided with a source of illumination 70, an optical system 71 for focusing the light upon the drawing 31, and an inclined mirror 72 for reflecting the reflected light upon a photo-electric cell 73. This pick-up system may be similar to that shown and described in Fig. 2 on page 54 of Radio Facsimile, vol. I, Oct. 1938, published by R. C. A. Institute Technical Press and only so much thereof has been set forth herein as is necessary to an understanding of this invention.

Adjustably mounted upon the carrier 59 is a similar photo-electric pick-up system 75 which is provided with a photo-electric cell 76. The photo-electric pick-up system 75 is clamped to the carrier 59 in any desired position by means of screw 77. Adjustably mounted upon the carrier 60 is a base 78 which is clamped to the carrier 60 in any desired position by means of screw 79. Mounted on the base 78 are two solenoids

80 and 81 which are provided with cores 82 and 83, which are normally held in the positions shown by means of compression springs 85 and 86. Secured to the ends of the cores 82 and 83 are two marking crayons 87 and 88 which are of different colors, say for example red and blue respectively.

The photo-electric cells 73 and 76 are connected through batteries 96 and 95 respectively to resistors 98 and 97 respectively, which are connected in the grid circuits of triode tubes 91 and 92, forming a part of a bridge circuit 90. The plates of the tubes 91 and 92 are connected across a potentiometer 99, the adjustable contact of which is connected to ground through a plate supply battery 100. A galvanometer 101 is connected between the plates of the tubes 91 and 92 and is provided with a contact arm 102 which at suitable times engages one or the other of two contacts 103 and 104. The contacts 103 and 104 are connected to the solenoids 80 and 81 respectively. The return leads from said solenoids are connected through a battery 105 and a switch 106 to the contact arm 102 of the galvanometer 101.

In the operation of the invention the bridge system 90 is first calibrated by placing sheets of identical intensity of shading in place of the drawing 31 and the reproduction 38 on the drums 30 and 36 respectively. The switch 106 is opened and the motor 12 is started and as the photo-electric scanners 72 and 75 scan the calibration sheets, the potentiometer 99 is so adjusted that the contact arm 102 of the galvanometer 101 remains in a central position.

The calibration sheets are then replaced on the drums 30 and 36 by the drawing 31 and the reproduction 38, as shown in the figure. The scanners 69 and 75 are then returned to their initial positions by reversing the motor 12. The switch 106 is then closed and the motor 12 is started in the forward direction. This causes the drums 30 and 36 to be rotated and at the same time the scanners 69 and 75 and the marking device 87-88 will be slowly moved to the left as seen in the figure. The rate of feed of the scanner 75 and of the marking device 87-88 will be in this case twice as that of the scanner 69 because of difference in pitch of the threads 52 and 53. In this way the drawing 31 and the reproduction 38 will be simultaneously scanned by the scanners 69 and 75 in a well known manner.

As long as the intensity of shading of the original drawing 31 and of the reproduction 38 are equal the contact arm 102 of the galvanometer 101 will remain in a central position. If the shading should be unequal, however, the illumination of the photo-cells 73 and 76 will be unequal. If, for example, the shading is deeper on the reproduction 38 than on the original 31, the photo-cell 73 will receive more light than the photo-cell 76. This will cause relatively more current to flow through the resistor 98 than through the resistor 97 as indicated by the arrows thus making the grid of the tube 92 more positive than the grid of the tube 91. This will allow relatively more current to flow through the tube 92 than through the tube 91 and will cause the plate of the tube 92 to become more negative than the plate of the tube 91, which in turn will cause the contact arm 102 of the galvanometer 101 to move to the left. Conversely if the shading is lighter on the reproduction 38 than

on the original 31 the contact arm 102 will move to the right.

When the contact arm 102 moves to the left it will engage the contact 103 thus closing a circuit from the battery 105 through the solenoid 80 which will cause the core 82 to be moved forward. This in turn will cause the marking crayon 87 to contact the transparent sheet 40 making a distinctive mark thereon, which for example may be red in color. When the contact arm 102 moves to the right it will engage the contact 104 thus energizing the solenoid 81 which will cause the marking crayon 88 to engage the sheet 40 making a different type of mark thereon, which for example may be green in color.

It is thus seen that when the reproduction 38 is darker than the original 31 a red mark is made on the sheet 40 and when the reproduction is lighter a green mark is made on the sheet 40. After the original and reproduction have been completely scanned and the corrective record made on the sheet 40, the motor 12 is stopped and the original 31, the reproduction 38 and the sheet 40 are removed from their respective drums. The transparent sheet 40 is then placed over the reproduction 38 and the colored markings thereon show which parts of the reproduction are darker and which parts are lighter than the original.

While the corrective record on the sheet 40 has been described as being made up of different colored markings it is to be understood that any type of distinctive marking may be employed, such for example as different width lines or lines of different density.

In the present example of the invention the reproduction is approximately twice the size of the original. If a different size reproduction is to be compared the screws 29 are loosened and the bracket 28 is taken off. The nut 37 is then unscrewed from the shaft 25 and the drum 36 is removed. Another drum of the proper size is then placed upon the shaft 25 and the nut 37 is replaced and tightened up so that the drum is clamped between the nut 37 and the collar 35.

The screws 51, 65, and 66 are loosened and the bracket 50 is removed. The coupling 47-48 is then disengaged and the threaded shaft 49 together with the brackets 67 and 68 is removed. Another threaded shaft 49 together with associated brackets 67 and 68 is substituted for the first shaft 49 and the replaced brackets 50, 67, and 68 are screwed in place. The threads 53 on the new shaft 49 have a pitch corresponding to the size of the new drum 30 so that when the apparatus is set in motion the photo-electric pick-up 75 will scan the new reproduction 38 at the proper rate.

If the original 31 and the reproduction 38 are of the same size the drum 36 will be of the same diameter as the drum 30 and the threads 53 on the shaft 49 will have the same pitch as the threads 52 on the shaft 45.

It is to be understood that the scanning devices may remain stationary and the drums may be shifted for scanning purposes. If desired the surfaces to be scanned may be flat instead of circular and the movement of the scanning devices may be correspondingly modified to simultaneously scan the two surfaces point-by-point. The scanning device shown may also be replaced by other scanning devices such as a cathode ray scanning tube, or the like. The galvanometer 101 may be used for a visual indication in which

case the sheet 40 and the marking devices may be omitted. The invention is particularly adapted to comparing drawings, pictures, designs or even printed matter regardless of variations in size.

Although only a few of the various forms in which this invention may be embodied have been shown herein, it is to be understood that the invention is not limited to any specific construction but may be embodied in various forms without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. The method of comparing an original surface design or insignia with a facsimile thereof and indicating the points of difference on a record, which comprises simultaneously scanning the original, the facsimile and the record point by point, balancing against each other the scanning effects produced by scanning the original and the copy, to thereby cause the effects to be cancelled when the scanned points are identical and to produce a resultant effect when the scanned points differ, and utilizing the resultant effects derived from any scanned point to produce a predetermined designation on said record at the corresponding point, for thereby making a record of the locations of any inaccuracies in said facsimile.

2. The method set forth in claim 1 further characterized by making the record on a transparent sheet and superimposing said transparent record sheet on said facsimile to indicate by the location of the designations thereon the locations of any inaccuracies in said facsimile.

3. The method set forth in claim 1 further characterized by producing differently characterized designations on said record to indicate whether the inaccuracies in said facsimile are lighter or darker than the original at the points involved.

4. An apparatus for comparing an original surface design or insignia with a facsimile thereof, which comprises scanning devices for scanning said original and said facsimile, means causing said devices to simultaneously scan the same point by point, means comparing the scanning effects produced by said devices to cause the effect to be cancelled when said scanned points are identical and to produce a resultant effect when the scanned points differ, a record, a stylus moving thereover in synchronism with the movement of said scanning means, and means actuated in response to differences in said scanning effects at the various scanned points to cause said stylus to make a predetermined designation on said record at the corresponding point, for thereby indicating the positions of any inaccuracies in said facsimile.

5. An apparatus for comparing an original surface design or insignia with a facsimile thereof, which comprises scanning devices for scanning said original and said facsimile, means causing said devices to simultaneously scan the same point by point, means comparing the scanning effects produced by said devices, a record, a pair of differently characterized styluses movable over said record in synchronism with the movement of said scanning means, and means responsive to differences in scanning effects at the various points to actuate a selected stylus and to cause said stylus to make a designation on said record, said designation indicating the position of an inaccuracy in said facsimile and whether the facsimile is lighter or darker than the original at said point.

6. A machine for making a record of inaccuracies in a facsimile on a record, which comprises a pair of scanning means adapted respectively to scan an original surface design or insignia and the facsimile to be compared therewith, means balancing the scanning effects produced by said scanning devices whereby the effects are cancelled out at points where the surfaces are of equal intensity, recording means movable over said record in synchronism with the movement of said scanning means, and means responsive to differences in scanning effects at the various points to actuate said recording means, for thereby producing predetermined designations on said record corresponding to the positions of any inaccuracies in said facsimile.

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