

March 15, 1938.

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2,111,068

MEANS FOR DETERMINING INK PRINTING CAPACITIES OF PRINTING ELEMENTS

Filed April 5, 1935

5 Sheets-Sheet 1

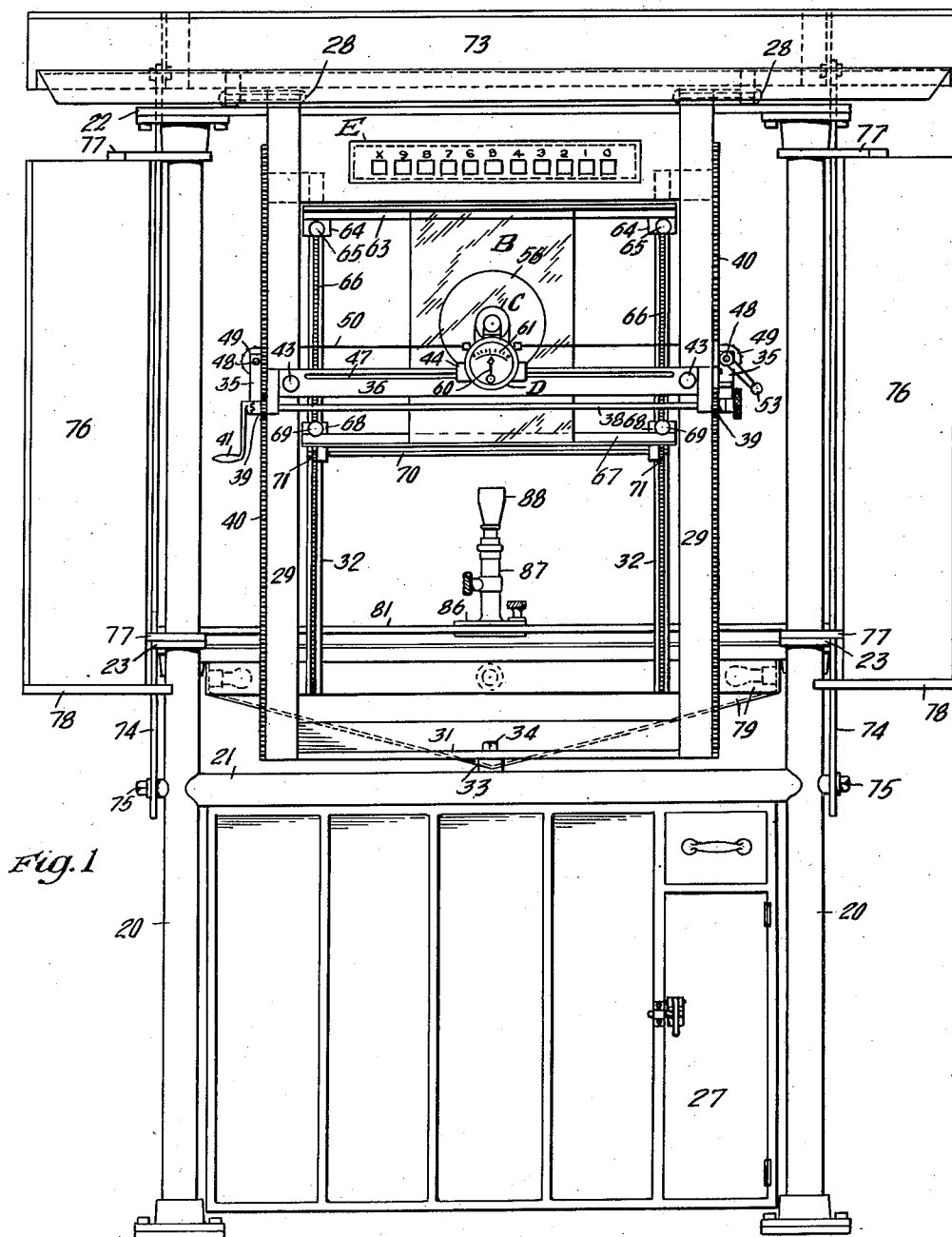


Fig. 1

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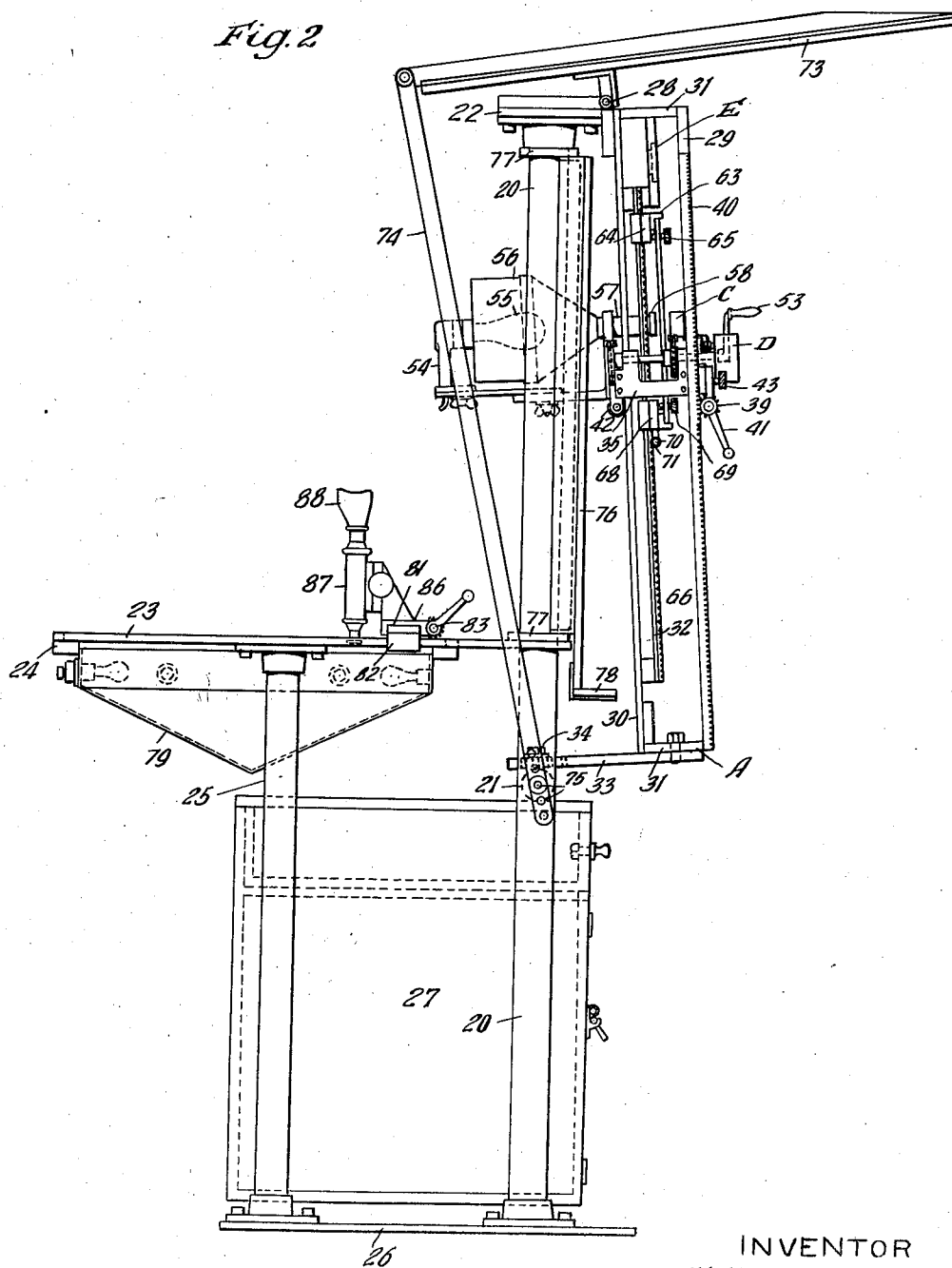
2,111,068

MEANS FOR DETERMINING INK PRINTING CAPACITIES OF PRINTING ELEMENTS

Filed April 5, 1935

5 Sheets-Sheet 2

Fig. 2



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MEANS FOR DETERMINING INK PRINTING CAPACITIES OF PRINTING ELEMENTS

Filed April 5, 1935

5 Sheets-Sheet 3

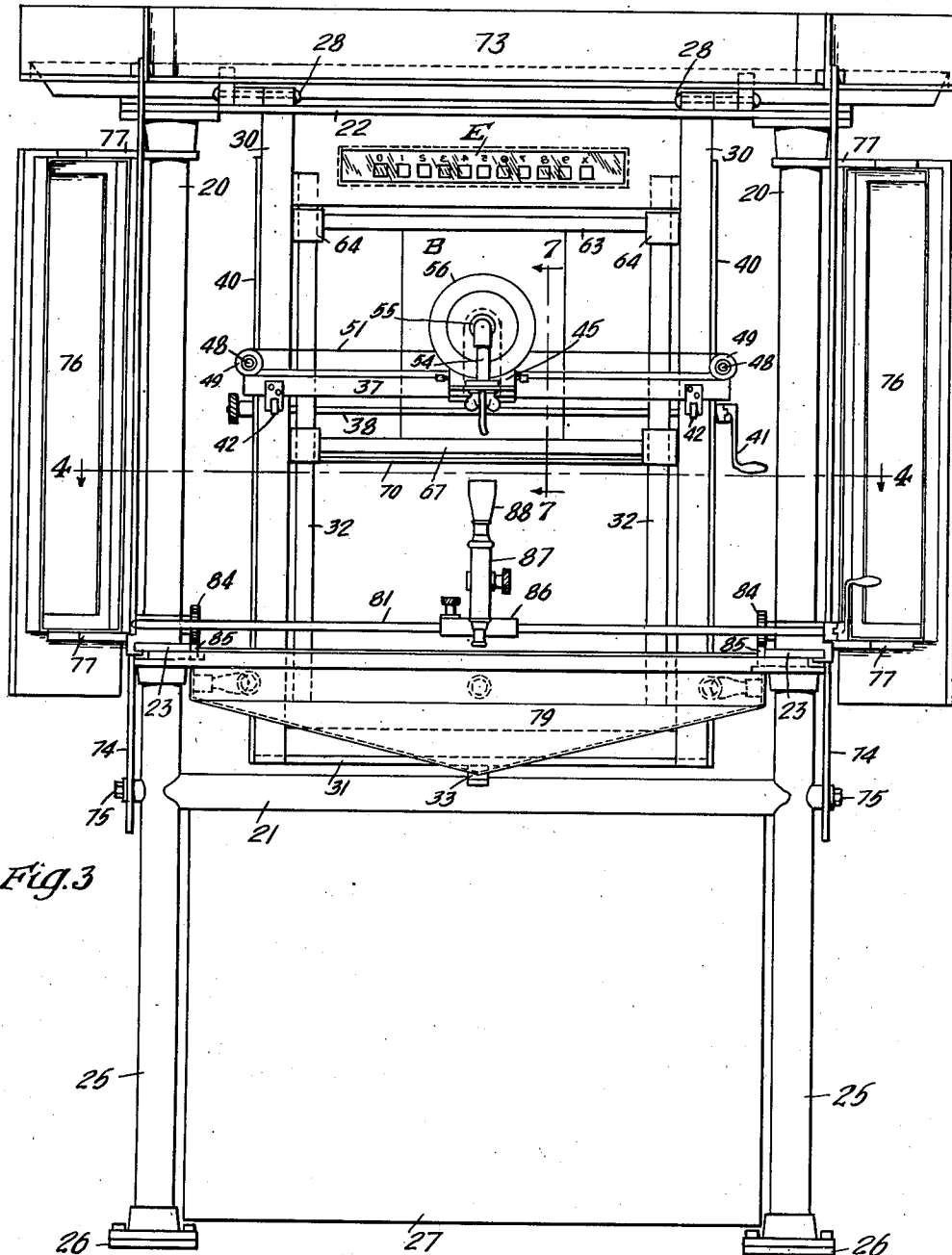


Fig. 3

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MEANS FOR DETERMINING INK PRINTING CAPACITIES OF PRINTING ELEMENTS

Filed April 5, 1935

5 Sheets-Sheet 4

Fig. 4

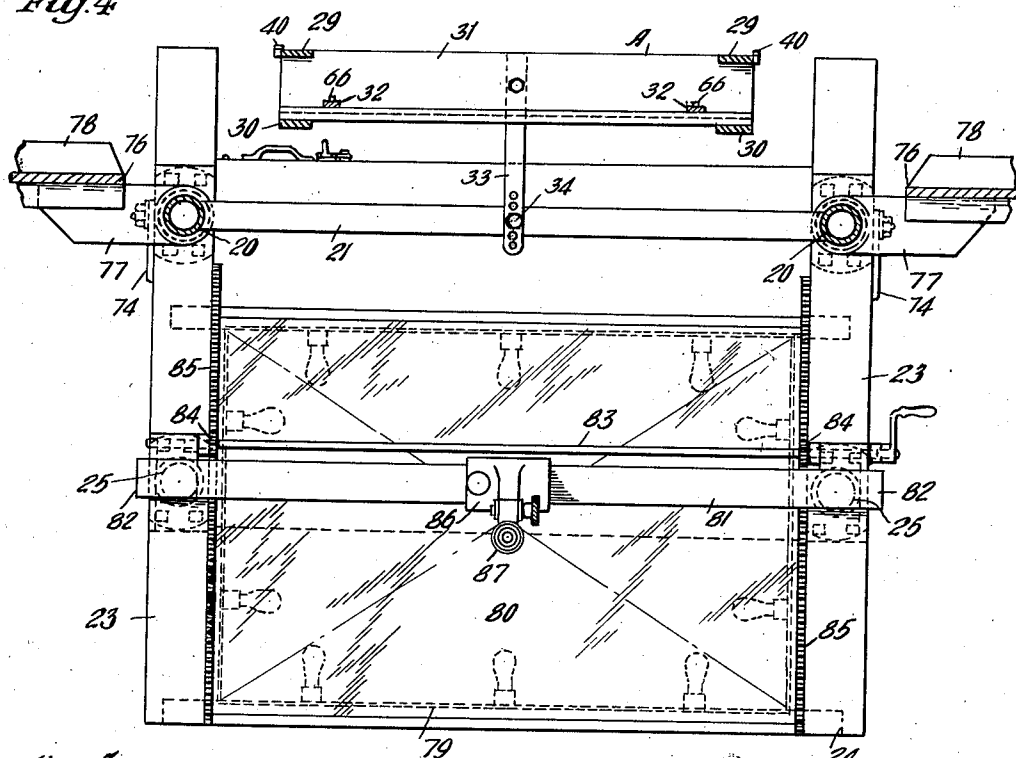


Fig. 5

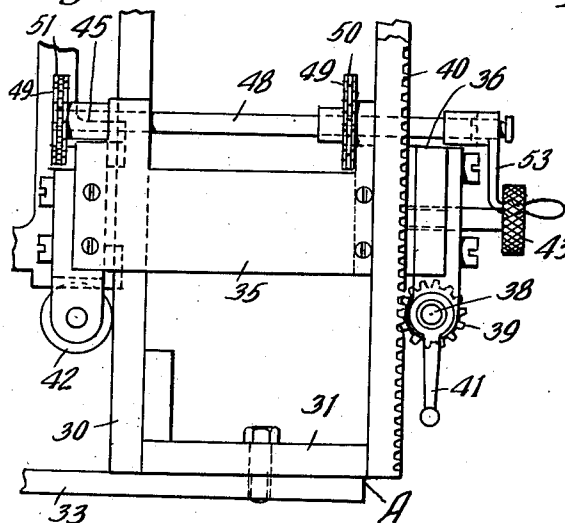
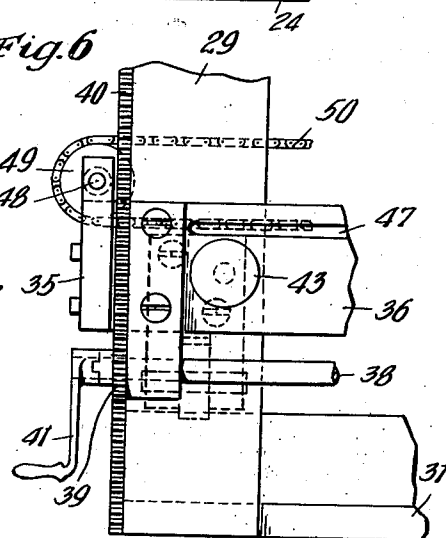


Fig. 6



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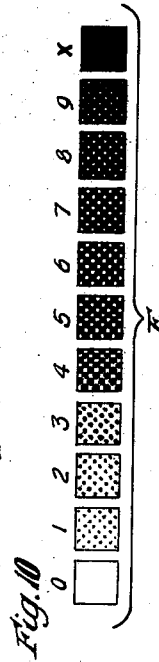
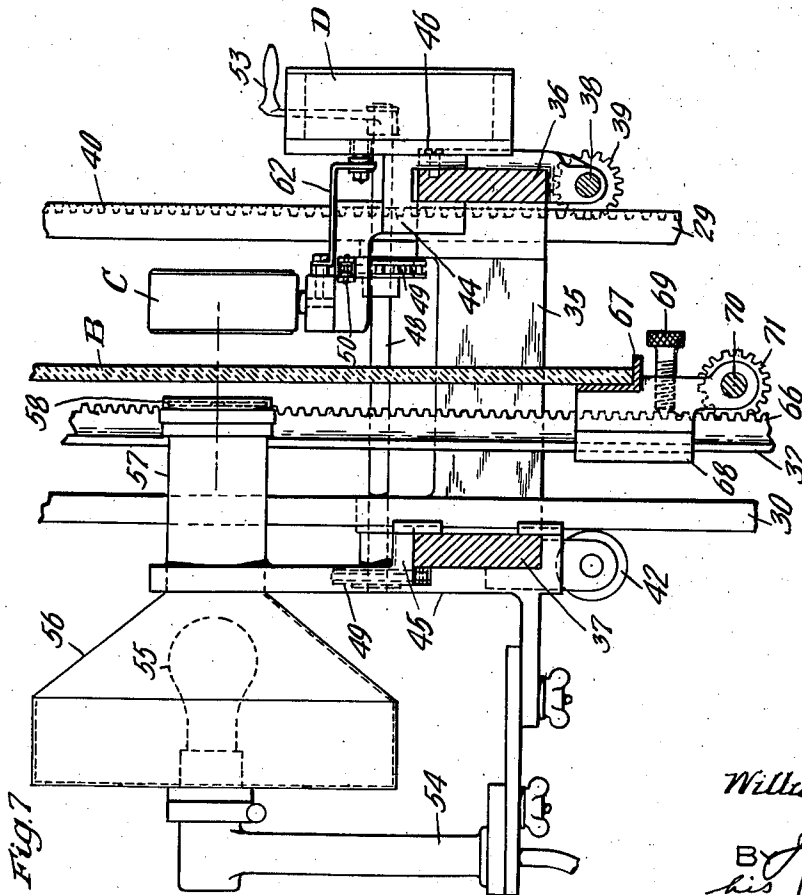
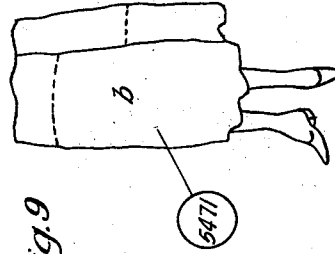
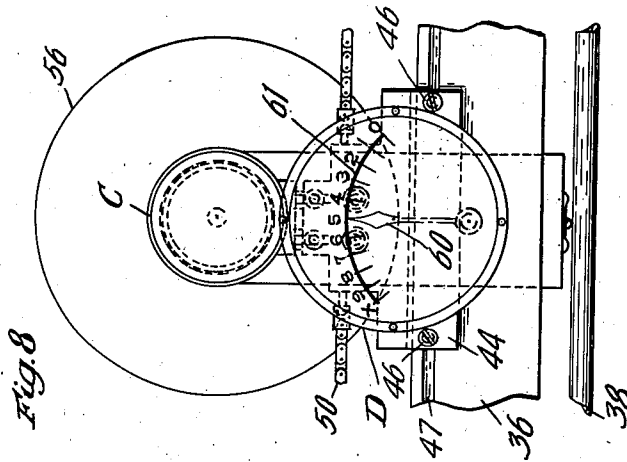
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MEANS FOR DETERMINING INK PRINTING CAPACITIES OF PRINTING ELEMENTS

Filed April 5, 1935

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,111,068

MEANS FOR DETERMINING INK-PRINTING
CAPACITIES OF PRINTING ELEMENTS

William C. Huebner, New York, N. Y.

Application April 5, 1935, Serial No. 14,810

4 Claims. (Cl. 88-14)

This invention relates to improvements in means for determining ink-printing capacities of printing elements.

As well known, the use of color printing is increasing rapidly, particularly in connection with advertising, due to the greater appeal to the prospective consumer. With the increasing use of color printing there has been a constant demand for improvement in the fidelity of the reproductions, particularly in connection with advertising of such products as wearing apparel and the like where, if the color in the advertisement departs in any material respect from that of the actual goods, the purchaser is likely to become dissatisfied, with consequent loss of sales and good will of the seller.

One object of my invention, therefore, is to provide improved means which will insure true and faithful printed reproductions of colored original subjects and whereby reliance upon human variables heretofore universally attending color printing, is eliminated or reduced to the absolute minimum.

More specifically, the object of my invention is to devise precision apparatus utilizable at the most critical step in the color printing process for determining the quality of the printed reproductions and thereby eliminate the guess-work or cut and try methods heretofore used.

Other objects of my invention will more clearly appear from the description and claims hereinafter following.

In the art of color printing, the general practice heretofore has been as follows. Upon determining the number of different color pigments to be employed in printing the reproductions, usually yellow, red, blue and black (the latter being herein considered as a color in the interests of conciseness), a corresponding number of color-separation photographic negatives are made of the subject to be reproduced. From the negatives are then usually prepared a corresponding set of positives which in turn are then used to photographically prepare the set of color press plates.

As understood by those skilled in the art, a great many variables enter into the production of such a set of color press plates. In the steps of photographically obtaining and preparing the negatives and positives, the time of exposure of the different negatives may vary even with the best of care; the intensity of the light used for exposing may vary from time to time, and there is also likelihood of variations in the sensitive coatings, emulsions and the like, so that the dif-

ferences existing between the several final photographic plates or printing elements of a color series and even between portions of the same photographic plate may be quite extensive. Inasmuch as the ink capacities of the ink-conveyor units of the final press plates are determined, in last analysis, by the condition of the photographic printing-elements used directly in preparing the press plates, it is obvious that variations and deviations from the original subject in said printing-elements will correspondingly affect the respective press plates and hence correspondingly affect the finished printed reproductions. To overcome these disadvantages, it has been the universal practice to retouch the photographic printing-elements, negatives or positives, strengthening or reducing the same in those areas as thought necessary by the particular retoucher by whom treated. While retouchers are usually men of long experience and considered highly skillful, nevertheless experience has demonstrated that it is impossible for the human eye to detect, on the usual monotone photographic plates, all of the delicate variations in the separation color plates needed to build up the final colors on the printed sheet. The same retoucher will vary from day to day in his judgment or estimates of the printing values of the plates; rarely will two retouchers exercise similar judgment; and the final result that will be obtained in the finished printed reproduction remains unknown until the printing of all the colors is completed. This has necessitated the use of many trial proofs, frequent recorections and often made-over plates before a finished printed product is obtained sufficiently close to the original to satisfy the customer.

Briefly, the herein described improvements contemplate the four following main features. First, critical or control areas of the original color subject are selected and, by direct comparison thereof with a previously accurately graduated and indexed master color chart built up from combinations of those colors to be utilized in the printing, determination is thereby made of the relative proportions of each of the individual colors that will be required to reproduce those complete colors or hues appearing in the critical areas of the original subject. The master chart is provided with proper indicia showing accurately, for each hue thereof, the chroma or color intensity of each component color necessary, when all are combined, to reproduce the hue of the corresponding area of the original subject with which it matches.

The second main feature involves the use of what may be termed a key chart. The latter may be and preferably is a black and white outline reproduction of the original subject. As each selected critical area of the original subject has its color composition determined by matching with the master chart, as indicated in the preceding, the identifying indicia for each of the component colors thereof is then placed on the key chart for the areas corresponding to the selected areas of the original subject. In so far as the two main features just above referred to are concerned, they may be, and preferably are, carried out by the means and method disclosed in my prior Patent 1,703,449 of February 26, 1929, to which reference should be had for a fuller understanding of the present invention.

The next main feature of the present invention involves the use of precision apparatus which directly measures and indicates by scale readings, the effective capacities of the same selected areas on each of the color separation printing elements, for producing the ink-conveyor units in the corresponding press plates when prepared from the photographic printing elements. The means for obtaining the indicated measurements will vary in accordance with the particular method of printing employed, as hereinafter described, that is, whether color gravure, relief or off-set.

The color value scale measurements having been obtained as described in the preceding for, and indicated on, each of the respective photographic plates, where a variation is thus shown to be present on any control or selected area of a photographic plate from the previously determined chroma index of the corresponding area of the key chart, correction is made so as to increase or decrease, as may be called for, the values on the photographic plate so that the printing value capacity thereof coincides with that of the original subject as determined and called for on the key chart. When all the photographic plates have thus been measured for their respective color value capacities and corrections made where necessary, the plates are then suitable for the final step of preparing the press plates therefrom.

In the drawings forming a part of this specification, two types of precision apparatus for carrying out the invention are shown embodied in the one machine and as such machine is supplied to the trade in order that the printer may use the invention in connection with any one of the three general methods of printing.

As understood in the art, in the color gravure method of printing, the printing values of the ink conveyor units of the gravure plates are determined by the depths to which the units are etched below the surface of the plate, each unit being of the same surface area. The greater the depth of each ink-conveyor unit, the greater the density of the ink that will be transferred to the paper under an impression.

In relief and off-set color printing methods, the values or gradations between solid or full-color and white or no color, are obtained by varying the sizes of the dots, lines or grains which constitute the ink-conveyor units of the press plate. In order therefore, in carrying out my invention, to measure the capacities of the ink conveyor units which will be obtained from the photographic plates on the press plates, the measurements for units utilized in the relief and off-set methods will be measurements of area whereas the measurements utilized in the gravure

process will be measurements of light densities or light transmitting capacities of the photographic plates. It is with reference to the latter method of printing that the present application is more specifically concerned, although the invention as applicable to all methods is contemplated broadly herein.

In the drawings forming a part of the present application, Figure 1 is a front elevation of an apparatus embodying my invention and suitable for carrying out the method of my invention. Figure 2 is a side elevation of the apparatus shown in Figure 1. Figure 3 is a rear elevational view of the apparatus shown in Figure 1. Figure 4 is a horizontal sectional view corresponding to the section line 4-4 of Figure 3. Figure 5 is an enlarged side elevational view, similar to Figure 2, illustrating the details of certain of the parts. Figure 6 is an elevational view of that portion of the structure illustrated in Figure 5 and taken at right angles thereto. Figure 7 is an enlarged vertical sectional view of a portion of the apparatus shown in Figure 3 and corresponding to the line 7-7 thereof. Figure 8 is a front elevational view of part of the structure illustrated in Figure 7, Figure 9 is a diagrammatic indication of a portion of a key chart such as may be used in carrying out my invention. And Figure 10 is a graphic representation illustrative of a printing-element chroma-scale for one color such as utilized in calibrating and checking the indicating meter of my improvements.

Describing first the structural features of the apparatus embodying the invention, the same comprises a main framework consisting of two vertically extending tubular uprights 20 connected by an intermediate cross brace 21 and a top plate 22. Extending rearwardly from the uprights 20 at a point approximately midway their length, are two horizontal arms 23 connected by a rear cross piece 24 so as to provide a table, the latter in turn being supported in part by two smaller tubular uprights 25. Both sets of uprights 20 and 25 are in turn suitably rigidly connected at their bottom ends by floor plates 26. For convenience of the operator, the apparatus is preferably provided with a cabinet 27 between the uprights, said cabinet having suitable drawers, cupboards and pigeon holes, unnecessary to describe in detail, for the reception of plates, brushes and other articles used in the retouching process.

Pivottally connected to the top of the main upright frame at 28, is what may be termed a guide-bar frame designated, generally, by the reference character A. Said guide-bar frame A, as shown, comprises four main corner guide-bars 29-29 and 30-30 rigidly connected at their tops and bottoms by horizontally extending plates 31-31. A supplemental set of vertically extending guide-bars 32-32 is also carried by said frame A, the guide-bars 32 being disposed within the area defined by the four corner bars 29 and 30, as clearly shown in Figures 1, 2 and 4. The entire frame A is angularly adjustable about its pivot 28 to suit the convenience of the operator, by means of a bottom strap 33 which is adapted to be detachably connected in any adjusted position by bolt 34 cooperating with the main cross brace 21.

Vertically adjustable on the four corner guide-bars 29 and 30 is a carriage which consists, preferably, of two end blocks 35-35 and two front and rear longitudinally extending connecting plates 36 and 37. The rigid rectangular carriage thus formed is adjusted up and down on the guide-

bars 29 and 30 by any suitable means, that shown comprising a horizontally extending operating shaft 38 journaled in extensions of the end blocks 35 and having secured thereto, at each end, gears 39—39 which cooperate with racks 40—40 carried by the two front corner guide-bars 29 respectively. The shaft 38 carries at one end a suitable crank arm 41 for facilitating its rotation. Preferably, the carriage is provided with guide rollers 42—42 which engage the rear faces of the rear or inner set of guide-bars 30 so as to facilitate the up and down movements of the carriage. The carriage is retained in any vertically adjusted position by any suitable means such as the set screws 43—43, each having threaded engagement with the front cross-plate 36 and adapted to frictionally engage the respective guide-bars 29, as will be understood.

Horizontally, slidably mounted and guided on each of the cross-plates 36 and 37, are saddles 44 and 45 respectively, as best illustrated in Figure 7. The front saddle 44 is retained in position, preferably, by pins 46 extended through one of the embracing arms thereof into a horizontally extending slot 47 provided in the front carriage plate 36. The rear saddle 45 is suitably formed as shown in Figure 7, to embrace all sides of the rear carriage plate 37 so as to prevent accidental disengagement therefrom. The two saddles 44 and 45 are disposed and maintained in alignment at all times, and to this end the main carriage end blocks 35 each has journaled therein a shaft 48 extending at right angles to the carriage plates 36 and 37. Each shaft 48 is provided with a pair of sprocket gears 49—49 over which run front and rear sprocket chains 50 and 51 respectively. The front sprocket chain 50 is connected to opposite sides of the front saddle 44, as best shown in Figures 1 and 8, and the rear sprocket chain 51 is similarly connected to the rear saddle 45. One of the shafts 48 is provided with a suitable crank handle 53 so that, upon rotating said shaft, both saddles 44 and 45 will be adjusted simultaneously either to the right or to the left, as viewed in Figure 1, dependent upon the direction of turning of the crank handle 53.

The rear saddle 45 carries a suitable standard 54 for an electric bulb, or other suitable source of light, 55, preferably confined within a hood 56 and also a barrel 57 and lens 58. By this means, a narrow beam of light is emitted adapted to pass through the photographic printing-element designated generally by the reference character B, as best shown in Figure 7, for the purpose hereinafter described.

Carried by the saddle 44 is a selenium or photo-electric cell designated generally by the reference character C and indicated conventionally in the drawings. Said cell is disposed directly opposite the light beam apparatus and in such position that the beam of light coming from the latter will impinge directly on the light-sensitive element of the cell. As will be understood from the preceding description, the light beam structure and electric cell will always be maintained in the positions described, regardless of the adjustment of the carriage or the saddles on the carriage. Also carried by the saddle 44 is a milli-ammeter indicated conventionally at D, the same having an indicating finger 60 and reading scale 61 disposed so as to face the operator, as best indicated in Figure 8, said scale being hereinafter described more in detail. The photo-electric cell and ammeter are in electric circuit with each other, the conductors being indicated at 62. As best shown in Figure 7, the photo-electric cell is on the front

side of the printing-element B, that is, on the opposite side to that of the light beam means.

Adjustably slidably mounted on the auxiliary guide-bars 32 is an upper horizontally extending shouldered plate 63 carrying guide blocks 64 at each end directly cooperating with the bars 32, said blocks 64 being adapted to be locked or retained in adjusted position by set screws 65—65 engageable with the racks 66 which are formed on the front sides of the guide-bars 32. A similar ledge-supporting plate 67 is mounted on the guide-bars 32 by means of guide blocks 68—68, the latter in turn being adapted to be locked in adjusted position by set screws 69—69. Preferably, the blocks 68 are provided with downward extensions, as best shown in Figure 7, in which is journaled a cross-shaft 70 carrying at its ends gears 71 which cooperate with the racks 66 so as to facilitate the up and down adjustment of the lower supporting plate 67. Said plates 63 and 67 are adjustable toward and from each other so as to support positive or negative photographic printing-elements B, of different lengths, as will be understood.

The apparatus is also preferably provided with a canopy 73 at the top thereof which is hinged to the main frame at the same pivot points 28 previously referred to, said canopy being angularly adjusted by means of rods 74—74 pivotally connected to the rear edge of the canopy and adapted to be adjustably connected at their lower ends to the main uprights 20 by nuts and series of holes in the rods, as indicated at 75. By means of the canopy, the apparatus and operator are protected from undue influence from outside sources of light. Preferably, also, for convenience of the operator, two wings or easels 76—76 are provided, one on each side of the machine, the same being pivotally connected to the main uprights 20 by hinge plates 77—77. Said wings are provided at the bottom thereof with ledges 78 on which are adapted to be supported various items, such as the original copy, the key sheet, color chart or other paraphernalia, as will be understood.

Also carried by the frame A, above and in the same plane as the photo-printing-element B, is a standard or graduated and indexed chroma-scale printing-element or color wedge value scale, indicated generally by the reference character E, and the specific formation of which is hereinafter more specifically described.

Referring next to the apparatus on the rear side of the main frame, the horizontal arms 23 support on their under sides, a light hood 79 which is covered by a top glass plate 80. On the latter is adapted to be laid any positive or negative photo-printing-element to be checked and which is made by processes for off-set or relief printing. Horizontally movable back and forth on the supporting arms 23 is a main carriage 81 having suitable guide-blocks 82—82 at its ends cooperating with the supporting plates 23. Adjustment is effected, preferably, by a shaft 83 mounted in the end blocks, said shaft having gears 84 near each end thereof cooperable with racks 85—85 carried by the supporting arms 23.

Adjustable lengthwise of the carriage 81, that is, at right angles to the bodily line of movement of the carriage, is a carrier 86 slidably mounted and guided on the carriage 81. Said carrier 86 has supported thereon a microscope 87 with the objective at its bottom end and closely adjacent the negative or positive supported on the table therebeneath, and the eye-piece at its top. Pref-

erably, the microscope carries at the top thereof a hood 88 which is provided with a matt surface focus plate which has thereon graduated value wedge scales of both dots and grains. In lieu of the focus plate attachment, the eye-piece of the microscope may be provided with a transparent microscopic scale showing divisions in thousandths of an inch or in millimeters. In the latter case, as will be evident, the dots or grains on any selected area of the photo-printing-element may be accurately measured and with the attachment focus plate, direct comparison of the sizes of the dots and grains can be made with the graduated wedge value scale.

Referring now to the improved method and apparatus with particular reference to the method and apparatus employing the photo-electric cell. A standard graduated chroma-scale printing-element or color value wedge-scale, such as indicated at E, is made, produced by that method to be employed in the printing which, in the present instance, is color gravure. Such a scale is indicated more fully in Figure 10 and, as there shown, is a half-tone positive. The scale is prepared from an initial copy utilizing a single color, such as yellow, which is to be employed in the printing. The scale is divided into any suitable number of divisions, preferably eleven, the divisions ranging in chroma from pure white or complete absence of color at the one end, to full chroma or solid color at the opposite end, with nine intermediate accurately graduated divisions. By the usual steps, the positive photographic half-tone printing-element is obtained as illustrated in Figure 10 and each of the divisions given an index in accordance with a definitely adopted system, which in the instance shown, utilizes zero for that division indicating pure white or complete absence of color; x for full chroma or solid color; and the numerals 1 to 9 for the respective intermediate divisions, all as more fully set forth in my prior Patent 1,703,449.

With the standard color-value scale so obtained, the ammeter D is then calibrated as follows. The beam of light from the light and lens device described, is projected successively through each of the divisions of the scale so as to impinge on the photo-electric cell C, and the readings for each division are then marked on the scale of the ammeter D and the scale indexed exactly in accordance with the color-value scale, that is, from zero to 9 and x, as illustrated at 61 in Figure 8. With the meter thus calibrated, it is evident that when a beam of light is projected through any selected and restricted area of any similar photographic printing-element, whether of the same or different color, the light-transmitting capacity of such restricted area will be accurately reflected or indicated by the meter and, hence, the color reproductive value of that area of the photo-printing-element may be thus predetermined by precision means. In the preceding, reference has been made to a positive printing-element in which the meter readings will be as indicated. Should a negative be measured, the readings would of course be the exact reverse of those shown.

As is well known, the voltage of any electric current supplied for lighting purposes, may vary from time to time and, hence, it is necessary to check against the voltage of the current or the effective light-producing capacity thereof at any particular time. To this end, the scale E is employed in the apparatus so that, at any time, a direct reading can be taken through the divisions

of the scale E to determine definitely the accuracy of the readings of the meter as influenced by the strength of the light beam which impinges on the photo-electric cell C. In this way, I am enabled at all times to retain positive control of the accuracy of all readings.

The apparatus having been calibrated as above described, the procedure is as follows. Dominant restricted areas or spots of the original color copy are selected by masking out surrounding areas with an apertured cardboard or the like. These selected areas are then individually compared with a master composed color chart indexed in accordance with a definite system for each graduated division thereof, as more fully described in my said Patent 1,703,449. As therein described, each of the 14,641 different color combinations of yellow, red, black and blue is so indexed that the exact proportions of each color entering into the particular hue is indicated by the system employed, that described in said patent using an arrangement wherein the yellow, red, black and blue (if said four colors are used), are indicated by the index numbers in the order named. As in said patent described and as indicated conventionally in Figure 9 of the present application, the area b, as shown by comparison with the master chart, is comprised of the colors yellow, red, black and blue in the relative respective proportions of 5, 4, 7 and 1. When each of the selected dominant areas of the original copy has thus had its color composition so determined by direct matching with the master chart, the color compositions are indicated on the key chart for each area, as shown in Figure 9 of the present application and, similarly, in Figure 9 of said prior patent.

Each color-separation-photo printing-element is, in turn, checked or measured by the improved means herein described. Taking the positive of a yellow photo-color-separation printing-element, each of its areas corresponding to those selected from the original copy and shown on the key chart, is checked by the light-transmission method to determine whether or not the light-transmission capacity of the same coincides with that called for on the key chart. If, for instance, the chart calls for a yellow chroma value of 5 and the meter so indicates, then it is assured that that particular portion of the positive will reproduce, on the press plate, the correct capacities of the ink-conveyor units. Should the meter reading indicate a lesser light-transmitting capacity, the area on the positive is reduced by re-touching and, conversely, if the reading is too high, the area is strengthened. When each of the areas has been checked as indicated and the plate re-touched as called for by the indicated corrections, it is then again rechecked by the light-transmitting and recording apparatus until the proper values on the photo-printing plates are obtained, thus doing away practically with the necessity of proofs. When all of the positives (or negatives) of the color-separation series have been thus accurately measured and corrected as to all of the critical areas, the printer is then assured that when the edition is printed, the final hues will coincide with those of the original copy or subject-matter. In this connection, it will of course be understood that it is desirable that standardized inks and color filters be utilized at all times. By utilizing the process and apparatus described, the guesswork is entirely eliminated with

consequent large savings to the printer and greater satisfaction to the customer.

Although I have herein shown and described what I now consider the preferred manner of carrying out my invention, the same is by way of illustration and not by way of limitation, since I am aware that many changes and variations may be made without departing from the spirit of the invention. All changes and variations are contemplated that come within the scope of the claims appended hereto.

What is claimed is:

1. In apparatus of the character described, the combination with a frame having means thereon for supporting a photo-printing-element in fixed position; a carriage adjustably mounted on said frame to move in one direction parallel to the surface of the printing element; saddles mounted on said carriage and simultaneously adjustable thereon in a direction at right angles to the line of adjustment of the carriage also parallel to the surface of the printing element, said saddles being on opposite sides of the printing-element when the latter is in position; light-emitting and transmitting means carried by one of said saddles; a photo-electric cell carried by the other saddle; and an indicating meter in circuit with the photo-electric cell, the photo-electric cell being disposed in the path of the emitted light beam whereby the intensity of the light transmitted through any selected area of the printing element is indicated through the photo-electric cell and meter.

2. In apparatus of the character described, the combination with a frame having adjustable means for supporting photo-printing-elements of various sizes in relatively fixed position; of a carriage adjustably mounted on said frame to move in one line in a plane parallel to the surface of the printing element; saddles mounted on said carriage and adjustable thereon in a direction at right angles to the line of adjustment of the carriage and also in a plane parallel to the surface of the printing element, said saddles being on opposite sides of the printing element; light emitting means on one of said saddles; light sensitive means on the other saddle; means for moving the carriage on the frame; means for simultaneously and similarly moving the saddles on the carriage whereby the entire area of the printing element may be scanned; and calibrated indicator means in circuit with said light sensitive means.

3. In apparatus for predetermining the rela-

tive ink-printing capacity of the ink-conveyor units of a series of color press plates made from photo-color-separation printing elements, the combination with a frame having means thereon for fixedly securing a printing element in relatively fixed position; of means on said frame for supporting a printing element primary color chroma scale in position adjacent the printing element; light emitting means; light sensitive means, said light emitting and light sensitive means being disposed on opposite sides of the printing element and chroma scale when in position on the frame; means for adjusting said light emitting means and light sensitive means simultaneously and similarly over any portion of the work area of the printing element and also over the chroma scale; and means operatively associated with said light sensitive means for indicating the intensity of the light beam after transmission through the printing element or the chroma scale.

4. In apparatus of the character described, the combination with a support for a printing element; of means, including light-emitting means and light-sensitive means responsive to the intensity of light impinging thereon, for transmitting light from one side of a printing element, when positioned on said support, through a selected and restricted area of the printing element and receiving the light so transmitted, said light-emitting means and said light-sensitive means being disposed on opposite sides of the support and aligned when used to scan the printing element; means operatively associated with said light-sensitive means for indicating the extent of the response thereof; a printing element primary color chroma scale for use in measuring the intensity of the emitted light beam at intervals, said scale being mounted adjacent the support and in a plane substantially parallel to the plane of the printing element when positioned on said support, said scale being also positioned between the planes of movement of the light-emitting means and the light-sensitive means; and means for relatively adjusting, in directions parallel to the plane of the printing element when positioned on said support, said first mentioned means, on the one hand, and said support and chroma scale, on the other hand, to position said first mentioned means opposite a selected area of the printing element when positioned on the support or opposite a selected area of said chroma scale.

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