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PROCESS FOR PERMANENTLY FLATTENING PHOTOGRAPHIC PRINTS

Filed Jan. 11, 1933

2 Sheets-Sheet 1

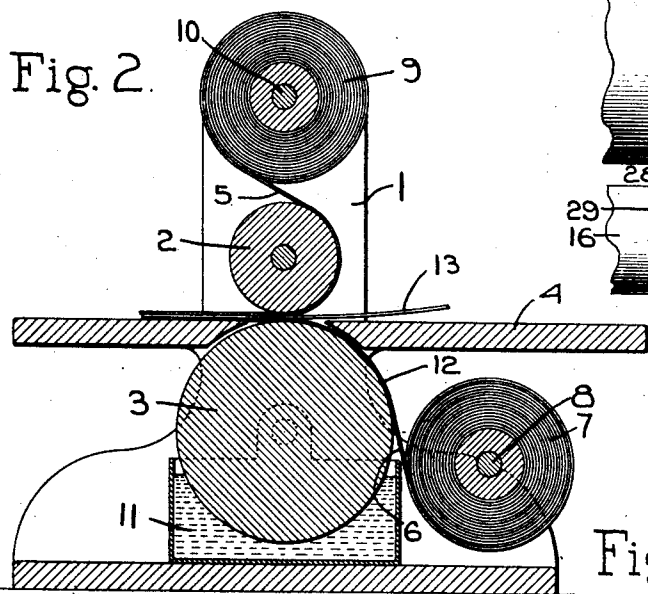
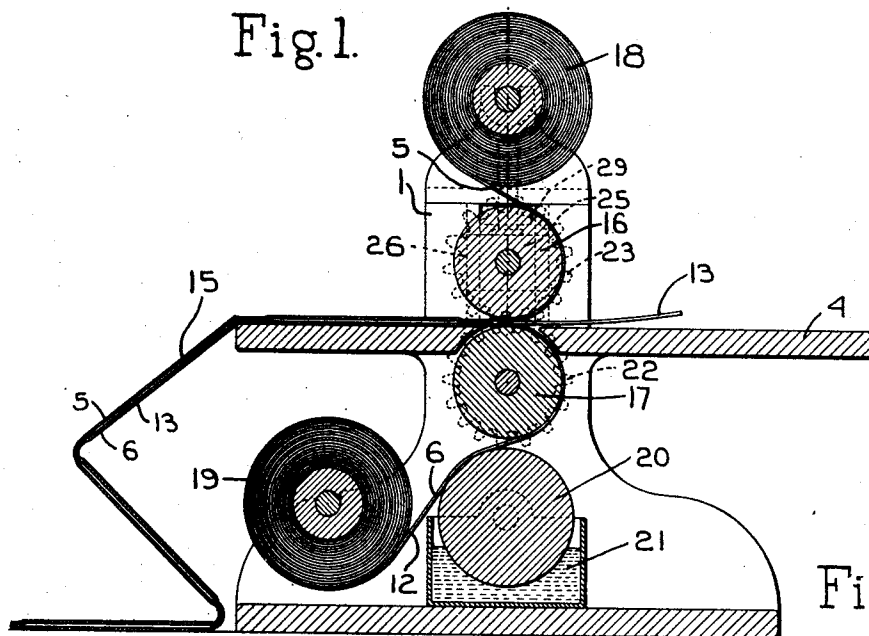


Fig. 3.

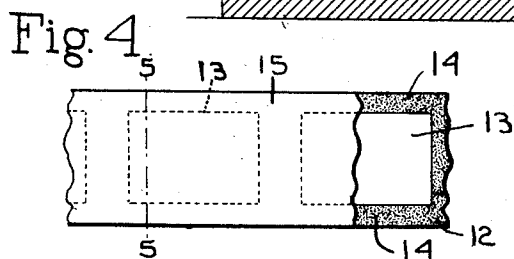
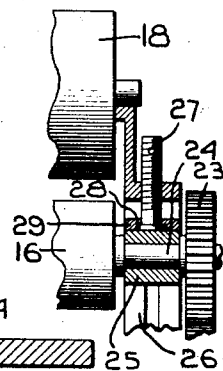
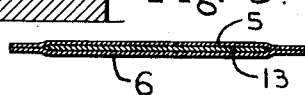


Fig. 5.



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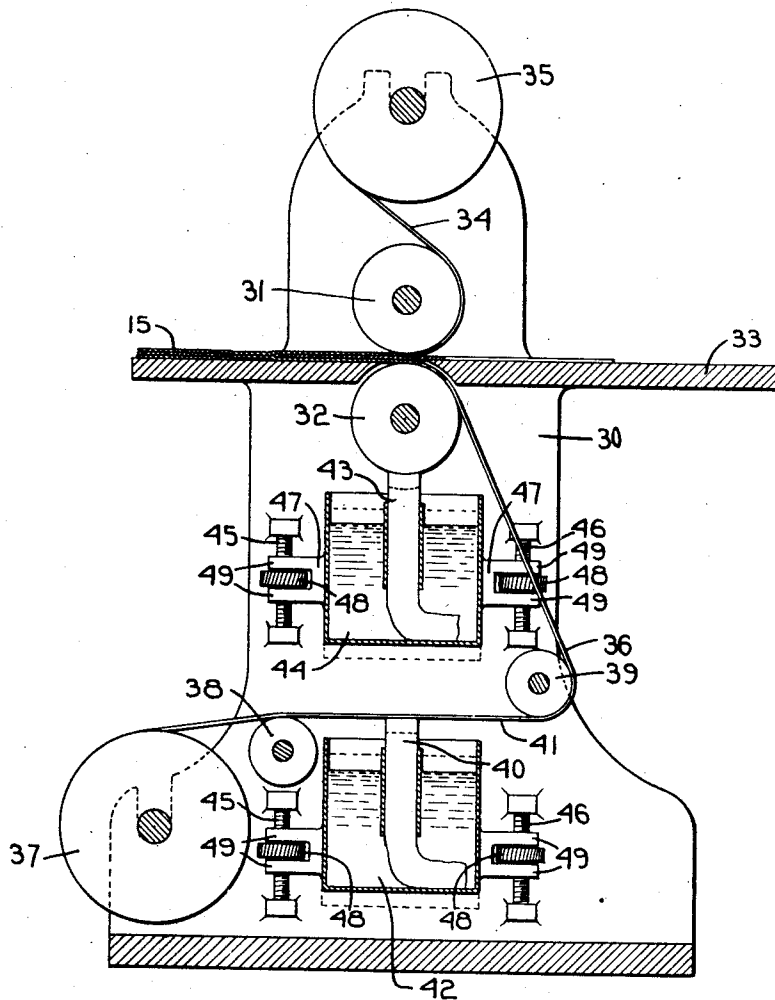
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PROCESS FOR PERMANENTLY FLATTENING PHOTOGRAPHIC PRINTS

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2 Sheets-Sheet 2

Fig. 6



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UNITED STATES PATENT OFFICE

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PROCESS FOR PERMANENTLY FLATTENING
PHOTOGRAPHIC PRINTS

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Application January 11, 1933, Serial No. 651,105

20 Claims. (Cl. 154—40)

This invention relates to a process and apparatus for permanently flattening photographic prints, and more particularly in connection with prints composed of a paper sheet having a sensitized gelatin emulsion on one of its faces.

A photographic print composed of a paper sheet and a gelatin film bearing the photographic image has an inherent tendency to curl inwardly toward its gelatin-coated face when dried. This curling tendency is caused by the unequal contraction of the gelatin and the paper sheet during the drying process. The gelatin in drying contracts more than the paper, thereby setting up a tensile force tending to curl or buckle the print. It is the general object of this invention to process the reverse face of the print in a manner to counteract the tensile force created by the gelatin tending to curl the print. By so counteracting this force the print is caused to lie flat throughout a wide range of changes in temperature and atmospheric conditions.

A particular object of the invention is to apply to the reverse face of the print a coating of adhesive having the property when dried of compensating for the tensile force exerted by the gelatin film upon the face of the print.

A further object of the invention is to prevent curling of a photographic print by adhesively securing to the reverse face thereof a suitable backing sheet.

A further object of the invention is to provide an apparatus for uniting an adhesively-coated backing sheet to the reverse face of the photographic print.

A further object of the invention is to provide an apparatus for applying moisture to the uncoated face of an adhesive-coated backing sheet, allowing the moisture to penetrate the backing sheet to moisten the adhesive and press the backing sheet into engagement with the reverse face of the print.

A further object of the invention is to provide an apparatus for applying an adhesively-coated backing sheet to the reverse face of a photographic print by wetting the adhesive on the backing sheet only, by wetting the uncoated face of the backing sheet only, or by wetting both faces of the backing sheet and pressing it into engagement with the print.

These and other objects and features of the invention will more fully appear from the following description and the accompanying drawings and will be particularly pointed out in the claims.

In the drawings:

Fig. 1 is a longitudinal sectional view of a pre-

ferred embodiment of an apparatus suitable for carrying out the invention;

Fig. 2 is a longitudinal sectional view of an apparatus similar to that shown in Fig. 1, in which certain steps of the process may be carried out in a preferred manner;

Fig. 3 is a detail cross sectional view showing the means employed to adjust the pressure between the pressing rolls;

Fig. 4 is a detail view of a portion of the continuous strip produced by the apparatus; and,

Fig. 5 is a cross section on line 5—5, Fig. 4.

Fig. 6 is an illustration of an apparatus containing elements capable of performing any one or all of the methods disclosed herein.

In its broad aspect the invention contemplates the application to the reverse face of a gelatin coated photographic print a layer of adhesive substance, applying it either directly to the print or by applying the moistened coated face of an adhesively coated backing sheet to the reverse face of the print, the adhesive thus applied when dried acting to compensate for the tensile force set up by the gelatin coating of the print.

The use of a backing sheet bearing the adhesive is the preferred method of applying the invention. In the preferred method moisture is applied to the uncoated face of the backing sheet. The moisture is then permitted to penetrate through the backing sheet sufficiently to moisten the dry adhesive. The backing sheet is then applied under pressure to the reverse side of the print. The adhesive when dried contracts and creates a tensile force compensatory of the inherent force of the gelatin coated face of the print. The dry print with its backing sheet bearing the adhesive will then remain permanently flat. The character of the adhesive is such that it will compensate the curling tendency of the gelatin face of the print throughout a wide range of temperature, and also when subjected to air which is heavily moisture-laden.

In carrying out the process the adhesive coating on the backing sheet may be moistened in any desired manner, such as by applying water directly to the adhesive, and then pressing the print and backing sheet into contact in the same manner as above described. Moisture may also be applied to both the adhesive coated face and the back of the backing sheet before applying it to the print.

In carrying out the invention on a commercial scale it is desirable to utilize a special apparatus by means of which the process may be carried out continuously and with uniform results. A

preferred form of such apparatus comprises a frame 1 in which are journaled a pair of driven pressing rolls 2 and 3 between which the prints are fed. To facilitate the feeding of the prints a horizontal work table 4 is secured to the frame 1 having its upper working face in a plane coinciding with the plane of the bite of the rolls 2 and 3. It is found desirable, but not essential, to the process to provide a protective sheet 5 of sufficient area to completely cover the backing sheet 6. To maintain continuous operation of the machine the backing sheet 6 is supplied from a roll 7 which is provided with a shaft 8 journaled in the frame 1 upon which the roll rotates. The protective sheet 5 is also supplied from a roll 9 rotatable upon a shaft 10 journaled in the frame 1, preferably at a point above the pressing roll 2. The pressure at the bite of the rolls 2 and 3 is adjustable and may be accomplished by means of an adjusting mechanism to be described hereinafter. The pressing roll 3 desirably is of greater diameter than the roll 2, its lower periphery extending into a tank of water 11.

In the operation of the device the protective sheet 5 is threaded from the roll 9 around a portion of the upper pressing roll 2 and thence between the bite of the rolls. The protective sheet may be of any suitable thin paper stock preferably of an inexpensive quality since its use is only temporary. The backing paper is made of any suitable thin unglazed paper stock and desirably is sufficiently absorbent to allow moisture to readily penetrate from one of its faces to the other. The backing sheet 6 is fed from the roll 7 over a portion of the upper surface of the roll 3 with its adhesive-coated face 12 upward, and thence between the rolls 2 and 3. The dry prints 13 are fed between the protective sheet 5 and the backing sheet 6, with their gelatin coated faces upward, as they pass between the pressing rolls.

The water in the tank 11 is carried upwardly by the roll 3 into engagement with the uncoated face of the backing sheet 6 and as the sheet 6 moves toward the bite of the rolls the moisture penetrates the paper and thus moistens the adhesive coating 12 which is pressed into engagement with the reverse face of the prints 13 by the action of the pressing rolls.

The areas 14 of the protective sheet, which extend beyond the edges of the prints, come in contact with the moistened adhesive-coated face of the backing sheet 6, thereby preventing the upper presser roll 2 from accumulating the adhesive carried by the areas 14 of the backing sheet. The completed continuous sheet 15 may then be allowed to dry and thereafter is trimmed along the edges of the prints. The area of the protective sheet covering the faces of the prints is then readily removed since there is no adhesive bond therebetween. The finished prints will now lie perfectly flat throughout wide ranges in temperature and atmospheric conditions.

A modified form of the apparatus is shown in Fig. 1 in which a pair of driven rolls 16 and 17 are journaled in the frame 1. The protective sheet 5 in this form of the device is supplied from a roll 18 similarly situated above the pressing roll 16 as in the form of the apparatus above described. The backing sheet 6 is supplied from a roll 19 and is fed therefrom over a portion of the upper periphery of a moisture-applying roll 20 which is rotatably mounted in the frame, with its lower periphery extending into a tank of water 21. The backing sheet is then fed

around a portion of the pressing roll 17 and thence between the bite of the pressing rolls. The adhesive-coated face 12 of the backing sheet, as it leaves the roll 19, is facing downward, so that the adhesive is moistened directly by the film of water fed thereto by the roll 20. The operation of the device is otherwise similar to that described in connection with the other form of the apparatus.

The prints 13 are fed between the pressing rolls 16 and 17 with the protective sheet 5 engaging their upper faces and the moistened backing sheet 6 adhesively engaging their reverse faces. A continuous strip 15 is thereby formed identical to the strip produced by the other form of the mechanism.

Any suitable means may be employed to adjust the pressure between the pressing rolls in either of the forms of the apparatus. As illustrated in Fig. 1 the two pressing rolls 16 and 17 are desirably of the same diameter. One of these rolls, for instance roll 17, is driven from any suitable source of power not shown herein. The roll 17 has secured thereto a gear 22 which meshes with a gear 23 secured to the roll 16. The roll 16 is thereby driven from the roll 17 through the gears 22 and 23. The gears have an especially designed tooth which permits a limited movement of the rolls toward and from each other.

The gudgeons 24 of the roll 16 extend into adjustable bearing blocks 25 which are vertically movable in ways 26 in the frame 1. Adjustment of the pressure between the rolls is obtained by rotating adjusting screws 27 which have threaded engagement with the frame at their upper ends. The lower ends of the adjusting screws are provided with a head 28 which is rotatably fitted within a countersunk recess in caps 29. The caps 29 are secured to the bearing blocks 25 in any suitable manner. The top faces of the screw heads bear against the top faces of the blocks 25. By adjusting the screws 27 the bearing blocks 25 are moved either upward or downward until the desired pressure of the rolls upon the prints is obtained.

While only one side of the mechanism is illustrated in Fig. 3, it will be understood that the construction at the other end of the rolls is similar to that shown.

The invention may also be practiced by applying moisture to both faces of the backing sheet and then uniting the backing sheet and the print. It has been found that by this method the process may be speeded up and that excellent results are obtained in this manner. By wetting both faces of the backing sheet it is found that the sheet becomes thoroughly impregnated and as a result of this condition expands slightly. The backing sheet and the adhesive both contract when dried and both act to oppose the curling of the print due to the contraction of its gelatin emulsion.

An apparatus is shown in Fig. 6 suitable for treating and applying the backing sheet to the print by any of the above described methods. The apparatus as shown in full lines is adjusted for applying moisture to both faces of the backing sheet. The elements of the device are mounted in a frame 30. A pair of pressing rolls 31 and 32 are rotatably mounted in the frame. A work table 33 is provided substantially in the plane of the bite of the pressing rolls. The protective sheet 34 is supplied from a roll 35 rotatably mounted in the upper portion of the

frame 30 and is threaded around the roll 31 and between the bite of the pressing rolls. The continuous sheet of backing paper 36 is fed from a roll 37 and passes over an idler roll 38 and thence over another idler roll 39 from which it passes to and between the bite of the pressing rolls.

Moisture is applied to the sheet 36 as it travels from the roll 37 to the bite of the pressing rolls at two points. Moisture is first applied by the wick 40 which engages the gummed face 41 of the backing sheet. The wick 40 is supported in and receives its moisture from a tank of water 42 supported in the frame 30. Another wick 43 is supported in and receives its moisture from a tank of water 44. The wick 43 engages the lower peripheral portion of the pressing roll 32 which roll acts to carry a film of moisture to the uncoated face of the backing sheet. The dried prints are fed from the work table to and between the pressing rolls 31 and 32 over which are passing the protective sheet and the backing sheet 36. A composite sheet 15 is thereby produced which is treated in the same manner as above described in connection with the other forms of the apparatus. Any other suitable arrangement of the elements of the apparatus may be made without departing from the scope of the invention.

The tanks 42 and 44 carrying the wicks 40 and 43 are adjustable vertically within the frame. This adjustment may be obtained in any suitable manner. As herein shown, a pair of screw-threaded vertical posts 45 and 46 are fixedly mounted in the frame adjacent the ends of the tanks. The tanks are provided with bifurcated projecting arms 47 through the legs of which the vertical posts 45 and 46 extend. Adjusting nuts 48 having threaded engagement with the posts 45 and 46 are situated between the legs 49 of each arm 47. By rotating the nuts 48 the wicks 40 and 43 are moved into or out of engagement with the backing sheet. If it be desired to wet only the gummed face 41 of the sheet 36, the wick 43 is adjusted downwardly out of engagement with the roll 32, as shown in dotted lines Fig. 6. If it be desired to wet only the uncoated face of the sheet, the wick 40 is adjusted downwardly out of engagement with the sheet 36, as shown in dotted lines. The apparatus shown in Fig. 6 with these adjustments provides in one apparatus the means of applying a backing sheet to a print by any one of the three methods disclosed herein.

In preparing prints by the above-described methods, it has been found to be desirable to regulate the amount of moisture applied to the backing strip. The amount of moisture required depends upon the moisture content of the prints at the time they are to be treated. This factor depends upon the atmospheric conditions at the place where the prints have been stored. If the prints are to be treated directly after printing and development, their moisture content is dependent upon the degree to which the drying apparatus has removed the washing water. The moisture content of the prints can be determined in any suitable way, such as by means of obtaining the relative humidity of the atmosphere by means of hygroscopic apparatus.

To obtain the best results from the process, the amount of moisture applied to the backing strip should bear a definite relation to the moisture in the print. To obtain this condition, therefore, after the moisture content of the print has

been determined the moistening apparatus is adjusted to supply the proper amount of moisture.

The regulation of the amount of moisture applied to the strip may be obtained in any suitable way. In the apparatus illustrated in Fig. 6, the adjustment is made by means of the thumb nuts 48 on the tanks 42 and 44. By means of the thumb nuts, the wick 40 in the tank 42 may be adjusted into contact with the strip 41 with various degrees of pressure and consequent area of contact with the strip, thereby feeding more or less moisture to the strip. At this time the wick 43 in the tank 44 may be disengaged from the roll 32. If desired, in this way enough moisture may be fed to the strip to penetrate from one face to the other and thereby moisten the adhesive.

Another method of regulating the moisture applied to the strip is to adjust the wick 40 into contact with the strip 41 and the wick 43 into contact with the roll 32, and by adjusting the degree of pressure of the wicks and their consequent area of contact a wide range in the quantity of moisture applied to the backing sheet can be obtained. It is, therefore, possible to maintain the most effective ratio between the moisture already in the prints and that applied to the backing strip. In the foregoing description and in the following claims reference is made to dry photographic prints. The term "dry" in each instance refers to the condition of the print, which it naturally assumes from its surrounding atmosphere.

The period of time elapsing between the application of the moisture to the adhesive and the moment that the backing strip and the print are united is an important matter which must be considered in connection with the absorbing characteristics of the adhesive. In order to obtain thorough absorption of moisture by the backing sheet, it may be necessary to allow a sufficient lapse of time after the application of the moisture thereto and before it is united with the print. In the simplest form of the invention, the process may be delayed a sufficient period of time after the moisture has been applied to the backing sheet and before the print is applied thereto. When the method is carried out through the agency of specially constructed apparatus, such as shown and described herein, the speed of the rolls may be adjusted in order to obtain the proper time interval. The speed of the rolls may be adjusted by varying the speed of the driving apparatus or in any other suitable manner.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. The process of permanently flattening a dry photographic print, which consists of a thin paper sheet having one surface thereof coated with a sensitized gelatin film, which comprises applying moisture to the uncoated face of an adhesive-coated backing sheet, allowing the moisture to penetrate the sheet to moisten the adhesive and pressing the backing sheet while moist into contact with the dry print, said backing sheet having its adhesive-coated face engaging the reverse face of the print, and acting when dried to exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film.

2. The process of permanently flattening dry photographic prints, which consist of a thin paper sheet having one surface thereof coated with a sensitized gelatin film, which comprises applying moisture to the uncoated face of an adhesive-

coated continuous backing sheet, allowing the moisture to penetrate the sheet to moisten the adhesive and pressing the backing sheet while moist into contact with the prints at separated intervals, the adhesive-coated face of the backing sheet engaging the reverse face of the prints, and acting when dried to exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film.

3. The process of permanently flattening a dry photographic print, which consists of a thin paper sheet having a sensitized gelatin coating, which comprises pressing the print between a dry protective sheet and a backing sheet having a moistened adhesive-coated surface engaging the reverse face of said print, and acting when dried to exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film.

4. The process of permanently flattening dry photographic prints, which consist of a thin paper sheet having one surface thereof coated with a sensitized gelatin film, which comprises moistening the uncoated face of a continuous adhesive-coated backing sheet, allowing the moisture to penetrate the paper sheet to moisten the adhesive and pressing a plurality of the dry prints at separated intervals between a continuous dry protective sheet and the backing sheet having the adhesive-coated face of the backing sheet engaging the reverse faces of the prints and removing the protective sheet whereby said adhesive coated backing sheet will when dried exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film.

5. The process of permanently flattening dry photographic prints, which consist of a thin paper sheet and a sensitized gelatin film, which comprises applying moisture directly to both the coated and uncoated faces of an adhesively-coated backing sheet and pressing the adhesive face of said backing sheet into contact with the reverse face of the prints, said backing sheet acting when dried to exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film.

6. The process of permanently flattening dry photographic prints, which consist of a thin paper sheet and a sensitized gelatin film, which comprises applying moisture to both faces of the adhesively-coated backing sheet and pressing the dry prints between said backing sheet and a protective sheet with the adhesive face of the backing sheet engaging the reverse face of the prints, said backing sheet and adhesive acting when dried to exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film.

7. A permanently flattened photographic print comprising a thin paper sheet having one surface thereof coated with a sensitized gelatin film and a thin backing sheet adherently applied to the reverse face of said print by the process of claim 1 acting when dried to exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film when subjected to variations in atmospheric conditions.

8. The process of permanently flattening a dry photographic print, which consists of a thin paper sheet having a sensitized coating on one face thereof, which comprises moistening an adhesive coated backing sheet and pressing the print between said adhesive coated backing sheet and a dry protective sheet with the adhesive coated surface of the backing sheet engaging the reverse

face of the print, said backing sheet acting when dried to exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film.

9. The process of flattening dry photographic prints, which consist of a thin paper sheet having a sensitized coating on one face thereof, which comprises moistening a continuous adhesive coated backing sheet and pressing a succession of prints at separated intervals between said backing sheet and a continuous dry protective sheet with the adhesive coated face of said backing sheet engaging the reverse face of said prints, said backing sheet acting when dried to exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film.

10. The process of permanently flattening a dry photographic print, which consists of a thin paper sheet having one surface thereof coated with a sensitized gelatin film, which comprises impregnating a thin backing sheet with a quantity of moisture which is in predetermined proportion to the moisture contained in the print by reason of atmospheric conditions, adhesively uniting the print and the backing sheet with the backing sheet engaging the reverse face of the print, said backing sheet acting when dried to exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film.

11. The process of permanently flattening dry photographic prints, which consist of a thin paper sheet having one surface thereof coated with a sensitized gelatin film, which comprises impregnating a continuous thin backing sheet with a quantity of moisture which is in predetermined proportion to the moisture contained in the prints by reason of atmospheric conditions, adhesively uniting a succession of the prints with the backing sheet at separated intervals, the reverse face of the prints engaging the backing sheet, said backing sheet acting when dried to exert a tensile force compensatory of the inherent contractive force of said gelatin film.

12. The process of permanently flattening dry photographic prints, which consist of a thin paper sheet having a sensitized gelatin film on one face thereof, which comprises applying moisture at a predetermined rate to a continuously moving thin paper backing sheet, adhesively applying a succession of prints to the backing sheet at separated intervals, said backing sheet acting when dried to exert a tensile force compensatory of the inherent contractive force of said gelatin film.

13. The process of permanently flattening a dry photographic print, which consists of a thin paper sheet having a sensitized gelatin film on one face thereof, which comprises moistening a thin adhesive coated backing sheet of slightly larger area than said print, applying the reverse face of said print to the adhesive coated face of said backing sheet, completely covering the front face of said print and the backing sheet with a protective sheet, applying pressure to the composite sheet thus formed and removing the protective sheet whereby said backing sheet will act when dried to exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film.

14. The process of permanently flattening dry photographic prints, which consist of a thin paper sheet and a sensitized gelatin film on one face thereof, which comprises moistening a continuous

thin adhesive coated backing sheet which is wider than the prints, applying the reverse face of a plurality of the prints to the adhesive coated face of said backing strip at separated intervals, completely covering the front face of said print and said backing sheet with a protective sheet, applying pressure to the composite strip thus formed, removing the protective sheet and separating the prints whereby said backing strip will act when dried to exert a tensile force compensatory of the inherent contractive force produced by the sensitized gelatin film.

15. A composite sheet comprising a dry photographic print, consisting of a thin paper sheet having one face thereof coated with a sensitized gelatin film, a thin paper backing sheet slightly larger than said print, adhesively engaging the reverse face of said print and a protective sheet as large as said backing sheet, covering the front face of said print and adhesively securing it to the backing sheet beyond the edges of said print produced by the process of claim 3.

16. A composite strip comprising a continuous thin paper backing sheet, a plurality of dry photographic prints narrower than said backing sheet, consisting of a thin paper sheet and a sensitized gelatin film on one face thereof, the reverse face of said photographs being adhesively secured to said backing sheet at separated intervals and a continuous protective sheet as wide as said backing sheet covering the front face of said photographs and adhesively secured to said backing sheet beyond the edges of said prints produced by the process of claim 4.

17. The process of permanently flattening a dry photographic print, which consists of a thin paper sheet having one surface thereof coated with a sensitized gelatin film, which comprises moistening a thin paper backing sheet and adhesively securing said backing sheet while moist to the reverse face of said print, whereby said backing sheet when dried will exert a force which

neutralizes the curling tendency of said print under all atmospheric conditions.

18. The process of permanently flattening a dry photographic print which consists of a paper sheet having a sensitized gelatin film on one face thereof which comprises expanding an adhesive coated backing sheet a predetermined amount by applying moisture thereto and securing said backing sheet while expanded to the reverse face of said print, whereby said backing sheet when dried will exert a force which neutralizes the curling tendency of said print under all atmospheric conditions.

19. The process of permanently flattening a dry photographic print which consists of a paper sheet having a sensitized gelatin film on one side thereof which comprises determining the amount of moisture in the print due to atmospheric conditions, applying to an adhesive coated backing sheet an amount of moisture having a predetermined proportion to that contained in the print and securing said backing sheet while moist to the reverse side of said print, whereby when dried said backing sheet will exert a force which neutralizes the curling tendency of said print under all atmospheric conditions.

20. The process of permanently flattening a photographic print, which consists of a paper sheet having a sensitized gelatin film on one face thereof, which comprises determining a constant which is a ratio of the amount of moisture in the print due to atmospheric conditions and that necessary to be applied to a backing sheet to accomplish the process, determining the amount of moisture to be applied to the backing sheet by means of said constant, applying the determined amount of moisture to said backing sheet and adhesively securing said backing sheet while moist to the reverse face of said print, whereby said backing sheet when dried will act to exert a force which neutralizes the curling tendency of said print under all atmospheric conditions.

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