UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN PHOTOLITHOGRAPHY.

Specification forming part of Letters Patent No. **19,626**, dated March 16, 1858.

To all whom it may concern:

Be it known that we, JAS. A. CUTTING and LODOWICK H. BRADFORD, both of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Photolithography; and we hereby declare the following to be a full, clear, and exact description of the same, and of the peculiarities which distinguish them from anything heretofore discovered or known.

Our invention has for its object the production of a photographic picture upon the surface of a lithographic stone from which impressions may be taken by the ordinary process of lithographic printing, by which we are enabled to greatly multiply the results of photography and to avoid the tedious and expensive process of drawing upon the stone by hand, as at present practiced.

In the ordinary process of lithographic printing the surface of the stone, after the drawing is completed, is washed or coated with a solution of gum-arabic in acidulated water. The gum thus applied enters into a close union with the surface of the stone, or adheres with great tenacity thereto, so that it cannot readily be removed by washing, and thus protects it from absorbing the ink employed in the printing process. In the process of photolithography it is found, however, that the gum-arabic adheres so closely to the stone as not to be readily removed by washing from those portions not fixed by the light. On this account in the experiments heretofore made in photolithography it has been found impracticable to employ this gum, and a solution of gelatine has been used in its stead. Stones thus prepared, however, yield but few impressions, and are of comparatively small value in the arts.

To remedy this difficulty is the object of our invention, which consists in the employment of gum-arabic, which has been deprived of its power of intimate union with the stone at the same time that it is rendered capable of becoming fixed or insoluble by the operation of light.

We have also discovered that when a stone treated with the above prepared gum is subsequently submitted to the action of a solution of soap the unlighted portions of the gum are readily and expeditiously removed, while the lighted portions are not injuriously affected thereby, at the same time that the soap performs its well-known duty of forming the insoluble soap upon the stone to produce the body or printing-surface.

We will now proceed to describe our invention and to set forth more fully its nature and the manner in which we have carried it out.

The stone, after being prepared in a manner which will be more fully explained hereinafter, has the following solution applied to its surface: water, one quart; gum-arabic, four ounces; sugar, one hundred and sixty grains; bichromate potassa, one hundred and sixty grains; the sugar retarding the immediate fixing of the gum upon the stone, and the chromic salt causing it to become more firmly fixed or much less soluble on exposure to the light. The stone thus prepared is preserved in the dark until required, and when the coating is dried it may be exposed in the camera a suitable length of time to fix the gum upon those parts of the picture where the lights are to appear; or it may be covered by the print or picture to be reproduced and exposed to the light. After it is thus "lighted" the stone is washed with a solution of soap, which attacks the stone, removing the coating and fixing itself (or an insoluble soap formed by the mutual decomposition of the stone and the soap employed) upon the surface in place of the coating removed. Where the gummed surface has been entirely protected from the light the gum is easily removed and the soap has free access to the stone, and the consequence is a thorough union of the soap with its surface. Where, on the contrary, the lights were strong, the gum, having been rendered much more insoluble, is protected from the action of the soap, and is not affected by it, and at all intermediate points the effect of the soap upon the stone is universely proportionate to the extent to which the gum was fixed by the light. The most delicate grades and tints of light and shade may thus be produced upon the stone, true to nature as the photographic picture itself. The stone, having been thoroughly washed with clean water and dried, now receives a coating of ink from the roller, which, uniting with the soap already deposited thereon, serves to give additional body to the picture, and shortly after the stone is ready for the printer, the portions which have been protected by

the undissolved or lighted gum when wet resisting the ink.

Previous to the commencement of the above-described process the stone is to be prepared, and this preparation will vary according to the nature of the picture or subject to be produced. If it be a manuscript, a lithograph, line engraving, or any plan or line drawing, without gradations of shade or shadow running the one into the other, a polished surface may be employed. This will not answer, however, so well for portraits, landscapes, and a great variety of other pictures in which the variations of shade blend the one into the other. In such cases it becomes necessary to give the stone a roughened surface; or, in the language of the workmen, the stone is "grained." Into such a surface the chromated solution of gum sinks deeper and is then removed, more or less, according as it has been fixed by the light, and thus the required variations of intensity and the gradations of shade and shadow are produced. Where a polished stone is employed the chromated gum lies upon the surface, and it is found that the variations of shade and shadow cannot be produced with that nicety necessary to make a perfect graduated picture—such as a portrait—that shall be easily printed.

In preparing the chromated solution the proportions of the ingredients given above are by no means rigid, though they are those which we have found to answer the purpose. The sugar we have found also may be replaced by other substances, such as molasses, acetic acid, or various acetates not decomposable by the bichromate of potassa. We do not therefore confine ourselves to the exact proportions given above, nor even to the use of the exact substances named, when there are equivalents for them which may be used in their stead without departing from the essence of our invention; and in place of removing the unlighted portions of the coating by means of the direct application of soap they may be washed off with water, acetic acid, or their equivalents, oils, resins, or printing-inks being applied after the stone has been dried for the purpose of forming the required insoluble soap in the stone. Such process we consider to be the entire equivalent of the one above described, although it is not so expeditious and, in our opinion, not so efficient.

The quality of the soap employed is not rigid, though those containing a proportion of resin will in general give a better result. The strength of the saponaceous solution is not material. We have found one-half pound soap to six quarts water to answer the purpose.

We have heretofore spoken of our process as applied to lithographic stones; but there are other substances which may be employed in lieu of the stone, to which our process may be applied, one of which we may name is zinc, which has been heretofore used by printers as a substitute for stone. In the use of this metal in our process an insoluble soap of zinc is formed instead of one of lime.

What we claim as our invention in photo-lithography, and desire to secure by Letters Patent, is—

1. The employment of gum-arabic deprived of its power of intimate union with the stone by means of sugar or its equivalent, as set forth.

2. In combination with the above, the use of soap, as set forth, for the purpose of readily removing the unlighted portions of gum and of forming the printing-surface, as described.

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Witnesses:
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