UNITED STATES PATENT OFFICE.

C. F. BALDAMUS AND F. W. SIEMENS, OF BERLIN, PRUSSIA.

IMPROVEMENT IN ANASTATIC PRINTING.

Specification forming part of Letters Patent No. **4,239**, dated October 25, 1845.

To all whom it may concern:

Be it known that we, CARL FRIEDRICH BALDAMUS, of Berlin, in the Kingdom of Prussia, and F. W. SIEMENS, of the same place, have invented Improvements in Producing and Multiplying Copies of Designs and Impressions of Printed or Written Surfaces; and we do hereby declare that the following is a full and exact description thereof.

Our invention of improvements in producing and multiplying copies of designs and impressions of printed or written surfaces consists in the process whereby we obtain transfers or reversed fac-similes on metallic surfaces from designs or writings in lithographic ink and from prints and printing in general; and as this process is applicable to the reprinting of old works we propose to term it "anastatic printing." The improvement for obtaining transfers or reversed fac-similes consists of several distinct operations, and will be best understood by a simple description of each.

First. The surface to receive a reversed copy of the design or print may be of brass, steel, iron, copper, zinc, or other convenient metal; but we prefer zinc to any other metal in consequence of the greater facility of management which it admits. It may be used as plates or cylinders, and in each case requires to be perfectly homogeneous and to present a clean surface. We prefer polished surfaces, and prepare the plate by grinding it with emery and water, applied by means of a cloth rubber, so as to produce fine parallel lines from end to end or from side to side, but not crossing each other more than can be avoided. When the surface has acquired a uniform appearance we rub the dirt and water off with clean blotting-paper and polish the plate with another cloth and dry fine emery, or with fine emery-paper, in the same parallel direction as before, taking care not to touch the surface with the hand or any dirty or oily substance. We next rub off all dust and dirt with clean blotting-paper until it is perfectly clean and free from oxide and presents a surface polished in a parallel direction for receiving the ink.

Second. The design or writing to be copied and printed must be executed in ink of a saponaceous or fatty nature—such as common lithographic or printing ink—and may be on any clean well-sized paper. These may be transferred either when quite new or when many years old, or after traveling from one country to another. The designs or printed papers, which throughout this specification we call "originals," are then charged with any convenient acid, which we prefer to be nitric. Any originals so fresh as to yield an impression to a piece of clean paper when pressed firmly together by means of a burnisher we treat thus: We lay the written or printed side on a clean piece of blotting-paper and wet the upper side equally by means of a soft brush with a mixture of one part of nitric acid of 1.362 specific gravity and eight parts of water, by weight. So soon as the acid has completely soaked through the originals we lay it between sheets of blotting-paper and remove the excess of dilute acid by gentle pressure, and if the acid has equally penetrated the originals we lay its written surface on the cleaned metallic surface, place double blotting-paper over it, and pass it under considerable rolling pressure, which causes the acid to attack the metal where unprotected by the writing, drawing, or printing, &c., on the originals and produce what we call a "negative etching." The original may be thus pressed between two metallic surfaces without any blotting-paper when it is desired to obtain a reversed counterpart from each side. The originals may be immediately removed, and a reversed impression should be perceived in all parts of the plate distinct from the etched surface. Prints of more than two months old have their ink more indurated and require a modification of the above treatment of transferring, which may be effected as follows: We first lay a sheet of blank white paper in the bottom of a flat porcelain or glass vessel large enough to contain the original, and then lay as many originals alternately with blank ones as we require to transfer; but if the original is thick and strong the intermediate papers may be omitted. We next pour over the whole mass a sufficient quantity of nitric acid of about 1.362 specific gravity to soak through the mass of paper, and then cover the basin or vessel with a plate of glass and let it remain for from twelve hours to seven days, according to the age and nature of the print, for which

no accurate rule can be given, and must be conducted by experience acquired by practice. Printed books of ten years generally require about twenty-four hours, and those of thirty to forty years require some days; but after that age no material difference appears to have taken place in the chemical condition of the printing-ink. When we consider that the originals have been sufficiently acted on by the acid we remove the cover and add water so as to reduce the strength of the acid contained in each sheet to such a degree as that it shall not act strongly or disagreeably on the tongue when brought into contact. We now lay the originals between sheets of clean blotting-paper and subject them to slight pressure to remove superfluous moisture. We then lay it on the polished metallic surface, as before described, and subject it to much greater rolling pressure than recent originals. If saving of time is an object and when the originals have been very much indurated and dried, as in engravings, &c., we proceed by washing over the back of the original to be transferred with a solution of caustic potash in pure rain or distilled water of about 1.014 specific gravity, which we prefer to carbonate of potash, as that substance would evolve gas in the next process; and when the original is fully soaked we prepare a saturated solution of tartaric acid in water in a shallow flat basin or on a sheet of glass with a wax border to form tank sides. We then place the original, which has been soaked in caustic potash, in this solution with the face to be transferred uppermost, and a reaction takes place between the tartaric acid and potash in the paper, forming crystals of cream of tartar, which appear over the whole surface and are sparingly soluable in water, leaving only those parts which are protected with printing-ink uncovered with crystals. We next roll a hard lithographic inking-roller charged with a small portion of ink over its wet surface several times and in several directions until the black lines become revived by a new coat of ink, leaving the blank part of the paper covered with crystals almost untouched. We next remove the superfluous ink by a second application of a hard roller uncharged with ink, and dissolve the crystals of cream of tartar by immersing the paper for some hours in dilute nitric acid, twenty parts water by one part acid of 1.362 specific gravity, by weight, after which it is partially dried in blotting-paper, placed on the metallic surface, and subjected to slight pressure, as before.

Instead of using printing-ink, as before described, for reviving the print so as to protect the metallic surface from the action of the acid, we sometimes employ the vapor of convenient volatile oils to effect the same object, as that of oil of turpentine.

Having now described our process of transferring reversed fac-similes of new and old designs and printed surfaces to the metallic plate, we proceed to explain the next operation for completing their preparation as printing-surfaces.

We remove the originals from the plate after pressure and wash the plate over in all directions with a very thick gum-water by means of a sponge, and next rub up or fill in the plate with linen rag or sponge charged with a mixture of lithographic printing-ink and gum-water, whenever it has been protected from the action of the acid, which operation of charging the plate constantly follows the continuous washing with gum, as it is usual for lithographic printers to charge their stones, and if the transfer has not been quite complete, or is from old work, this process should be repeated at intervals of one hour or more. When this process is finished we wash all dirt and gum off with a linen rag wetted with water, and roll over the whole plate with a soft leather roller charged with ink, and if spots of dirt remain on the plate we grind them out with slate-pencil and water. We could now (in the usual mode) print a few hundred copies from the plate; but the fine lines would begin to thicken and the plate to fill up with ink, the constant tendency to do which has hitherto been a great impediment to inking and printing by machinery. To prevent this spreading of the ink and its adhesion to the negatively etched or blank surface of the metal we wash the plate over with an acid preparation of phosphorus, which we prefer to be a solution of the substance called by Dulong "phosphatic acid," and as termed by Davy "a mixture of phosphorus and phosphoric acids," mixed with gum-water. This acid etches in the surface partially and enables it effectually to reject the ink. By carrying this process further with stronger phosphatic acid we can obtain a palpably raised surface for printing from, similar to stereotype. The phosphatic acid, or combination of phosphorus and phosphoric acids, we prepare by placing long pieces of phosphorus upright in a glass bottle and filling it with water to within a quarter of an inch of their tops. Then cork the bottle, leaving an aperture of about one-sixteenth of an inch, and for admission of air we let it remain three or four days or until the water is sufficiently acidulated for use, which may be ascertained by placing a drop of it on a clean zinc surface, where it must produce an evident action and leave a white mark. Gum is then added to the solution and dissolved until the whole acquires the consistence of unboiled white of egg, and the mixture is preserved from the air in stoppered bottles.

Having now described the nature of our improvements in producing and multiplying copies of designs and impressions of printed or written surfaces, we would have it understood that we do not confine ourselves to the details shown and described, provided the peculiar character of the arrangements or processes be retained. We would also have it understood that we make no claim to many of the separate parts herein described; but

What we claim is—

1. The herein-described process whereby we transfer by means of treating the originals with acids of strengths varying with the induration of the ink, and so pressing out the acid as to cause an etching of the blank spaces and a reversed impression of the original (where protected from the action of the acid) on metallic surfaces.

2. The process of reviving the printing-ink on originals by first acting on them with caustic potash or its carbonate and tartaric acid, so as to form cream of tartar in the paper, which prevents the adherence of fresh ink in the blank spaces, while the old ink is left in a state to take up an additional quantity from a roller passed over it.

3. The herein-described process of preventing the adhesion or sticking of printing-ink during the operation of printing to any part of the plates which are required to remain blank by acting upon such blank surfaces with acid preparations of phosphorus.

In witness whereof we, the said C. F. BALDAMUS and E. W. SIEMENS, have hereunto set our hands and seals this 30th day of January, 1845.

CARL FRIEDRICH BALDAMUS. [L. S.]
F. W. SIEMENS. [L. S.]

Witnesses:

THEO. S. FAY,
Sec. U. S. Leg. at Berlin.
JOHN ULR. WAGNER,
Of Sydney, at Berlin.