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APPARATUS FOR CONDITIONING ENGRAVING PLATES

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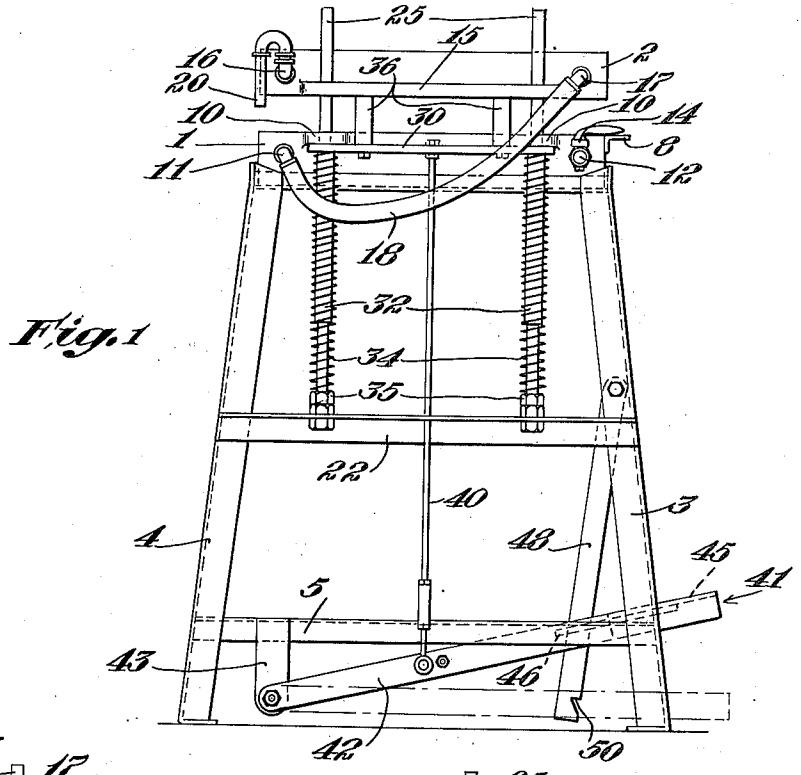


Fig. 1

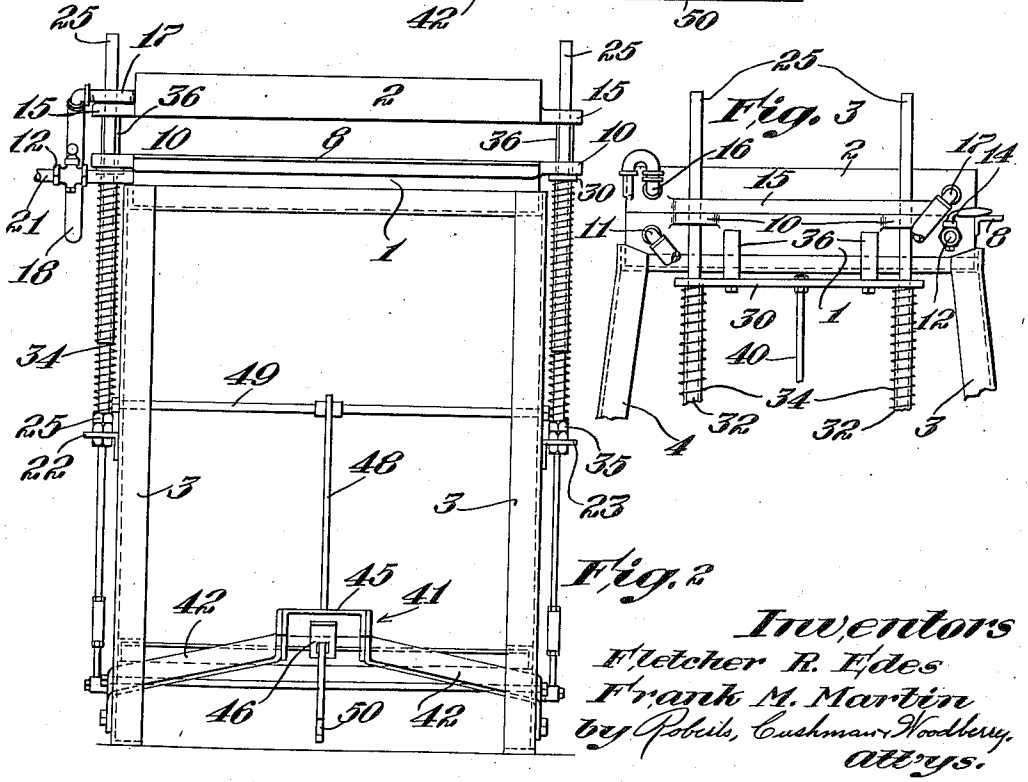


Fig. 2

Fig. 3

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APPARATUS FOR CONDITIONING ENGRAVING PLATES

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1 Claim. (Cl. 266—2)

This invention relates to the art of photo-engraving, and more particularly to an apparatus for conditioning photo-engraving plates.

In preparing photo-engravings it is the usual practice first to produce the negative of a picture, design or other character on a photo-sensitive film carried by a plate having a composition which is susceptible to attack by various chemicals, and subsequently to develop and fix the image on the film in accordance with any of the well known procedures. Thereafter the unaffected parts of the film are removed and the exposed areas of the plate are treated to bring out in relief the fixed image. The plates carrying the image are usually of a material or composition which does not readily resist distortion or deformation, particularly when subjected to heat or any type of strain, such plates usually being of zinc, zinc alloys, copper, aluminum and the like metals or compositions which have a relatively low elastic limit and which do not stand up under heat without undergoing distortion.

In order to bring out the image on the plate it is the usual practice, when using hot top enamel, to "burn in" or "set" the unremoved portions of the film by subjecting the entire plate to a temperature of the order of 500 or 600° F., this treatment being effective to render the film highly resistant to the action of the etching acid. Such treatment invariably causes the plate to become buckled or warped, and since satisfactory reproductions can not be obtained from such plates, it is necessary to remove all distortions or deformations.

In certain types of work (which may or may not involve a heat treatment prior to the initial etching operation), the edges of the image, formed by the first etching treatment, are given a coating of an acid-resistant material such as "dragon's blood" in order to prevent subsequent etching treatments from eating away or undercutting the edges of the image, and the plate is then subjected to elevated temperatures in order to set the coating, after which it is subjected to the usual etching treatment. This procedure is often repeated eight to sixteen times, and as a result of the heat treatment between etchings, the plates invariably become buckled or warped, such buckling being more pronounced with the so-called "hard zinc" plates.

Irrespective of the particular cause of the distortions, such engraving plates must present flat or regular surfaces in order to produce satisfactory results, particularly where "Ben-Day" work is to be done, since a slight departure from substantial flatness or regularity prevents a proper "laying" of the "Ben-Day" screen on the surfaces of the plate. Although numerous attempts have been made to prevent such plates from becoming distorted and also to overcome distortions, yet we are not aware of any commercially satisfactory method or apparatus which may be relied upon either to prevent buckling or to remove distortions from such plates. We are aware of the use of presses or clamps for holding engraving plates while being cooled, but such devices are incapable of effecting a rate of cooling which is sufficiently rapid to prevent buckling when the plate is removed. We are also aware of the use of coolers embodying a quenching action resulting from the direct application of water to one surface of the plate, but such apparatus has likewise proved unsatisfactory, due to the fact that the plates invariably become buckled and hence necessitate a subsequent treatment for the removal of such distortions.

The principal objects of this invention are to overcome the aforementioned difficulties and to provide a commercially satisfactory method and apparatus operative either to remove distortions from engraving plates and the like, or to prevent engraving plates from becoming buckled or warped as a result of any form of heat treatment used in preparing such plates; and to provide a method and apparatus which is efficient and reliable in operation, which requires less time than is ordinarily required to cool the plates after heat treatment, and which does not increase the cost of producing engravings or require additional time, labor or other expense.

Further objects will be apparent to those skilled in the art from a consideration of the following description and the accompanying drawing.

We have discovered that engraving plates composed of zinc, zinc alloys and like compositions having a relatively low elastic limit can be subjected to elevated temperatures and subsequently cooled without undergoing substantial deformation if the cooling is carried out rapidly, uniformly and under pressure. The simultaneous application of pressure and a rapid and uniform cooling constitutes a quenching under pressure which not only insures a uniform reduction of the temperature throughout the body of the plate under treatment, but also avoids the production of unequal internal strains which are the principal cause of buckling and warping.

In accordance with the present invention we provide a quenching press having relatively movable cooperating pressure members which are constructed and arranged to receive between them the plate to be treated. At least one of the members, and preferably both, are designed to receive a refrigerant which absorbs the heat of the plate under treatment uniformly throughout its entire area, and is thus effective uniformly and rapidly to reduce the temperature of the plate simultaneously with the application of pressure. Although the pressure to which the heated plate is subjected may be varied throughout a wide range, we have found that for ordinary engraving plates

having the thickness of the order of 0.065 inch, the pressure should be at least forty pounds, although preferably of the order of sixty-five pounds, per square foot, and for thicker or heavier plates the pressure should be increased proportionately, but in no case should pressures be used which are great enough to cause rupture or distortion of the enamel top. In any case the pressure used must be sufficient quickly and completely to flatten the buckled plate, since it is essential that all parts of both surfaces of the plate be brought quickly into contact with the chilling surfaces of the press so as to cause instant cooling.

As the rate and uniformity of reduction of temperature are important factors, at least one, and preferably both pressure members, should not only be capable of making a good thermal contact with the plate under treatment, but also of dissipating the heat at a rate of the order of 500° F. per minute. Accordingly, the refrigerant in the pressure members should be maintained at a temperature sufficiently low to insure the desired rate of cooling. For ordinary engraving plates a temperature of less than 68° F. in the pressure members is usually satisfactory, although for heavier plates a lower temperature should be used, depending upon the temperature to which the plate is heated prior to being subjected to the quenching treatment.

In employing the invention in conjunction with the preparation of etched engraving plates, the application, development and fixation of the image on the photo-sensitive film may be carried out in the usual manner. When hot top enamel is used the plate is subjected to a temperature of the order of 500° to 600° F. for a period of approximately five minutes in order to "burn in" the portions of the film still remaining on the plate, thus rendering the film resistant to etching. Immediately upon the removal of the plate from the oven or heater (and while still hot), it is quenched under pressure by being subjected to the action of cooperating pressure members maintained at a temperature of the order of 70° F., preferably between 40° and 70° F., the pressure members being in close thermal contact with the surfaces of the plate and operative to exert pressure of at least forty pounds per square foot on the entire surface of the plate, thereby simultaneously reducing the temperature of the plate to a temperature at or below room temperatures (65° to 70° F.) in a period of less than one minute. The plate, thus treated, is entirely free from distortions and internal strains and without further treatment may be etched and used in making accurate reproductions in the usual manner.

In applying the invention to remove buckling, warping or other types of distortions, the plate is first subjected to a temperature of 200° to 300° F. or more until it is uniformly heated, and while still hot it is immediately quenched under pressure in the manner above described, thereby removing all distortions from the plate.

In carrying out the invention either in conjunction with the preparation of an etched engraving plate, or for removing distortions from a plate, we preferably use an apparatus of the type shown in the accompanying drawing, wherein:

Fig. 1 is a front elevation of an apparatus constructed in accordance with the present invention;

Fig. 2 is a side elevation of the apparatus shown in Fig. 1; and

Fig. 3 is a fragmentary elevation showing the pressure members in closed position.

The embodiment chosen for illustration is designed to treat or condition flat engraving plates and comprises a pair of cooperating, relatively movable pressure members 1 and 2, each consisting of a hollow rectangular metal casting having a smooth flat surface adapted to contact the adjacent surface of an engraving plate inserted between these members so as to produce a close thermal contact therewith. The lower member constitutes a base for holding the engraving plate and is supported at a convenient height by a pair of front and rear uprights 3 and 4 which are suitably braced by crossbeams 5 adjacent to their lower ends. The base 1 is provided with an outwardly projecting lip 8 on its front edge, which serves as a guide for the edge of an engraving plate when being inserted between the pressure members, and the side walls of the base are formed with laterally projecting ears 10, each having a vertically extending aperture. One of the side walls of the base is provided with an inlet port 12 near its front edge, and an outlet port 11 near its rear edge, the inlet port having a valve 14 by means of which the flow of refrigerant through the pressure members may be varied.

The upper member 2 constitutes a movable head or platen and when designed for use in treating engraving plates of the order of 15 x 18 inches or smaller, the weight of the platen should be at least one hundred pounds. The side walls of the platen are formed with lateral projections 15 having spaced apertures which register with corresponding apertures in the ears 10 of the base. One of the side walls of the platen is also provided with an inlet port 17 near its front edge, and an outlet port 16 near its rear edge, the inlet port 17 being connected with the outlet port 11 of the base by a flexible tube 18. The inlet port 12 is connected by a pipe line 21 (Fig. 2) to a suitable source of cold water or other fluid refrigerant, and the outlet port 16 is connected to a line 20 (Fig. 1) which conducts the refrigerant to a drain or back to the supply.

Crossbeams 22 and 23 are rigidly secured to the front and rear uprights between their ends, and these crossbeams each support a pair of spaced vertically extending guide rods 25 which project through the apertures in the ears 10 and projections 15 so as to provide a guide for the platen 2 in its movement toward and away from the base 1. Along each side wall and below the ears 10 is a crossarm 30 having at or near each end an opening through which one of the guide rods 25 passes. A downwardly extending sleeve 32 is secured to each end of each crossarm in vertical alignment with the openings in its ends and the apertures in the ears and projections, and a coiled compression spring 34 surrounds each sleeve and the lower end of each guide rod. The upper ends of the springs 34 engage the under side of the crossarm, and their lower ends are seated on nuts 35 which secure the guide rods to the crossbeams. A pair of upstanding posts or brackets 36 are carried by each crossarm, and these posts are positioned to engage the lateral projections 15 at points between the apertures therein, as shown in Figs. 1 and 2. The springs 34 are at all times under sufficient compression to support the entire weight of the platen and hold the crossarms 30 against the under side of the ears 10, in which position the

brackets **36** hold the platen at a convenient height above the base (approximately two inches) to insert an engraving plate between the press members.

The crossarms **30** are connected by links **40** to a treadle **41** having arms **42** pivotally connected at their ends to depending brackets **43** (Fig. 1) carried by the braces or crossbeams **5**. The front of the arms **42** converge and support a pedal **45** which carries a slotted member **46** constituting a part of a locking device. A latch member **48** is pivotally supported at its upper end by a rod **49**, and this latch hangs downwardly with its free end projecting through the slot in the member **46**, the latch being inwardly inclined so that the locking notch or dog **50** adjacent to its free end engages the slotted member **46** to lock the treadle when depressed. The parts are so constructed and arranged that when the treadle is depressed sufficiently to become locked by the latch **48**, the crossarms **30** are pulled downwardly, against the action of the springs **34**, to a position wherein the upper ends of the brackets **36** are held spaced below the platen **2**, as shown in Fig. 3, thus permitting the platen to drop, under the action of gravity, upon an engraving plate on the base **1**.

The latch **48** may be easily released by pressing it inwardly, and to this end the operator may rest his foot on the pedal **46** with the toe of his shoe against the latch, and by applying a slight pressure on the latch it may be swung inwardly, thus releasing its grip on the member **46** and permitting the platen and associated parts to be restored to normal position (Figs. 1 and 2) by the springs **34**.

In using this apparatus either for preventing engraving plates from becoming buckled or warped, or for removing distortions from such plates, cold water or other refrigerant is continuously circulated through the base and platen so that these members are maintained at the desired temperature. For example, a temperature between 40° and 70° F. is satisfactory when treating ordinary commercial photo-engraver's plates which have been heated to a temperature of approximately 600° F., although for heavier or thicker plates a lower temperature is desirable. The plate to be treated is transferred directly from the oven or heater to the press, the guide lip **8** being effective to facilitate the insertion of the hot plate between the pressure members. Having positioned the engraving plate between the pressure members, the treadle is then depressed and held in clamping position (Fig. 3), thus permitting the platen to exert its entire weight on the engraving plate. With an apparatus of the type herein shown and described, it is merely necessary to hold the pressure on the plate for a period of approximately one-half minute, during which period the plate is subjected to pressure of at least forty pounds per square foot, and at the same time its temperature is rapidly reduced from approximately 500°–600° F. to room temperature (65°–70° F.). The plate may then be removed and finished or treated in the usual manner.

In treating heavier or thicker plates with an apparatus of the type herein shown and described, it may be desirable, if not necessary, to increase the weight of the platen, and to this end any form of weight may be piled on the upper face of the platen so that its dead weight, including the weight of the water circulating therethrough, may be adjusted so as to produce the desired or predetermined amount of pressure on an engraving plate supported on the base. We have found that in treating ordinary commercial photo-engraver's plates with the apparatus herein shown and described, a platen having a dead weight of approximately one hundred ninety pounds gives satisfactory results, although a greater or less weight may be used, but in no case should the minimum dead weight be less than that required to flatten completely a buckled plate.

The effectiveness of the foregoing treatment may be determined by applying a straight edge to the marginal portions of a treated plate and measuring the departure from a straight line. Engraving plates such, for example, as 15" x 18" commercial photo-engraver's regular "soft" and "hard" zinc plates, when treated in accordance with the present invention, show no material distortion or buckling; whereas the same type of plate, when rapidly quenched without pressure, almost invariably shows a substantial distortion, often as great as ¾ of an inch along the 18" edges and $\frac{5}{16}$ of an inch along the 15" edges, and when slowly cooled, the distortion is commonly as much as ⅜ of an inch along the 18" edges and $\frac{3}{16}$ of an inch along the 15" edges. It is very difficult to remove such distortions by any method heretofore known, since a plate after cooling becomes set, and it is often necessary wholly to discard the plate.

While we have shown and described one desirable embodiment of the invention, it should be understood that this disclosure is for the purpose of illustration, and that various changes in shape, proportion and arrangement of parts, as well as the substitution of equivalent elements for those herein shown and described, may be made without departing from the spirit and scope of the invention as set forth in the appended claim.

We claim:

Apparatus for conditioning zinc base engraving plates and like compositions having a relatively low elastic limit, which comprises a rigidly supported base having a supporting surface shaped to provide a close thermal contact with one of the faces of the plate under treatment, a platen cooperating with the base and capable of exerting a pressure of at least 40 pounds per square foot thereon, means for maintaining the upper surface of said base and the lower surface of said platen at a predetermined temperature, guiding means for supporting said platen for movement toward and away from said base, upstanding supports carried by said guiding means and vertically movable so as to engage said platen, retractable means normally operative to maintain said supports in an elevated position wherein said platen is held above said base, and means operative to retract said retractable means and the supports associated therewith so that said platen may descend by gravity upon said base, whereby to subject said plate to the simultaneous effect of its weight and the heat dissipating action of the contacting surfaces of said base and platen.

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