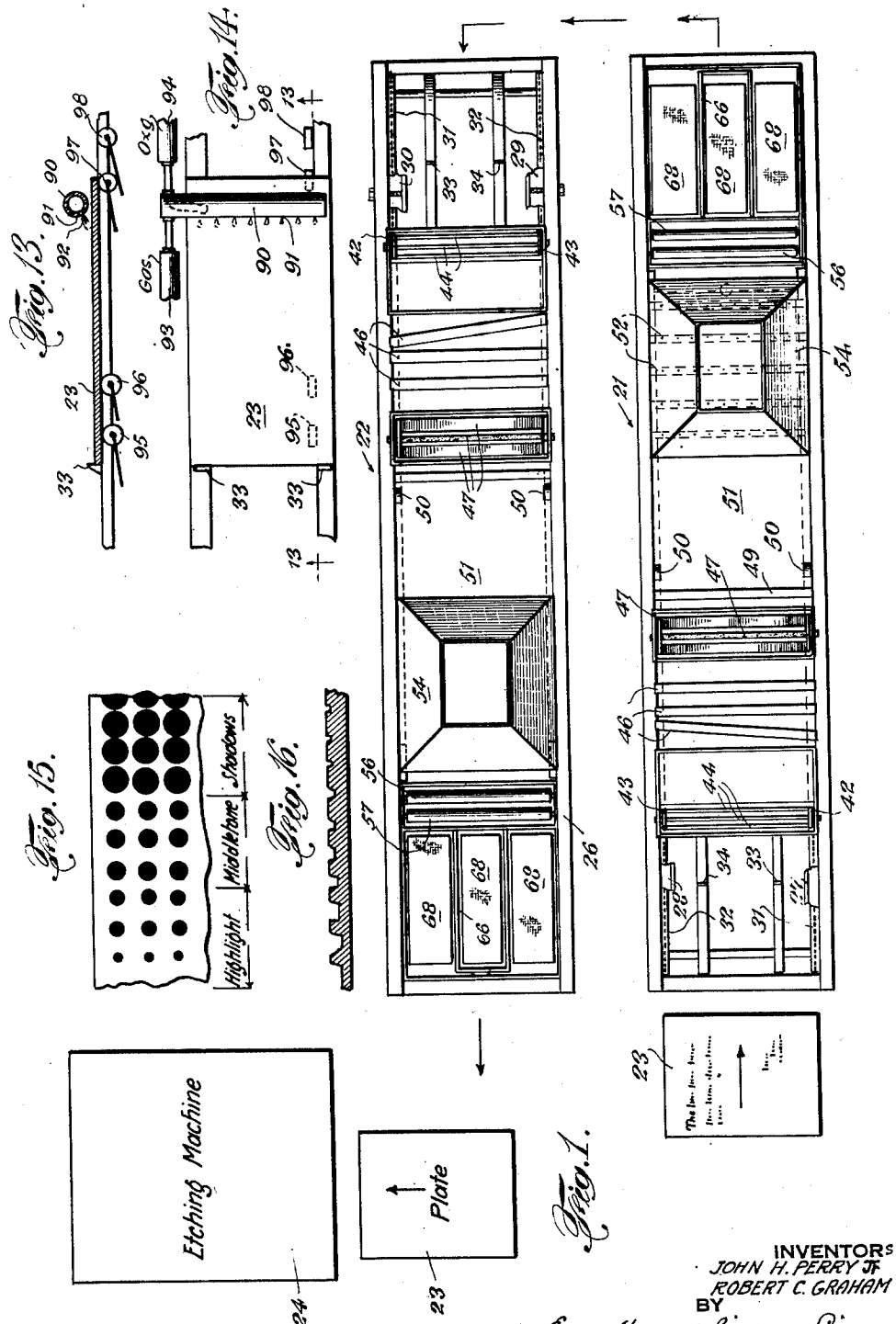
May 26, 1953 J. H. PERRY, JR., ET AL 2,639,995

PROCESS AND APPARATUS FOR PREPARING A PRINTING PLATE

Filed Feb. 28, 1949 4 Sheets-Sheet 1



INVENTORS
JOHN H. PERRY JR.
ROBERT C. GRAHAM
BY
Emery, Vanny, Whittemore & Dix
ATTORNEYS

May 26, 1953 J. H. PERRY, JR., ET AL 2,639,995

PROCESS AND APPARATUS FOR PREPARING A PRINTING PLATE

Filed Feb. 28, 1949 4 Sheets-Sheet 2

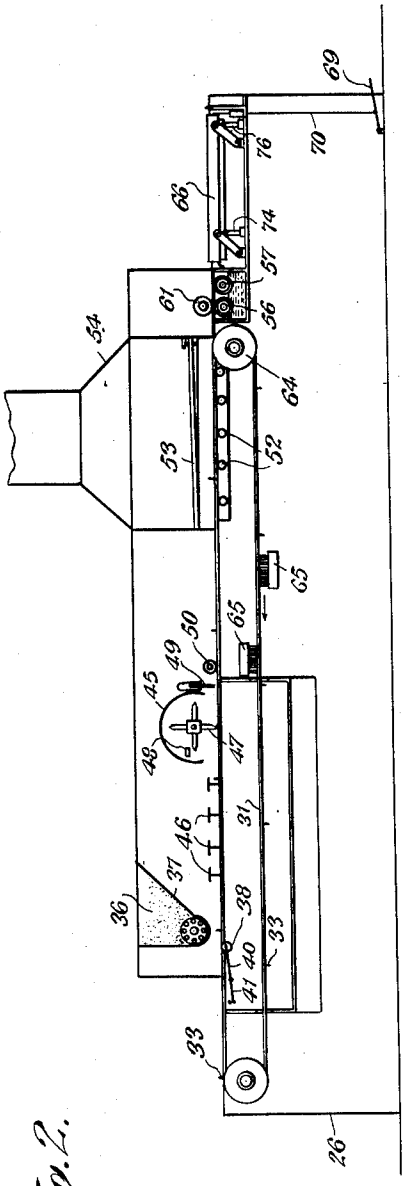


Fig. 2.

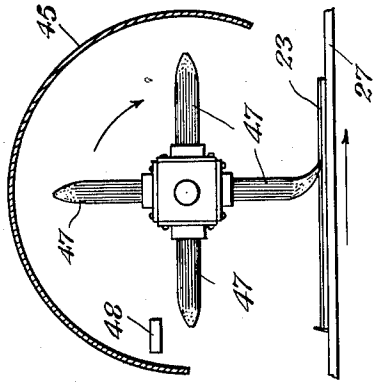


Fig. 4.

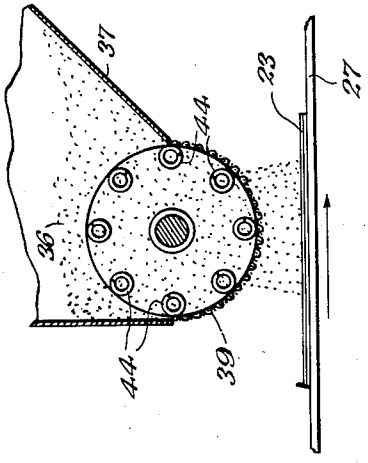


Fig. 3.

INVENTORS
JOHN H. PERRY, Jr.
ROBERT C. GRAHAM
BY
Emery, Vaney, Whittemore & Dix
ATTORNEYS

May 26, 1953 J. H. PERRY, JR., ET AL 2,639,995

PROCESS AND APPARATUS FOR PREPARING A PRINTING PLATE

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Fig. 5.

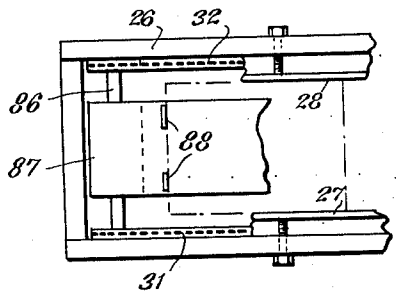


Fig. 6.

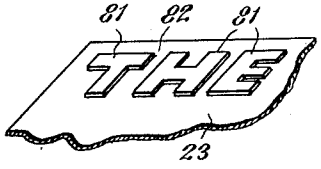


Fig. 7.

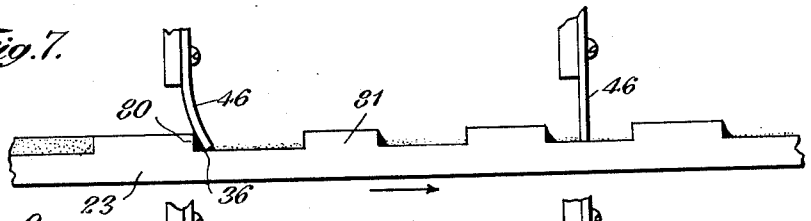


Fig. 8.

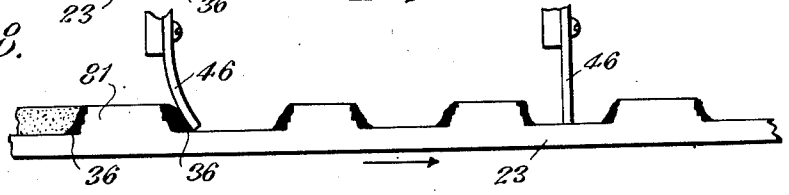


Fig. 9.

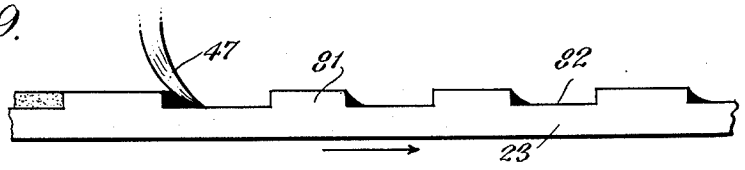
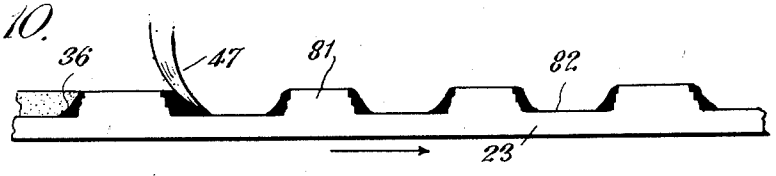


Fig. 10.



INVENTORS
JOHN H. PERRY Jr.
ROBERT C. GRAHAM
BY
Carney, Carney, Whittemore & Dix
ATTORNEYS

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PROCESS AND APPARATUS FOR PREPARING A PRINTING PLATE

Filed Feb. 28, 1949 4 Sheets-Sheet 4

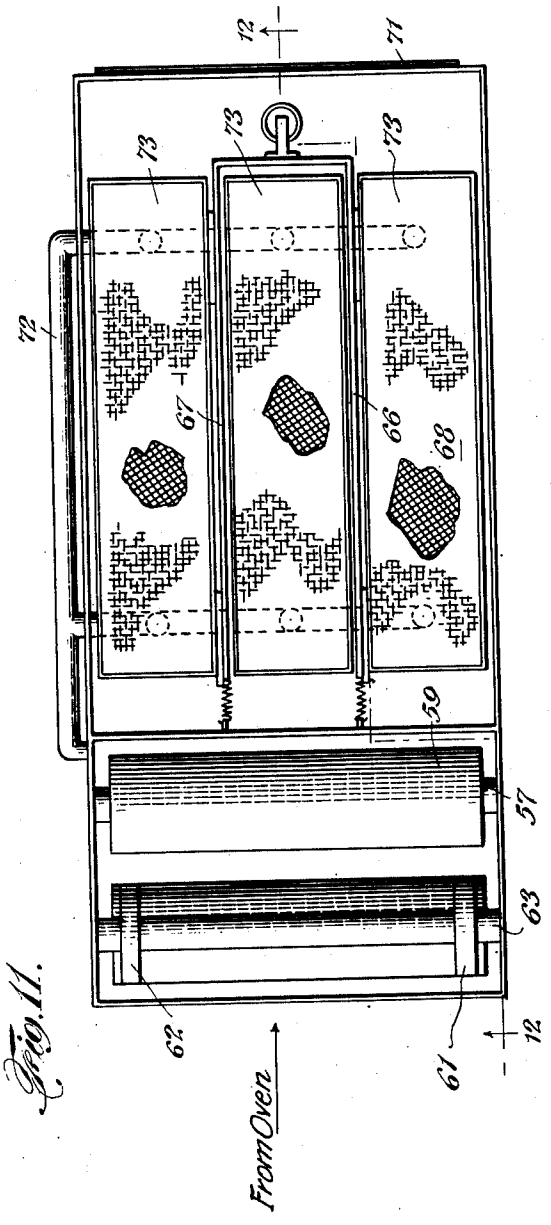


Fig. 11.

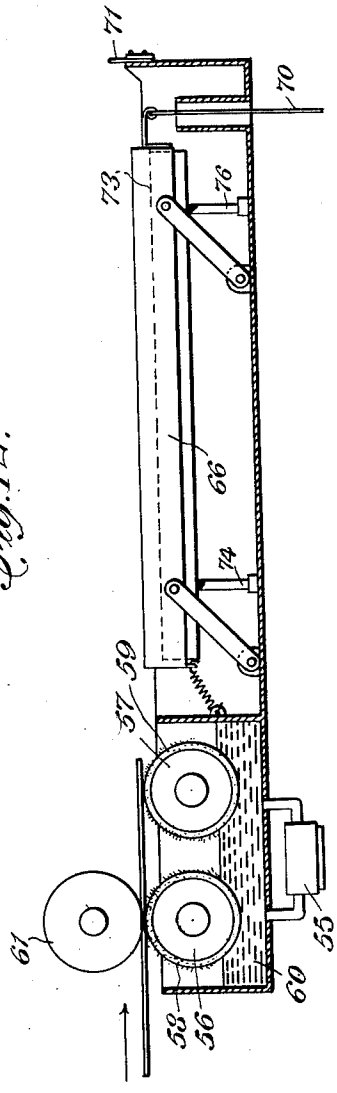


Fig. 12.

INVENTORS
JOHN H. PERRY Jr.
ROBERT C. GRAHAM
BY
Emery, Vaney, Whittemore & Dix
ATTORNEYS

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UNITED STATES PATENT OFFICE

2,639,995

PROCESS AND APPARATUS FOR PREPARING A PRINTING PLATE

John H. Perry, Jr., Palm Beach, Fla., and Robert C. Graham, Elizabeth, N. J., assignors, by mesne assignments, to John H. Perry, Jr., West Palm Beach, Fla.

Application February 28, 1949, Serial No. 78,818

10 Claims. (Cl. 117—19)

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This invention relates to improvements in apparatus for and the methods of preparing printing plates employed in the present day printing process. The invention also relates to the printing plates themselves.

Further, the invention also pertains to certain steps in the method of producing one or many improved printing plates for use on the present printing presses. Also, this invention pertains to an improved apparatus in this art for carrying out the several steps in the process.

It has long been known in the printing industry that a printing plate may be prepared for the press by what is known as the etching process. However, there have been many drawbacks and disadvantages to producing one or many of such plates by that prior or old process.

The disadavntages are: the apparatus has been large and complicated; there have been no adequate controls; the operations have been especially slow, such as five or six plates per day; half-tones could not be included as part of the plate without separate and special coatings of asphalt, or the like, placed thereon during each etching step; the plates became warped in the process and therefore special and additional apparatus was required to maintain them flat; the material of the original plates did not stand up; defective printing often resulted due to powder being shifted or removed by being touched when warm; and the etching only carried to 0.017" depth and then it was necessary to hand gouge or rout out the material between the letters, line cuts and small areas in the half-tones.

The invention herein, however, by reason of experiments and operation of the present full size machine, does permit alternate powdering (applying protective material) and etching so that a final depth of the grooves between the letters and line cuts is approximately 0.025". The reverse of this statement is that the top of the letters and line cuts are 0.025" high above the "floor" or bottom of the grooves. Thus, with the improved process and apparatus herein, improved, effective, printing plates are obtained in minimum time and with minimum cost of labor and minimum overhead cost of operating the apparatus.

The present methods and apparatus of etching plates does give the etching depth of approximately 0.025" for newspaper work. However, different types of printing, such as books, special designs, etc., are etched to different depths, but still such etchings are relatively deep compared to the 0.017".

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In providing effective etched printing plates by means of the now preferred etching process, the following outline is presented when, as an example, the process is employed in the production of a newspaper. A typewritten "setup" or "makeup" for one plate, which is equivalent to one sheet of a newspaper, is provided in any desired manner, and includes the typed articles, any pictures, various kinds of art work, and headings of different size type, all assembled on a suitable cardboard or support. This "setup" is photographed and after the development of the photograph, it is transferred to, or "burned into" a sensitized emulsion spread over an improved alloy plate, which plate later becomes the printing plate with letters, line cuts, and half-tones therein. The pictures are also readily transferred with the typed articles to the plate, and in the plates become the half-tones under the broad term "art work."

This plate as thus prepared, is then subjected to a first etching of desired depth. An effective protecting material is then applied to the plate to protect the vertical side walls or shoulders of the type and art work against being eaten while the unprotected part of the plate is being further etched to deepen the grooves between the type and the various art work elements. The process usually provides for a series of alternate etching and shoulder protecting steps until the grooves have been formed deep enough to give satisfactory final newspaper printing without smudging or causing the grooves to be filled with ink.

In carrying forward this improved invention, there are certain steps in the process which have been improved and the overall efficiency of the process has been greatly enhanced. An improved apparatus has been provided to effectively carry out the improvements.

In respect to one step in the process, and that is in providing a suitable protection for the side walls or shoulders of the type and art work formed by etching, a satisfactory material for protecting these shoulders of the type may be any commodity or material or powder that will be hardened in position and form a suitable protection to the side walls of the type while the etching operation is going on. A powder which can be fused against the vertical walls has been found to be satisfactory for this purpose. The improved use and treatment of this powder constitutes some of the improvements herein.

Usually in the improved process herein the powder is spread on the printing plate and the

excess powder is scraped off in a novel manner, and in the scraping some of this powder is pushed or packed against the shoulders or verticals of the type and art work, and into the grooves of the half-tones. After excess powder has been scraped from the plate, it is desirable to satisfactorily "set" this powder to properly protect the shoulders during the etching operation. One manner of setting the powder against the verticals or shoulders is by heating it to a certain extent and have it cool by its own accord, or by actively cooling it, if such a step is desirable.

Referring to the pictures which constitute part of the original "setup" as photographed and transferred to the printing plate, it has been found for newspaper work that using the 65 line engraver's screen is satisfactory. The half-tones in the plate of pictures usually approximates 3600 dots per square inch in such a screen, and the dots are of different diameters across their tops. In the powdering and etching steps as disclosed herein, these half-tone pictures are etched to different or graduated depths extending from 0.006" for the white areas of the pictures to 0.0015" for the shadow and black printing areas. The middle tones of the pictures etch to various depths averaging approximately 0.0035" and usually these give the gray portions of the picture.

With the improved apparatus for pressing the powder against the vertical sides of the type, the same apparatus presses powder into the various grooves between the dots of the half-tones so that as the alternate powdering and etching steps take place, the white or high lights of the half-tones etch to the greater depth.

It has also been found that the carrying out of the alternate powder and etching steps gives a pyramidal form of support underneath the type and numbers and underneath the dots of the half-tones. Thus, a larger and greater strength support is obtained.

The improved process provides for the applying and setting of the protecting material on all of the vertical sides of the type and art work, and then the plate is etched in the usual manner of applying an acid. Any suitable etching apparatus may be employed.

It has been found from experience that the powdering and heating, and when desirable cooling, of the plate constitute steps in the etching process which in the old process were required to be carried out with great caution as those steps were delicate and complicated. The improved process herein, however, provides for the conducting of these steps in a quick and efficient manner that does not require the full attention of the attendant, as part of the operation is automatic. After the final etching, the plate is properly washed and is then curved and mounted on a base which is inserted in a printing press and the printing of the newspaper is then carried out. If desired, the plate after being curved and mounted on the base may be employed to form a matrix to receive a casting metal, which later is employed to print the paper.

For other methods of printing, the plates may be retained flat for flat bed printing presses. In addition, the plates may be curved to fit around a plate cylinder on an offset press, and in such a case, the use of water is eliminated, thus providing novel and efficient offset printing.

Certain parts of the improved apparatus have been provided to give exceptionally efficient operation and results while at the same time having each plate produced without special apparatus required to prevent buckling of the plates.

There also is an improvement in the final printing plate itself. The improved plate consists of a series of letters, figures, line cuts, and half-tones, and sometimes other special showings which fall under the term "art work." All of these several elements have been properly formed by etching to different depths in the plate. This situation has been accomplished substantially automatically for there has been no change in the alternate applications of the powder and the etching steps that follow, and there has not been any special attention given to the half-tones or other art work parts of the plate over the letter parts of the plate, but the depths of the etchings are different and varied.

In carrying out this invention, it is desirable to use an alloy plate which is satisfactorily treated in accordance with the invention herein, to thereby give the proper final printing plate with letters, figures, line cuts and half-tones etched to their proper various depths as the plate moves through the powdering and etching apparatus, and to obtain these different etched depths without special attention as the plate has its regular passes through the apparatus. One of the best forms of alloy for this purpose is a magnesium plate having approximately 96% magnesium, and the other elements of the alloy are as follows: approximately 3% aluminum, and approximately 1% of zinc, iron and beryllium. This alloy plate for this printing purpose gives a most satisfactory result in properly accepting the treatments of powdering and etching, and, as finally formed, will not show wear in the printing, but will stand up and permit many more printings from the same type than has heretofore been possible.

It has been found that this alloy plate after having been finally prepared by the process herein disclosed, and as noted above, is particularly adaptable and efficient in having matrixes made therefrom. As is well known, these matrixes are for the later casting of type for printing. It has also been found that this novel alloy plate will make at least 50% more matrixes than other types of alloy plates used for the same purpose. For instance, the present alloy plate has allowed 3,000 matrixes to be made therefrom without showing hardly any wear. The zinc type plate, as a competitor of the present alloy magnesium plate, would only give approximately 600 matrixes before the wearing was so great that it was necessary to replace the plate. The so-called copper alloy plate for this printing purpose breaks down when approximately 1200 or 1250 matrixes have been made.

Another feature of this invention is to provide a small size and relatively inexpensive apparatus which will quickly and easily and efficiently complete the powdering, scraping, heating and cooling steps in this process, so that one plate may be completed in its production in a very short space of time, say in the matter of minutes.

In conducting the improved process, it has been found desirable to provide two machine units positioned beside each other so that the proper application of the protecting material to the sides of the type and art work, may be accomplished quickly. The plates are usually rectangular in that they are 18" x 22" and 18" x 24", although other size plates may be used. Therefore, it is desirable to have the width between the guides in one unit of the apparatus constructed to receive

the 18'' width and in the adjacent unit to receive the plate on its 24'' width. Each of these units provides for the application of the powdering to two vertical sides of the type and art work, and, therefore, the plates are prepared quickly, completely and satisfactorily by making two passes of the plate through each machine unit, where the steps of powdering, scraping, heating, and cooling, if desired, are accomplished. Then the plate is ready for an etching operation. This part of the improved invention is to provide these two machine units and to operate them so that the cost of operation will be materially reduced while efficiently producing an improved printing plate. It has been found that with little experience two operators may conduct this portion of the process in a relatively short space of time.

Many improved structural features for properly applying the powder to the plate and scraping off the excess powder and "pushing" or packing the powder against the shoulders or verticals of the type and art work and to "fuse" the powder in position to protect the type shoulders and then to quickly and easily cool the plate so that it may be readily handled, are herein provided to easily and quickly give the improved printing plate. It will be noted that there is no routing required, that there has been no special attention paid to the half-tones, and that the plate has been etched to different depths.

There are many improvements in the apparatus and many detailed features which make it operate very successfully. These will be disclosed and defined in the detailed description below. It will be particularly noted that the process of producing the plates in their final form, has been greatly improved and shortened in time by reason of the novel apparatus and the steps of its operation, all as will be disclosed in detail by referring to the accompanying drawings, wherein:

Fig. 1 is a top plan view of a layout of two machine units with portions of the covers removed therefrom and of an etching machine;

Fig. 2 is a side view of the essential portions of one of the machine units shown in Fig. 1;

Fig. 3 is an enlarged view of a powder dispersing mechanism showing the powder dropping onto one of the plates;

Fig. 4 is an enlarged view of a brush for cleaning excess powder from the plate;

Fig. 5 is a modified view of one portion of one of the machine units of Fig. 1 and shows an adjustable means for widening or narrowing the supporting guides to receive plates of different widths;

Fig. 6 is a perspective view of a portion of the printing plate showing letter type formed in the plate by the etching process;

Figs. 7, 8, 9 and 10 illustrate type formed in a plate by etching and shows the packing of powder protecting means on the shoulders of the type by suitable scraping and brushing means, and shows a pyramidal type of support;

Fig. 11 is a top plan view of a cooling mechanism incorporated in the machine units;

Fig. 12 is a sectional view of Fig. 11, taken on line 12—12 thereof;

Fig. 13 is a side view in section taken on line 13—13 of Fig. 14, of a modified form of heating arrangement for setting the powder against the shoulders of the type in the printing plate;

Fig. 14 is a top plan view of a portion of the apparatus shown in Fig. 13;

Fig. 15 is a top plan view of a portion of a half-tone showing dots of different sizes, and notations of different portions of the half-tone; and

Fig. 16 is a side view of the dots of different sizes and illustrates the varied depth of etching and the pyramidal form of support.

In accomplishing the production of improved printing plates by the novel process and apparatus herein, there are provided two machine units 21 and 22, Fig. 1, preferably set side by side and particularly adapted for carrying out the steps of applying powder, scraping off excess powder, setting the powder in protecting positions, cooling the plate to a temperature for ready handling, and etching.

In carrying on the invention herein by using machine units 21 and 22, a plate 23 is introduced in unit 21 presenting the greater width of the plate as its leading edge. As this plate proceeds through unit 21 and is delivered to the cooling end thereof, the operator takes the plate by hand, turns it 90°, and inserts it into machine unit 22 which is either built or adjusted to accommodate the narrower width of the plate. When this plate finishes its course through unit 22, it is again turned 90° and the operator reenters it into unit 21 with its wide width leading. The plate is now 180° from its first entrance into machine unit 21. After passing through unit 21, the plate is again turned 90° and again passed through unit 22. In being removed from unit 22 all four sides of the type and art work in the plate have been protected by setting the powder in position against the shoulders of the type and art work. The plate is then introduced into a suitable etching machine 24, where the unprotected portions of the plate are etched a desirable amount, thereby increasing the depth of the grooves between the various letters and between the various portions of the art work.

The proper application of the protecting material against the sides of the type and art work, and the etching may be continued as desired until proper or desired depth of grooves has been obtained.

By means of the alternate powdering and etching steps, the type and points of the half-tones have supporting bases that are larger at the bottom, i. e., at the bottoms of the grooves than at the top as will be described below.

Referring now to the structures of the machine units 21 and 22, a frame 26 is provided for supporting the various parts. Normally unit 22 is a duplicate of unit 21 with the exception that guides 27 and 28 in unit 21 are positioned sufficiently far apart to receive plate 23 with its wider side or edge foremost. Guides 29 and 30 in unit 22 are positioned closer together so as to receive the plate 23 with its narrow width foremost. When desired the guides may be positioned or adjusted to receive a square plate.

A suitable means for moving the plate through each unit is provided, and usually it comprises chain drives 31 and 32 having a series of pickups 33 and 34 mounted thereon. These pickups are spaced apart, as will be noted in Fig. 2.

The plate 23 after being engaged by the moving pickups 33 and 34, moves forward into the powdering area of the machine, as will be noted in Fig. 3. The powder 36 in hopper 37 only drops to the plate 23 during the time the plate is within the powdering area. A suitable switch mechanism is provided with a roller 38, Fig. 2, so that as the plate 23 enters the powdering area, it engages the roller and a switch is closed to a motor, not shown, that drives the powdering mechanism

illustrated in Fig. 3, and causes the powder to be sifted through a suitable screen 39 onto the plate 23. The roller 38 of the switching mechanism is carried by a pivoted lever arm having a longer portion 40 and a shorter portion 41 for causing two switch points to be closed when the roller is depressed. The switch automatically starts and stops the operation of the powder mechanism, as the plate 23 passes under the screen 39.

Any suitable powdering mechanism may be provided for properly sifting the powder, so that lumped portions thereof will not drop onto the plate. It is desirable in this preferred structure, to provide two drum heads 42 and 43 and to assemble rods 44 between these two heads, as particularly indicated in Fig. 1 and in the end view of Fig. 3. When this powdering mechanism is in operation, these rods 44 will move across the screen 39 and sift the powder. It is to be understood that spiral elements may take the place of rods 44, or even rubber squeegees may be employed in place of the rods 44.

The plate now passes from the powdering area to the scraping area which provides for the scraping or removing of excess powder from the plate and for pressing or packing some of the powder against the shoulders of the type and the points in the half-tones, as will be particularly noted in Figs. 7 to 10, inclusive. Any suitable means may be provided for properly accomplishing this function. In the prior processes, the scraping mechanism had not been satisfactory without employing considerable apparatus and giving it careful attention. There is provided herein an illustration of three different types of satisfactory scraping means, any one or all of which give satisfactory operations. In some instances when the grooves in the plate are quite deep, it may be desirable to have at least two of these scraping means operating. The illustrated types of scrapers have been successfully operated in a full size machine.

In the preferred apparatus for scraping the powder from the plate and pressing some of it against the shoulders of the letter type and the portions of the half-tones, one of more scrapers 46 may be employed. In the preferred structure herein, three squeegees of rubber or other flexible material are shown, but experiments have shown that one squeegee will act satisfactorily. It is desirable to have the first squeegee 46 placed at an angle to the center line of the machine unit 21, thereby obtaining an increase in efficiency in the scraping operation. In addition to the squeegees, a rotary brush having separate brushes 47, Fig. 4, is provided for assisting in the scraping of the powder from the plate, and these several brushes also assist squeegee 46 in pushing or packing the powder against the sides of the type. The brush is helpful when the depth of the etching is relatively deep. It is helpful that any powder remaining on the brushes 47 be removed after each contact with the printing plate and before a second contact therewith, and for this purpose a suitable bar structure 48 is provided which engages the ends of the brushes during each revolution thereof and removes any excess powder adhering thereto. While four separate brushes are shown, they may be assembled in spiral form across their length, as in the well known carpet sweeper brushes. It is not necessary to operate these brushes 47 at all times of the operation of the machine. In some instances, it is desirable to have a hood 45 placed over the rotary brush.

The bristles of the brush may be cut at their ends to form a particularly desired thickness. It will be noted that the brushes rotate counterwise to the travel of the printing plate as it passes through the machine unit. It is to be understood that these brushes in operating alone or in assisting other scraping units, may be located at adjusted distances above the plate to cause the powder to be more or less compacted into position or to be removed from the flat part of the plate.

While not necessary but in some instances desirable, a vertical brush 49 is provided and is mounted on the frame of the machine in any suitable manner. This brush assists in removing excess powder and also assists in packing the powder against the shoulders of the type and art work.

Usually the guides 27 and 28 maintain the printing plate in its proper travel through the machine unit, but it is desirable in some instances to provide a suitable means for holding the plate steady as it is moving out from under the scraping area. For such functioning, a pair of suitable wheels 50 is provided to engage the top edges of the plate and exert a slight pressure thereon so that the plate engages the guides and continues a steady movement into and through the open space 51 formed in the machine units between the powder scraping area and the beginning of the heating area. If desired the rollers may be replaced by inclined pieces mounted over the guides 27 and 28 to effect the same function.

This open space 51 is particularly useful for two purposes. The first purpose is to allow the printing plate to be introduced into the machine unit after its first etching and to pass through a heating area and a cooling area thereby providing a dry plate after its travel through etching and washing baths. The plate thereafter is introduced at the beginning or left hand end of the machine unit 21 where it will be subjected to all of the steps in passing through the unit. The second reason for the provision of space 51 is for inspection of the printing plates as they pass through the machine units. Providing this space is not necessary, but it has been found to be helpful.

It now becomes desirable to "set" the packed or pressed powder against the shoulders or vertical sides of the type and half-tones formed in the printing plate by the etching, so that further etching will not eat into the sides of the type or will not "undercut" the type. Any suitable means may be employed for setting this powder, but one form which has proven successful in the improved apparatus herein, is the provision of one or more heating units for effecting the powder to have it affix itself to or adhere firmly against the side of the type formed in the plate. In the structures herein, there are provided a series of gas jets or burners 52 for heating the plate from beneath. A modified form of means for setting the powder is shown in Figs. 13 and 14, wherein a suitable heating unit is employed above the plate. This modified structure will be described more in detail below.

As the printing plate enters the heating area, it operates a suitable switching means which corresponds in general to the switching means for operating the powdering mechanism. The switching means in this heating area functions

to fully open a gas valve to allow for the expansion of the size of the gas flame in the gas burners.

In some instances in this heating area, it is desired to employ a heat reflecting plate 53, Fig. 2, so that some of the heat passing through the printing plate will be reflected back onto the top thereof to assist in heating the powder to an extent that will firmly affix itself to the shoulders of the type. With some types of powder, it is heated to approximately 185° F. to fuse it into position against the shoulders. This heat reflecting unit 53 is not always needed in the operations of preparing printing plates, and in many instances, may not be employed at all. A suitable hood 54 is provided over the heating area for properly removing excess heat.

It will be especially noted that no specially designed apparatus has been incorporated to keep the plate from buckling, as has been the requirements in the prior apparatus.

In the machine units herein described as the preferred structures, it is desirable that the drive chains 31 and 32 go around wheel 64 and return to the front end of the machine. It has been helpful to make sure that these chains be kept clean of any powder that may have fallen or gotten on them during the scraping operation and then been carried through the heating area. Any suitable cleaning apparatus or means may be employed. One form of cleaning means constitutes one or more brushes 65 which function to clean heated powder off the chains. If desired, the bristles of these brushes may be very stiff, sometimes being made of metal, if desired.

As the plate 23 issues from the heating area, it is desired to cool it to a temperature which permits ready handling. Any suitable means may be employed for accomplishing this purpose. Experiments have shown that two types of cooling means are helpful and may be employed, singly or together. The first cooling means provides for having the plate engaged by rollers 56 and 57, Figs. 2, 11 and 12, which rollers are provided with coatings 58 and 59 of water retaining fabric and which rollers are positioned to rotate the fabric coatings in a refrigerated water supply 60 preferably maintained at about 30° F. by a refrigerating means, represented at 55, Fig. 12. It has been found that the best fabric arrangement for the best cooling is to provide a fabric sleeve to slide over each roller. This sleeve performs the cooling function most effectively. A fabric wrapping around the roller is not good as the end of the fabric leaves a space before the next layer is available to engage the plate and the cooling is, therefore, uneven and warping may take place.

Suitable drive wheels 61 and 62 are provided to engage the plate and move it across the two rollers 56 and 57 and to keep the plate in contact therewith. Preferably, it is desirable to have the wheels 61 and 62 mounted above roller 56 so that they engage the edge of the plate and press it against roller 56. It is desired to have wheels 61 and 62 driven by shaft 63 at a speed that is greater linearly to some extent than the speed of movement of chains 31 and 32. By reason of this increased speed, the plate is removed from the heating area at a faster rate than would be the case should the plate still be moved by the pickups. By reason of this increase of speed, the plate thus moves away from the pickups 33 and 34, so that as those pickups move around pulley 64, there is no opportunity of the ends of the pickups engaging the trailing end of the plate and bending the same, or tipping it up off roller 57.

After the plate passes beyond roller 57, it moves to the second preferred cooling means. This second cooling means provides rails or supports 66 and 67 for receiving the plate and initially holds the plate above a series of burlap cooling pads 68, Fig. 11, which pads are preferably mounted over perforated supports such as expanded metal lath. Water is employed for soaking these pads. In cooling the plate in this second apparatus, the operator or attendant, presses on foot pedal 69 and causes the rails 66 and 67 to drop in height by rod 70 being pulled down against the action of a spring and thereby allowing the plate to engage the pads 68 and be cooled. After the plate has been sufficiently reduced in temperature to allow handling, it is drawn from the machine unit 21 over a suitable rubber doctor 71 which scrapes the water from the underside of the plate. The plate is then rotated 90° and started into machine unit 22.

In constructing the cooling unit having the pads 68, the water supply flows through pipe 72 into separate containers 73 suitably supported by standards 74 and 76. The flow of water in the containers 73 can be regulated so that the pads 68 have an easy flow of water through their upper surfaces without causing spraying. While burlap has been employed for engaging the plate and expanded metal lath employed to support the burlap, it will be understood that other means for accomplishing the same result may be employed.

Again referring to Fig. 1, the machine unit 22 in the preferred construction herein, is a duplicate of machine unit 21 except for the width of the plate guide. These two machine units are placed beside one another so that a plate may be removed from the exit end of one unit and quickly introduced into the other unit.

Referring now to Figs. 7 to 10, the plate 23 is shown with the squeegee 46 operating to compact or press the powder 36 against the shoulders or vertical sides 80 of the formed letter type 81, Fig. 6. As the plate 23 moves along, a second squeegee 46 assists in removing excess powder from between the formed type 81 when it is desired to employ another squeegee.

There is an advantage in employing a scraper of the squeegee type in that it has been found in most instances to press or pack the powder against the shoulders of the letters and line cuts in a more compact manner than results by the use of the ordinary brushes. Such additional effective packing is especially helpful as it gives the added protection to the shoulders of the type and it is also helpful in packing the powder into the depressions in the half-tones formed in the plate. It has been found that when the squeegee operates first to scrape off extra powder and then to hard press or pack the powder against the type shoulders and into the half-tones, and the plate is then subjected to the operation of a brush, the powder so positioned against the shoulders and in the half-tones has not been affected to any great extent by the brush even though the brush operates to clean the spaces between the letters and line cuts. In some instances when the etching is particularly deep, the brush appears to assist in further packing of the powder against the shoulders of the type and effects a good cleaning of the extra powder from the remainder of the plate. Such pressing and scraping does not

affect the powder which has been pressed in the half-tone depressions.

In Fig. 8 the powder **36** is shown as having been pressed against two opposite shoulders of the type **81** by reason of the plate having passed through unit **21**, unit **22** and back on its second travel through unit **21**. With two passes through each of the machine units, the four sides of any of the type or letters **81** and the sides of the art work, will have received powder pressed against their shoulders. The plate will then be ready to be etched.

Figs. 9 and 10 show the operation of brush **47** when the depths of the grooves have been increased as will be noted by referring to these figures. Fig. 9 also shows the application of the powder to one side of the shoulders of the type **81**, while Fig. 10 shows the application of the powder to the two opposite sides of the letter type **81**.

The alternate etching and powdering finally provides the outstanding letter type **81**, see Fig. 6, from the plate **23** and printing may be accomplished without the ink getting into the grooves **82** between any of the type letters or portions of the art work to an extent to cause trouble or defects.

An advantageous result has been obtained by practicing the method herein with the preferred apparatus. That result is that by the time the plate is etched to a depth of approximately 0.025'', each letter or number or line cut has a supporting base of pyramidal construction. This pyramidal construction results by reason of the alternate powdering and etching as each successive powdering covers the prior powder and the side of the letter which is unpowdered by reason of the last etching. It will, therefore, be noted that as each alternate powdering and etching takes place that the final metal support for each letter, line cut, and the like, has a widened base, as will be noted in the right ends of Figs. 8 and 10. After the final etching takes place, the plate is thoroughly scrubbed in water and solvent powder, and all of the "set" powder is removed leaving the pyramidal type of support for each letter and line cut. This widened supporting base for each letter and line cut is helpful in giving more supporting strength to each letter during the printing of the newspaper. Also this pyramidal type of support for each letter and line cut portion and half-tone points, Fig. 16, permits the making of a matrix in a most efficient manner as there is no opportunity of the matrix material getting in under any of the letters or line cuts and the matrix is, therefore, easily pulled from the printing plate.

On the half-tones, the white or high lights etch down to approximately 0.006'' depth. The middle tones etch down to 0.0035''. These are the gray part of the picture. The shadow areas are formed by reason of the first etch and are not usually deeper etched by any further operation. The white or high lights are noted in any half-tone picture as being the very light or small dots.

Any half-tone prints by reason of the diameters of the dots give the high lights, middle tones, shadow areas or the black part of the pictures, see Fig. 15.

The half-tones are only dots so far as printing is concerned, and the diameters of the dots show up in the printing as graduated from black to substantially white, Figs. 15 and 16.

An advantageous feature or result which has been found in the practice of the invention herein in the preferred apparatus also disclosed, is that any picture included in the original typewritten setups or makeups, can be carried through the developing, burning-in steps and to the alternate powdering and etching steps and still only have an etched depth suitable for printing the picture itself. This result comes about by reason of the fact that after the first one or two etchings which only give a final depth of approximately 0.006'' in the picture portion of the plate, it has been found that these pictures will not etch deeper, because with the squeegee type of scraper the powder is pressed or packed into the fine openings in the half-tone and act as a resist to further etching. This result usually comes about automatically and is particularly advantageous as the picture reproduces in the newspaper in excellent fashion without smearing or without leaving out important portions of the picture.

In reproducing pictures by the improved method herein, it is helpful to have the screen of the picture approximately 65 lines per inch in each direction for newspaper work. With a screen lined as thus indicated for newspaper work, it has been found that the etching depth is approximately 0.006''. When using this process for book work instead of newspaper work, it is desirable that the picture have about 120 lines in each direction per inch.

In the half tone printing, the pictures are spoken of as "65-line engraver's screen." In this 65-line screen there are approximately 3600 dots per square inch, each dot being of different diameter across its top.

Usually the center of each dot is equidistant from the four adjacent dots even though the diameters of the adjacent dots are different. In some few instances in the printing art, there may be some small changes from the above arrangement, but they are considered as being within the foregoing general statement.

Referring now to the modified form of structure shown in Fig. 5, the guides **27** and **28** are shown as being movable back and forth to accommodate the narrow width of the plate **23** or the wider width of that plate. Thus, with the adjustment shown in Fig. 5, one machine unit may be employed when desired to properly powder, scrape, set the powder and cool the plate. In this modification in Fig. 5, the driving chains **31** and **32** are preferably positioned near the outer edges of the frame **26** and are driven by a suitable shaft **86**. In such an instance, the propelling means for moving the plate **23** through the machine unit, takes the form of a relatively wide belt **87** preferably having two pickups **88** thereon for engaging the plate and moving the same forward. This belt is driven by the shaft **86** and may have a series of pickups fastened thereto.

In the modification of structure shown in Figs. 13 and 14, Fig. 13 shows the plate **23** being moved under a burner **90** provided with jet openings **91** so that a burning gas **92** preferably issues on the slant against the leading edge of the shoulders of the type **81**, and thus acts to properly heat the powder so as to set it or affix it against the shoulders to protect them against etching acids. The heat from the burner **90** may be of so-called blast formation, or may be reduced in intensity and nearness to the plate.

On this top or down-heating modified structure shown in Figs. 13 and 14, it is desired to obtain suitable heating to accomplish the powder setting without heating the body of the plate too high. If desired, a series of burners may be

employed, but it is found that the single burner 90 extending across the frame of the machine, is satisfactory when employing the combination of gas and oxygen to form a small heating flame. In some instances, a small welding type flame suffices. In Fig. 14 a gas supply is shown at 93 and the oxygen supply at 94. The oxygen pipe extends into the gas pipe as shown in Fig. 14, for safety purposes. In the operation of this type of heater, the flow of gas will be enlarged to full volume when the plate engages switch roller 95 of a switching mechanism, which switch mechanism corresponds in general to the switching mechanism for the powder mechanism noted above. As the plate further proceeds and after about one second, it engages switch roller 96 of a suitable switching mechanism and the oxygen is turned on and mixes with the gas and creates the desired flame. Both switch mechanisms operate electro-magnets for opening suitable valves in the gas and oxygen lines. As the end of the plate 23 passes under the burner 90, a switch roller 97 of a suitable switching mechanism moves to operate a magnet to close the valve in the oxygen line. As the plate passes on further, a switch roller 98 of another switching mechanism becomes free to swing to a position to operate the magnet to shut down the volume of gas supply. It is usual to have a pilot light for the gas so that it responds to the operations of the movements of the plate 23. In employing the combination of gas and oxygen, it is always desirable to have the gas burning first and then add the oxygen. In shutting down the heat, it is desirable to shut off the oxygen first and then the gas. This is a safety precaution.

From the foregoing description, it will be noted that the two machine apparatus units are of relatively short length and small structure and therefore, can be provided at small cost, and the space for installing them is small. Preferably, these machine units are employed to properly affix a protecting material on the side of the letter type formed in the printing plate, so that the plate may then pass to additional etching steps in the process of producing the printing plate. It will be further noted that the machine units are simple, automatic in their operations and are operated with a minimum number of operators, and they produce printing plates having the letter and art work sufficiently high in the plate for producing printing without smudging or trouble. It will also be noted that the plates may be used for printing in their regular flat position or they may be readily curved to be applied to a curved printing base, or may be applied to the circular offsetting frame of an offset press. The units herein and the improved structural features thereof provide for the rapid production of printing plates in relatively short time, such as, approximately six plates per hour, and these units are operated at a very small expense to quickly produce the desired formed printing plates.

It will also be particularly noted that there are no provisions made for extra apparatus that acts to keep the plates from warping. Such apparatus is not needed in the improved structures described herein, as there is little or no warping that needs special apparatus to keep the plates flat. It will be further noted that when employing the top or down-heating that practically no cooling is demanded. When using the top or down-heating and when operating the machines at relatively high speed, then it may be desired to employ some cooling to bring the plate to a temperature to allow proper handling by the attendant.

In addition, it will be noted that the printing plates produced include the half-tones as well as letters and numbers and line cuts. It will be noted further that the depth of etching varies. This is particularly true between the letter type and the half-tone. However, no special arrangement or steps in the process have been added or subtracted to obtain this result. While the exact theory for this result is not exactly known, it is believed, however, that the actions of the squeegee in pressing the powder into proper position has a great deal to do in obtaining the advanced and improved results.

With this successfully operated small size installation, it will be noted that many plates can be produced within specific time units, thus the cost of final printing production is reduced. The apparatus being relatively small is not complicated, and the initial cost is small. The number of operators or attendants required is less than four and thus, there is a further reduction in the cost of preparing the plates.

The terms and expressions which have been employed are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described, or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed.

The invention claimed is:

1. In an apparatus for producing an etched printing plate, said apparatus having a frame, guiding means in said frame for the plate as it passes through said apparatus, travel means for moving said plate, powder applying reservoir supported on said frame above the travel of said plate, scraping means mounted on said frame and in engagement with said plate for pressing powder against the type in said plate and for removing excess powder from said plate, heating means mounted in said frame beyond said scraping means for semi-liquefying said powder, and a means for cooling the plate, comprising a series of fabric covered pads mounted in said apparatus for holding on the surface thereof a film of moisture, a series of semi-rigid perforated elements for supporting said pads in position so that the tops of said pads lie substantially in a horizontal plane, containers for holding said pads, water supply for keeping said pads moist and overflowing into said container, two pivoted supports adjacent said pads and having their top edges normally positioned higher than the surfaces of said pads, said supports receiving said plate after said material has been set thereon, and pedal means associated with said supports for moving the same against a spring bias to withdraw said supports from said plate and allowing said plate to engage said pads for cooling.

2. In the method of preparing a printing plate with type and art work formed in one surface thereof, the steps of moving a plate having raised letters and art work in one surface thereof to a powdering area with the type and art work uppermost, applying powder to said uppermost surface, pressing said powder against shoulder portions of said type and portions of said art work, removing excess powder from said plate, moving said plate to a heating area, semi-melting said powder against the shoulders of said type and projections in said art work, mov-

ing said plate out of said heating area, moving said plate at an increased rate of speed to a cooling area, applying cooling medium to a side of said plate opposite said letters and said art work while it is being moved at the higher speed, applying additional cooling medium to the wet side of said plate after said plate has moved from the higher speed area, and repeating the steps with the plate orientating into positions at right angles until the four sides of the letters of the words and symbols are coated and the powder set.

3. In an apparatus for producing an etched printing plate for use on printing presses, the combination of a frame for supporting various parts of said apparatus, guides in said frame for receiving and guiding the plate through most of said apparatus, travelling means engaging said plate for moving it along said guides, first supports carried by said frame near the front end of said apparatus, a powder reservoir mounted on said first supports and above said guides for holding and dropping powder onto said plate as the plate passes thereunder, second supports affixed to said frame back of said first supports, a squeegee mounted in said second supports for engaging said plate as it moves from in under said powder reservoir, to press the opwder against the shoulders and the art work raised on said plate and for removing excess powder therefrom, third supports mounted on said frame beyond said squeegee, means mounted in said third supports for causing said powder to firmly adhere against the shoulders of said type and art work, and means following said powder adhering means for cooling said printing plate without affecting the type formed in the surface of said plate

4. In an apparatus for producing an etched printing plate for use on printing presses, the combination of a frame for supporting various parts of said apparatus, guides in said frame for receiving and guiding the plate through most of said apparatus, travelling means engaging said plate for moving it along said guides, first supports carried by said frame near the front end of said apparatus, a powder reservoir mounted on said first supports and above said guides for holding and dropping powder onto said plate as the plate passes thereunder, second supports affixed to said frame back of said first supports, a squeegee mounted in said second supports for engaging said plate as it moves from in under said powder reservoir to press the powder against the shoulders and the art work raised on said plate and for removing excess powder therefrom, third supports mounted on said frame beyond said squeegee, means mounted in said third supports for causing said powder to firmly adhere against the shoulders of said type and art work, additional engaging means for gripping said plate as it passes from in under said powder adhering means for moving said plate at an increased speed and away from said travelling means, and cooling means for receiving said plate from said additional engaging means for cooling the under side of said plate.

5. In a powdering apparatus for preparing printing plates, the combination of a frame, a guide supported in said frame for receiving the plate, travelling means for engaging the plate and moving it through some portions of said apparatus, a support mounted on said frame near the front end thereof, a powdering mechanism including a reservoir mounted on said support for applying powder to one surface of said plate as the same passes under said powdering mechanism, second supports mounted back of said powdering mechanism, a rubber squeegee mounted in said second supports and positioned at an angle to the axis of travel of said plate, said plate passing under said squeegee for removing some of said powder and for pressing other portions of said powder against type shoulders of said plate, third supports near said second supports, additional squeegees mounted in said third supports for assisting in removing excess powder and additionally pressing powder against said shoulders, fourth supports mounted on said frame, a brush mounted in said fourth supports and rotating in opposite direction to the movement of said plate for also removing excess powder from said plate, holding means mounted in said frame beyond said fourth supports for engaging said plate to hold it from vibrating, fifth supports mounted in said frame, means mounted in said fifth support for setting said powder against the upright sides of the type letters formed in said plate, a gripping means positioned in said frame beyond said fifth supports for engaging said plate and for moving it at an increased speed through another portion of said apparatus, a first cooling means for engaging said plate while it is issuing from said gripping means, a second cooling means mounted in said frame beyond said gripping means and positioned to receive said plate, and a doctor means mounted in said frame beyond said second cooling means for scraping liquid from the bottom of said plate as it is removed from said apparatus.

6. In an apparatus for preparing printing plates for use on printing presses, the combination of a frame, a guide supported in said frame for receiving and guiding a printing plate through each of the treating positions in said apparatus, means for engaging and moving said plate along said guide, a support carried by said frame near and above the front end of said apparatus, a powder reservoir mounted on said support for dropping the powder onto one surface of said plate as it moves thereunder, second supports mounted on said frame next to said powder reservoir support, a squeegee carried by said second supports and positioned at an angle to the travel axis of said plate as it passes from in under said powder reservoir, said squeegee engaging said plate for pressing some of said powder against type shoulders and art work formed in said plate and for removing excess powder therefrom, and heating means carried by said frame next to and in succession to said squeegee supports for setting said powder tightly against said shoulders as said plate passes thereunder.

7. In a system of producing an etched printing plate, an apparatus for applying a protecting element to the shoulders of the printing type and art work of said plate, said apparatus including a frame, a guide for supporting and guiding the plate through said apparatus, a travelling means for moving said plate along said guide, a powder reservoir, a support on said frame near the front of said apparatus for holding said reservoir over the travel of said plate, a mechanism in said reservoir for agitating said powder to have it drop in substantially uniform thickness onto said plate as said plate moves under said reservoir, a second support mounted on said frame beyond said powder reservoir, a squeegee mounted in said second support in position to engage said plate for pushing some of the powder against the upright shoulders of the type and art work and for removing excess powder, third

supports, heating means mounted in said third supports to fix the powder to the shoulders of the type and art work to prevent etching material from eating said shoulders, and cooling means mounted in said frame beyond said heating means for cooling said plate as it moves from the heating area in said frame.

8. In a system of producing an etched printing plate, an apparatus for applying a protecting element to the shoulders of the printing type and art work of said plate, said apparatus including a frame, a guide mounted in said frame for supporting and guiding the plate as it moves through said apparatus, a travelling means for moving said plate along said guide, a powder reservoir, a support on said frame near the front of said apparatus for holding said reservoir over the path of travel of said plate, a mechanism in said reservoir for agitating said powder to have it drop in substantially uniform thickness onto said plate as said plate moves under said reservoir, a second support mounted on said frame beyond said powder reservoir, a squeegee mounted in said second support in position to engage said plate for pushing some of the powder against the upright shoulders of the type and art work and for removing excess powder, third supports, heating means mounted in said third supports and being held adjacent said printing plate as it moves under said heating means to fix the powder to the shoulders of the type and art work, and a cooling mechanism comprising a support held in said frame for receiving said plate after said powder has been set, a cooling pad carried by said frame and in near relation with said support, means also carried by said frame for removing said support from said plate and allowing said plate to engage said pad for further cooling said plate.

9. In the method of preparing printing plates for use on printing presses, the steps of conveying a printing plate through successive treating zones, applying powder to the plate as it moves under a powder supply mechanism, pressing the powder against the shoulders of type and art work in said plate by engaging said plate by a squeegee, removing excess powder from the plate as it moves through the apparatus, holding the plate from vibration during the pressing step, semi-liquefying said powder by heating, cooling the semi-liquid powder, thereafter moving said plate at an increased speed beyond said heating means, and cooling said plate as it issues from the increased speed area.

10. In the method of preparing printing plates for use on printing presses, the steps of conveying a printing plate through successive treating zones, applying powder to the plate as it moves under a powder supply mechanism, pressing the powder against the shoulders of type and art work in said plate by engaging said plate by a squeegee, removing excess powder from the plate as it moves through the apparatus, holding the plate from vibration during the pressing step, semi-liquefying said powder by heating, cooling the powder as so semi-liquified, thereafter moving said plate at an increased speed beyond said heating means, cooling said plate as it issues from the increased speed area, and cleaning the conveyor preparatory to receiving the next plate.

JOHN H. PERRY, JR.
ROBERT C. GRAHAM.

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