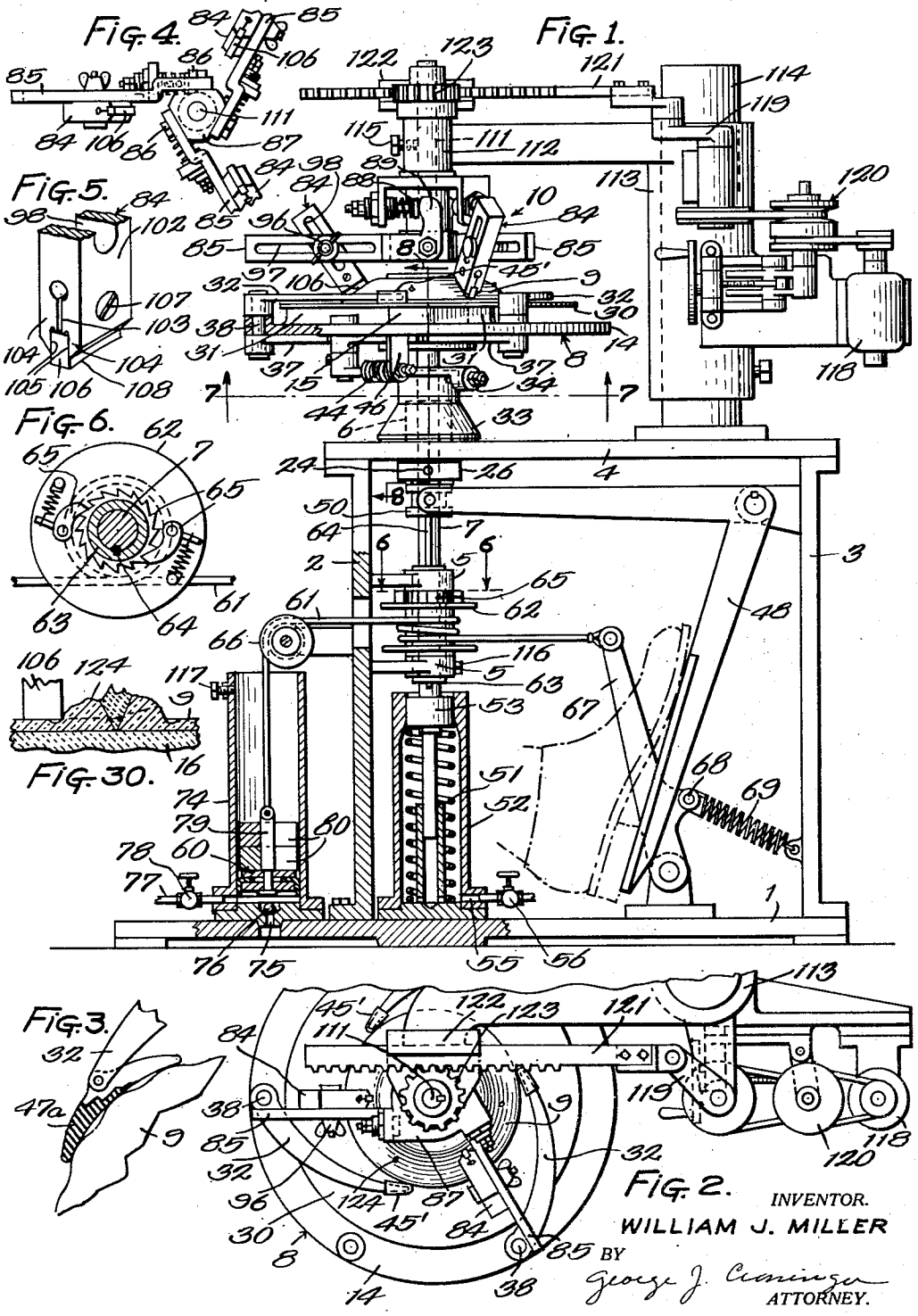
April 26, 1949. W. J. MILLER 2,468,404

APPARATUS FOR MANUFACTURING POTTERY WARE

Filed Feb. 24, 1943 5 Sheets-Sheet 1



INVENTOR.
WILLIAM J. MILLER
BY
George J. Cranmer
ATTORNEY.

April 26, 1949. W. J. MILLER 2,468,404

APPARATUS FOR MANUFACTURING POTTERY WARE

Filed Feb. 24, 1943 5 Sheets-Sheet 2

FIG. 7.

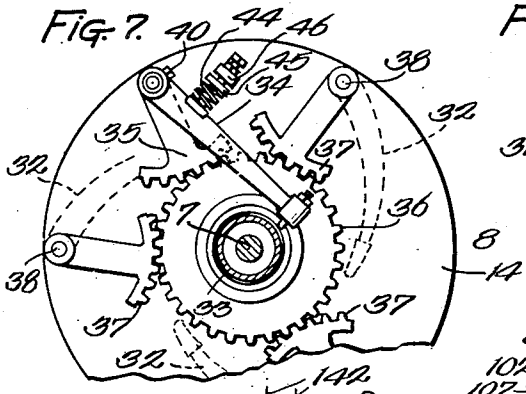


FIG. 9.

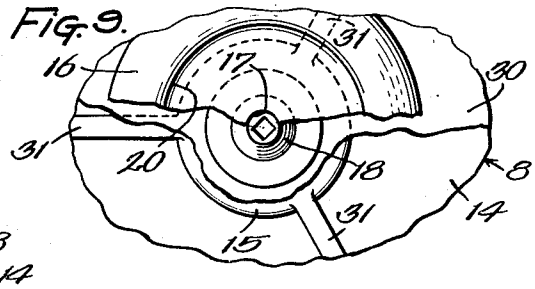


FIG. 10.

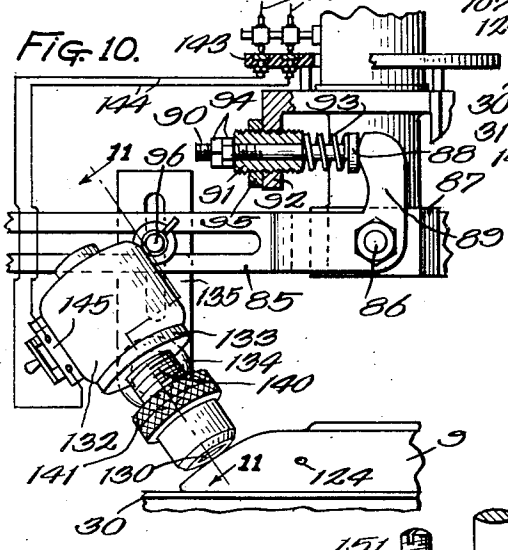


FIG. 8.

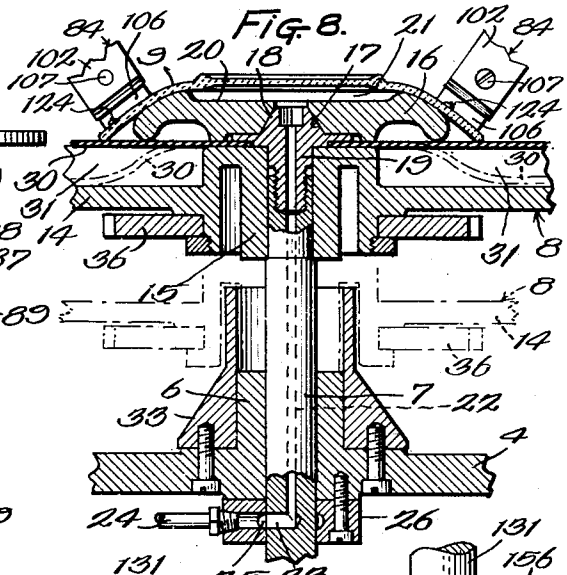


FIG. 13.

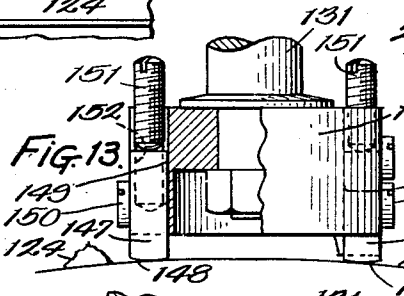


FIG. 14.

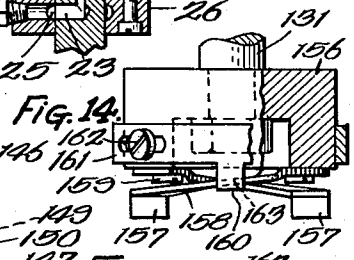


FIG. 11.

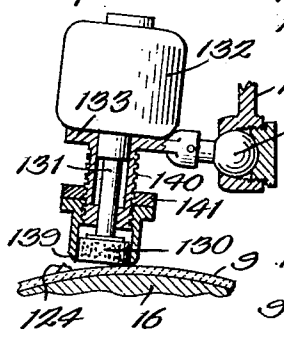


FIG. 12.

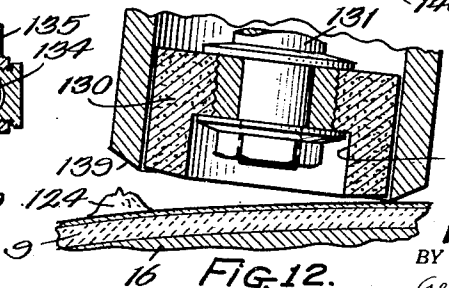
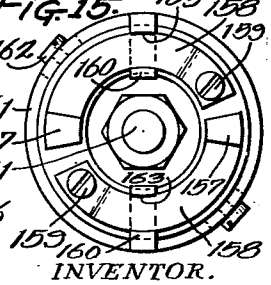


FIG. 15.



INVENTOR.
WILLIAM J. MILLER
BY
George J. Cronin
ATTORNEY.

April 26, 1949. W. J. MILLER 2,468,404

APPARATUS FOR MANUFACTURING POTTERY WARE

Filed Feb. 24, 1943 5 Sheets-Sheet 3

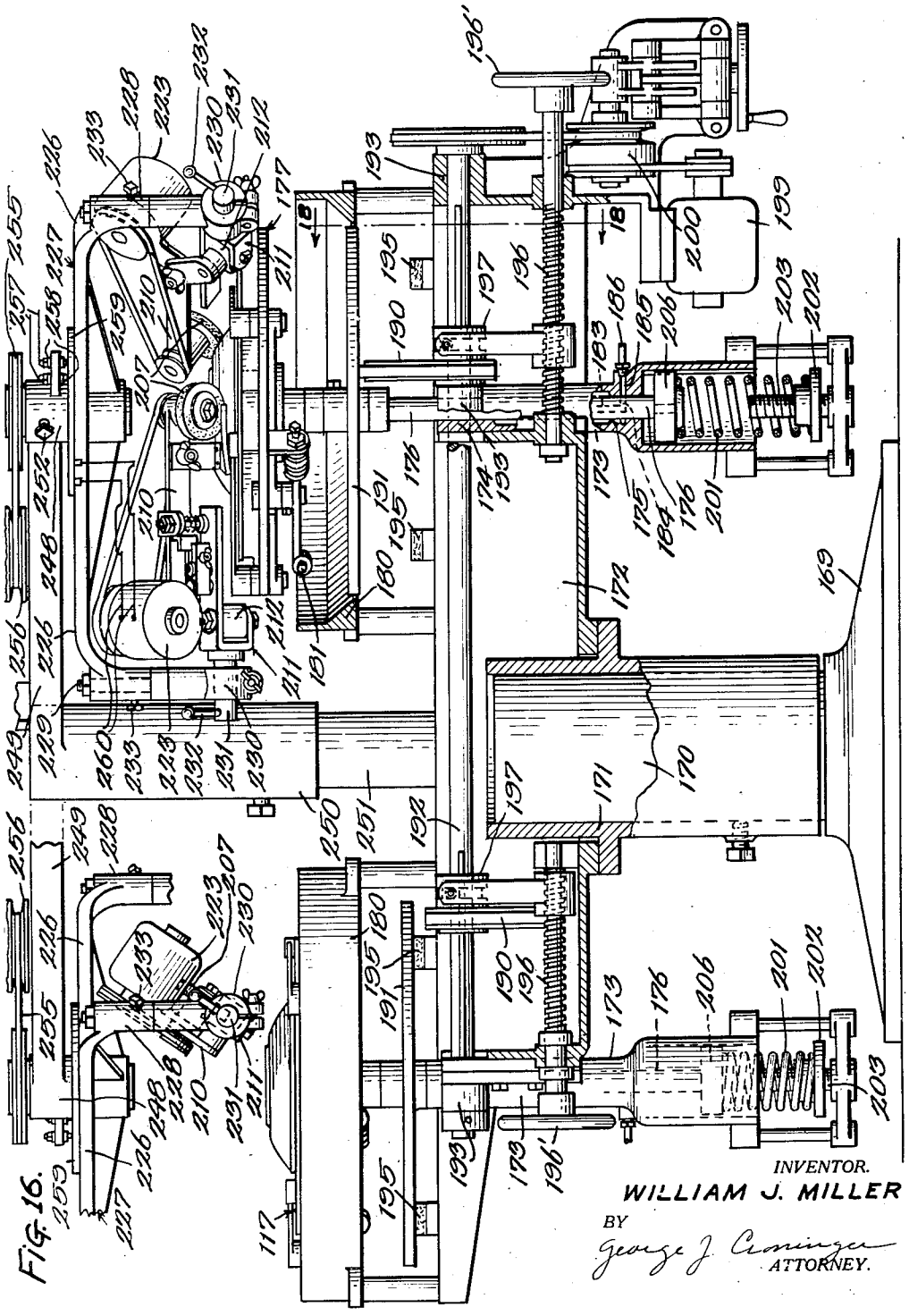


Fig. 16.

INVENTOR.
WILLIAM J. MILLER
BY
George J. Cronin
ATTORNEY.

April 26, 1949. W. J. MILLER 2,468,404

APPARATUS FOR MANUFACTURING POTTERY WARE

Filed Feb. 24, 1943 5 Sheets-Sheet 4

FIG. 29.

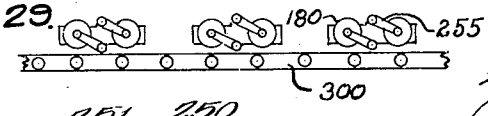


FIG. 17.

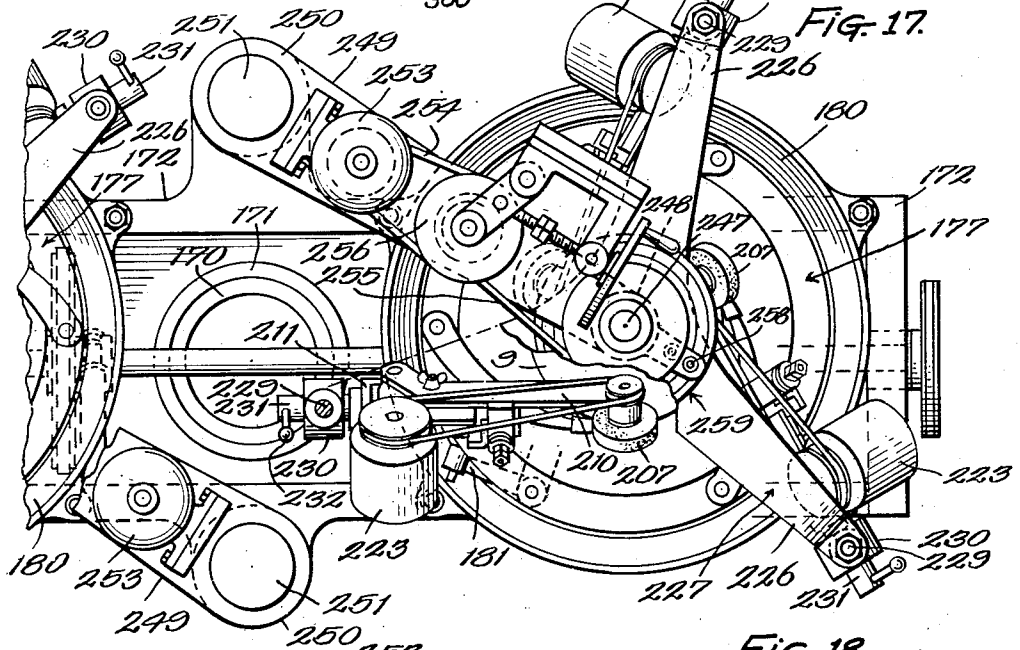


FIG. 19.

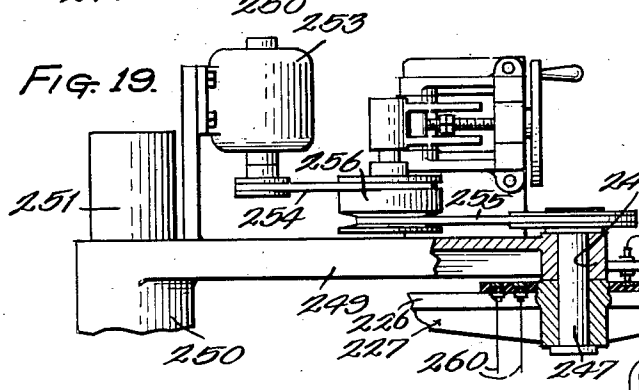


FIG. 18.

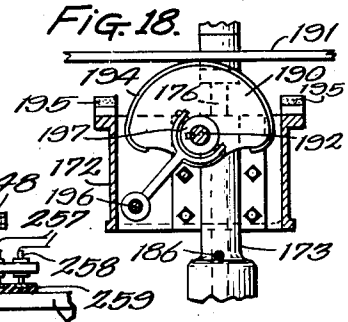


FIG. 28.

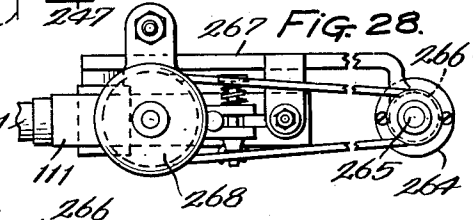
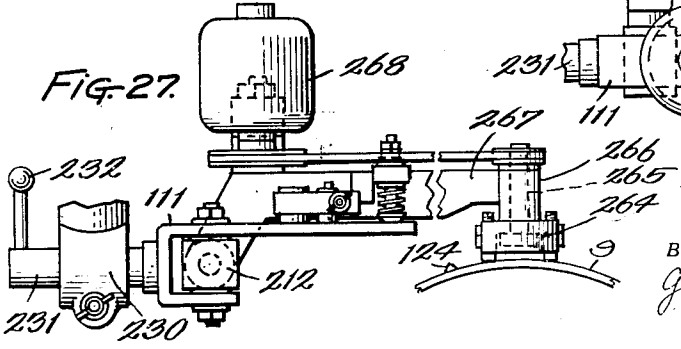


FIG. 27.



INVENTOR.
WILLIAM J. MILLER
BY
George J. Cominger
ATTORNEY.

April 26, 1949. W. J. MILLER 2,468,404

APPARATUS FOR MANUFACTURING POTTERY WARE

Filed Feb. 24, 1943 5 Sheets-Sheet 5

FIG. 20.

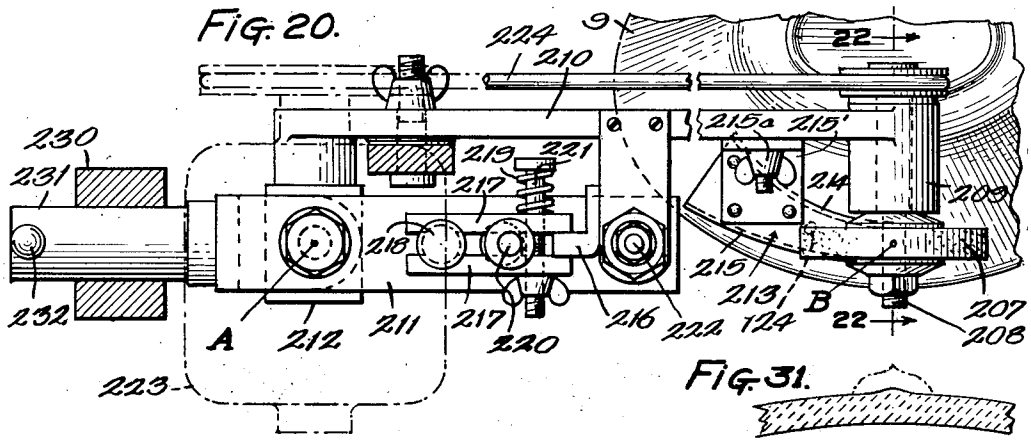


FIG. 31.

FIG. 32.



FIG. 21.

FIG. 22.

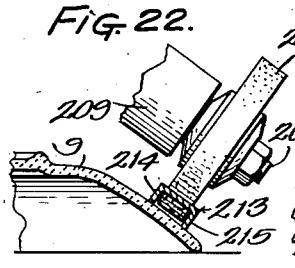


FIG. 23.

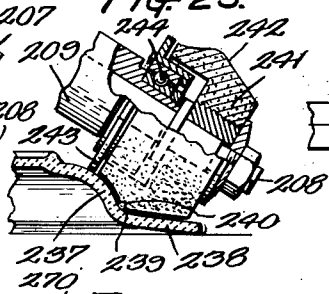


FIG. 26.

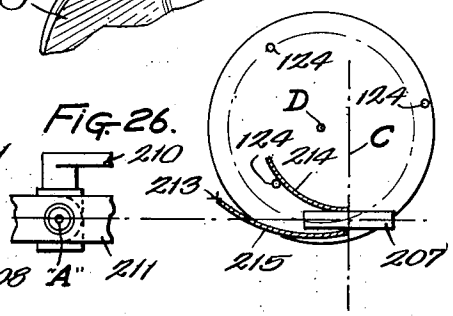


FIG. 24.

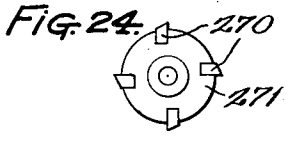


FIG. 25.



INVENTOR.
WILLIAM J. MILLER
BY
George J. Cranmer
ATTORNEY.

Patented Apr. 26, 1949

2,468,404

UNITED STATES PATENT OFFICE

2,468,404

APPARATUS FOR MANUFACTURING POTTERY WARE

William J. Miller, Swissvale, Pa., assignor to Miller Pottery Engineering Company, Swissvale, Pa., a corporation of Pennsylvania

Application February 24, 1943, Serial No. 476,939

49 Claims. (Cl. 51—90)

1

This invention relates to methods and apparatus for manufacturing potteryware, particularly dinnerware, such as plates, saucers, dishes and the like. It has to do with the removal of protuberances hereinafter called "burrs" from the backs of glazed, fired ware of the class described.

The most common type of burr is known as a sagger pin burr. Dinnerware is usually fired in saggers which are large containers made of clay capable of holding several pieces of ware. Fire clay pins hereinafter called "sagger pins" inserted in holes in the wall of the sagger are used to support the ware so that the glaze will not be unduly injured during firing. Sagger pins are triangular in cross-section so that they contact the ware as little as possible and three pins spaced at approximately 120° apart are used to support each individual piece of ware, although the spacing may not be exact and the point of contact may not be the same for any two pieces.

Other types of burrs or unwanted protuberances which project above the level of the surface of the ware are produced by stray bits and scraps of clay which escape the sponger's notice and become glazed over in firing and there may be other causes of burrs of which I am not aware.

During firing, the glaze melts and becomes soft allowing the pins to sink in thereby displacing the glaze and raising protuberances which take a permanent set when the glaze cools and hardens. As a rule, the glaze and pin become bonded together and a piece of the pin breaks off when the ware is removed from the sagger. These "burrs" while they are not large are nevertheless unsightly and detract from the appearance of the ware. If the burrs contain pieces of sagger pins, they are apt to have sharp, ragged edges which can cut and injure the fingers.

Heretofore, it has been customary to laboriously chip off these hardened burrs by hand using an implement such as a chisel. Burrs do not come off easily and care must be taken against breaking the fragile ware. In the cheaper grades, the product is passable and therefore merchantable if only the top of the burr is knocked off and the sharp, ragged edges smoothed off. This leaves the surface of the ware somewhat less unsightly. In the case of high-quality ware, such as china or porcelain, the last vestiges of the burr are removed by grinding them down to the surface of the ware or almost to the surface. Care must be taken not to grind off or scarify the glaze surrounding the burr because this produces a permanent blemish and therefore the root of the

2

burr may remain but it is hardly noticeable, in fact, the back of the piece will have a smooth appearance and will, of course, not be injurious to the fingers.

Being done by hand, the work is slow and tedious and the average pottery is compelled to employ large numbers of chippers and grinders in order to keep pace with production throughout the balance of the plant. The advent of high-speed, mass-producing forming and drying machinery, such as that in my Patent No. 2,046,525 and the increased output of ware resulting therefrom has created the need for efficient time and labor-saving machinery and practices in what I shall call the "ware dressing department" where the sagger pin burrs are removed, this in order to place production in the aforesaid department of the pottery on an equal footing with the fabricating department both from the standpoint of economy and production capacity and otherwise.

Therefore, one object of this invention is to provide new and improved labor-saving methods and apparatus for dressing the backs of glazed, fired ware with precision and despatch to thereby render the ware devoid of burrs and smooth to the touch and sightly to the eye.

Another object is to provide for economically and expeditiously dressing large quantities of ware of various sizes and shapes with a minimum of time and labor.

Still another object is to relieve the average pottery of a potential "bottleneck" in the ware dressing department.

In the drawings:

Fig. 1 is an elevation showing a manually-controlled and operated machine embodying the principles of my invention.

Fig. 2 is a fragmentary plan view of the machine of Fig. 1.

Fig. 3 shows a modified form of the jaw chuck structure illustrated in Fig. 2.

Fig. 4 is a bottom-plan view of the dressing device illustrated in Fig. 1.

Fig. 5 is a fragmentary view in perspective of one of the dressing tools illustrated in Fig. 1.

Fig. 6 is a horizontal section taken on the line 6—6 of Fig. 1.

Fig. 7 is a horizontal section taken on the line 7—7 of Fig. 1.

Fig. 8 is an enlarged vertical section taken on the line 8—8 of Fig. 1.

Fig. 9 is a plan view of the apparatus illustrated in Fig. 8 with certain of the parts broken away.

Fig. 10 is an enlarged detail of one of the tool carriers shown in Fig. 1 with another form of tool thereon.

Fig. 11 is a detail section taken on the line 11—11 of Fig. 10.

Fig. 12 is an enlarged sectional detail of the tool and associated parts seen in Fig. 11.

Fig. 13 is an enlarged view partly in section and partly in elevation of another form of dressing tool.

Fig. 14 is a view partly in section and partly in elevation of still another form of dressing tool.

Fig. 15 is a bottom plan view of the tool shown in Fig. 14.

Fig. 16 is an elevation partly in section of another form of ware-dressing machine embodying the principles of this invention wherein the machine is mechanically operated and has accommodations for more than one piece of ware.

Fig. 17 is a plan view of the machine of Fig. 16.

Fig. 18 is a detail in section taken on the line 18—18 of Fig. 16.

Fig. 19 is a detail of the upper portion of the machine of Fig. 16 which has been omitted from Fig. 16.

Fig. 20 is an enlarged plan view of one of the dressing devices shown in Fig. 16.

Fig. 21 is an elevation of the apparatus shown in Fig. 20.

Fig. 22 is a section taken on the line 22—22 of Fig. 20, illustrating the position of the tool with respect to the ware.

Fig. 23 is a view similar to Fig. 22 illustrating how the tool will be shaped to remove burrs from the depression sometimes found in fruits and cereals.

Fig. 24 illustrates another form of tool that may be employed with the machine of Fig. 16.

Fig. 25 is a side view of the tool of Fig. 24.

Fig. 26 is a diagrammatic view illustrating another position of the tool of Fig. 20 when operating on very small ware pieces.

Fig. 27 is an elevation showing another form of tool and operating means therefore that may be employed with the machine of Fig. 16.

Fig. 28 is a plan view of the apparatus of Fig. 27.

Fig. 29 is a diagrammatic plan view illustrating how the machines of Fig. 1 or 16 may be installed adjacent a ware conveyor system.

Fig. 30 is an enlarged view in section of a portion of a piece of ware as taken across one of the burrs.

Figs. 31 and 32 are fragmentary sectional views illustrative of the appearance of burrs after they have been dressed by chipping and grinding respectively.

Generally speaking, I employ two methods of removing burrs, one which I shall call "chipping" and the other "grinding," and either one or both methods may be employed to obtain the result sought herein. The operation of removing "burrs" is one which I shall refer to as that of "dressing" the ware.

The glaze which covers the ware provides a hard-transparent wear-resistance surface not ordinarily marred or scratched by chipping tools which are in the nature of edged implements that slide over the surface of the ware and shear off the burr. On the other hand, glaze can be scraped and marred by grinding and therefore any grinders disclosed herein will have the grinding wheel supported slightly above the glazed surface of the ware and out of contact therewith so that during relative rotation a line or circle will not be cut into the glazed surface. These various tools which I employ for removing the burrs will be generally referred to as "dressing tools."

It has been mentioned that the ware rests on three sagger pins during firing and that the pins are spaced apart in order to provide a three-point support for the ware. The point of contact of the pins with the ware may or may not be equidistant from the center of the ware. Ordinarily, these points of contact as represented by the burrs on the glazed article are found to fall some place within an inch or so of the brim. Therefore, the location of the burrs in a radial direction from the center of the ware is variable as between the burrs found on a single piece of ware and as between the burrs found on two identical pieces of ware. The machinery of the present invention is designed to compensate for this variable factor.

In the average pottery, the ware is unloaded from the kiln and placed on a conveyor 300, Fig. 29, which delivers the fired material to the dressing department. In the dressing department, the manual workers are ranged alongside the conveyor which carries the ware in an endless circuit past the kiln and through the dressing department until the ware is eventually removed by the dresser and processed. It is customary for the dresser to sit on a low stool because the ware is usually handled in stacks of a dozen or so pieces that are heavy to lift. Being close to the floor, the dresser does not have to lift the ware so high and therefore does not become so fatigued as if the ware had been lifted to table height. The machine of Fig. 1 is designed to rest on the floor and to be operated by a dresser while sitting on a low stool as is customary whereas the machine of Fig. 16 is preferably designed for use by a standing operator. It will be understood that the machine of Fig. 1 may be of low construction in order to be operated by a dresser substantially sitting on the floor and that the machine of Fig. 16 may be placed on a table or on legs and operated from a standing position.

The machine of Fig. 1 is designed to handle one piece of ware at a time, that is to say, it is equipped to dress a single piece of ware at a time. The machine of Fig. 16 is designed to dress one piece of ware while a previously dressed piece of ware is being removed from the machine and another piece substituted therefor. It may be said to handle two pieces of ware or more than one piece of ware at a time and therefore helps to increase the individual dresser's output. The dressing operation performed by the two machines and the dressing tools utilized are substantially the same in both instances although there may be some structural differences. It may also be said that the mode or method of dressing the ware performed by the two types of machine is substantially the same whether it be chipping or grinding.

With reference to Fig. 1, the machine illustrated therein which I shall call a "manual machine" has a base 1 with uprights 2 and 3 supporting a horizontal frame member 4. Reciprocably and rotatably mounted in space bearings 5 and bearing 6 is a vertical shaft 7 carrying the chuck 8, Figs. 1 to 7, arranged to be raised and lowered to move an inverted piece of ware 9, for instance a saucer into and out of cooperate relation with overhead dressing apparatus 10 to thereby remove the burrs from the back of the ware upon relative rotation between the ware

and the dressing apparatus. The machine illustrated in Figs. 1 to 9 is equipped to rotate either the ware or the dressing tools, either one or both depending on the operator's choice.

The chuck 8, Fig. 8, includes a disc-like base 14 having a hub 15 on the top end of which is centrally supported a ware positioning disc 16 of which a number may be provided for various sizes of ware. Said discs are detachably mounted on the chuck base and have a taper bore 17 to be received over the conical head 18 of a screw 19 for holding the chuck base on the end of the shaft 7.

Ware is placed on the disc 16 with the chuck in lowered position as shown in dot and dash lines in Fig. 8. When the ware is placed on the disc, it forms with a depression 20, in the disc 16, a chamber 21 which is vacuumized when the chuck is raised to grip the ware to the disc. A central passage 22 in the shaft 7 communicates with chamber 21 and a lateral port 23 connected to a vacuum line 24 through the internal annular port 25 of a stationary valve 26 surrounding the shaft 7, the arrangement being in the nature of a slide valve. When the chuck is lowered, the chamber 21 is vented to release the ware piece by opening the port 23 to atmosphere. An effective vacuum seal is provided around the brim of the ware by thin rubber disc 30 clamped on the hub 15 by screw 19. As seen in Figs. 8 and 9, the positioning disc extends beyond the hub 15 and the sealing disc 30 normally rests upon radial fins 31 of the chuck base 14. This arrangement permits depression of the seal disc so that the dresser may insert the fingers of the hand under the edge of the ware piece to remove the ware from the chuck.

As a substitute for, or in addition to the disc 16, the ware may be held in centrally located position on the chuck by a jaw chuck comprising a plurality of arms 32 grouped in a circle on the chuck base and arranged to swing into the ware-holding position as the chuck is raised. The fingers are rotated on their pivots 38 into and out of ware-centering and holding position in response to elevation and lowering of the chuck shaft. The apparatus for causing such movement of the fingers includes a stationary cam 33, Fig. 8, on the bearing 6, a spring-pressed lever 34, Fig. 7, fulcrumed on the under side of the base, a gear segment 35 attached to the lever and mounted on the lever pivot and meshing with a rotatable gear 36 on the hub of the chuck base and gear segments 37 meshing with gear 36 secured to pivot shafts 38, Fig. 1. Shafts 38 are mounted in bearings near the edge of the chuck and the gear segments 37 are below the chuck and the fingers 32 are above the chuck, as illustrated.

The lever 34 may be mounted on the hub of the gear segment 35, see Fig. 7 for angular adjustment by means of a set screw 40 to permit adjustment of the jaws to actuate ware of different diameters. The fingers are resiliently urged into engagement with the edge of the ware by a compression spring 44 acting on the lever 34 and backed up by an adjustable stop 45, or screw in a lug 46 of the chuck base to regulate the pressure engagement of the fingers. The fingers are preferably rubber-tipped as at 45' to prevent injury to the edge of the ware. In the case of ripple-edged ware, each finger may be provided with a contact shoe 47*a*, Fig. 3, preferably made of hard rubber and pivotally connected to the finger. Such shoe is self-aligning.

The chuck is raised and lowered by a foot-operated lever 48, Fig. 1 in the form of a bellcrank pivoted on the machine frame. The other arm of the bellcrank is connected to a collar 50 pinned to the shaft 7 and rotatable therewith and pivoted on the pin. When the foot lever is released, the chuck is raised by an enclosed spring 51 which engages the piston 53 on shaft 7. The reduced lower end of the shaft is carried in the bushing 52. During the final upward movement of the chuck, its rate of travel is retarded in order to gently engage the work with the tools. This is accomplished by the retarded dissipation of vacuum created in the cylinder as the piston 53 enters the reduced upper end thereof.

The rate of retarded upward movement of the chuck may be regulated by a port vent 55 and valve 56.

When the chuck is raised, it may be rotated by means of a weight 60 which transmits rotation to the shaft 7 through a cable 61 wound about a pulley 62 on a sleeve 63 supported in the bearings 5 about the shaft 7 and transmitting rotation to the shaft from the pulley through a sliding key connection 64 with the shaft and a pawl and ratchet connection 65 with the pulley. The weight end of the cable is supported over an idler 66 and its other end is connected with a top end of a lever 67 having an abutment 68 arranged in the path of the foot lever 48 to be operated thereby when the chuck is lowered and the weight 60 is raised. When the foot lever is released, the cable 61 is held taut about the pulley 62 by a spring 69 which pulls on the lever 67 with less force than the weight. The weight 60 reciprocates in an upright cylinder 74 having an air intake port 75 controlled by a check valve 76 and a vent 77 controlled by a valve 78 whereby the weight may be readily raised and its descent controlled to regulate the rate of rotation of the chuck. The weight 60 may have an upright stem 79 on which may be placed any number of added weights 80 to thereby regulate the speed of rotation of the chuck.

The dressing apparatus 10, Figs. 1 to 4, inclusive, includes a number of tools 84 arranged in a circle about the axis of the ware in the path of the burrs. One tool may be set to strike off burrs in a given path and the next tool set to strike off burrs in an adjacent path, it being remembered that the burrs are not equi-distantly spaced in a radial direction from the axis of the ware. If desired, the tools may be of sufficient length to span the entire zone where the burrs normally occur as will be later explained.

Each tool is carried by a horizontal arm 85 pivoted at 86 on a side of a supporting hub 87 centrally located over the chuck and carrying adjustable spring-pressed stops 88 engaging lever extensions 89 of the arms to resiliently resist downward movement of the arms about their pivots. For regulation, each stop may be in the form of the head of a bolt 90, see Fig. 10, slidable in a sleeve 91 threaded in bearing 92 of the hub 87 with a coiled spring 93 adjustably held under compression between the sleeve and bolt head by nuts 94 on the bolts engaging the sleeve. After the spring has been adjusted for compression by shifting the bolt in the sleeve 91 the head of the bolt may be returned to its original or desired position in determining the normal position of the arm by adjusting the sleeve in the bearing 92 and locking same by means of a locknut 95 thereon.

The tools are mounted on the arms by means

of wing nuts and bolts 96 which pass through longitudinal slots 97 and 98 in the arms and tools respectively whereby the tools may be adjusted angularly crosswise and longitudinally on the arms to operate on ware of various sizes and contour.

To reduce operation interference and increase the efficiency of the apparatus, each tool may comprise a shank portion 102, see Fig. 5, slotted at its lower end as at 103 to form jaws 104 recessed at 105 to receive a blade 106 clamped therebetween by a screw 107 passing through the jaws. The blade 106 may have a straight edge for chipping off the burrs or the chipping edge may be contoured if the ware is in the zone where the burrs occur. The blade 106 is perferably composed of hard material such as "carboloy" and is preferably rectangular in cross-section to provide sharp-cutting edges 108 which may be changed around in obvious fashion as the edges dull.

The hub 87 carrying the arms 85 is mounted on the bottom end of a shaft 111 supported in a bearing 112 on a horizontal extension of bracket 113 of cylindrical form mounted for vertical adjustment of a pedestal 114 to elevate or lower the entire dressing apparatus with respect to the ware.

If it is desired to rotate the ware only and to hold the dressing tool stationary, a set screw 115 in the bearing 112 may be tightened against the shaft 111 and the means for rotating the shaft 111 disconnected. If it is desired to rotate the dressing tools rather than the chuck, a set screw 116 on the bearing 5 may be used to lock the sleeve 63 therein with the weight 60 in raised position, a set screw 117 in the wall of the cylinder 74 being provided to hold the weight inactive.

The dressing tools are rotated in the following manner; a motor 118 mounted on the bracket 113 drives a crank 119 through a variable speed pulley and belt drive 120. The crank operates a rack 121 which is reciprocated and supported in a guide 122 swiveled on the bearing 112 and a gear 123 on shaft 111 meshing with the rack. The motion produced is an oscillating motion which has certain advantages, however, it should be perfectly clear that the motor shaft may be extended and the pulley 120 raised to the level of the gear 123 which may be removed and replaced by pulley. A belt may connect the two pulleys in order to directly drive and continuously rotate the dressing tools.

Oscillating the tools or the ware for that matter has a distinctive advantage in that a burr 124, see Fig. 30, may be struck on opposite sides by the tool. In case, a portion of the burr is knocked off when hit on one side, the balance of the burr may be knocked off by striking it on the other side. It will be understood that the tool suspension is such that the tool may raise and ride over a stubborn burr and it may require repeated blows on the part of the tool or tools to dislodge and remove the burr. If the tools or ware are rotated in one direction only, the burr may be struck successively by the same tool or by different tools, and if the tools or ware are simply oscillated, the burr may be struck on both sides by the same tool or by the several tools. This act of chipping away at the burr by delivering repeated blows thereto will eventually shear away the burr down to the normal surface level of the back of the ware, leaving it smooth and sightly in appearance.

The action thus far described employed to remove the burrs has involved chipping or shearing away by means of an edged tool however, the burr may also be ground down by an abrasive tool which may be substituted for the edged tools or may be operated in conjunction with the edged tools by substituting an abrasive tool for one of the edged tools.

The abrasive tool preferably employed with the machine of Fig. 1 is illustrated in Figs. 10, 11 and 12 and is shown as comprising a grinding wheel 130 mounted on a motor shaft 131 driven by a motor 132. The base 133 of the motor is attached to the lower end of a slotted bracket 135 by univeral joint 134. The bracket 135 is mounted on the arm 85 in the same fashion as the arm 84 carrying an edged tool is mounted thereon.

One of the sides of the grinding wheel is used to remove the burrs rather than the periphery of the wheel. In Fig. 12, the wheel is centrally recessed at 136 so as to countersink the attached nut. The abrasive wheel grinds at an angle relative to the surface of the ware and the degree of angularity may be such that the burr is progressively ground off as the wheel travels over the same, this being illustrated by the relative position of the ware and the grinding wheel in Figs. 10 and 12.

It has been mentioned that the grinding wheel does not contact the surface of the ware and while it could probably be adjusted so that it would not touch, there are sometimes variations in ware thickness of fractional proportions which would result in the wheel coming in contact with the ware. In order to avoid this, a metal shield may be thrown around the grinding wheel and projected fractionally below the cutting surface in order to space the cutting surface slightly above the surface of the ware. The shield or guard is preferably composed of hard metal having its ware-contacting surface ground down smooth so that it will slide over the surface of the ware without marring or scratching the same. This shield due to its hardness and edged character may also act to deliver a blow to the burr or to the vestiges of the burr to further tend to dislodge the same. Therefore, this tool may be considered as a combination grinding and chipping tool. Said guard is in the form of a sleeve whose bottom edge 139 is preferably tapered inwardly. It is threaded on a sleeve of the motor base 143, Fig. 11, for adjustment to compensate for wearing off the grinding surface of the ware. The locknut 141 on the stem 140 holds the guard in adjusted position.

The motor 132 may be energized from a main power line 142 by distributor 143 on the hub 87 and conductors 144 leading to a rheostat 145 thereby regulating the speed of rotation of the grinding wheel.

Another form of rotating tool that may be employed on the motor shaft 131 is shown in Fig. 13. This tool has a cylindrical head 146 provided with a plurality of blade-like burr removing implements 147 having cutting edges 148 which rest on the surface of the ware as the tool is rotated. The tools will rotate over two points of the path of travel of the burrs and strike them on one side and then on the other in rapid succession in order to completely remove said burrs.

Blades 147 may be made of a very hard substance such as "carboloy" and they are retained in slots 149 in the periphery of the head 146 by screws 150 whose heads overlap the slots. The blades are adjustable in the slots for alignment with their cutting edges by set screws 151 in threaded bores 152 extending within the slots.

Guards 138 are not used with this type of dressing tool and may be raised out of operating position.

The modified form of cutter 146 shown in Figs. 14 and 15 has a head 156 with a plurality of arcuate leaf springs 158 attached to the underside of the head by screws 159. Blades 157 are secured to the free ends of the leaf springs. To regulate the tension of the springs, each is provided with a shiftable fulcrum 160 interposed between the same and the cutter body and being in the form of an inturned ear on a ring 161 mounted for rotative adjustment on the body by screw and slot connections 162 to shift the fulcrums in varying the effective lengths of the springs. The springs may be received in recesses 163 in the ears 160 whereby the ears will further serve to hold the springs against edgewise movement during the dressing operation.

The springs insure that the blades will remain in contact with the ware surface where there are variations in the level of the ware surface on which the tool is operating. For instance, where the tool is being operated near the brim of a piece of flatware, oppositely disposed blades are alternately aligned tangentially and laterally of the conical or sloping side of the ware as they rotate thereon in the path of the burrs. The springs will cause the blades to remain in intimate contact with the surface, although the operating lever of the blades will vary during a complete revolution about the axis of the motor shaft.

Figs. 16 to 28, inc., illustrate the other form of dressing machine which is in the nature of a twin unit having two dressing stations that are alternately operated.

With reference to Fig. 16, the apparatus has a base 169 with a central pedestal 170 over which is sleeved a hollow cylinder 171 supporting horizontal frame 172. Arranged on the frame at each side of the part 171 is a sleeve-like member 173 having upper and lower bearings 174–175 supporting for rotation and reciprocation, a shaft 176 on the top end of which is mounted a ware chuck 177. This chuck is substantially the same as chuck 3, Fig. 1, except that the ware-gripping jaws here identified by the reference character 178 are moved into and out of ware holding position by a stationary ring cam 180 on the frame and cooperating with a lever 181 which serves the same purpose as the lever 34 of chuck 8. Vacuum is also applied, if desired, to hold the ware on the chuck and to accomplish this, the shaft 176 has a central passage 183 with a port 184 that communicates with a port 185 of a vacuum line 186 extending in the bearing 175.

Chucks 177 are alternately raised and lowered by cams 190 arranged under and cooperating with discs 191 on the shafts 176. The cams are arranged on a rotating shaft 192 mounted in bearings 193, each cam having a dwell portion 194 cooperating with its respective disc 191 to provide a friction drive connection for rotating the chucks when raised. The cams disengage from the disc 191 after being lowered which brakes the disc against stationary brake-shoes 195. This stops the rotation of the chucks immediately the chuck shaft is lowered and permits the ware to be removed at once.

To regulate the rotation of the chucks, each cam 190 is slidably keyed on shaft 192 and may be adjusted toward and away from the axis of rotation of the disc 191 by means of a screw 196, hand wheel 196′ and a sliding collar 197 on the shaft 192 and attached to the cam. Shaft 192 is driven by a motor 199 through a variable speed pulley and belt drive 200.

To reduce the load on the cams 190 especially when initially raising the chucks, and to regulate the torque value imparted to the chuck by the cam and thus cause the ware to stop rotating temporarily in case an exceptionally large burr is encountered, the weight of the chuck and associated parts on each shaft 171 is counterbalanced by a compression spring 201 acting on the bottom end of the shaft. This spring is backed through an end-thrust bearing 206 by a collar 202 threaded on a threaded stem 203 carried by the sleeve 173 whereby the collar may be adjustable in regulating the counterbalancing effect of the spring.

When each chuck is raised and rotated, the burrs on the ware carried thereby are removed by a multiple of grinding wheels 207 preferably three, equally spaced about the axis of the ware and disposed at right angles to the sloping or conical bottom surface thereof in planes extending tangentially of the path of the burrs, as seen in Figs. 16, 17 and 20.

Each grinding wheel 207 is detachably mounted on a shaft 208 rotatable in a bearing 209 at one end of a horizontal arm 210 whose other end is in swinging connection with a bracket 211 through a universal joint 212. Arranged on each arm 210 is a combination stop and cam-like guide 213 adapted to rest upon the surface of the ware to position the grinding wheel slightly thereabove, and to cooperate with burrs differently located on the surface from the center thereof to shift the wheel laterally from a normal position into the path of the burrs. This stop and guide may be in the form of an inverted arcuate channel section whose inner and outer flanges 214 and 215 taper toward and terminate at opposite sides of the grinding wheel to respectively shift the wheel toward and away from the axis of the ware when engaged by the burrs. Adjustment and substitution is through bracket 215′ and screw 215*a*, Fig. 20.

Each grinding wheel is yieldably held in a normal or neutral position against lateral movement by its arm 210 having an abutment 216 disposed between yieldable stops 217 on the bracket 211, Figs. 20 and 21. These stops may be in the form of levers fulcrumed on a stud 218 of the bracket 211 and resiliently held against a positioning pin 220 therebetween by a compression spring 219 acting on both levers through a bolt 221 extending therethrough with the spring arranged on the bolt between the head thereof and one of the levers.

To regulate the pressure-engagement of the grinding wheels 207 against the burrs during the grinding operation, the weight of each arm 210 is counterbalanced by a spring-pressed stop 222 on the arm engaging the bracket 211 and being similar to the stop 88 of Fig. 10 so as to be adjustable in regulating the counterbalancing effect thereof.

Each grinding wheel 207 is driven by a motor 223 through a pulley and belt drive connection 224, the motor being mounted on the arm 210 above the universal joint 212 to reduce the load on the arm.

The brackets 211 of each trimming unit are supported on the arms 226 of a supporting spider 227 arranged centrally over the chuck, each arm having a bearing 228 at its end supporting the upright stem 229 of a split bearing 230 within which is supported a horizontal trunnion 231 of

its associated bracket. The axis of the trunnion of each bracket (see Figs. 20 and 21) intersects the central point A of the universal joint 212 and the point of engagement B of its associated grinding wheel with the burrs on the ware, whereby the angular position of the wheel with respect to the ware surface may be made by adjusting the trunnion in the bearing 230 without shifting the wheel out of the path of the burrs. For convenience, a hand lever 232 may be provided on the trunnion for adjusting same. Adjustment of the grinding wheel toward and away from the axis to the ware, to accommodate the size of the ware, may be made by adjusting the bearing 230 on the bearing 228, a set screw 233 being provided to hold the stem 229 of the bearing in adjusted position. To re-position the grinding wheel tangentially of the path of the burrs on the ware after the aforesaid adjustment has been made, the trunnion 231 may be adjusted longitudinally in the bearing 230.

In the case of small-sized ware, it may be desirable to position the grinding wheel so that its axis C (Fig. 26) is disposed tangentially of the axis D of the ware at the far side thereof with respect to the center A of the universal joint. Thus, the side cam-portions 214 and 215 of the cam 213 could be somewhat longer than otherwise and consequently more favorably disposed angularly to the paths of irregularly located burrs to cooperate therewith under a minimum amount of resistance encountered from the arm 210 to shift the grinding wheel into position to remove the burrs.

In trimming dished ware, Fig. 23, having inner and outer sloping dished portions 237 and 238 forming a concentric groove 239 in the region of which the burrs 240 may be located, a comparatively wide grinding wheel 241 would be employed with its peripheral grinding edge 242 contoured correlatively with the groove. This grinding wheel may be held slightly spaced above the ware surface by an idler wheel 243 arranged adjacent the inner side thereof to ride on the surface of the ware and being rotatably mounted on an anti-friction bearing 244 on the outer end of the bearing 209. The burr finders would be removed when this form of dressing tool is used and the tool would not be radially movable during the operation for obvious reasons.

The spider 227 of each dressing unit, Fig. 16, is mounted on the bottom end of a shaft 247 disposed coaxially over its respective chuck 177 and received in a bearing 248 at the end of an arm 249 of a cylindrical support 250 mounted on an upright column 251 of the frame 172 for adjustment therealong and angularly thereabout in locating the dressing apparatus in various positions over the chuck.

As so far described, the dressing apparatus of each unit would be held normally stationary by means of a set screw 252 arranged in the bearing 248 to engage the shaft 247. The trimming operation could also be effected by rotating the trimming apparatus in a direction opposite to that of the chuck, thus requiring a slower rate of rotation of both devices than that required of either if the other were held. The trimming apparatus may be rotated by an electric motor 253 on the arm 249 and being in driving connection with the shaft 247 through pulley and belt connections 254—255 and a variable speed pulley 256 cooperating therebetween to regulate the rate of rotation of the apparatus (see Fig. 19).

The motors 223 may be energized from the power lines 257 by way of contacts 258 on the part 248, a distributor 259 on the spider 227, and conductors 260 leading therefrom (Figs. 16 and 19).

In place of the grinding wheels 207, cutters such as that illustrated in Fig. 13 may be employed, in which case the tool carrying structure shown in Figs. 20 and 21 would be somewhat modified as seen in Figs. 27 and 28. To this end, the cutter 264, a duplicate, of the cutter 146, would be mounted on a vertical shaft 265 received in an upright bearing 266 at the end of the arm 267, similar to the arm 210, and the motor 268 driving the cutter would be arranged vertically on the arm.

Also, face cutters, such as that illustrated in Figs. 24 and 25, may be substituted for the grinding wheels 207. This cutter may include a minimum number of cutting teeth 270 arranged about the periphery of the circular cutter body 271 and so spaced to permit the teeth to effect a chiseling action on the burrs.

With reference to Fig. 31, I have shown herein what a burr may look like after it has been cracked off and smoothed down by the edged burr removing implements. A low prominence X sometimes remains which is not unsightly and which is smooth to the touch.

With reference to Fig. 32, I have shown therein what a burr may look like after it has been cracked off by the edged burr removing tools and/or ground down by the grinding implements. A low prominence Y, substantially flat on top and almost flush with the surrounding surface of the ware and therefore barely noticeable remains.

Any one of the grinding wheels shown and described herein may have the grinding surface thereof composed of industrial diamonds or the like in order to reduce tool wear and eliminate the need for frequent adjustment to compensate for wear.

It will be understood that the holder for the edged tools may be pivotally mounted on its supporting arm for swinging movement in one direction, movement in the other direction being arrested by a stop. This arrangement is advantageous where the tool or ware is oscillated, the object being to produce a working stroke and an idle stroke, the tool simply riding over the burr on the idle stroke.

Obviously, the method and apparatus hereof would remove from the ware any other unwanted protuberances which project above the level of the surface of the ware, for instance stray bits or scraps of clay which may escape the sponger's notice and become glazed over in firing. Ordinarily, the piece would be rejected for imperfections of this character, however with the present method and apparatus, these protuberances would also be removed along with the burrs thereby rendering salable a piece which might otherwise be scrapped. Protuberances of this description may also be called "burrs" and it is to be understood that the term "burrs" is to encompass protuberances of this description.

I claim:

1. In combination with a ware support, means for removing hardened burrs from the back of glazed, fired potteryware comprising a burr removing implement and a support therefor constructed and arranged to allow the implement to pass smoothly over the glazed back of the ware without grinding the surface and to act on the burrs projecting thereabove and means for rela-

tively moving the ware support and implement support.

2. In combination with a ware support, means for removing hardened burrs from the back of glazed, fired potteryware comprising a burr removing implement and a support therefor constructed and arranged to allow the implement to pass smoothly over the glazed back of the ware without grinding the surface and to act on the burrs projecting thereabove, mechanism for relatively moving the ware support and implement support toward and away from one another and means for relatively rotating the burr removing implement and the ware support.

3. In combination with a ware support, means for removing hardened burrs from the back of glazed, fired potteryware comprising a burr removing implement and a support therefor constructed and arranged to allow the implement to pass smoothly over the glazed back of the ware without grinding the surface and to act on the burrs projecting thereabove and mechanism for relatively rotating the burr removing implement and ware support.

4. In combination with a ware support, means for removing hardened burrs from the back of glazed, fired potteryware comprising, a burr removing implement and a support therefor constructed and arranged to allow the implement to pass smoothly over the glazed back of the ware without grinding the surface and to act on the burrs projecting thereabove and means operable to move said implement over the surface of the ware to remove burrs located at different points on the back of the ware.

5. In combination with a ware support, means for removing hardened burrs from the back of glazed, fired potteryware comprising a burr removing implement, means for relatively moving the ware support and implement to cooperate the ware and implement, a burr finder for directing the movement of the implement over the surface of the ware operable when the ware and implement are in cooperative relation and means for maintaining spaced relation between the working surface of the implement and the surface of the ware such that the implement engages the burrs but does not contact the surface of the ware between burrs.

6. The combination with a ware support of relatively rotatable means for removing hardened burrs from the back of glazed, fired potteryware comprising, a burr removing implement and means for supporting the implement for radial and vertical movement over the surface of the ware when in cooperation with the ware and means for limiting the movement of the implement in the directions specified.

7. The combination with a ware support of relatively rotatable means for removing hardened burrs from the back of glazed, fired potteryware which comprises, a burr removing implement and a support for said implement constructed and arranged to allow the implement to pass smoothly, without grinding the back of the ware over the glazed back of the ware and to act on the burrs projecting thereabove, means for relatively moving the implement support and the ware support to bring the ware and implement into cooperation and means for regulating the working pressure of the implement.

8. The combination with a ware support, of relatively rotatable means for removing hardened burrs from the back of glazed, fired potteryware which comprises, a burr removing implement and

a support for said implement constructed and arranged to allow the implement to pass smoothly, without grinding the back of the ware over the glazed back of the ware and to act on the burrs projecting thereabove, means for relatively moving the implement and support to cooperate the ware and implement, and means for varying the operating position of the implement relative to the work.

9. The combination with a ware support of relatively rotatable means for removing hardened burrs from the back of glazed, fired potteryware including an implement for breaking off burrs, a support for said implement, and means for relatively moving said ware support and implement support to cooperate the ware and implement in order that the burrs may be knocked off by relative rotation between the implement and the ware.

10. In combination with a ware support, means for removing hardened burrs from the back of glazed, fired potteryware which comprises, a rotatable burr removing implement for breaking off burrs, means for relatively rotating the implement and said ware support about a common axis and means for moving the ware support and implement relative to one another to bring the ware into cooperation with the implement.

11. In combination with a ware support, means for removing hardened burrs from the back of glazed, fired potteryware which comprises, a burr removing implement including a grinding wheel, means for rotating the grinding wheel, means for relatively rotating the ware and implement about a common axis, means for relatively moving the ware support and implement to bring the ware into cooperation with the implement and means normally resting on the glazed back of the ware when the implement is at work for spacing the working surface of the implement above the surface of the ware and out of contact with the ware surface so that said implement acts only upon burrs projecting thereabove.

12. The combination with a ware support of a relatively rotatable means for removing burrs from the back of glazed, fired potteryware including a burr removing implement and a support therefor constructed and arranged to allow the implement to pass smoothly over the glazed back of the ware without grinding the surface and to act on the burrs projecting thereabove, means for regulating the radial and vertical position of the implement with respect to the ware and means for relatively moving the ware and tool to cooperate the same in order to remove burrs by means of relative rotation therebetween.

13. The combination with a ware support of relatively rotatable means for removing burrs from the back of glazed, fired potteryware including a burr removing tool having a working surface contoured as the surface of the ware and a supporting means therefor formed to allow the tool to pass over the glazed back of the ware without acting thereon in position to act on burrs projecting thereabove and including means for permitting the tool to float up and down as the tool and ware are relatively rotated when in cooperation.

14. The combination with a ware support of relatively rotatable means for removing burrs from the back of glazed, fired potteryware including a rotatable burr-removing tool, means in rolling contact with the back of the ware for spacing the working surface of the tool above the surface of the ware when in burr removing co-operation therewith, the working surface of the tool

being contoured to conform to the contour of the surface of the back of the ware.

15. In a machine for removing burrs from the backs of glazed, fired potteryware, a burr-removing implement and a supporting means therefor constructed and arranged to allow the implement to pass smoothly over the back of the glazed ware, without grinding the back and to act on the burrs projecting thereabove means for supporting and centering ware in position to be operated upon by said implement, and means for relatively moving the ware support and implement to effect a burr removing operation.

16. In a machine for removing burrs from the backs of glazed, fired potteryware, a burr removing implement and a supporting means therefor constructed and arranged to allow the implement to pass smoothly over the back of the glazed ware, without grinding the surface, and to act on the burrs projecting thereabove, a grip chuck for releasably supporting ware, means for relatively moving the grip chuck and implement to effect a burr removing operation and means operable to cause the ware to be gripped to the chuck prior to the burr-removing operation and released from the grip of the chuck subsequent to the burr removing operation.

17. In a machine for removing sagger pin burrs from the backs of glazed, fired potteryware, a burr-removing implement and a supporting means therefor arranged to allow the implement to pass smoothly over the back of the glazed ware, without grinding the surface, and to act on the burrs projecting thereabove means enabling the adjustment, exchange and substitution of burr removing implements in order to operate on various sizes and shapes of ware, a ware chuck having means for gripping the ware thereto during the burr removing operation, ware centering means operable to center ware of various sizes and means for relatively moving the implement and chuck to effect a burr removing operation.

18. In apparatus for removing burrs from the back of glazed, fired potteryware, a rotatable ware support rotatable about an axis, a rotatable tool support thereabove rotatable about said axis, a burr removing tool mounted on said support in an eccentric position relative to said axis, said tool support including means operable to allow the tool to float up and down on the surface of the ware, the tool passing over said surface smoothly without grinding said surface, but in position to act on the burrs projecting thereabove and means for relatively rotating the ware support and tool support.

19. Apparatus for deburring the back of glazed, fired potteryware which comprises, a ware support, a deburring implement, means for relatively moving the ware support and deburring implement to remove burrs from the ware and means to be acted upon by the burrs for shifting the implement into a burr removing position.

20. Apparatus for deburring glazed, fired potteryware comprising, in combination, a deburring implement and a support therefor constructed and arranged to permit the implement to slide over the surface of the ware to be deburred without acting thereon and to remove the burrs therefrom by a chiseling action, a ware support, means for moving one of the supports relative to the other to move the ware and implement into deburring relation and means for moving the implement and ware relative to one another to effect a deburring operation.

21. Apparatus for deburring glazed, fired potteryware comprising, in combination, a deburring implement formed for detaching burrs from the surface of the ware by a chiseling action, a support for said implement formed to permit the implement to rest on the surface of the ware having associated therewith counterbalancing means for removing some of the weight of the implement from the ware, a ware support, means for moving one of the supports relative to the other to move the ware into deburring position and means for moving the implement and ware relative to one another to effect a deburring operation.

22. Apparatus for deburring glazed, fired potteryware comprising, in combination, a deburring implement and a support for said implement constructed and arranged to allow the implement to pass smoothly over the glazed surface of the ware without acting thereon and to act on the burrs projecting thereabove, a ware support, means for moving one of the supports relative to the other to move the ware into deburring position and means for moving the implement and ware relative to one another to effect a deburring operation, said ware support having associated therewith means for centering the ware thereon.

23. Apparatus for deburring glazed, fired potteryware comprising, in combination, a deburring implement and a support for said implement constructed and arranged to allow the implement to pass smoothly over the glazed surface of the ware without acting thereon and to act on the burrs projecting thereabove, a ware support, means for moving one of the supports relative to the other to move the ware into deburring position and means for moving the implement and ware relative to one another to effect a deburring operation, said ware support having associated therewith a plurality of movable members operable to center the ware on said support and means for moving said members.

24. Apparatus for deburring glazed, fired potteryware comprising, in combination, a deburring implement and a support for said implement constructed and arranged to allow the implement to pass smoothly over the glazed surface of the ware without acting thereon and to act on the burrs projecting thereabove, a ware support, means for moving one of the supports relative to the other to move the ware into deburring position and means for moving the implement and ware relative to one another to effect a deburring operation, said ware support being formed for providing finger space adjacent and underneath the outer rim of the ware seated on the support to facilitate removal of the ware from the support.

25. Apparatus for deburring glazed, fired potteryware comprising, in combination, a deburring implement and a support for said implement constructed and arranged to allow the implement to pass smoothly over the glazed surface of the ware without acting thereon and to act on the burrs projecting thereabove, a ware support, means for moving one of the supports relative to the other to move the ware into deburring position and means for moving the implement and ware relative to one another to effect a deburring operation, said implement being formed for removing burrs from the surface of the ware by a chiseling and grinding action.

26. Apparatus for deburring glazed, fired potteryware comprising, in combination, deburring means and a support for said means constructed and arranged to allow the means to pass smoothly over the glazed surface of the ware without acting thereon and to act on the burrs projecting

thereabove, a ware support, means for moving one of the supports relative to the other to move the ware into deburring position and means for moving the deburring means and ware relative to one another to effect a deburring operation, said deburring means comprising a power driven rotatable grinder and a power driven rotatable chiseling device.

27. Apparatus for deburring glazed, fired potteryware comprising, in combination, a deburring implement and a support for said implement constructed and arranged to allow the implement to pass smoothly over the glazed surface of the ware without acting thereon and to act on the burrs projecting thereabove, a ware support, means for moving one of the supports relative to the other to move the ware into deburring position and means for moving the implement and ware relative to one another to effect a deburring operation, said implement comprising a power driven rotatable chiseling device.

28. Apparatus for deburring glazed, fired potteryware comprising, in combination, deburring means including a power driven grinder and a chiseling implement, supporting means for said grinder and implement constructed and arranged to support same by the weight of the grinder and implement so they may pass smoothly over the glazed surface of the ware without acting thereon, but in position to act upon the burrs projecting thereabove, a ware support, means for moving the ware support and the support for the grinder and chiseling implement relative to one another to move the ware into deburring position and means for moving the ware support and support for the grinder and chiseling implement relative to one another to effect a deburring operation.

29. Apparatus for deburring glazed, fired potteryware comprising, in combination, a plurality of deburring implements including means for removing the burrs by grinding action and means for removing burrs by chiseling action, a supporting means for said implements constructed and arranged to support at least a part of the weight of the implements to permit them to pass over the glazed surface of the ware without acting thereon, but in position to act upon the burrs projecting thereabove, a ware support, means for moving the ware support and implement supporting means relative to one another to move the ware into deburring position relative to the deburring implements, and means for moving the deburring implements and the ware relative to one another to effect a deburring operation.

30. Apparatus for deburring glazed, fired potteryware comprising, in combination, an implement support provided with a plurality of spaced arms, a deburring implement carried by each arm, a ware support, means for moving one of the supports relative to the other to move the tools and ware into deburring position and means for moving the ware and tools relative to one another to effect a deburring operation.

31. Apparatus for deburring glazed, fired potteryware comprising, in combination, a spider having a plurality of arms, a deburring implement carried by each arm, a ware support, means for rotating the spider to cause the deburring implements to engage and remove burrs from ware therebelow and means for moving the ware support relative to the spider to move the ware into and out of deburring position.

32. Apparatus for deburring the back of glazed, fired potteryware which comprises, a ware support, a deburring implement, means for relatively moving the ware support and deburring implement to remove burrs from the ware and means to be acted upon by the burrs for shifting the implement into a burr removing position.

33. Apparatus for deburring glazed, fired potteryware, comprising, a deburring implement, a support for said implement, a ware support, means for moving one of said supports relative to the other to effect a deburring operation and means to be acted upon by the burrs projecting above the surface of the ware operable to shift the deburring implement over the surface of the ware during operations from one deburring position to another.

34. Apparatus for deburring glazed, fired potteryware, comprising, a deburring implement, a support for said implement, a ware support, means for moving one of said supports relative to the other to effect a deburring operation and means to be acted upon by the burrs projecting above the surface of the ware operable to shift the deburring implement over the surface of the ware during operations from one deburring position to another including a member engageable with the surface of the ware and slidable thereover.

35. Apparatus for deburring glazed, fired potteryware, comprising, a deburring implement, a support for said implement, a ware support, means for moving one of said supports relative to the other to effect a deburring operation and means to be acted upon by the burrs projecting above the surface of the ware operable to shift the deburring implement over the surface of the ware during operations from one deburring position to another including a pair of oppositely disposed members, formed and arranged to provide a throat diverging toward the inlet end.

36. Apparatus for deburring glazed, fired potteryware, comprising, a deburring implement, a support for said implement, a ware support, means for moving one of said supports relative to the other to effect a deburring operation and means to be acted upon by the burrs projecting above the surface of the ware operable to shift the deburring implement over the surface of the ware during operations from one deburring position to another including a member engageable with the surface of the ware and slidable thereover attached to the implement support.

37. Apparatus for deburring glazed, fired potteryware comprising, a deburring implement, a support for said implement, a ware support, means for moving one of said supports relative to the other to effect a deburring operation and means to be acted upon by the burrs projecting above the surface of the ware operable to shift the deburring implements over the surface of the ware during operations from one deburring position to another including a pair of oppositely disposed members arranged with the implement between them and projecting forwardly thereof and outwardly therefrom and adapted to rest on and slide over the surface of the ware.

38. Apparatus for deburring glazed potteryware comprising, a base, a frame rotatably supported thereon, a plurality of ware receiving chucks carried by said frame, means for centering ware on said chucks, means for gripping ware to said chucks, a deburring tool mounted above each chuck for angular movement therewith, means for rotating said tool, means engageable with the surface of the ware for moving the tool from one position to another over

the surface of the ware and means operable to alternately raise and lower said chucks and rotate them.

39. Apparatus for removing burrs from the surface of glazed, fired potteryware which comprises, a deburring tool, a movable support for said tool, a ware support, means for moving one of said supports relative to the other to effect a deburring operation and means engageable with the burrs projecting above the surface of the ware for shifting the deburring tool from one working position to another.

40. Apparatus for removing burrs from the surface of glazed, fired potteryware which comprises, a deburring tool, a movable support for said tool, a ware support, means for moving one of said supports relative to the other to effect a deburring operation and means engageable with the burrs projecting above the surface of the ware for shifting the deburring tool from one working position to another, said deburring tool including a rotatable grinder and means for counterbalancing the weight of the grinder.

41. Apparatus for deburring glazed potteryware comprising, a ware support, a deburring implement movably mounted thereabove, means for rotating the support and implement, one relative to the other to effect a deburring operation and means to be acted upon by the burrs projecting above the surface of the ware, for shifting the deburring implement in a radial direction relative to the axis of the ware during deburring operations.

42. Apparatus for deburring glazed potteryware comprising, a base member, an angularly movable frame supported by said member, a plurality of movable ware supports carried by said frame, a deburring implement mounted above each support for movement therewith, a driven shaft, a cam mounted on said shaft below each support, a motion plate associated with each support for rotating the same, and means for rotating said shaft to thereby cause said cams to engage a motion plate and elevate and rotate it.

43. Apparatus for deburring glazed potteryware comprising a base member, an angularly movable frame supported by said member, a plurality of movable ware supports carried by said frame, a deburring implement mounted above each support for movement therewith, a driven shaft, a cam mounted on said shaft below each support, a motion plate associated with each support for rotating the same, and means for rotating said shaft to thereby cause said cams to engage a motion plate and elevate and rotate it and means for changing, the position of the cam on the shaft.

44. Apparatus for deburring glazed potteryware comprising a base member, an angularly movable frame supported by said base member, a plurality of movable ware supports carried by said frame, deburring means mounted above each support for angular movement therewith, a rotatable motion plate for rotating each ware support, a driven shaft, a variable speed drive for said shaft, a cam on said shaft below each motion plate to be rotated into engagement with a motion plate to lift and rotate it and means for moving the cam relative to the shaft to vary the speed of rotation of the motion plate.

45. Apparatus for deburring glazed potteryware comprising a base member, an angularly movable frame supported by said base member, a plurality of movable ware supports carried by said frame, deburring means mounted above each support for angular movement therewith, a rotatable motion plate for rotating each ware support, a driven shaft, a variable speed drive for said shaft, a cam on said shaft below each motion plate to be rotated into engagement with a motion plate to lift and rotate it and means for moving the cam relative to the shaft to vary the speed of rotation of the motion plate and a brake associated with each motion plate for stopping the rotation of said plate upon completion of the deburring operation.

46. Apparatus for deburring glazed potteryware comprising, a deburring implement and a support for said implement constructed and arranged to permit the implement to pass harmlessly over the surface of the ware without acting thereon but in position to act upon burrs projecting thereabove, a ware support, mechanically operated means for raising and lowering said ware support to lift ware up to the deburring implement, a ware centering means and means for actuating the same incident to movement of the ware support.

47. Apparatus for deburring glazed potteryware comprising, a base, a frame rotatably supported thereon, a plurality of ware receiving chucks carried by said frame, means for centering ware on said chucks, means for gripping ware to said chucks, a deburring tool mounted above each chuck for angular movement therewith, means for rotating said tool and means operable to alternately raise and lower said chucks and rotate them.

48. Apparatus for deburring glazed potteryware comprising, a base, an angularly movable frame, a plurality of ware supports carried by said frame, a rotatable spider mounted above each support for angular movement therewith, a rotatable deburring implement supported from each arm of the spiders, means for rotating the spiders and the deburring implement and means for raising and lowering and rotating the ware supports.

49. Apparatus for deburring glazed potteryware comprising, a base, an angularly movable frame, a plurality of ware supports carried by said frame, a rotatable spider mounted above each support for angular movement therewith, a rotatable chisel supported from each arm of the spiders, means for rotating the spiders and the chisels and means for raising and lowering and rotating the ware supports.

WILLIAM J. MILLER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
441,570	Leighton	Nov. 25, 1890
949,381	Polk	Feb. 15, 1910
1,233,701	Pfeifer	July 17, 1917
1,246,996	Pfeifer	Nov. 20, 1917
1,491,079	Champion	Apr. 22, 1924
1,572,451	Taylor	Feb. 9, 1926
1,626,026	Dake et al.	Apr. 26, 1927
1,677,484	Milliken	July 17, 1928
2,194,780	Andersen	Mar. 26, 1940
2,213,426	Anderson et al.	Sept. 3, 1940
2,272,055	Carlson	Feb. 3, 1942
2,290,051	Hinkley et al.	July 14, 1942
2,387,927	Miller	Oct. 30, 1945

Certificate of Correction

Patent No. 2,468,404. **April 26, 1949.**

WILLIAM J. MILLER

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 4, line 40, for "Fig. 1" read *Fig. 16*; line 43, for "Fig. 16" read *Fig. 1*; column 17, line 27, claim 28, for the words "same by" read *some of*; column 18, line 59, claim 37, for "implements" read *implement*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of October, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.