March 10, 1942. C. R. MOON 2,276,059

GRINDING AND POLISHING MACHINE

Filed June 13, 1940 6 Sheets-Sheet 1

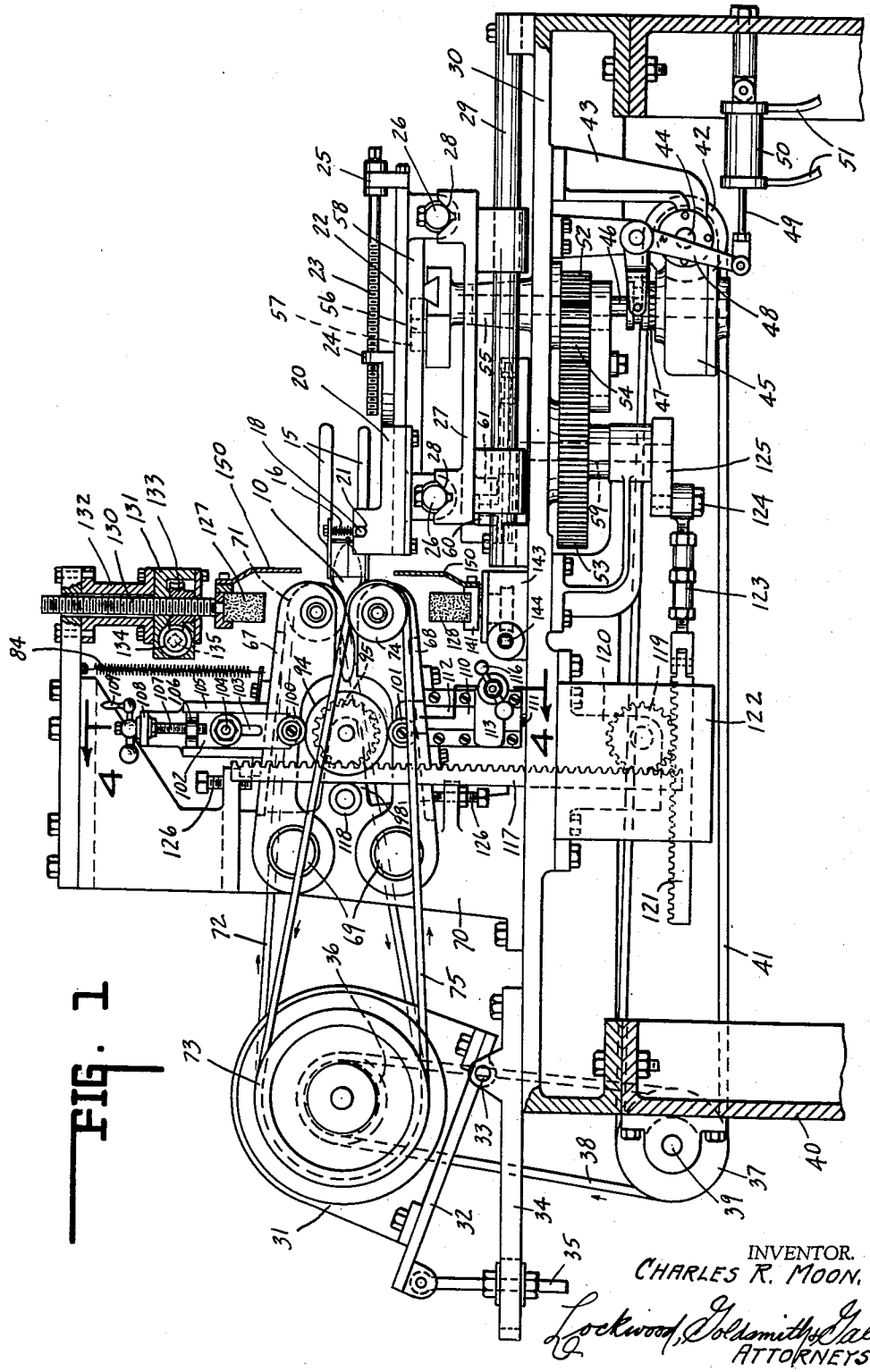


FIG. 1

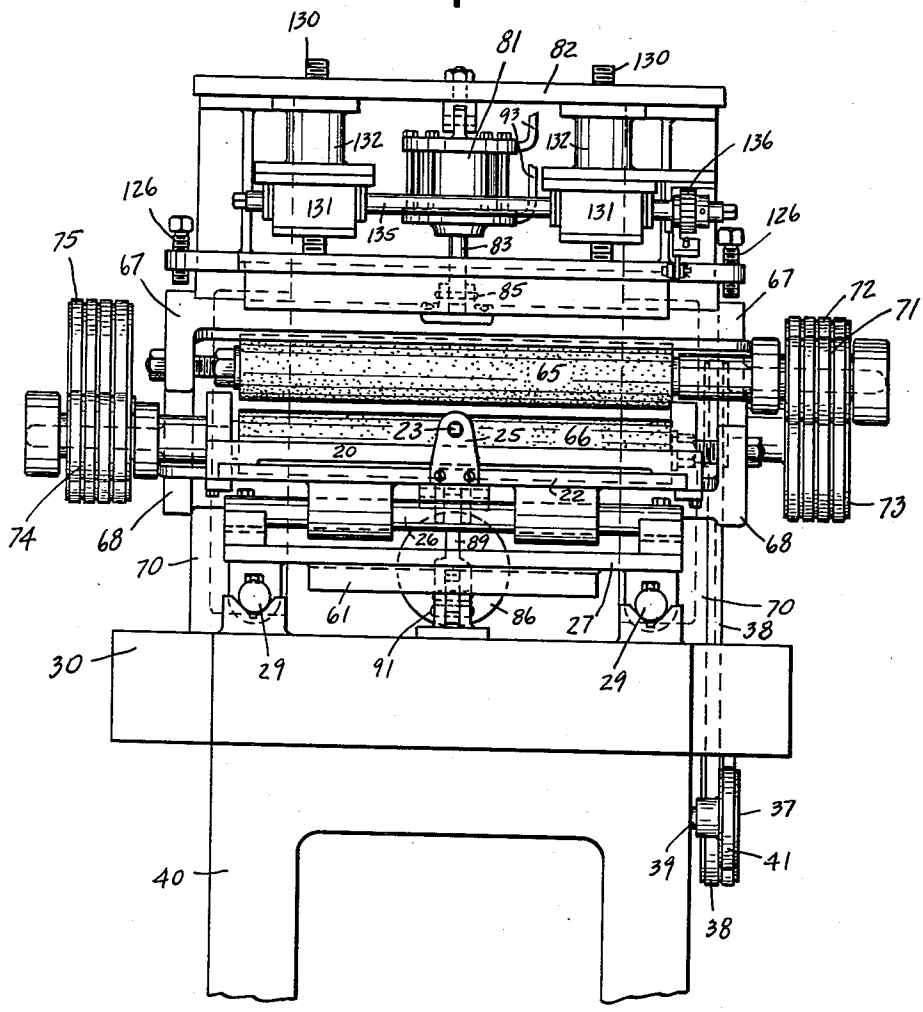
INVENTOR.
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GRINDING AND POLISHING MACHINE

Filed June 13, 1940 6 Sheets-Sheet 2

FIG. 2



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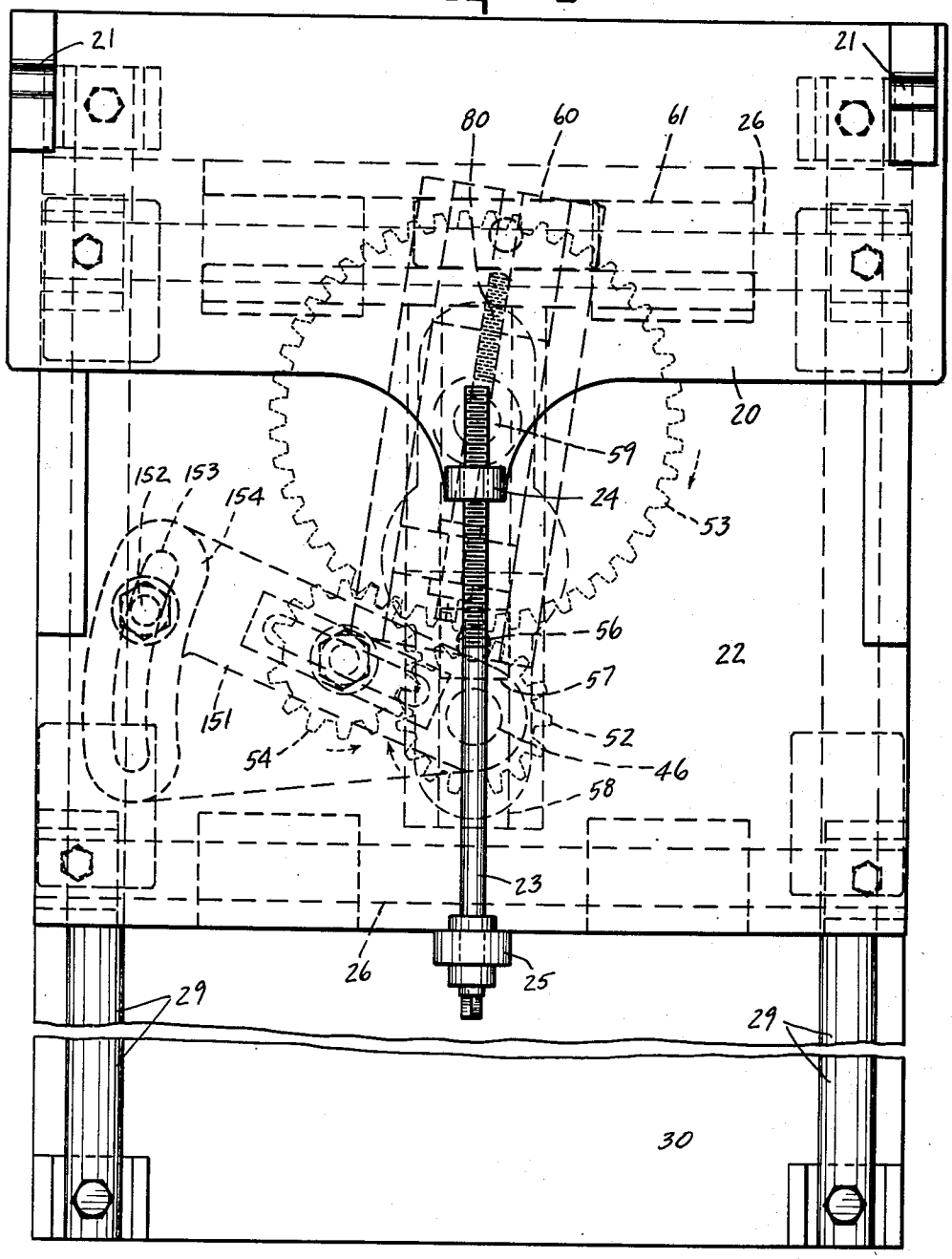
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GRINDING AND POLISHING MACHINE

Filed June 13, 1940 6 Sheets-Sheet 3

FIG. 3



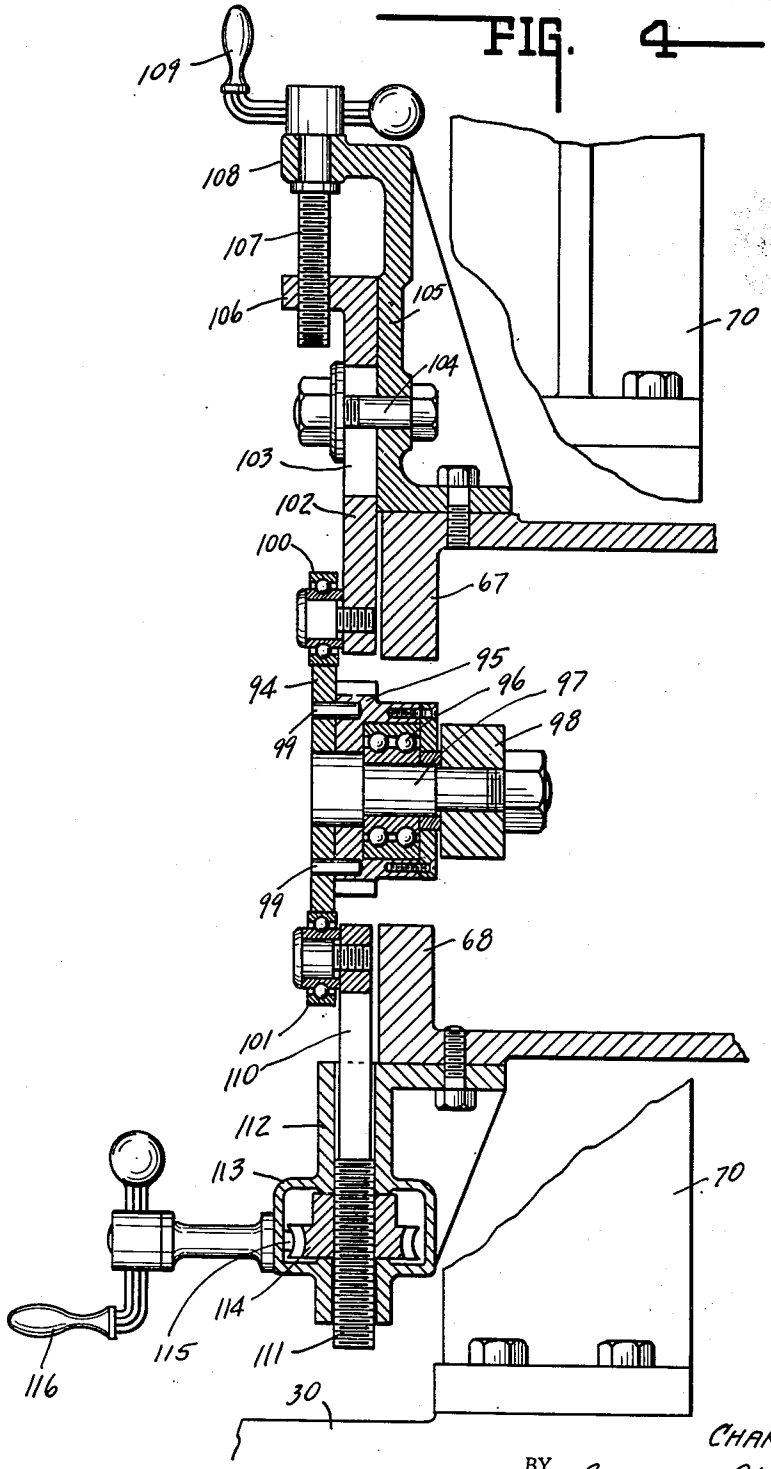
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GRINDING AND POLISHING MACHINE

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FIG. 4



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March 10, 1942. C. R. MOON 2,276,059

GRINDING AND POLISHING MACHINE

Filed June 13, 1940 6 Sheets-Sheet 5

FIG. 8

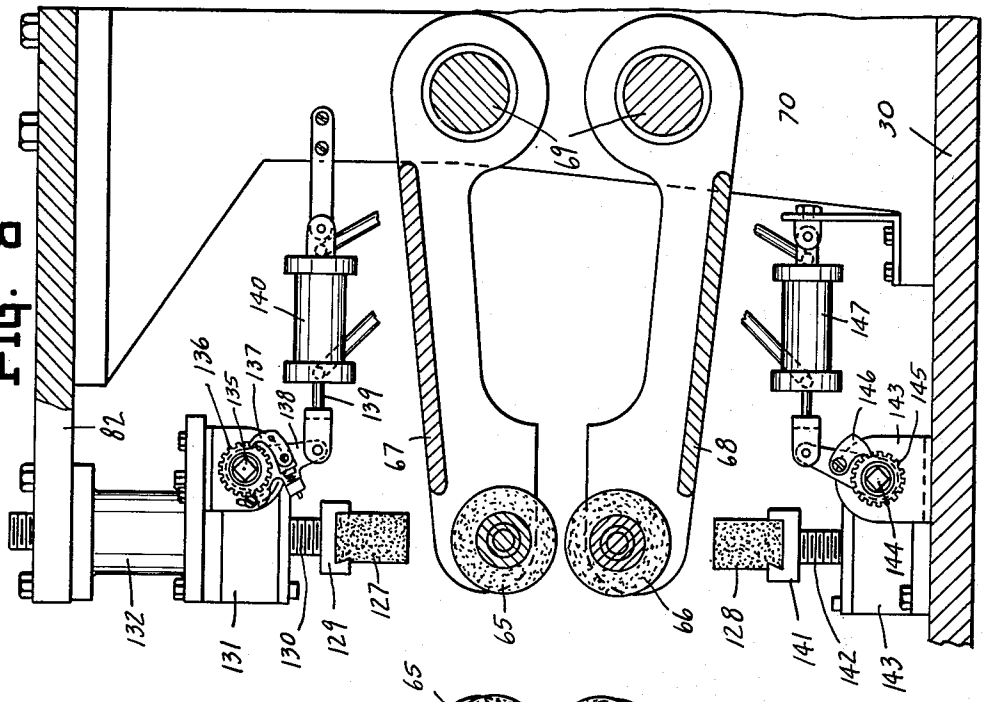
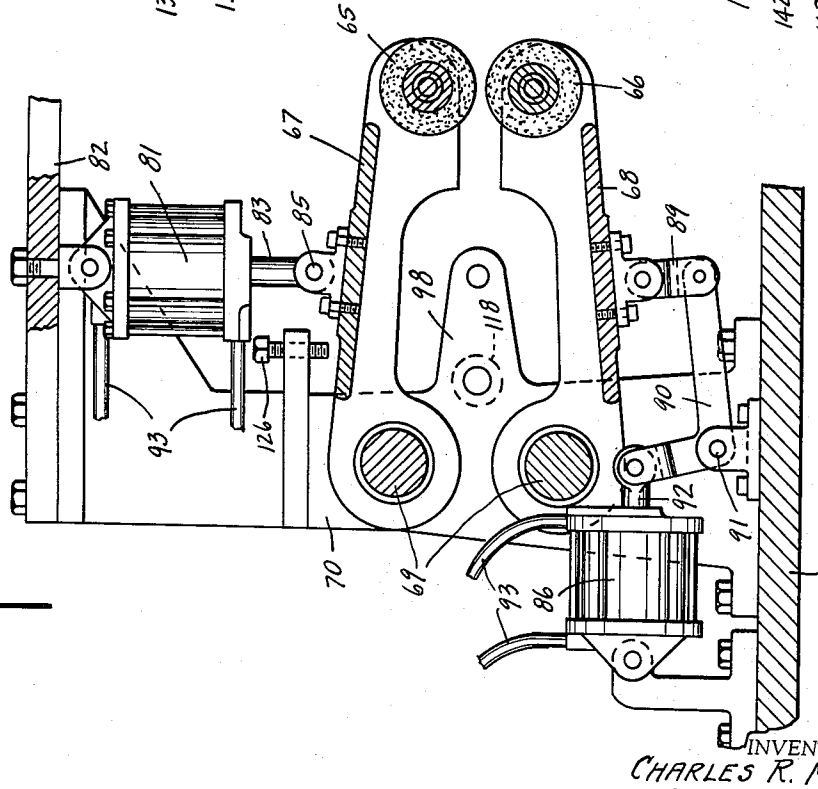


FIG. 5



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GRINDING AND POLISHING MACHINE

Filed June 13, 1940 6 Sheets-Sheet 6

FIG. 6

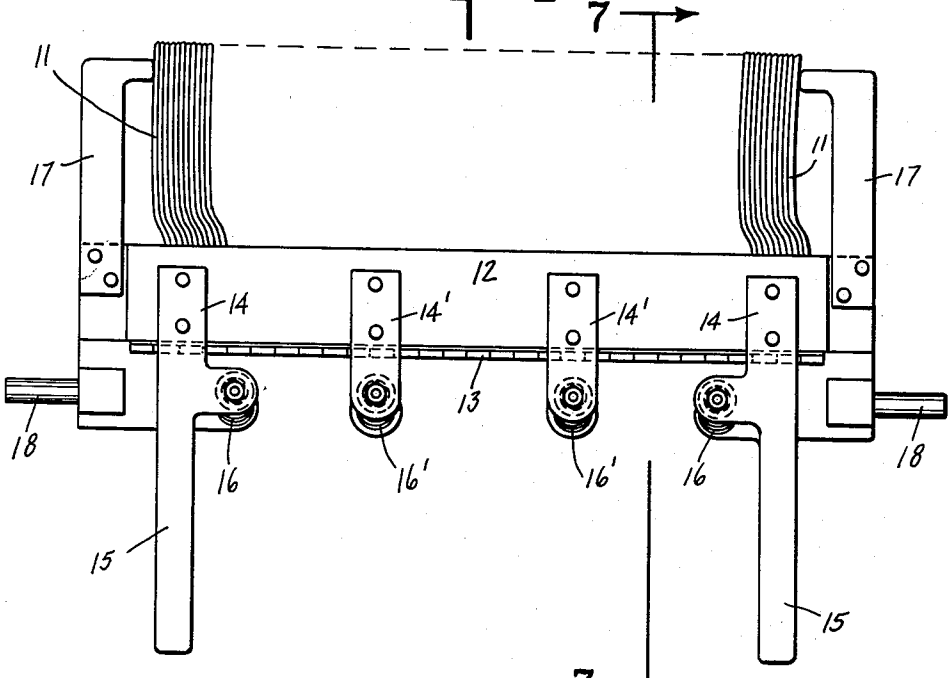
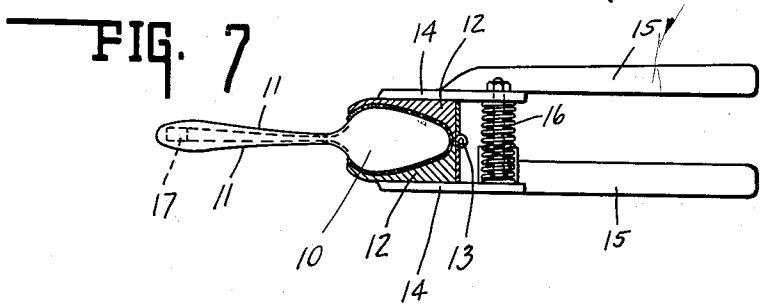


FIG. 7



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Patented Mar. 10, 1942

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UNITED STATES PATENT OFFICE

2,276,059

GRINDING AND POLISHING MACHINE

Charles R. Moon, Muncie, Ind., assignor to Ontario Manufacturing Company, a corporation

Application June 13, 1940, Serial No. 340,265

6 Claims. (Cl. 51—84)

This invention relates to a machine for grinding, polishing and buffing the curved surface of metal articles, such as spoons, knives and forks, and particularly the curved edges of the handle portions thereof.

One feature of the invention lies in an automatic machine for effectively grinding away the rough edges on the handles of table ware resulting usually from the stamping operation in the forming of such handles, and buffing the edges to give them a smooth and finished appearance, such operation being simultaneously applied to a large number or a group of such articles. This is accomplished generally by clamping a number of the articles together so that the edges to be processed form continuous curved surfaces over which the grinding and buffing spindles carrying suitable abrasive are automatically moved to conform with the curvatures of such surfaces, and wherein an oscillatory movement is imparted to the group.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

Fig. 1 is a side elevation of the apparatus with parts thereof shown in sections. Fig. 2 is a front elevation thereof. Fig. 3 is an enlarged top plan view of the oscillating table. Fig. 4 is an enlarged section taken on the line 4—4 of Fig. 1. Fig. 5 is a side elevation of the spindle heads and pressure cylinders with parts omitted for clearance. Fig. 6 is a plan view of the clamping holder for the articles to be processed. Fig. 7 is a section taken on the line 7—7 of Fig. 6. Fig. 8 is a side elevation of the automatic abrasive feed.

The machine for simultaneously grinding, buffing or polishing both curved edges of a plurality of articles, such as table ware and the like, is herein disclosed, for purposes of illustration, as being applied to the edges of spoon handles. However, it is equally and in the same manner applicable, with variations, to other articles of a like nature.

Reference being made to Figs. 6 and 7, the article, such as a spoon, 10 is applied to the machine for the purpose of having the edges 11 of its handle ground, buffed or polished to remove any excess metal or irregular surface resulting from the stamping operation, and give the handle the desired finish about its exposed edge. As herein shown, a large number or group of spoons are clamped against each other between the jaws 12 which extend transversely of the group and are hinged at 13, as shown in Fig. 6. Said jaws are secured to the clamping members 14 having handles 15 extending therefrom beyond the hinge 13, whereby said handles may be employed to open the jaws against the tension of springs 16. Due to the length of the holder it is provided at opposite ends with the clamping members 14, handles 15 and springs 16, intermediate of which there are similar members 14' and springs 16'. At opposite ends of the clamping jaws 12, end members 17 are provided for engaging the end articles to hold the group against lateral displacement. Also at each end there is provided a supporting trunnion pin 18.

Preparatory to feeding the articles to the machine, they are arranged in a group, and clamped in the holder, as shown in Fig. 6. Several such holders may be employed so that the articles may be placed therein and removed therefrom while another set is being operated upon, the holder with the articles being fed to and removed from the machine as a unit. The form of the clamping jaws, herein shown as applied to a spoon, may be of any desired shape, depending upon the articles to be processed.

Referring to Fig. 1, the holder carrying the nested group of spoons 10 is seated in place upon an oscillating carrier 20, by locating the trunnion pins 18 within the sockets 21. Said carrier is slidably mounted upon a carriage 22 and adjustable longitudinally thereof by an adjusting screw 23 screw threaded in a rearwardly extending boss 24 connected therewith, said screw being rotatably supported within a boss 25 on the carriage 22. Said carriage is slidably supported upon the cross rods 26 which are secured upon the bed 27 at 28, whereby lateral movement may be imparted to the carriage and the articles carried thereby. The bed 27 is slidably supported upon the rods 29 extending longitudinally of a supporting table 30, whereby said bed may have a longitudinal movement imparted thereto. Thus, as hereinafter described, the lateral movement of the carriage, in conjunction with the longitudinal movement of the bed, will effect an oscillatory movement of the holder and the articles carried thereby.

For imparting such oscillatory movement, there is provided one of a pair of motors, generally indicated at 31, mounted upon one of a pair of adjustable inclined platforms 32 hinged at 33 upon an extension 34 of the table. Thus, there are provided two such platforms 32 mounted side by side, but independently adjustable. Each platform carries one of a pair of independent motors 31. The position of the motors is adjusted through the respective screws 35 for tak-

ing up any slack in their driving belts. One of said motors drives the pulley 36, which is turn drives the pulley 37 through the belt 38. Pulley 37 drives the shaft 39 mounted upon the table supporting frame 40. Keyed to said shaft there is a companion pulley driving a belt 41 which drives the pulley 42 carried by a bracket 43 at the other end of the table support. Pulley 42 drives a worm (not shown) on the shaft 44, said worm driving a worm gear within the gear casing 45. The worm gear is operatively connected with the shaft 46 through a clutch 47 operated by the bell crank lever 48. Said bell crank lever is controlled by a plunger rod 49 movable to clutching and declutching position by an air cylinder 50 operated through the air hose 51.

When the air cylinder 50 is operated to throw in the clutch 47, the shaft 46 rotates the gear 52 which drives a gear 53 through an adjustable idler gear 54. The shaft 46 extends directly upwardly past the gear 52 through an upper bearing 55 terminating in an eccentric crank pin 56 pivotally connected with a block 57, which is slidable in the ways 58 in the underside of the carriage 22. The rotation of shaft 46, therefore, through the eccentric crank pin 56 and block 57 imparts lateral movement to said carriage, causing it to slide upon the rods 26.

The gear 53 is keyed to a shaft 59 extending upwardly through the table 30 and having an eccentric crank connection with a block 60 slidable in the ways 61 mounted on the underside of the bed 27. Thus, rotation of the gear 53 causes said bed to slide longitudinally upon the rods 29. The combined lateral and longitudinal movements thus imparted to the carriage and bed, respectively, effects an oscillatory movement of the carrier and the group of articles contained in the holder.

The edges 11 of the spoons or similar articles are processed by grinding, buffing or polishing, through the medium of the abrasive spindles 65 and 66 extending the full length of the group of articles clamped within the jaws 12, reference being made to Figs. 1, 2 and 6. Said spindles are mounted for rotation between the forward ends of the spindle heads 67 and 68, which have their rear ends pivotally supported at 69 between the uprights 70 mounted on the table 30. As illustrated in Fig. 2, the spindle 65 is provided on one end thereof with a pulley 71 which is driven by a belt 72 from a pulley 73, said pulley 73 being driven by the second motor mounted on one of the platforms 32 and associated with the first motor, as indicated at 31. The spindle 66 is similarly provided with a pulley 74 driven by a belt 75 from a corresponding pulley 73 keyed to pulley 36 on said first mentioned motor. Thus, each spindle is driven at high speed by a suitable motor mounted on the platforms 32, and in such manner that they may be swung toward and away from each other about the pivotal mountings of the spindle heads 67, 68. In such movement they are caused to conform to the curvatures of the edge surfaces 11 of the article as it in turn is oscillated by the carrier 20 in the manner above described.

The longitudinal extent of the oscillation is such that the relative movement of the article with respect to the spindles will extend the full length of the surface to be processed, such as the length of the handle of the spoon. The extent of such longitudinal movement may be adjusted to accommodate articles of lesser or greater length by adjustment of the eccentric block 60 (Fig. 3) through an adjusting screw 80. Thus, if the adjusting screw is manipulated to shorten the distance between the shaft 59 and the block 60, the longitudinal movement will be shortened to accommodate the processing of an article of less length. The full extent of the relative longitudinal movement of the articles with respect to the spindles is twice that of the distance between the shaft 59 and the eccentric block 60 as controlled by said screw.

The spindles 65, 66 are pressed toward each other and in contact with the article by air pressure, but are guided to accommodate themselves to the curvature of the article by a cam. The air pressure (Figs. 2, 8) is applied to the upper spindle 65, and more particularly against its spindle head 67 by an air cylinder 81 which is suspended from a cross member 82 carried by the uprights 70. It is pivotally connected by a plunger 83 with the spindle head 67 at 85. A spring 84 also connects said head 67 with cross member 82 to elevate the head and spindle when the air is shut off from the air cylinder. Similarly, pressure is applied to the lower head 68 of the spindle 66 by an air pressure cylinder 86 mounted upon the table 30 and operatively connected therewith by a pivotally connected link 89. Said link is pivotally connected to a bell crank lever 90 pivotally supported at 91 and which in turn is pivotally connected with a plunger rod 92. The air applied to said cylinders is applied through the air hose indicated at 93.

As illustrated in Figs. 1 and 4, said spindles 65, 66 are moved relative to each other in accordance with the curvature of the surface processed by means of a suitable oscillating cam 94 conforming thereto. Said cam is removably mounted upon a gear 95 supported by the ball bearings 96 upon a spindle 97 secured to an extension 98 of the supports 70. Said cam is removably mounted on the head by the pins 99 so that it may be replaced by other cams of different contour to correspond with the particular curvature of the surface processed. Cam followers 100, 101 are adjustably mounted upon the spindle heads 67, 68, respectively, for causing relative movement between the spindles in accordance with the contour of the cam and under pressure of the air cylinders 81, 86, as above described.

For adjusting the heads 67, 68 with respect to their corresponding cam followers, the follower 100 is rotatably supported upon a sliding plate 102 longitudinally slotted at 103 to receive a locking stud 104. Said plate is slidable in a bracket 105 bolted to the head 67. The plate 102 carries a flange 106 which is screw threaded to receive an adjusting screw 107 rotatably carried in a bearing 108 of the bracket 105, and which is operable by an adjusting handle 109.

For similar adjustment the follower 101 is rotatably mounted upon a sliding plate 110 having a threaded stud 111 at the lower end thereof, said plate being carried by a bracket 112 bolted to the head 68. Said bracket carries a gear housing 113 for the worm gear 114, said worm gear having an internally threaded boss engaging the threads of the stud 111. The worm gear 114 is driven by a worm 115 on a shaft operated by an adjusting handle 116.

Through the adjusting handles 109, 116 the spindles 65, 66 may be adjusted with respect to each other and the cam 94 for determining the bite or depth of metal to be removed in the proc-

essing operation, as well as compensate for abrasive wear on the spindles.

For oscillating said cam, it is provided with a gear 95 driven by a vertically moving rack 117 held in mesh therewith by a roller 118. Said rack extends downwardly through the table 30 with its lower end meshing with the pinion 119 mounted for free rotation between the bearing supports 120. Said pinion 119 or a companion pinion is driven by a horizontally extending rack 121 slidable within a bearing bracket 122 and having its driven end connected with an adjustable link 123 through the pin 124 on a crank arm 125 keyed to the shaft 59. Thus, as shaft 59 is rotated to impart oscillatory movement to the bed 27, corresponding oscillatory movement is imparted to the cam 94 in timed relation therewith. Thus, the cam is oscillated in accordance with the oscillatory movement of the articles so as to effect relative movement between the spindles 65, 66 in confromity with the curvature of the surface processed. To limit the movement of the spindles and their carrying heads from each other, stop screws 126 are provided, which screws are adjustable through screw engagement with suitable bosses extending from the support 70.

A suitable abrasive supply is provided and it is intermittently applied to the spindles 65, 66, as best illustrated in Figs. 1 and 8. Extending longitudinally of spindle 65 and spaced above its upper surface, there is provided an abrasive stick 127. A similar abrasive stick 128 is provided along the lower spindle 66 in spaced relation to its lower surface. The stick 127 is carried by a head 129, see Figs. 1 and 8, connected with the lower end of the threaded screw 130 extending upwardly through a gear housing 131 and bearing support 132. Said screw is in threaded engagement with a worm gear 133 driven by a worm 134 mounted on shaft 135. Said shaft has keyed thereto (Fig. 8) a ratchet wheel 136 driven one step at a time by a pawl 137 mounted on an arm 138 which is connected with an air plunger 139 periodically operated by an air cylinder 140. Similarly, the lower stick 128 is carried by a head 141 mounted on a threaded screw 142 extending into a housing 143 for threaded engagement with the worm gear driven by a worm on a shaft 144 in a manner above described in respect to the stick 127. In this instance the shaft 144 is provided with a ratchet 145 operated by a pawl 146 through the periodic action of an air cylinder 147.

Air cylinders 140 and 147 are interconnected with the air supply so that the sticks 127 and 128 are intermittently and slightly fed toward their respective spindles in timed relation with the movement of the article and the spindle heads. Said sticks are initially adjusted so that upon each separating movement of the spindle effected by the cam 94, said spindles will contact the abrasive sticks and thereby receive an abrasive treatment. The above described inward feeding of the sticks is to compensate for their loss of abrasive at each operation.

To protect the operating parts of the machine from loose and flying abrasive and dislodged metal particles, there is provided an apron 150 which is secured to the abrasive stick holder 129 and at the bottom to the holder 141, said apron having sufficient opening for the free passage of the article therethrough into engagement with the spindles.

For adjusting the machine to different articles having various curvatures along their edges to be ground, and of different lengths, it is to be noted that the cam 94 is interchangeable, a different cam being used for articles of different curvature and length. Also the longitudinal throw of the article carrier is adjusted in accordance with the length of that portion to be processed. This is accomplished by adjusting the screw 80. A change in the speed of oscillation is accomplished by the usual change gear arrangement including the changing of the gear 53 and readjusting the idler gear 54 upon the pivoted arm 151 (Fig. 3), which arm is adjustable about the shaft 46. For this purpose, the outer end of the arm 151 has a stud 152 movable in an arcuate slot 153 provided in a quadrant support 154.

In operation, the cam 94 and gear 54 are mounted on the machine in accordance with the article to be processed. The longitudinal throw of the article carrier is adjusted by the screw 80 (Fig. 3) and the carrier 20 is adjusted by the screw 23. Thereupon a series of holders, as shown in Figs. 6 and 7, are provided and the articles clamped therein. One of the holders is positioned on the carrier, the motors and air cylinders placed into operation. The clutch is then thrown in by the clutch actuating air cylinder 50. Oscillatory movement is thereby imparted to the article with respect to the processing spindles which revolve in contact with the edges to be processed. As the articles are moved in and out with respect to the spindles, the cam moves them relative to each other to conform to the curvature of the surface. On each outward movement of the spindles by the cam, they contact the abrasive sticks which are periodically fed inwardly as they are used. Further, adjustment of the abrasive contact with the article to avoid low or high spots in the processing is accomplished through manipulating the adjusting handles 109, 116 (Fig. 4).

At the completion of the operation, the processed edges of the articles will have been smoothed and polished to the desired finished surface, whereupon the clutch controlled air cylinder is actuated to stop the operation of the carrier and the air pressure on the spindle heads is reversed to separate them. Replacement of the holder containing another group of articles to be processed may then be effected.

The invention claimed is:

1. A grinding and polishing machine for processing metal articles having a curved surface, comprising a holder for securing said articles with their curved surfaces exposed, an abrasive spindle extending transversely of said surface in engagement therewith, driving mechanism for rotating said spindle, a pivotally mounted spindle head for carrying said spindle, a cam, a cam follower engaging said cam, means for adjusting said cam follower on said head, and means for moving said cam and imparting an oscillatory movement to said articles in timed relation for moving said spindle in conformity with the curvature of said articles during their relative movement.

2. A grinding and polishing machine for processing metal articles having oppositely curved surfaces, comprising a holder for securing said articles with their oppositely curved surfaces exposed, a carrier for removably receiving said holder, mechanism for imparting an oscillatory movement to said carrier, a pair of abrasive spindles positioned to engage said opposite surfaces respectively, a pivotally mounted spindle head for carrying each of said spindles, a cam

follower adjustably mounted on each of said heads, a cam mounted between said heads and cam followers for engagement thereby, and means for imparting movement to said cam in timed relation with the oscillatory movement of said carrier.

3. A grinding and polishing machine for processing metal articles having a curved surface, comprising a holder for securing said articles with their curved surfaces exposed, an abrasive spindle, driving mechanism for rotating said spindle in engagement with said surface, mechanism for imparting an oscillatory movement to said articles relative to said spindle, means for bodily moving said spindle to conform with the curvature of said articles and in timed relation with the oscillatory movement thereof, and an abrasive treating stick extending longitudinally of said spindle and spaced therefrom to be periodically engaged by said spindle when moved to its extreme position in following the curvature of said articles.

4. A grinding and polishing machine for processing metal articles having a curved surface, comprising a holder for securing said articles with their curved surfaces exposed, an abrasive spindle, driving mechanism for rotating said spindle in engagement with said surface, mechanism for imparting an oscillatory movement to said articles relative to said spindle, means for bodily moving said spindle to conform with the curvature of said articles and in timed relation with the oscillatory movement thereof, an abrasive treating stick extending longitudinally of said spindle and spaced therefrom to be periodically engaged by said spindle when moved to its extreme position in following the curvature of said articles, and means for periodically feeding said stick toward said spindle in timed relation with its movement.

5. A grinding and polishing machine for processing metal articles having a curved surface, comprising a holder for securing said articles with their curved surfaces exposed, a carrier for removably receiving said holder, mechanism for imparting an oscillatory movement to said carrier and providing a longitudinal throw coextensive with the length of the edges to be processed, means for adjusting the longitudinal throw of said carrier, a pair of abrasive spindles, each carried by a pivoted spindle head extending into position for causing said spindle to engage and process opposite edges of the articles throughout said surfaces, a cam interposed between said heads, cam followers adjustably mounted on said heads for engagement with said cam, driving mechanism for rotating said spindles, and means for imparting movement to said cam and oscillatory movement to said carrier in timed relation.

6. A grinding and polishing machine for processing metal articles having a curved surface, comprising a holder for securing said articles with their curved surface exposed, a reciprocating carriage for said holder, a rack bar reciprocable therewith, an abrasive spindle extending transversely of said surface in engagement therewith, driving mechanism for rotating said spindle, cam means operably associated with said spindle adapted to move it in conformity with said surface, a rack bar adapted to actuate said cam means, and a pinion common to said rack bars whereby they will be actuated in timed relation.

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