Aug. 14, 1934. L. E. POOLE 1,970,018

REAMING MACHINE

Filed June 15, 1932 3 Sheets-Sheet 1

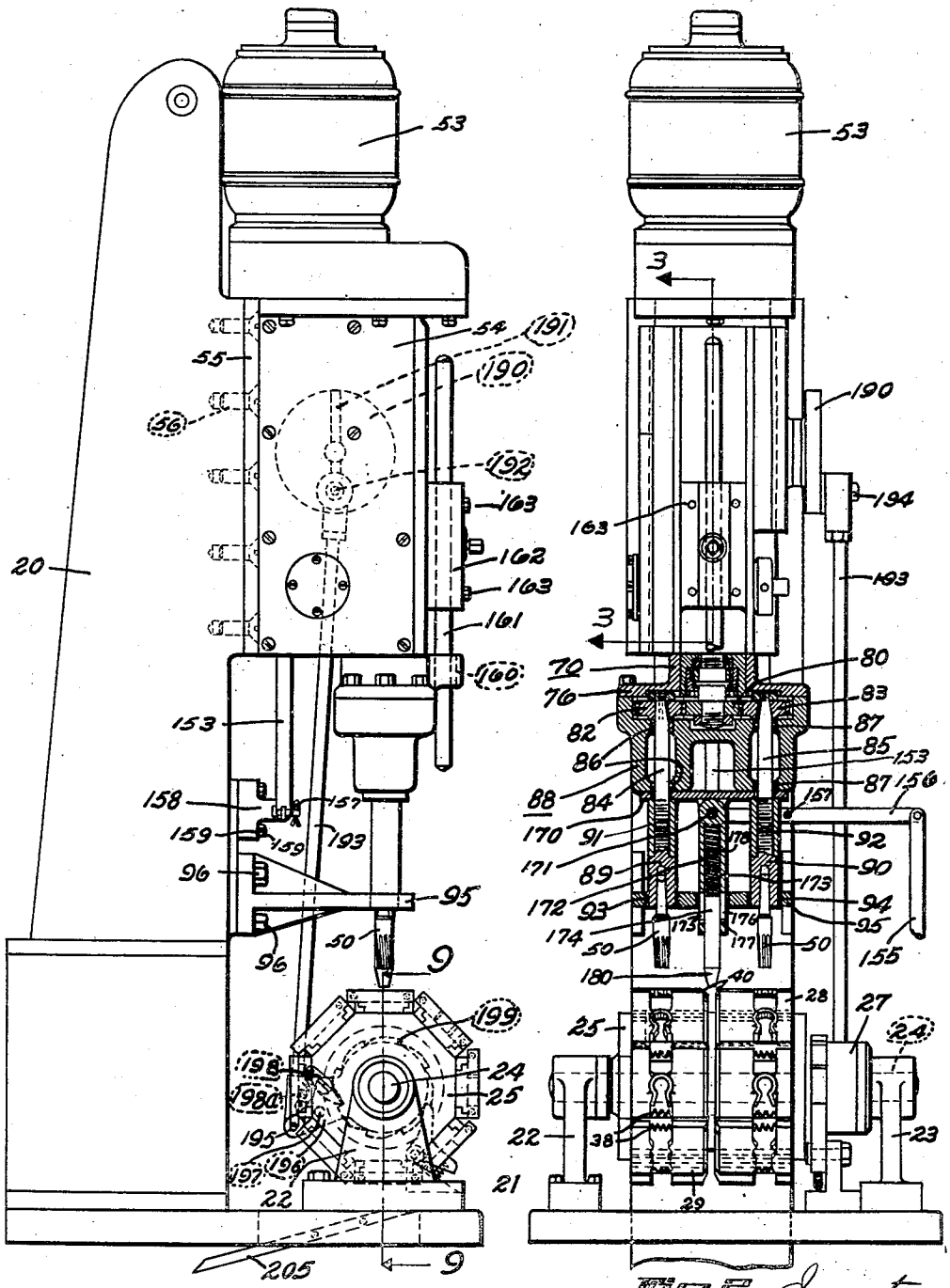



Fig. 1

Fig. 2

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REAMING MACHINE

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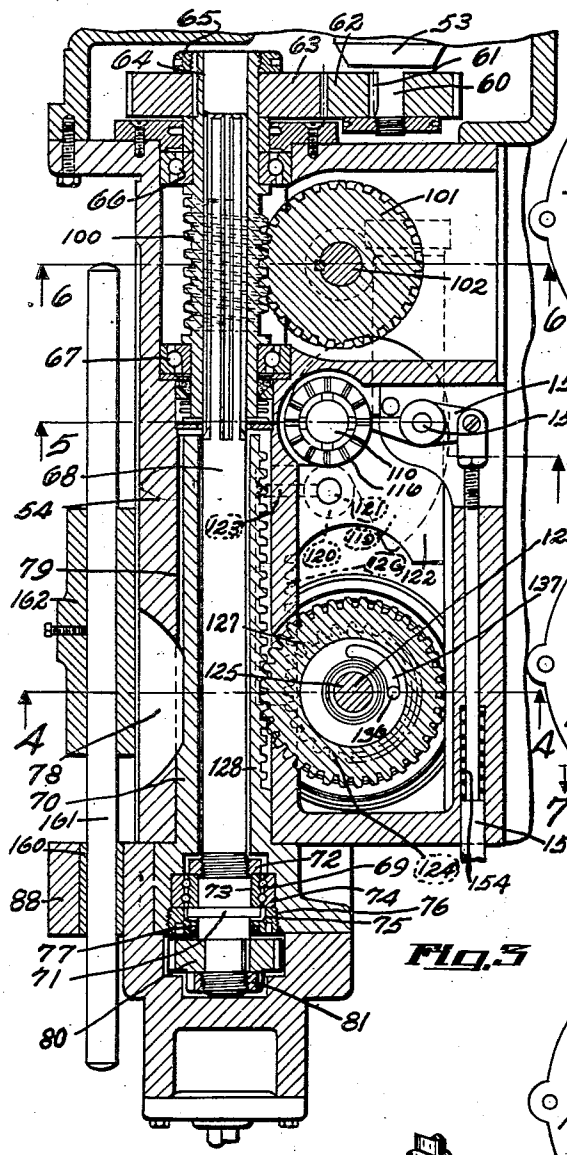
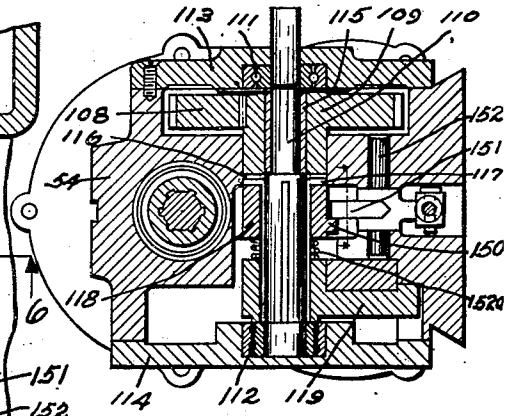


Fig. 3



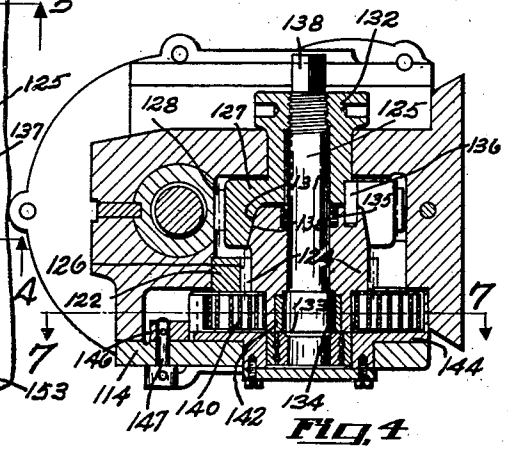


Fig. 4

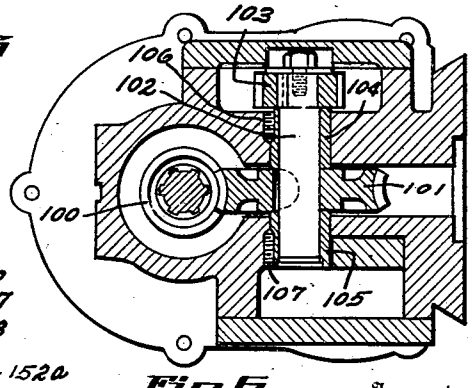


Fig. 6

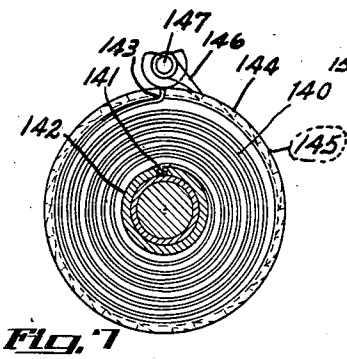


Fig. 7

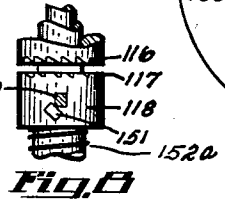


Fig. 8

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REAMING MACHINE

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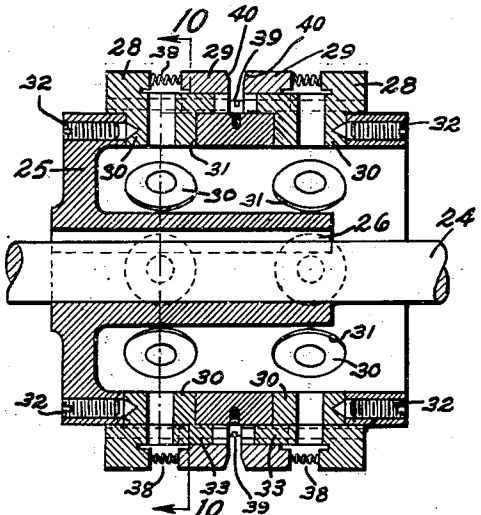



Fig. 9

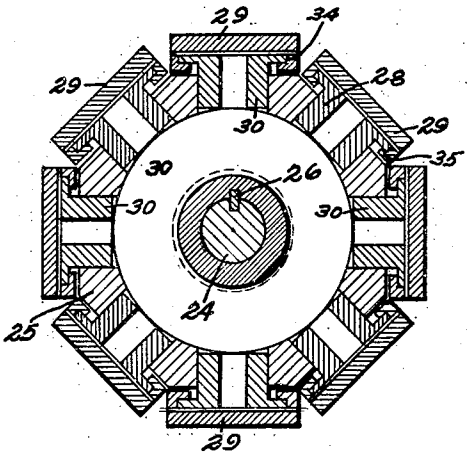



Fig. 10

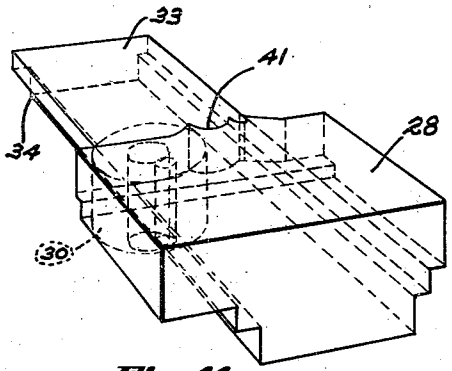



Fig. 11

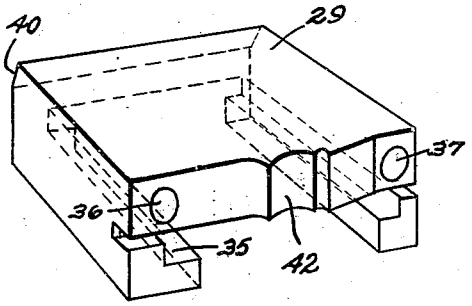



Fig. 12

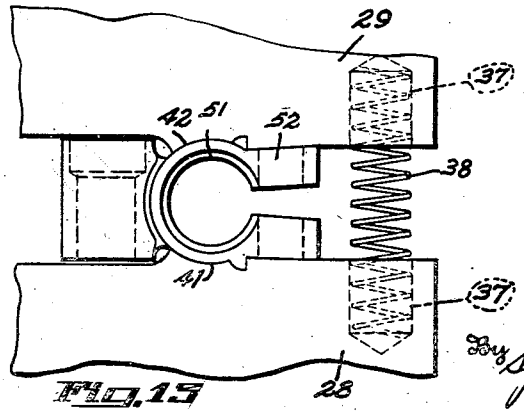



Fig. 13

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Patented Aug. 14, 1934 1,970,018

# UNITED STATES PATENT OFFICE

1,970,018

## REAMING MACHINE

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Application June 15, 1932, Serial No. 617,309

9 Claims. (Cl. 77—4)

This invention relates to a machine for reaming split clamps and particularly clamps for storage battery terminals.

It is an object of the present invention to provide a machine which successively and automatically moves a plurality of clamps into alignment with a plurality of rotary reamers and axially moves the same into operating engagement with the bores of the aligned clamps.

Another object of the present invention is to provide clamp holders or jaws which subsequent to and during the reaming operation force the clamps to maintain a shape which is substantially the same as that of the clamps in use.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a side elevation of the machine embodying the present invention.

Fig. 2 is a front elevation of the same.

Fig. 3 is an enlarged sectional view taken substantially on the line 3—3 of Fig. 2.

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3.

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 3.

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 3.

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 4.

Fig. 8 is a fragmentary elevational view of the one-way clutch which is shown in section in Fig. 5.

Fig. 9 is an enlarged sectional view taken on the line 9—9 of Fig. 1.

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 9.

Fig. 11 is a perspective view of a relatively stationary jaw.

Fig. 12 is a perspective view of a cooperating relatively movable jaw.

Fig. 13 is an enlarged fragmentary view of two cooperating jaws showing a workpiece clamped between them.

Referring to Figs. 1 and 2 the reference numeral 20 constitutes a frame which supports the various mechanisms of the machine. The frame 20 comprises a lower platform 21 on which are mounted spaced bearing brackets 22 and 23 which rotatably support a shaft 24. As best shown in Figs. 2, 9 and 10 a drum 25 is keyed as at 26 to shaft 24. A ratchet disc 27, which original function will be explained later, acts also as a spacing member between the drum and the bearing bracket 23, thus preventing the drum to move longitudinally between the bearing brackets.

With particular reference to Figs. 9 to 12 inclusive, a plurality of equally spaced cooperating stationary and movable jaws 28 and 29 respectively, are carried by the drum 25. Each of the stationary jaws 28 comprises a cylindrical boss 30 which fits in a corresponding hole 31 provided by the drum. A set screw 32 maintains said cylindrical boss within the hole 31. Each of the stationary jaws 28 comprises a support 33 for the cooperating movable jaw 29, the support 33 is furthermore shaped to provide a guide 34 for the stationary jaw for movement in a linear direction. The movable jaw 29 comprises a guide portion 35 which telescopes with the guide portion 34 of the support 33. Both jaws are provided with aligning and adjacent holes 36 and 37 (see Figs. 12 and 13), in which are located springs 38 adapted to maintain cooperating jaws separated. As indicated in Figs. 9 and 2 there are two pairs of cooperating jaws aligned axially with respect to the drum shaft. Intermediate both pairs of axially aligned jaws there is provided a Fillister head screw 39 which is threaded into the drum 25. The screw head determines the extreme separated position of the movable jaws 29 from the stationary jaws 28. Each of the movable jaws is provided with a beveled edge 40 which in the case of axially aligned jaws face each other. The purpose of these beveled edges will be explained later. The workpiece engaging surfaces 41 and 42 of two cooperating jaws 28 and 29 respectively, are shaped after the contour of the workpiece as best shown in Figs. 11, 12 and 13.

A pair of rotary cutting tools such as reamers 50 are adapted concurrently to ream the apertures 51 of workpieces 52 which are clamped between axially aligned pairs of jaws while in position A (see Figs. 1 and 2). For rotating and axially moving the reamers 50 there is provided an electric motor 53 mounted upon a casing 54 and adapted to drive certain mechanisms within the casing, which mechanisms are adapted to rotate the reamers and axially move the same. Casing 54 is attached to frame 20 by gib plates 55 which upon loosening of the screws 56 allow for vertical adjustment of the casing 54 relative to the frame 20.

The mechanism for simultaneously rotating the reamers 50 will now be described. Referring more particularly to Figs. 1, 2 and 3, the arma-

ture shaft 60 of the motor 53 has keyed thereto as at 61 a gear 62 which meshes with a gear 63, keyed to a tubular sleeve 64 and held in position by a collar 65 threadedly engaging the end of the sleeve 64 which is journaled in end thrust bearings 66 and 67. A spindle 68 is splined to the tubular member 64 and is journaled in a ball bearing 69. Endwise movement of the spindle 68 relative to a quill 70 is prevented by a shoulder 71, integral with the spindle 68, and a nut 72, threadedly engaging the spindle, the shoulder and the nut abutting the inner race of the ball bearing 69. The outer race 74 is held in position by a nut 75 engaging the flared end 76 of the quill 70. The nut 75 is provided with an annular groove 77 which is packed by a felt washer or other suitable packing material saturated with oil. A key 78 seated in the casing 54 cooperates with a slot 79 in the quill 70 to permit longitudinal movement and to prevent rotary movement of the quill. The lower end of spindle 68 has keyed thereto a gear 80 which is held in position by a nut 81 threaded over the extreme end of spindle 68. As best shown in Fig. 2 the gear 80 is in mesh with gears 82 and 83 carried by spindles 84 and 85 respectively, which are journaled in bushings 86 and 87 respectively, provided by a bracket 88 which is attached to the flared end 76 of the quill 70 in any suitable manner. Longitudinal movement of the spindles 84 and 85 in either direction relative to the bracket 88 is prevented by the attached gears 82 and 83 respectively, which are held against longitudinal movement between the flared end 76 of quill 70 and the upper bushings 86 and 87, respectively, in the bracket 88. Chucks 89 and 90 are drivingly connected with the spindles 84 and 85 respectively, by tubular sleeves 91 and 92 respectively, which sleeves threadedly receive the right-hand and left-hand threaded ends of the spindles 84, 85 and the chucks 89, 90 respectively. Each of the chucks 89 and 90 receives a reamer 50. The lower ends of the chucks are guided through bushings 93 and 94 which are press-fitted into a bracket 95, attached to the frame 20 by screws 96.

The mechanism for axially moving the reamers 50 toward and away from the workholding jaws will now be described with special reference to Figs. 3 to 8 inclusive. The tubular sleeve 64 is provided with a worm 100 which meshes with a worm gear 101, keyed to a shaft 102, which carries a spur gear 103 (see Fig. 6). Shaft 102 is journaled in bearings 104 and 105 mounted in the casing 54 and held in position by screws 106 and 107 respectively. Spur gear 103 meshes with a gear 108 (see Fig. 5) which is keyed to a tubular member 109 rotatably mounted on a shaft 110 journaled in ball bearings 111 and 112 which are mounted in a gear retaining cap 113 and an end plate 114, respectively, each of which is attached to the casing 54 by suitable screws. Intermediate the tubular member 109 and shaft 110 is mounted a bushing 115. The tubular member 109 terminates in radial teeth 116 which cooperate with corresponding teeth 117 integral with a member 118 which is splined on the shaft 110. Also splined on the shaft 110 is a spiral cam 119 which cooperates with the cam follower 120, mounted on a pin 121, carried by a rack 122 and held in position by a set screw 123. As the cam 119 is rotated counterclockwise as viewed in Fig. 3, the rack 122 will be urged downwardly so as to feed the spindle 68 and the reamer carrying bracket 88 toward the workpiece through a driving connection consisting of a gear member 124, rotatably mounted upon a shaft 125 and meshing with the teeth 126 of the rack 122. Gear member 124 cooperates with a gear member 127 meshing with the teeth 128 provided therefore on the quill 70 to feed the bracket 88 toward the work. Gear member 124 terminates into a frusto-conical external surface 130 cooperating with a frusto-conical internal surface 131 of gear member 127 so as to permit the adjustment of the distance of the bracket 88 from the workpieces. Gear members 124 and 127 are held in frictional engagement by a nut 132, threadedly engaging the end of shaft 125, and by a shoulder 133 provided by a collar 134 integral with shaft 125. Upon the loosening of the nut 132, gear member 127 is biased from gear member 124 by a helical spring 135 surrounding shaft 125 and positioned in a recess in gear member 124. Adjustment of the bracket 88 or spindle 68 relative to the casing 54 is limited by a pin 136, carried by gear member 124, which pin travels in an arcuate slot 137 in gear member 127. As best seen in Fig. 3, gear members 124 and 127 are limited in their relative angular movement by the lengths of the slot 137. The end of shaft 125 terminates in the square portion 138 which permits the operator to adjust the spindle 68 without dismantling the machine. The mechanism for retracting the spindle 68 from the work comprises, as best seen in Figs. 4 and 7, a spiral spring 140 which has a hooked end 141 engaging a recess provided therefor in a cylindrical portion 142 of gear member 124, and a hooked end 143 engaging a recess in a cup shaped member 144 which is rotatably mounted in the end plate 114. In order to adjust the tension of spring 140, member 144 has been provided with ratchet teeth 145 which cooperate with a pawl 146 mounted on a pin 147 carried by end plate 114. The spring 140 urges the spindle 68 away from the workpieces and the cam follower 122 upwardly as viewed in Fig. 3.

A device has been provided to stop the mechanism for reciprocating the spindle 68 after the latter has been retracted to the normal up position shown in Fig. 2. This stopping device consists of a cam projection 150 integral with member 118 which engages a releasing lever 151, mounted on a pivot 152 which is carried by the casing 54. In Figs. 3, 5 and 8 it may be seen that as the cam projection 150 strikes the lever 151 member 118 will be biased against the force of a helical spring 152*a* intermediate said member and spiral cam 119 so as to disengage the radial teeth 116 and 117 whereby member 109 will rotate without rotating member 118 and the parts driven thereby. When the operator desires to have the spindle 68 reciprocated once, he presses upwardly on a rod 153 as viewed in Fig. 3 by a mechanism which will be described later. Rod 153 which is pivotally connected to lever 151 and normally urged downwardly as viewed in Fig. 3 by a spring 154, then rotates lever 151 in a counterclockwise direction as viewed in Fig. 3, whereby the same clears the cam projection 150 thus permitting the spring 152*a* to actuate member 118 so that the teeth 117 and 116 may engage. The rod 153 is moved upwardly against the tension of spring 154 by a pedal (not shown) which, when actuated, pulls a rod 155 downwardly as viewed in Fig. 2, which rod turns a lever 156 clockwise and through a pivot connection between said lever and the rod 153 moves the latter upwardly for effecting the engagement of the teeth 116 and 117 of

members 109 and 118, respectively. The lever 156 is pivotally mounted as at 157 to a bracket 158 which is attached to the frame 20 by screws 159.

In order to relieve the torsion on the quill 70, frame 88 carries a bushing 160 which cooperates with a rod 161, firmly supported by a block 162 which is attached to the casing 54 by suitable screws 163. The block 162 also holds the key 78 in position so that it cannot be moved out of its key seat.

The means for moving two movable jaws of two axially aligned pairs of jaws in position A so as to clamp a pair of workpieces will now be described with special reference to Figs. 2 and 9. Movable in unison with the bracket 88 is a plate 170 which is interposed between said bracket and the tubular sleeves 91 and 92. Hinged to the plate 170 as at 171 is a bar 172, providing an annular recess 173 adapted to receive a cylindrical bar 174. The recessed bar 172 is provided with diametrically opposite oblong slots 175 and 176 for limiting the movement of a pin 177, carried by the cylindrical bar 174. Normally this bar 174 is urged into a lowermost position as shown in Fig. 2 by a spring 178 which is located in the recess 173. It will be noticed in Fig. 2 that the frustro-conical end 180 of the cylindrical bar 174 projects beyond the reamers 50, therefore, when the bracket 88 moves toward the work, the frustro-conical end of the bar 174 will first engage the beveled opposite edges of a pair of axially aligned movable jaws in position A, and move the same toward their perspective stationary jaws, thereby compressing the workpieces substantially into their compressed state in use before the reamers operatively engage the apertures thereof. This has the advantage of producing a clamp which aperture is slightly oval when uncompressed but cylindrical when compressed and therefore uniformly engages the male member to which the clamp is attached when in use.

The machine also provides an indexing mechanism for the drum which will now be described with particular reference to Figs. 1 and 2. One end of shaft 110 (see Figs. 3 and 5) which makes one revolution for each reaming operation extends beyond the gear retaining cap 113 and has mounted thereon in any suitable manner a disc 190 which is provided with a diametrical dove tail shaped groove 191 adapted to receive the corresponding head of a screw 192 which extends through an aperture of a rod 193. A nut 194 threaded upon the free end of the screw 192 holds the rod 193 in position thereon. Any suitable means may be adapted to lock the screw head within the groove 191 after having been properly adjusted to a desired position therein. The free end of the rod 193 is pivoted at 195 to a plate 196 which is pivoted at 197 to the bearing bracket 23. This plate 196 pivotally carries a pawl 198, yieldingly urged into engagement with the ratchet teeth 199 of the disc 27 which is keyed to the drumshaft 24 by a spring 198a. As has been stated earlier, the shaft 110 rotates counterclockwise as viewed in Fig. 3 and clockwise as viewed in Fig. 1. The position of the disc 190 as shown in Fig. 1 is that in rest. When the shaft 110 commences to rotate the rod 193 is moved upwardly as viewed in Fig. 1, thereby rocking the plate 196 clockwise whereby the pawl 198 indexes the ratchet disc 27 and therewith the drum 25 so that the jaws in loading position B move into operating position A. The indexing operation took place during the first 180° revolution of the shaft 110 in counterclockwise direction as viewed in Fig. 3, during which time the roller 120 of the rack 122 rolls over a concentric portion of the cam 119. No axial movement of the quill 70 takes place therefore while the indexing operation takes place. After the first half revolution of cam 119 the sloping portion of the cam 119 contacts with the roller 120 whereupon the rack 122 commences to move downwardly thereby effecting downward movement of the reamers 50 in the described manner.

In the operation of the machine the operator inserts one workpiece between each pair of separated jaws in position B. The operator then steps on a pedal (not shown) thereby effecting engagement of the teeth 117, 116 in the described manner whereupon the shaft 110 commences to rotate. During the first half revolution of the shaft 110 the detailedly described indexing operation takes place while during the second half revolution of shaft 110 the continuously rotating reamers 50 are advanced toward the work in position A. The frustro-conical end of bar 174 first engages the opposite beveled edges 40 of the movable jaws 29 thereby compressing the workpieces into their compressed state in use. Upon continued downward travel of the bracket 88 the reamers operatively engage the apertures of the workpieces and ream the same to a desired size. The relative motion between the bar 174 and the bracket 88 during the actual reaming of the workpieces is taken up by the spring 178. Toward the end of a complete revolution of shaft 110 the roller 120 is allowed quickly to move into engagement with the concentric portion of the cam 119. The spiral spring 140 which has been wound up during the greater part of the second half revolution of the cam 119 is suddenly released when the roller reaches the peak 200 of the cam 119 as can be understood from Fig. 3, whereupon the quill 70 together with bracket 88 and the reamers 50 is returned to normal up position again, which position is illustrated in Figs. 1 and 2. Although the reamers are continuously rotated, the quill 70 and the parts moving therewith rest again in the up position after one reciprocation due to the camming out of driven member 118 from driving engagement with member 109 by cam lug 150 and the cooperating lever 151 which has been restored to normal position again by spring 154 after the operator has released the pedal, which takes place before one complete revolution of shaft 110. The operator places workpieces between the separated jaws in loading position B while a reaming operation takes place in position A, so that no extra time is required for loading purposes and the operation may proceed with a new reaming operation immediately after a completed reaming operation. As the drum 25 is indexed in counterclockwise direction as viewed in Fig. 1 it is obvious that the reamed clamps finally fall off the separated jaws onto a suitable chute 205.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A machine for cutting the bore of a clamp to size comprising, in combination, a cutting tool; a mechanism for reciprocating the cutting tool in order operatively to engage the same with the bore of a clamp; a rotary drum; equally spaced clamp holders on the drum, each of said clamp holders comprising two parts; means actuated in

response to the operation of the tool reciprocating mechanism for effecting relative movement between the parts of a clamp holder aligned with the cutting tool, thereby compressing the clamp into its compressed state in use and maintaining the clamp in such a state during the cutting operation; a device for indexing the drum in response to the operation of the tool reciprocating mechanism; and means for actuating the mechanism.

2. A machine for cutting the bore of a clamp to size comprising, in combination, a cutting tool; a mechanism for reciprocating the cutting tool in order operatively to engage the same with the bore of a clamp; a rotary drum; equally spaced clamp holders on the drum, each of said clamp holders comprising a stationary and a movable part; means actuated in response to a work-stroke of the cutting tool for moving the movable part of the clamp holder which is aligned with the cutting tool relative to the other part thereof, thereby compressing the clamp into its compressed state in use and aligning the bore of the same with the approaching cutting tool; means for maintaining the clamp in its compressed state during a cutting operation; a device for indexing the drum in response to the operation of the tool reciprocating mechanism; and means for actuating the mechanism.

3. A machine for cutting the bore of a clamp to size comprising, in combination, a cutting tool; a mechanism for reciprocating the cutting tool in order operatively to engage the same with the bore of a clamp; a rotary drum; equally spaced clamp holders on the drum, each of said clamp holders comprising two parts; a ratchet wheel on said drum; a pawl yieldingly urged into engagement with the ratchet teeth; means for operating the pawl so as to index the drum while the cutting tool is at rest; means actuated in response to the operation of the tool reciprocating mechanism for effecting relative movement between the parts of a clamp holder aligned with the cutting tool, thereby compressing the clamp into its compressed state in use and maintaining the clamp in such a state during the cutting operation; and means for actuating the mechanism.

4. A machine for cutting the bore of a clamp to size comprising, in combination; a cutting tool; a mechanism for reciprocating the cutting tool in order operatively to engage the same with the bore of a clamp; a rotary drum; equally spaced clamp holders on the drum, each of said clamp holders comprising a stationary and a movable part; a ratchet wheel on said drum; a pawl yieldingly urged into engagement with the ratchet teeth; means for operating the pawl so as to index the drum while the cutting tool is at rest; means actuated in response to a work-stroke of the cutting tool for moving the movable part of the clamp holder which is aligned with the cutting tool relative to the other part thereof, thereby compressing the clamp into its compressed state in use and aligning the bore of the same with the approaching cutting tool; means for maintaining the clamp in its compressed state during a cutting operation; and means for actuating the mechanism.

5. A machine for cutting the bore of a clamp to size comprising, in combination, a cutting tool; a mechanism for reciprocating the cutting tool in order operatively to engage the same with the bore of a clamp; a rotary drum; equally spaced clamp holders on the drum each of said clamp holders comprising a stationary and a movable part; a ratchet wheel on said drum; a pawl yieldingly urged into engagement with the ratchet teeth; means actuated in response to the operation of the tool reciprocating mechanism for indexing the pawl thereby rotating the drum so as to align the consecutive workpiece with the cutting tool; means actuated in response to a work-stroke of the cutting tool for moving the movable part of the clamp holder which is aligned with the cutting tool relative to the other part thereof, thereby compressing the clamp into its compressed state in use and aligning the bore of the same with the approaching cutting tool; means for maintaining the clamp in its compressed state during a cutting operation; and means for actuating the mechanism.

6. A machine for cutting the bore of a clamp to size comprising, in combination, a prime mover; a cutting tool continuously rotated by the prime mover; a mechanism for reciprocating the cutting tool in order operatively to engage the same with the bore of a clamp; a rotary drum; equally spaced clamp holders on the drum, each of said clamp holders comprising two parts; a ratchet wheel on said drum; a pawl yieldingly urged into engagement with the ratchet teeth; means actuated in response to the operation of the tool reciprocating mechanism for indexing the pawl thereby rotating the drum so as to align the consecutive workpiece with the cutting tool; means actuated in response to the operation of the tool reciprocating mechanism for effecting relative movement between the parts of a clamp holder aligned with the cutting tool, thereby compressing the clamp into its compressed state in use and maintaining the clamp in such a state during the cutting operation; means for drivingly connecting the mechanism with the prime mover for one work-stroke of the cutting tool; and a spring released in response to a finished work-stroke of the cutting tool for moving the same on its reverse stroke, said spring being compressed by the movement of the cutting tool on its work-stroke.

7. A machine for cutting the bore of a clamp to size comprising, in combination, a prime mover; a cutting tool continuously rotated by the prime mover; a mechanism for reciprocating the cutting tool in order operatively to engage the same with the bore of a clamp; a rotary drum; equally spaced clampholders on the drum, each of said clamp holders comprising a stationary and a movable part; a ratchet wheel on said drum; a pawl yieldingly urged into engagement with the ratchet teeth; means actuated in response to the operation of the tool reciprocating mechanism for indexing the pawl thereby rotating the drum so as to align the consecutive workpiece with the cutting tool; means actuated in response to a work-stroke of the cutting tool for moving the movable part of the clamp holder which is aligned with the cutting tool relative to the other part thereof, thereby compressing the clamp into its compressed state in use and aligning the bore of the same with the approaching cutting tool; means for maintaining the clamp in its compressed state during a cutting operation; means for drivingly connecting the mechanism with the prime mover for one work-stroke of the cutting tool; and a spring released in response to a finished work-stroke of the cutting tool for moving the same on its reverse stroke, said spring being compressed by the movement of the cutting tool on its work-stroke.

8. A machine for cutting the bores of clamps to

size comprising in combination, a pair of continuously rotating cutting tools; a rotary drum; equiangularly spaced pairs of clampholders on the periphery of the drum, each pair being aligned axially with respect to the drum and each clampholder having a stationary and a movable part and the movable parts of each pair of axially aligned clampholders being intermediate the stationary parts thereof; means for indexing the drum in order to align consecutive pairs of clampholders with the cutting tools; means for simultaneously reciprocating the cutting tools in order operatively to engage the same with the bores of the aligned clamps; and a single member yieldingly movable with the cutting tools for simultaneously engaging and moving the movable parts of the aligned pair of clampholders toward their respective stationary parts in order to compress the clamps sufficiently so that the bores thereof are properly aligned with the cutting tools.

9. A machine for cutting the bores of clamps to size comprising, in combination, a pair of continuously rotating cutting tools; a rotary drum; equi-angularly spaced pairs of clampholders on the periphery of the drum, each pair being aligned axially with respect to the drum and each clampholder having a stationary and a movable part and the movable parts of each pair of axially aligned clampholders being intermediate the stationary parts thereof; means for indexing the drum in order to align consecutive pairs of clampholders with the cutting tools; means for simultaneously reciprocating the cutting tools in order operatively to engage the same with the bores of the aligned clamps; and a single wedge yieldingly movable with the cutting tools for simultaneously engaging and moving the movable parts of the aligned pair of clampholders toward their respective stationary parts in order to compress the clamps sufficiently so that the bores thereof are properly aligned with the cutting tools.

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