

March 26, 1940.

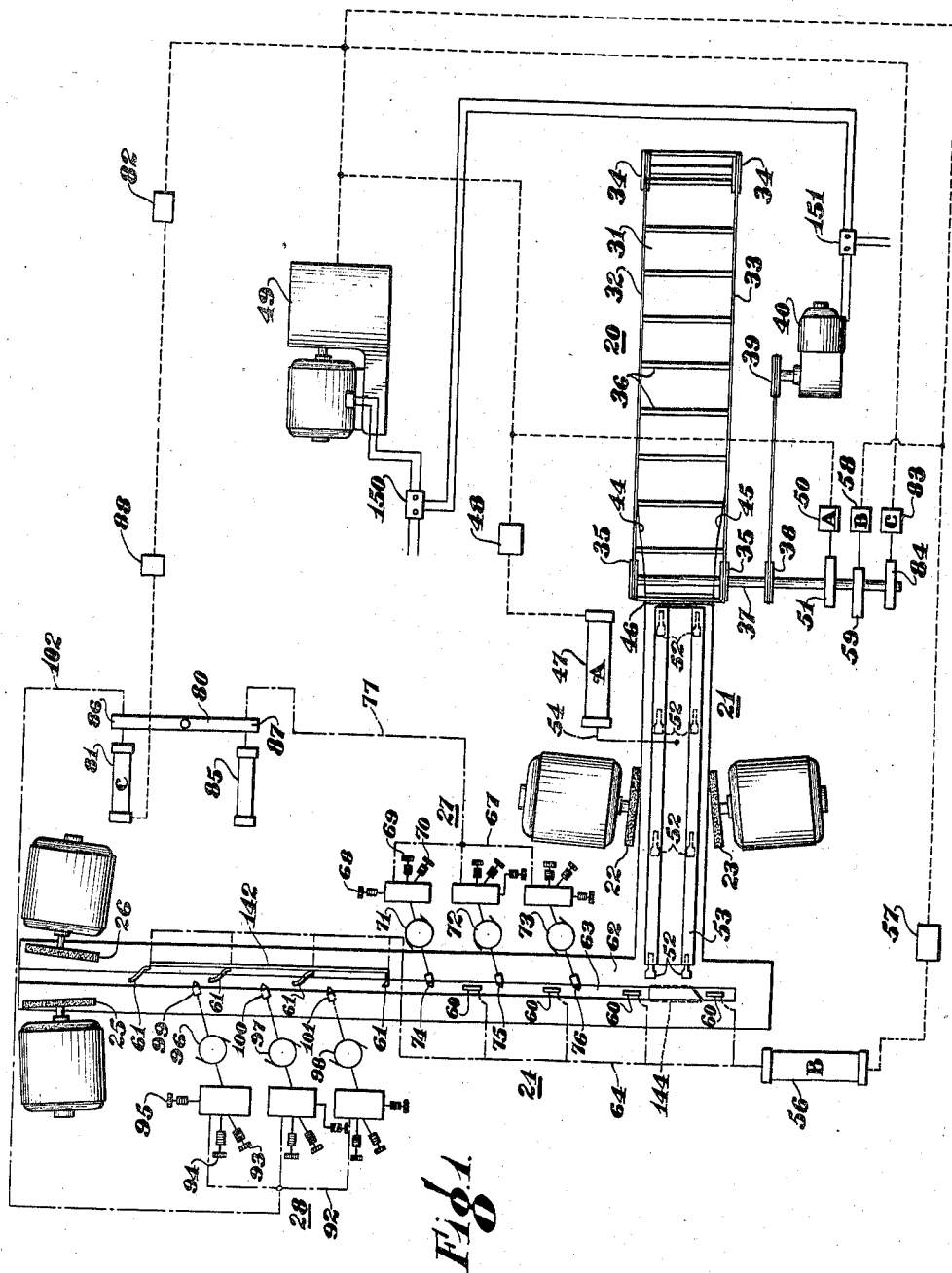
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2,194,757

FINISHING MACHINE

Filed Sept. 10, 1938

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

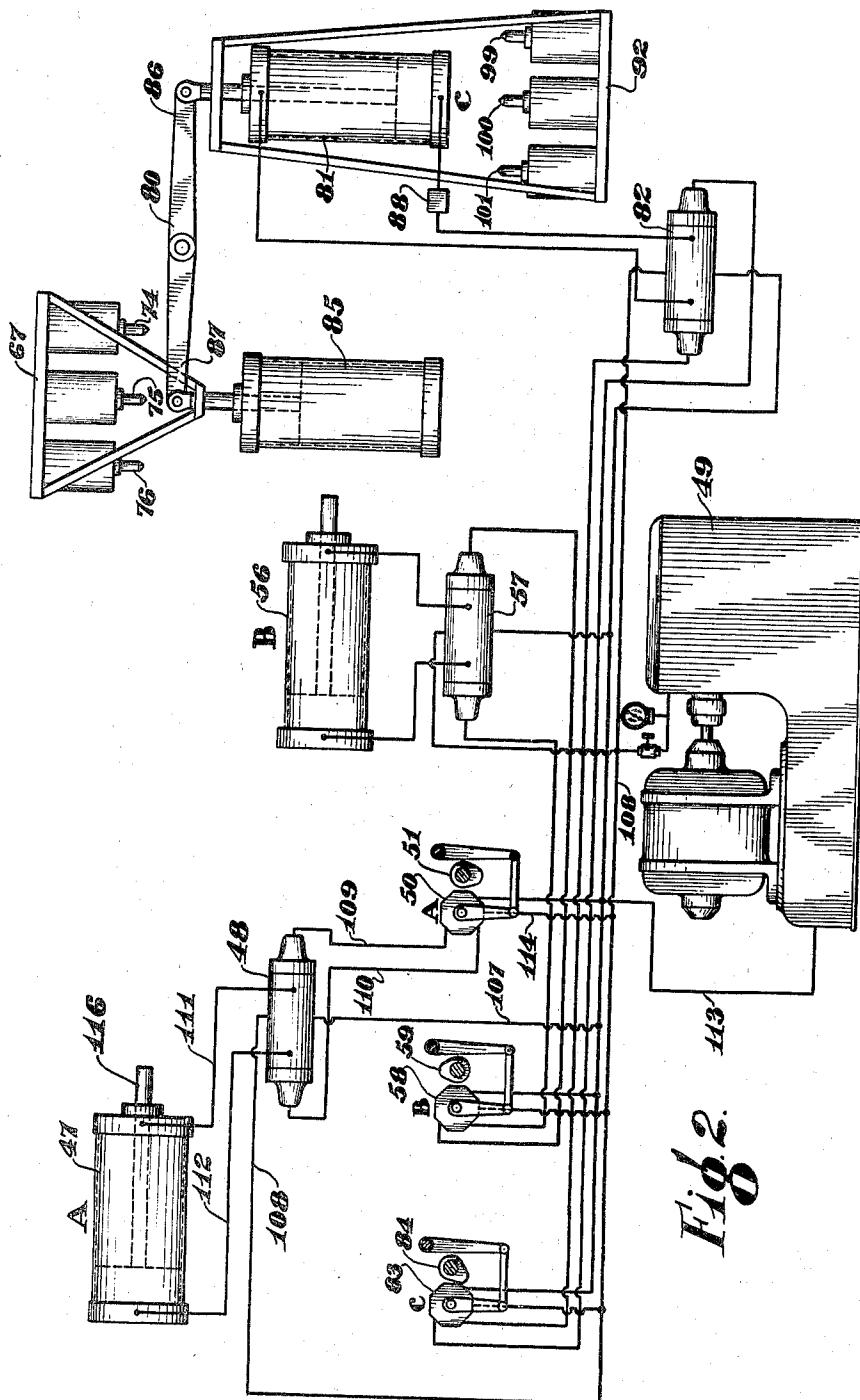


Fig. 2.

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4 Sheets-Sheet 3

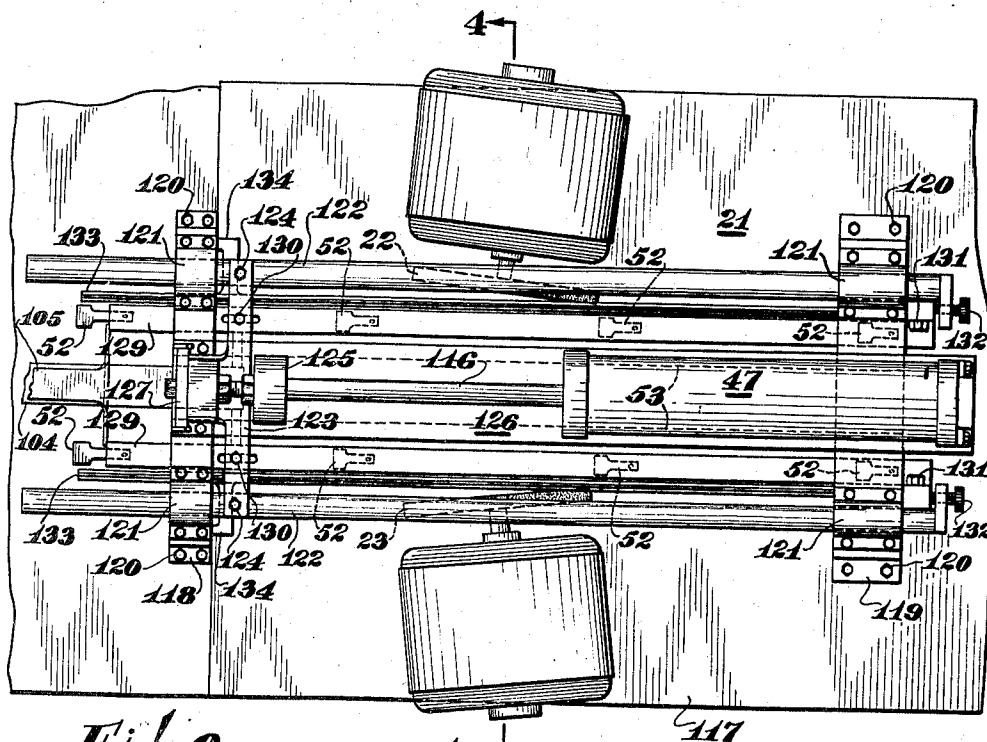


Fig. 3.

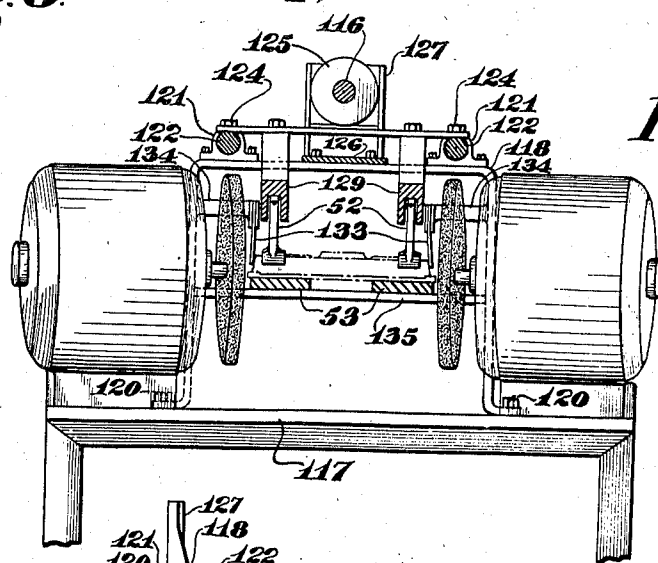


Fig. 4.

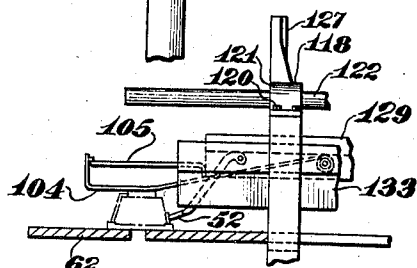


Fig. 5.

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4 Sheets-Sheet 4

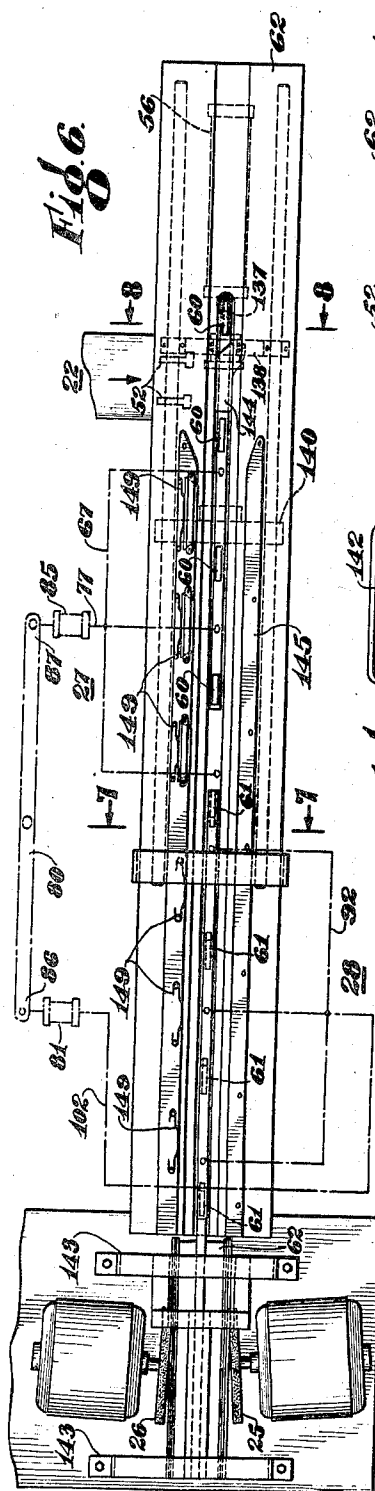


Fig. 6.

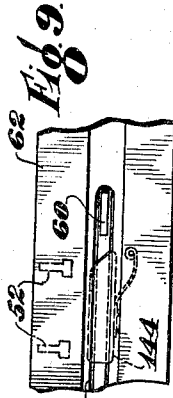


Fig. 9.

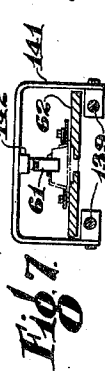


Fig. 7.

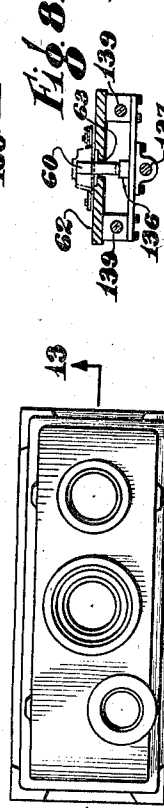


Fig. 8.

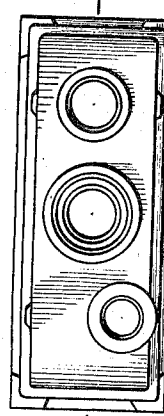


Fig. 12.

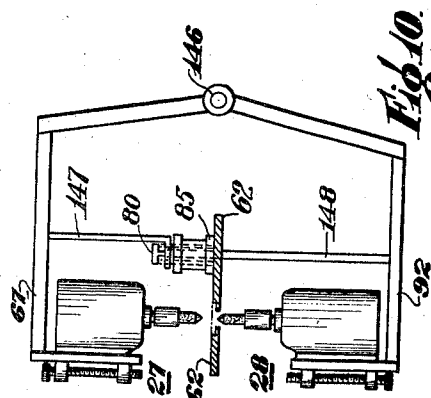


Fig. 10.

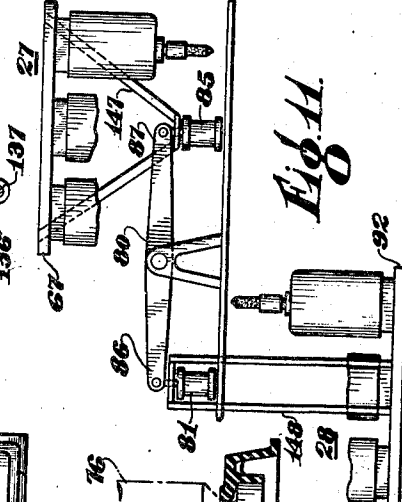


Fig. 11.

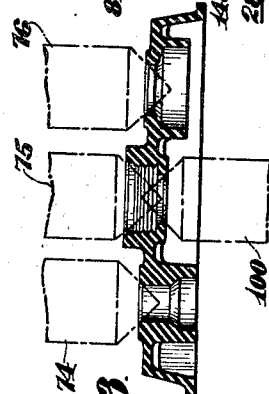


Fig. 13.

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UNITED STATES PATENT OFFICE

2,194,757

FINISHING MACHINE

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Application September 10, 1938, Serial No. 229,364

10 Claims. (Cl. 51-112)

Our invention relates in general to a mechanism for finishing the peripheral edges of battery top members and the apertures therein and more particularly to a mechanism of the class described which is completely automatic in operation.

In the manufacture of the hard rubber covers of battery boxes, it is necessary to finish the peripheral edges and the apertures therein which are rough and irregular as they are removed from the molds in which they are formed. The present invention will be described with reference to a machine for finishing the hard rubber covers of battery boxes, but it is to be clearly understood that the invention is not limited to this specific application and when the words "battery top members" are used in this application, it is to be clearly understood that these words are not limited to hard rubber covers for battery boxes but includes any article having marginal edges to be finished.

An object of our invention is the provision of a mechanism of the class described which will finish the peripheral edges of battery top members and the apertures therein without any manual work, except for the feeding of the battery top members into the machine or mechanism.

Another object of our invention is the provision of guiding the battery top members through the mechanism by means of resilient engaging members which engage the lateral sloping sides of the battery top members.

Another object of our invention is the provision of moving the battery top members through the machine at spaced distances between the same by reciprocating or actuating feed means which, upon the forward motion of the reciprocation, engages and moves the battery top members forward to the next successively advanced positions and which, upon the termination of the rearward movement of the reciprocation, engages the next rearwardly positioned battery top members in readiness for the next successive advancement.

Another object of our invention is the provision of finishing the apertures in the battery top members as the battery top members remain stationary during the rearward movement of the reciprocation of the feed means.

Another object of our invention is the provision of coordinating the feed means which moves the battery top members progressively through the finishing mechanism and the aperture finishing means to give complete automatic performance throughout the entire travel of the battery top member through our mechanism.

Another object of our invention is the provision

of fluid controlled arrangements for co-ordinating the several finishing operations performed by our machine in which the fluid controlled arrangements are governed by a plurality of cam actuating members driven from a single shaft.

Another object of our invention is the provision of positioning the grinding wheels at a slight angle with reference to the travel of the battery top members, particularly with the entrance edge of the grinding wheels closer together than the exit edge of the grinding wheels so that freedom of travel is provided to the battery top members as they pass between the grinding wheels.

Another object of our invention is the provision of adjustment means to cause the battery top members to move substantially square between the grinding means to insure that they move in a true right angular line.

Another object of our invention is the provision of adjustment means to accommodate battery top members of different dimensions and configurations.

Other objects and a fuller understanding of our invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings in which:

Figure 1 represents a diagrammatic illustration of our invention and particularly shows the travel taken by the battery top members and the finishing actions performed thereon as they travel from the entrance end of our mechanism to the exit end, where the battery top members are completely processed;

Figure 2 is a diagrammatic illustration of the fluid control arrangements to co-ordinate the several processing operations performed upon battery top members as they travel through our mechanism;

Figure 3 is a fragmentary view showing the structural features of the first reciprocating feed means of our mechanism which feed the battery top members broadwise between a first pair of spaced grinding means to grind the end edges;

Figure 4 is a cross-sectional view taken along the line 4-4 of Figure 3;

Figure 5 is a fragmentary side view of the mechanism in Figure 3 and shows particularly a spring means to hold the battery top members upon the base upon which they slide;

Figure 6 is a plan view of the second reciprocating feed means of our mechanism which feeds the battery top members lengthwise through a second pair of spaced grinding means to grind the longitudinal edges of the battery top members, and shows in addition diagrammatically

the aperture finishing means for finishing the apertures in the battery top members as they are progressively advanced to the second grinding means;

5 Figure 7 is a cross-sectional view taken along the line 7—7 of Figure 6;

Figure 8 is a cross-sectional view taken along the line 8—8 of Figure 6;

10 Figure 9 is a fragmentary plan view of a portion of Figure 6, and illustrating particularly the arrangement of a trap or a resilient latch which prevents interference between the first reciprocation feed means and the second reciprocation feed means, where the forwardmost part of the first feed means delivers the top battery members to the rearwardmost part of the second reciprocation feed means;

15 Figure 10 is a side view illustrating the mechanism for moving the aperture finishing means into and out of the apertures in the battery top members, as they are moved progressively and intermittently along and towards the second grinding means;

20 Figure 11 is a front elevational view of the aperture finishing means shown in Figure 10;

25 Figure 12 is a top plan view of a battery top member which may be finished by passing it through our mechanism, and

30 Figure 13 is a longitudinal cross-sectional view taken along the line 13—13 of Figure 12, and shows by dash-and-dot lines the position of the aperture finishing means for processing the apertures in the battery top members.

35 A typical battery top member is shown in Figure 12, and in the molding of these battery top members, the peripheral edges and the apertures therein, as they are taken out of the molds, in which they are formed, have rough or irregular edges which must be finished. In the finishing of the peripheral edges and the apertures in the battery top members by means of our machine, the battery top members are first fed into the machine broadly and thence in the first reciprocating feed means where the end edges are 40 ground as they progressively pass at spaced distances between the first pair of spaced grinding means. After this the battery top members are delivered to a second reciprocating feed means, which is positioned substantially at right angles to the first reciprocating feed means, where the 45 battery top members are progressively advanced at spaced distances between the second pair of grinding means where the longitudinal edges of the battery top members are ground to a smooth finish. As the battery top members are progressively and intermittently advanced to the second pair of grinding means, the peripheral edges of the apertures are processed by means of grinding tools which move in-and-out in timed sequence. The positions occupied by the grinding 50 tools for smoothing the edges of the apertures in the battery top members are illustrated by the dash-and-dot lines in Figure 13. Our mechanism is adapted to finish battery top members of a large variety and of different sizes and of different aperture arrangements. In certain battery top members, the apertures are provided with lead inserts which must be processed, and in these battery top members the working tools are designed to have a working end to give the proper inside and outside finish to the lead inserts.

75 With particular reference to Figure 1, diagrammatically illustrating the several operatively associated parts to perform the finishing opera-

tions, our invention comprises generally an advanced feed means 20, which delivers the battery top members broadly to the first reciprocating feed means 21 where the battery top members are advanced progressively at spaced distances between the same through the first pair of spaced grinding means or wheels 22 and 23 after which the battery top members are delivered to the second reciprocating feed means 24 which is positioned substantially at right angles to the first reciprocating feed means 21. The second reciprocating feed means 24 progressively advances the battery top members longitudinally or lengthwise to the second pair of spaced grinding means or wheels 25 and 26. The apertures in the battery top members, as they are progressively advanced along by the second reciprocating feed means 24, are processed from above by means of the aperture finishing means 27 and are processed from below by means of the aperture finishing means 28.

The advanced feed means 20 may be of any particular construction and comprises generally a bed arrangement 31 having side members 32 and 33 between which an endless conveyor operates around spaced sprocket wheels 34 and 35. The endless conveyor is provided with transversely arranged feed members 36 which engage the rearward longitudinal side edges of the battery top members and move them at spaced distances to the first reciprocation feed means 21. The endless conveyor having the transverse feed members 36 may be driven by means of a shaft 37 having a sprocket wheel 38 driven by a suitable chain from a sprocket wheel 39 actuated by a motor-driven gear reducer 40. As the battery top members approach the first reciprocation feed means 21, they are guided between converging guide members 44 and 45 which direct the battery top members to the first reciprocating feed means 21. A narrow space is provided between the end of the advanced feed means 20 and the reciprocating feed means 21 to afford room for the transversely arranged feed members 36 to pass therebetween. Positioned in the narrow space is a spring trap door 46 which may be biased downwardly to allow the transversely arranged feed member 36 to pass therethrough.

Just as soon as the transverse arranged feed member 36 passes therethrough, the spring trap door 46 swings upwardly and provides a smooth flat surface for the battery top members to move upon the first reciprocating feed means 21.

The first reciprocating feed means 21 comprises generally a base 52 upon which the battery top members may slide, and four sets of longitudinally spaced, hinged mounted engaging means 52 which engage the rearward longitudinal side of the battery top members and progressively move them forward broadly between the two grinding means 22 and 23. As illustrated diagrammatically, the first reciprocating feed means 21 is actuated by a two-way piston mechanism 47, in which the dash-and-dot line 54 indicates the actuating mechanism between the piston 47 and the first reciprocating feed means 21. The two-way piston mechanism 47 is governed by a fluid control valve 48 which is in turn governed by a pilot valve 50 actuated by a cam 51 mounted upon the shaft 37. The motor driven fluid pump 49 provides a source of fluid under pressure for actuating the fluid parts of our mechanism.

The second reciprocating feed means 24 is actuated by a two-way piston mechanism 56 which

is governed by a control valve 57 which is in turn governed by the pilot valve 58 by means of a cam 59 mounted upon the shaft 37. The second reciprocating feed means 24 is provided with four spaced, hingedly mounted engaging means 60 and four spaced engaging means 61. The spaced engaging means 60 and 61 are arranged in straight alignment, and are adapted to be reciprocated in a longitudinal central opening 63 provided within the base 62 of the second reciprocating feed means 24. As illustrated diagrammatically, the four longitudinally spaced engaging means 60 are actuated by suitable connections beneath the base 62 and the four longitudinally spaced engaging means 61 are actuated by suitable connections positioned above the base 62. The actuating connections or mechanism for operating the longitudinal engaging means 60 and 61 is indicated by the dash-and-dot line 64 which leads from the two-way piston mechanism 56. As the engaging means 52 of the first reciprocating means 21, and the engaging means 60 and 61 of the second reciprocating means 24, are actuated, they engage the battery top members upon their forward movement and move the battery top members to the next successive advanced positions; as the spaced engaging means move rearwardly the battery top members remain stationary in their forwardmost positions, and as the engaging means reach the termination of their most rearward portion of the reciprocation they engage the next rearwardly positioned battery top members, which are in readiness for the next successive advancement.

On the backward stroke the engaging means, since they are hingedly mounted, clear the battery top members and engage them on their rearward side at the termination of the stroke.

As the battery top members remain stationary during the rearward movement of the reciprocation of the second feed means 24, the apertures in the battery top members are processed from above and from below. The processing of the apertures in the battery top members from above is performed by three spaced grinding or work tools 74, 75, and 76 carried by a suitable head indicated by the dash-and-dot line 67 having three individual sub-cross-heads. The work or grinding tools 74, 75, and 76 are respectively and individually actuated by electric motors 71, 72, and 73 which are separately carried by the sub-cross-heads. As illustrated diagrammatically, the three sub-cross-heads are each adjustable in three dimensions. The set screw adjustments 68 are arranged to actuate the individual sub-cross-heads endwise in a horizontal plane, the set screw adjustments 69 are arranged to move the individual sub-cross-heads broadwise in a horizontal plane, and the adjustment set screws 70 are arranged to move the individual sub-cross-heads in a vertical plane. The purpose of the individualized adjustments of the sub-cross-heads is to accommodate the positioning of the grinding or work tools 74, 75 and 76 with reference to the apertures of the battery top members of any particular arrangement.

The entire cross-head 67 is arranged to be actuated by a fulcrum member 80 which in turn is actuated by a two-way piston mechanism 81 governed by a control valve 82 which is in turn controlled by a pilot valve 83 actuated by a cam 84 upon the shaft 37. As illustrated, the two-way piston 81 is connected to the end 86 of the fulcrum member 80. In order to give smooth operation, the end 87 of the fulcrum member 80

is connected to a dash pot 85 indicated by the reference character 85. The actuating structure for operating the entire cross-head 67 by means of the fulcrum member 80 is indicated by the reference character 147.

The processing of the apertures upon the underneath side of the battery top members is performed by the work or grinding tools 99, 100 and 101 carried respectively by the three sub-cross-heads of the entire cross-head arrangement indicated by the reference character 92. The work or grinding tools 99, 100 and 101 are respectively actuated by the electric motors 96, 97 and 98 carried respectively by the three sub-cross-heads of the entire cross-head 92. Each of the sub-cross-heads is arranged to be adjustable in three dimensions. The sub-cross-heads may be individually adjusted edgewise in a horizontal plane by means of the adjustment screws 95 and may be adjusted broadwise in a horizontal plane by the adjustment screws 94 and may be adjusted vertically by the adjustment screws 93. For the battery top member shown in Figures 12 and 13, only the middle finishing tool 100 is used underneath. The entire movement of the complete cross-head 92 is actuated by the end 86 of the fulcrum member 80 through means of a structural arrangement indicated generally by the reference character 148. The movement of the fulcrum member 80 is arranged to be slow and restricted as the aperture finishing means 27 and 28 are brought towards the battery top members. The movement, however, is unrestricted as the aperture finishing means 27 and 28 are moved away from the battery top members. The restricted movement of the fulcrum member 80 is governed by a one-way restriction valve 88 connected in fluid communication to the piston mechanism 81. This one-way restriction valve 88 permits fluid to flow restrictedly to the piston mechanism 81 as the aperture finishing means 27 and 28 are moved towards the battery top members for the finishing process, but allows the fluid to flow unrestrictedly as the aperture finishing means 27 and 28 are moved from the battery top member after the finishing processes are performed. The cam 84 controlling the pilot valve 83 governs the in and out movement of the aperture finishing means 27 and 28 in such sequence that the aperture feeding means 27 and 28 are actuated toward the battery top members for processing the apertures therein and away from the battery top members after the process is finished during the interval that the second reciprocating feed means moves rearwardly and when the battery top members are stationary. In other words, the operation or timing between the movements of the first and second reciprocating feeding means and the aperture finishing means 27 and 28 are governed by the arrangement of the shape of the cams 51, 59 and 84 actuated by the shaft 37.

The diagrammatic illustration of the fluid connections for operating the several fluid parts of our mechanism is shown in Figure 2. Thus, for example, the actuation of the two-way piston mechanism 47 takes place in the following manner. Let it be assumed that the cam 51 has actuated the pilot valve 50 in such direction as to cause the piston rod 116 of the piston mechanism 47 to move to the right in Figure 2. Under this assumption, the fluid from the motor driven pump 49 flows through feed pipes 103 and 114 to the pilot valve 50 and thence through arrangement of port connections in the pilot valve 50

the fluid is caused to flow through the pipe 109 to the control valve 48. The delivery of the fluid through the pipe 109 to the control valve 48 causes the valve arrangements therein to shift and force the fluid on the left-hand end of the control valve 48 to flow out through the pipe 110 to the pilot valve 50 and thence through port arrangements therein the fluid is discharged or drained to the motor driven pump through the pipe 113. Actuation of the control valve assembly within the control valve 48 to the left, causes fluid under pressure to be delivered through the feed pipe 108 to the control valve 48 and thence through arrangements of port connections therein the fluid under pressure is delivered through the pipe 112 to the rear of the cylinder of the piston mechanism 47. The delivery of the fluid through the pipe 112 under pressure to the piston mechanism 47 forces the piston rod 116 to the right for actuating the first feed reciprocating means 21. The actuation of the piston to the right forces the fluid on the right-hand end of the piston mechanism 47 therefrom through the pipe 111 to the control valve 48, and from there through the port connections therein, the discharged fluid flows through the pipes 107 and 113 to the motor driven pump 49. The actuation of the piston mechanism 56 through the control valve 47 and the pilot 48, and the actuation of the piston mechanism 85 through the control valve 82 and the pilot valve 83 is the same as that described with reference to the piston mechanism 47 controlled by the control valve 48 and the pilot valve 50. Therefore, the governing of the several parts of our invention is controlled hydraulically by means of the cams 51, 59 and 84 driven by a common shaft.

A somewhat detailed arrangement of the first reciprocating feed means 21 is illustrated in Figures 3, 4 and 5, in which the piston mechanism 47 is arranged through the piston rod 116 to actuate reciprocally the feeding mechanism for progressively advancing the battery top members at spaced distances broadwise through the two grinding wheels 22 and 23. As illustrated, the first reciprocating feed means 21 may be suitably carried by means of a support or table 117 upon which are mounted at spaced distances two inverted U-shaped brackets 118 and 119. The two spaced U-shaped brackets 118 and 119 are connected to the support 117 by the cap screws 120 and are arranged to carry the mechanism for carrying out the reciprocating movement. Mounted upon the two inverted U-shaped brackets 118 and 119, are four slide bearing brackets 121 through which longitudinal slide rods 122 arranged parallel to each other, are adapted to reciprocate. Attached to the left-hand end portion of the two parallel arranged slide rods 122, is a cross-head 123 which is actuated by the piston rod 116. The piston rod 116 may be connected to the cross-head 123 in any suitable fashion such as illustrated by the threaded end, and the cross-head 123 may be connected to the two parallel slide rods by the cap screws 124. A cushioning pad 125, preferably made from a block of rubber, may be connected to the outermost end of the piston rod 116 to take care of any shock as the piston rod 116 is moved to the right against the piston mechanism 47. The pad 125 encircles the rod 116 and is securely fastened to the rod 116 by any suitable securing means. The position of the pad 125 on the rod 116 is such that the pad 125 strikes the end of the cylinder of the piston mechanism 47 upon the movement of the rod 116

to the right in Figure 3 and the illustrated nut holds the pad 125 from slipping off the end of the rod. The shock is absorbed when the resilient head 125 engages the end of the cylinder of the piston mechanism 47. The outward movement of the piston rod 116 may be cushioned at its termination by means of a cushioning pad 127 suitably mounted upon the top of the inverted U-shaped member 118. The pad 127 is likewise preferably made of a block of rubber and metal confining sides and is secured in position, the confining metal sides being bolted or otherwise secured to the top of the inverted U-shaped member 118. The position of the pad 127 is such that the end of the rod 116 and illustrated nut upon its end strikes the rubber block of the pad 127 upon the movement of the rod 116 to the left in Figure 3. In other words, both ends of the stroke of the piston 116 are cushioned by means of the rubber pads 125 and 127. Positioned parallel to the two longitudinal slide rods 122 at the inside thereof, are two parallel arranged actuating members 129 which are arranged to hingedly carry the four engaging means 52 that slide over and engage the rearward side of the battery top members as they are pushed forward between the grinding means 22 and 23. The engaging means 52 may be hingedly connected to the lower edge of the actuating members 129, see Figures 4 and 5. The left-hand end portion of the actuating members 129 are slidably connected to the cross-head 123 by means of the slotted bolt connection 130. The right-hand end of the two actuating members 129 are likewise slidably connected by means of the slotted bolt connections 131 to the ends of the two slide rods 122. The actuating members 129 are arranged to be adjusted longitudinally in order that each set of the engaging members 52 may push the battery box covers between the grinding wheels 22 and 23 in a square or true alignment. The longitudinal adjustment of the actuating members 129 may be taken care of in any suitable manner and as illustrated, longitudinal slots are provided in the actuating members 129 at their left-hand end portions so that by unloosening the nut arrangement 130, the actuating members 129 may be moved longitudinally thereon. Also, the right-hand end portion of the actuating members 129 are slotted where the cap screws 131 extend therethrough, so that when the cap screws 131 are loosened, the longitudinal members may be moved longitudinally by actuating the adjustment screws 132. After the adjustment screws 132 are set, the cap screws 131 and the bolts 130 may be tightened to set the longitudinal actuating members 129 in a fixed relationship. The requirement for providing longitudinal adjustment of the actuating members 129 arises from the fact that the covers for battery boxes are not always the same on both ends, such for example, one end may be provided with a boss which means that the engaging means 52 attached to the longitudinal actuating member 129 on that particular side must be shifted to accommodate the movement of the battery top members between the grinding means 22 and 23 in a square or true alignment. As illustrated best in Figure 4, the base 53 upon which the battery top members slide may be carried upon a cross member 135 connected between the upright portion of the U-shaped support brackets 118 and 119. The piston mechanism 47 is mounted on top of a longitudinal plate 126 supported upon each end by the supporting brackets 118 and 119.

As the battery top members are moved forwardly, they are guided between two transversely

arranged resilient guide members 133 which are in turn carried by side brackets 134 suitably connected to the inside of the upright portion of the inverted U-shaped brackets 118 and 119. The resilient side members 133 may be constructed of relatively thin spring steel which extend from one end of the first reciprocating feed means to the other and which resiliently engage the sloping ends of the battery top members as they are moved broadwise between the grinding wheels 22 and 23. The first reciprocating feed means 21 is co-ordinated with the advanced feed means in such manner that the rearwardmost engaging means 52 is in its most rearward position and in readiness to engage the rearward edge of the battery top members as they are delivered by the spaced transversely arranged feed members 36.

The forwardmost engaging means 52 pushes the battery top members in alignment with the rearwardmost engaging members 60 of the second reciprocating feed means, which is shown somewhat in detail in Figures 5, 6, 7, 8 and 9. As shown in Figure 5, a spring means 104 positioned above the battery top members is arranged to hold the members down against the base 62 as they are transferred from the first reciprocating feed means 21 to the second reciprocating feed means 24. A spring stop member 105 is employed to keep the spring means from springing down too far and interfering with the next forwardly moving battery top member. The four engaging means 60 are arranged to be hingedly carried by a longitudinal member 136 which in turn is actuated by the piston rod 137 driven by the piston mechanism 56. The four engaging means 60 may be hingedly connected to the longitudinal member 136 and are each arranged to extend upwardly through the longitudinal central slot 63 in the base 62 and actuate the battery top members progressively forward. The reason that the four engaging means 60 are positioned underneath of the base 62 is that the space above the battery top members must be free for the access of the grinding or work tools 74, 75 and 76 which finish the apertures in the top of the battery top members. The four engaging means 61 are hingedly carried by a longitudinal actuating over-head member 142 which is carried at one end by an inverted U-shaped bracket 141 reciprocally actuated by the slide rods 139 which are connected to the cross-head 138 actuated by the piston rod 137. As illustrated, the slide rods 139 which actuate the four engaging means 61 may be guided underneath the base 62 within brackets mounted upon a cross-head or support 140. The forward end of the overhead actuating member 142 is slidably guided in brackets carried by the inverted U-shaped supports 143 shown on the left-hand end of Figure 6. The construction just described is such that reciprocation of the reciprocating piston mechanism 56 causes the four lower actuating engaging means 60 to operate from underneath of the base 62 and causes the four upper engaging means 61 to operate above the base 62, and progressively moves the battery top member toward and through the grinding or finishing means 25 and 26, which grind the longitudinal side edges of the battery top members.

The co-ordinating of the reciprocating motions of the first reciprocating feed means 21 and the second reciprocating feed means is such that the reciprocating motion of the first feed means is forwardmost when the reciprocating

motion of the second feed means is rearwardmost. Therefore, the forwardmost engaging means 52 are pushing the battery box covers in alignment with the four engaging means 60 of the second reciprocating feed means at the time that the rearwardmost engaging means 60 is moving rearwardly under the battery box cover which is pushed forwardly by the forwardmost engaging means 52. In order to prevent the rearwardmost engaging means 60 from interfering with the battery box cover just being pushed forward by the engaging means 52, we provide a trap slide member 144 under which the rearwardmost engaging member 60 slides upon its rearward movement of the reciprocating sliding movement. The trap slide member 144 comprises briefly a plate member hingedly connected so that as the rearwardmost member 60 moves forward it may cause the trap plate member 144 to swing to the left to permit the engaging means 60 to move forwardly in the longitudinally central opening 63. Upon the return stroke of the engaging member 60, it is caused to slide underneath of the trap slide member 144 and prevent any interference with the battery top member which has just been pushed forward by the engaging means 52. As illustrated in Figures 4, 7 and 8, the base upon which the battery top members slides is arranged to have an intermediate portion cut away to provide a clearance, so that in case any projection extends below the peripheral edges of the battery box covers they may clear within the space provided in the base. In Figure 6, the battery top members are guided between a longitudinal slide rail 145 and spaced resilient engaging devices 149. As illustrated, the engaging devices 149 comprise a resilient spring which constrains the battery box covers over against the opposite guide rail 145. The resilient engaging devices 149 are positioned at spaced distances so that they engage the battery box covers when they are in the forwardmost position of their reciprocal movement and constrain them to remain in the forwardmost position while the engaging means 60 and 61 are being moved rearwardly to make another engagement with the succeeding battery box covers. The guide rail 145 is spaced upwardly from the base 62, so that the peripheral edge on one side of the battery box covers extends thereunder and keeps them in alignment as they are moved forwardly.

As shown in Figures 10 and 11, the finishing means 27 and 28 for the apertures in the battery box covers may be mounted upon a pivotal structure having the rearwardmost portions pivotally connected to a shaft 146. The fulcrum member 80 is positioned between the two aperture finishing means 27 and 28 and is arranged to move them in and out from the battery top covers which are being processed. The structural features for moving the aperture finishing means 27 and 28 up and down, by the movement of the fulcrum member 80, may be of any suitable construction and as shown in Figure 11, a frame like construction 147 may be connected to the piston rod of the piston mechanism 85 and carried up to the cross-header 67. By a similar construction the cross-head 92 for the aperture finishing means 28, mounted underneath the base 62, may be carried by a suitable construction indicated generally by the reference character 148. Therefore, as the fulcrum 80 is operated in a clockwise direction in Figure 11, the aperture finishing means 27 and 28 are brought

toward the battery top members and as the fulcrum member 80 is operated in a counter-clockwise direction the aperture finishing means 27 and 28 are moved from the work or battery top members.

Our invention may be set in operation by pushing the starter switch 150 which energizes the motor for operating the fluid pump 49. After this the starter switch 151 for energizing the motor for driving the sprocket wheel 30 and the shaft 37, may be pushed for starting the operation of the advanced feed means 20, the first reciprocating feed means 21, the second reciprocating feed means 24, and the aperture finishing means 27 and 28. When our machine is set in operation the operator then places the battery top covers to be processed in the advanced feeding means 20, so that the battery top covers are delivered one by one in spaced relation by the endless chain to the first reciprocating means 21 where the battery top covers are processed as hereinbefore described.

It is arranged to have an interlocking arrangement between the switch 151 and 150 in order to prevent the motor 40 from being started unless the fluid operated pump 49 is first in operation to make certain that the continuous process will be co-ordinated and prevent the piling up of battery box covers in advance of the first reciprocating means 21 in the event that the fluid operated pump 49 is not in operation.

Although we have described our invention with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

We claim as our invention:

1. A mechanism for finishing the peripheral edges of battery top members and the apertures therein, said battery top members having sloping side and end portions, comprising, in combination, base means upon which the battery top members may slide, oppositely spaced resilient engaging members arranged above the base means for resiliently engaging the opposite sloping end portions of the battery top members and causing the end edges to extend laterally outside of said resilient members, grinding means spaced on opposite sides of the resilient engaging members, to grind the opposite end edges of the battery top members, feed means to engage the battery top members and move same forward and broadwise between said grinding means to grind the opposite end edges of said battery top members, said feed means having spaced engaging means for successively and intermittently moving the battery top members forward at spaced distances between same, second base means positioned substantially at a right angle to the first base means, means for causing the forwardmost of said spaced engaging means to deliver said battery top members to the second base means, resilient means for guiding the battery top members along the second base means, second grinding means spaced on opposite sides of the second base means to grind the opposite side edges of the battery top members, second feed means to engage the battery top members and move same forward and lengthwise between said second grinding means to grind the opposite side edges of the battery top members, said second feed means having spaced engaging

means for successively and intermittently moving the battery top members forward at spaced distances between same, means for causing the rearwardmost of the spaced engaging means of the second feed means from interfering with the forwardmost of the spaced engaging of the first feed means, means for finishing the apertures in the battery top members as they are intermittently moved forward, and means for coordinating the two feed means and the aperture finishing means.

2. A mechanism for finishing the peripheral edges of battery top members and the apertures therein, said battery top members having sloping side and end portions, comprising, in combination, base means upon which the battery top members may slide, oppositely spaced resilient engaging members arranged above the base means for resiliently engaging the opposite sloping end portions of the battery top members and causing the end edges to extend laterally outside of said resilient members, grinding means spaced on opposite sides of the resilient engaging members to grind the opposite end edges of the battery top members, feed means to engage the battery top members and move same forward and broadwise between said grinding means to grind the opposite end edges of said battery top members, said feed means having spaced engaging means for successively and intermittently moving the battery top members forward at spaced distances between same, second base means positioned substantially at a right angle to the first base means, means for causing the forwardmost of said spaced engaging means to deliver said battery top members to the second base means, resilient means for guiding the battery top members along the second base means, second grinding means spaced on opposite sides of the second base means to grind the opposite side edges of the battery top members, second feed means to engage the battery top members and move same forward and lengthwise between said second grinding means to grind the opposite side edges of the battery top members, said second feed means having spaced engaging means for successively and intermittently moving the battery top members forward at spaced distances between same, aperture finishing means movably positioned above and below the second base means for finishing the apertures in the battery top members as said battery top members are intermittently moved forward, fluid means for actuating the two feed means and the aperture finishing means, and coordinating means for governing the fluid means.

3. A mechanism for finishing the peripheral edges of battery top members and the apertures therein, said battery top members having sloping side and end portions, comprising, in combination, base means upon which the battery top members may slide, oppositely spaced resilient engaging members arranged above the base means for resiliently engaging the opposite sloping end portions of the battery top members and causing the end edges to extend laterally outside of said resilient members, grinding means spaced on opposite sides of the resilient engaging members, to grind the opposite end edges of the battery top members, feed means to engage the battery top members and move same forward and broadwise between said grinding means to grind the opposite end edges of said battery top members, said feed means having spaced engaging

means for engaging the battery top members, reciprocating means for actuating the spaced engaging means and causing the spaced engaging means upon the forward movement of the reciprocation to move the battery top members forward to the next successively advanced positions and causing the spaced engaging means upon the termination of the rearward movement of the reciprocation to engage the next rearwardly positioned battery top members in readiness for the next successive advancement, second base means positioned substantially at a right angle to the first base means, means for causing the forwardmost of said spaced engaging means to deliver said battery top members to the second base means, resilient means for guiding the battery top members along the second base means, second grinding means spaced on opposite sides of the second base means to grind the opposite side edges of the battery top members, second feed means to engage the battery top members and move same forward and lengthwise between said second grinding means to grind the opposite side edges of the battery top members, said second feed means having second spaced engaging means for engaging the battery top members, reciprocating means for actuating the second spaced engaging means and causing the second spaced engaging means upon the forward movement of the reciprocation to move the battery top members forward to the next successively advanced positions and causing the second spaced engaging means upon the termination of the rearward movement of the reciprocation to engage the next rearwardly positioned battery top members in readiness for the next successive advancement, means for finishing the apertures in the battery top members as said battery top members remain stationary during the rearward movement of the reciprocation of said second feed means, and means for coordinating the two feed means and the aperture finishing means.

4. A mechanism for finishing the peripheral edges of battery top members and the apertures therein, said battery top members having sloping side and end portions, comprising, in combination, base means upon which the battery top members may slide, oppositely spaced resilient engaging members arranged above the base means for resiliently engaging the opposite sloping end portions of the battery top members and causing the end edges to extend laterally outside of said resilient members, grinding means spaced on opposite sides of the resilient engaging members, to grind the opposite end edges of the battery top members, feed means to engage the battery top members and move same forward and broadwise between said grinding means to grind the opposite end edges of said battery top members, said feed means having spaced engaging means for engaging the battery top members, reciprocating means for actuating the spaced engaging means and causing the spaced engaging means upon the forward movement of the reciprocation to move the battery top members forward to the next successively advanced positions and causing the spaced engaging means upon the termination of the rearward movement of the reciprocation to engage the next rearwardly positioned battery top members in readiness for the next successive advancement, second base means positioned substantially at a right angle to the first base means, means for causing the forwardmost of said spaced engaging means to deliver said battery top mem-

bers to the second base means, resilient means for guiding the battery top members along the second base means, second grinding means spaced on opposite sides of the second base means to grind the opposite side edges of the battery top members, second feed means to engage the battery top members and move same forward and lengthwise between said second grinding means to grind the opposite side edges of the battery top members, said second feed means having second spaced engaging means for engaging the battery top members, reciprocating means for actuating the second spaced engaging means and causing the second spaced engaging means upon the forward movement of the reciprocation to move the battery top members forward to the next successively advanced positions and causing the second spaced engaging means upon the termination of the rearward movement of the reciprocation to engage the next rearwardly positioned battery top members in readiness for the next successive advancement, means for finishing the apertures in the battery top members as said battery top members remain stationary during the rearward movement of the reciprocation of said second feed means, and means for co-ordinating the two feed means and the aperture finishing means, and advanced feed means for delivering the battery top members at spaced distances between same to the first feed means.

5. A mechanism for finishing the peripheral edges of battery top members and the apertures therein, said battery top members having sloping side and end portions, comprising, in combination, base means upon which the battery top members may slide, oppositely spaced resilient engaging members arranged above the base means for resiliently engaging the opposite sloping end portions of the battery top members and causing the end edges to extend laterally outside of said resilient members, grinding means spaced on opposite sides of the resilient engaging members, to grind the opposite end edges of the battery top members, feed means to engage the battery top members and move same forward and broadwise between said grinding means to grind the opposite end edges of said battery top members, said feed means having spaced engaging means for engaging the battery top members, reciprocating means for actuating the spaced engaging means and causing the spaced engaging means upon the forward movement of the reciprocation to move the battery top members forward to the next successively advanced positions and causing the spaced engaging means upon the termination of the rearward movement of the reciprocation to engage the next rearwardly positioned battery top members in readiness for the next successive advancement, second base means positioned substantially at a right angle to the first base means, means for causing the forwardmost of said spaced engaging means to deliver said battery top members to the second base means, resilient means for guiding the battery top members along the second base means, second grinding means spaced on opposite sides of the second base means to grind the opposite side edges of the battery top members, second feed means to engage the battery top members and move same forward and lengthwise between said second grinding means to grind the opposite side edges of the battery top members, said second feed means having second spaced engaging means for engaging the battery

top members, reciprocating means for actuating the second spaced engaging means and causing the second spaced engaging means upon the forward movement of the reciprocation to move the battery top members forward to the next successively advanced positions and causing the second spaced engaging means upon the termination of the rearward movement of the reciprocation to engage the next rearwardly positioned battery top members in readiness for the next successive advancement, means for causing the rearwardmost of the spaced engaging means of the second feed means from interfering with the forwardmost of the spaced engaging means of the first feed means, means for finishing the apertures in the battery top members as said battery top members remain stationary during the rearward movement of the reciprocation of said second feed means, and means for coordinating the two feed means and the aperture finishing means.

6. A mechanism for finishing the peripheral edges of battery top members and the apertures therein, said battery top members having sloping side and end portions, comprising, in combination, base means upon which the battery top members may slide, oppositely spaced resilient engaging members arranged above the base means for resiliently engaging the opposite sloping end portions of the battery top members and causing the end edges to extend laterally outside of said resilient members, grinding means spaced on opposite sides of the resilient engaging members, to grind the opposite end edges of the battery top members, feed means to engage the battery top members and move same forward and broadwise between said grinding means to grind the opposite end edges of said battery top members, said feed means having spaced engaging means for engaging the battery top members, reciprocating means for actuating the spaced engaging means and causing the spaced engaging means upon the forward movement of the reciprocation to move the battery top members forward to the next successively advanced positions and causing the spaced engaging means upon the termination of the rearward movement of the reciprocation to engage the next rearwardly positioned battery top members in readiness for the next successive advancement, second base means positioned substantially at a right angle to the first base means, means for causing the forwardmost of said spaced engaging means to deliver said battery top members to the second base means, resilient means for guiding the battery top members along the second base means, second grinding means spaced on opposite sides of the second base means to grind the opposite side edges of the battery top members, second feed means to engage the battery top members and move same forward and lengthwise between said second grinding means to grind the opposite side edges of the battery top members, said second feed means having second spaced engaging means for engaging the battery top members, reciprocating means for actuating the second spaced engaging means and causing the second spaced engaging means upon the forward movement of the reciprocation to move the battery top members forward to the next successively advanced positions and causing the second spaced engaging means upon the termination of the rearward movement of the reciprocation to engage the next rearwardly positioned battery top members in readiness for the next successive

advancement, aperture finishing means movably positioned above and below the second base means for finishing the apertures in the battery top members as said battery top members remain stationary during the rearward movement of the reciprocation of said second feed means, fluid means for actuating the two feed means and the aperture finishing means, and co-ordinating means for governing the fluid means.

7. In a machine of the character described for finishing the edges of battery top members having flanged peripheral edges and sloping sides, base means upon which the battery top members may slide, oppositely spaced resilient engaging members arranged above the base means for resiliently engaging the sloping sides of the battery top members and causing the flanged peripheral edges to extend laterally outside said resilient members, grinding means spaced on opposite sides of the resilient engaging members to grind the flanged peripheral edges of the battery top members, and reciprocating feed means for progressively moving the battery top members forward between the grinding means at spaced distances between same, said reciprocating feed means having spaced engaging means which upon the forward movement of the reciprocation engages each of said battery top members and moves the battery top members forward to the next successively advanced positions and which upon the termination of the rearward movement of the reciprocation engages each of the next rearwardly positioned battery top members in readiness for the next successive advancement.

8. In a machine of the character described for finishing the edges of battery top members having flanged peripheral edges and sloping sides, base means upon which the battery top members may slide, oppositely spaced thin spring members arranged substantially vertically above the base means for resiliently engaging the sloping sides of the battery top members and causing the flanged peripheral edges to extend laterally outside said thin spring members, grinding means spaced on opposite sides of the spring engaging members to grind the flanged peripheral edge of the battery top members, and reciprocating feed means for progressively moving the battery top members forward between the grinding means at spaced distances between same, said reciprocating feed means having spaced engaging means which upon the forward movement of the reciprocation engages each of said battery top members and moves the battery top members forward to the next successively advanced positions and which upon the termination of the rearward movement of the reciprocation engages each of the next rearwardly positioned battery top members in readiness for the next successive advancement.

9. In a machine of the character described for finishing the peripheral edges of battery top members and the apertures therein, base means upon which the battery top members may slide, grinding means spaced on opposite sides of the base means to grind the opposite edges of the battery top members, and reciprocating feed means for progressively moving the battery top members forward between the grinding means at spaced distances between same, said reciprocating feed means having spaced engaging means which upon the forward movement of the reciprocation moves the battery top members forward to the next successively advanced positions and which upon the termination of the

rearward movement of the reciprocation engages the next rearwardly positioned battery top members in readiness for the next successive advancement, means for finishing the apertures in the battery top members as said battery top members remain stationary during the rearward movement of the reciprocation of the feed means, and means for co-ordinating the feed means and the aperture finishing means.

10 10. In a machine of the character described for finishing the edges of battery top members having flanged peripheral edges and sloping sides, base means upon which the battery top members may slide, oppositely spaced resilient engaging

15 members arranged above the base means for resiliently engaging the sloping sides of the battery top members and causing the flanged peripheral edges to extend laterally outside said resilient members, grinding means spaced on opposite

20 sides of the resilient engaging members to grind the flanged peripheral edges of the battery top

members, and reciprocating feed means for progressively moving the battery top members forward between the grinding means at spaced distances between same, said reciprocating feed means having spaced engaging means which upon the forward movement of the reciprocation moves the battery top members forward to the next successively advanced positions and which upon the termination of the rearward movement of the reciprocation engages the next rearwardly positioned battery top members in readiness for the next successive advancement, each said engaging means having two finger means arranged to engage spaced portions on the battery top members, and adjustable means to move the finger means to align transversely the opposite ends of the battery top members and cause them to move substantially square between the grinding means.

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