May 8, 1928. 1,669,054

H. D. HODGE

APPARATUS FOR ASSEMBLING GALVANIC CELLS

Filed July 17, 1926 5 Sheets-Sheet 1

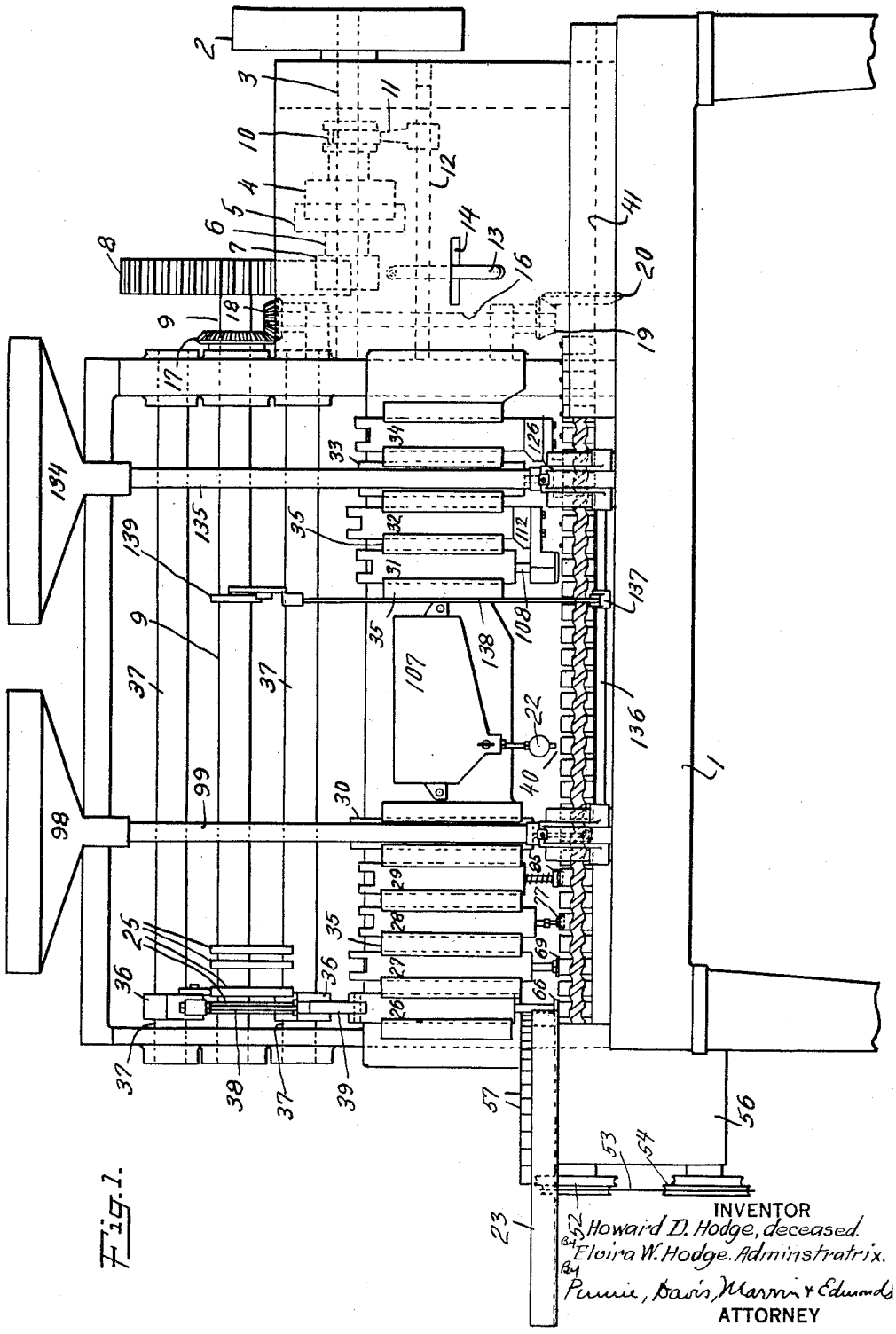


Fig. 1.

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Filed July 17. 1926 5 Sheets-Sheet 2

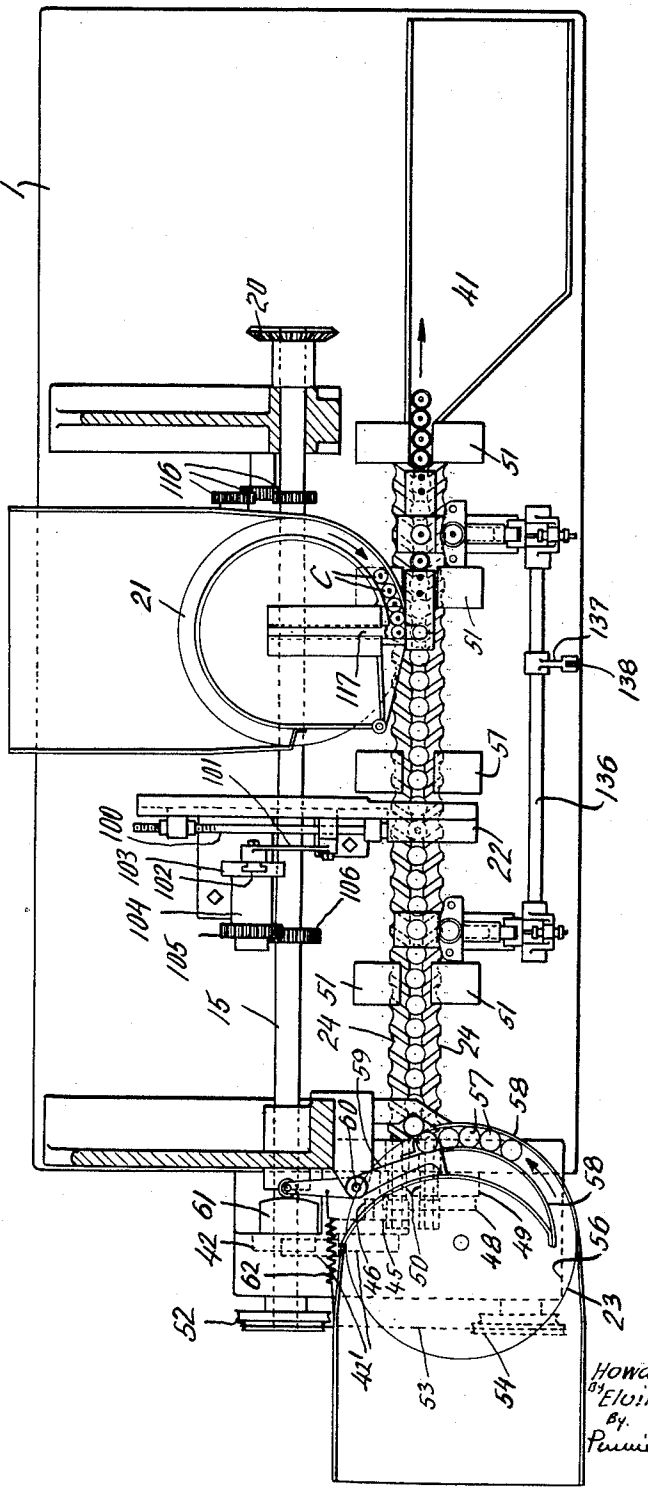


Fig. 2.

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Fig. 4.

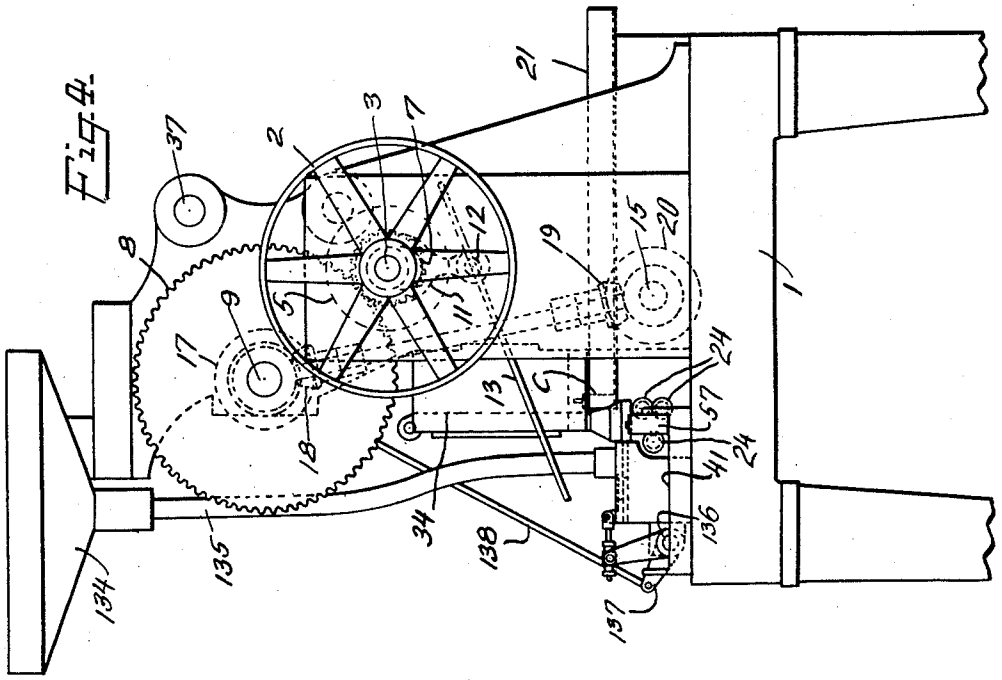
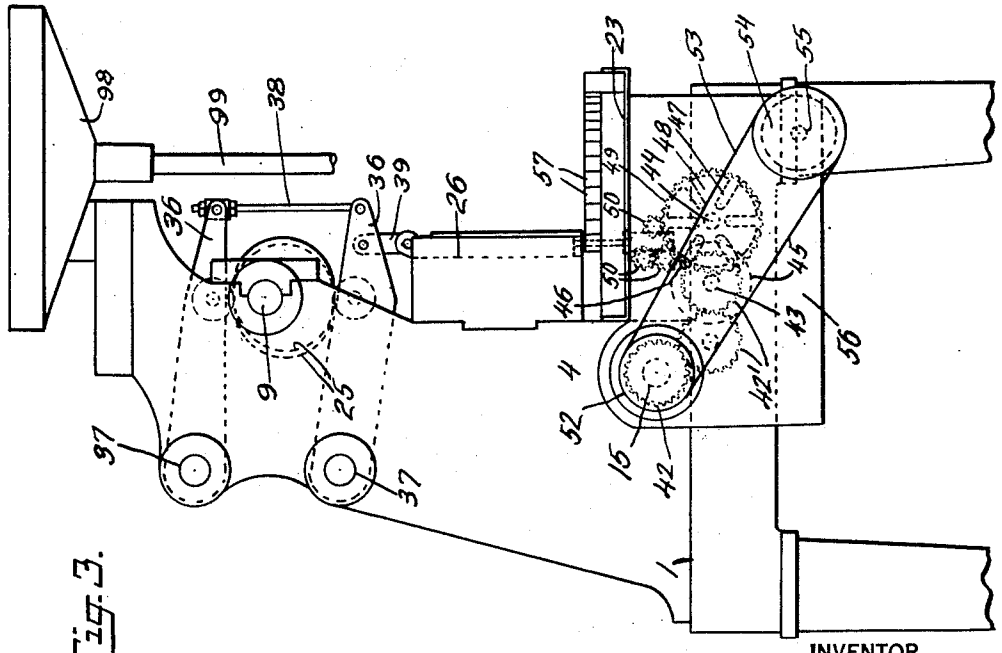


Fig. 3.



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Fig. 6.

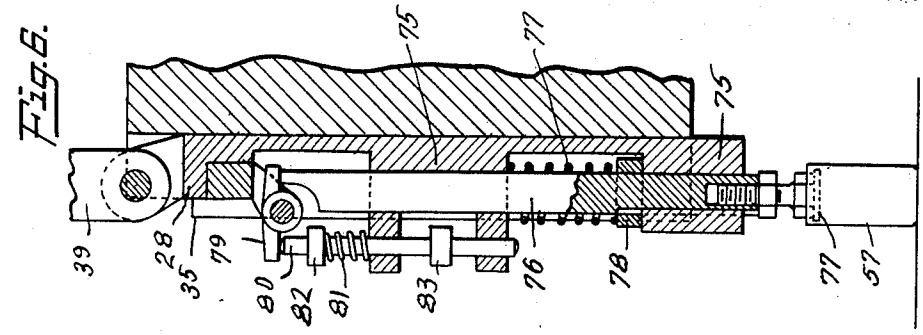
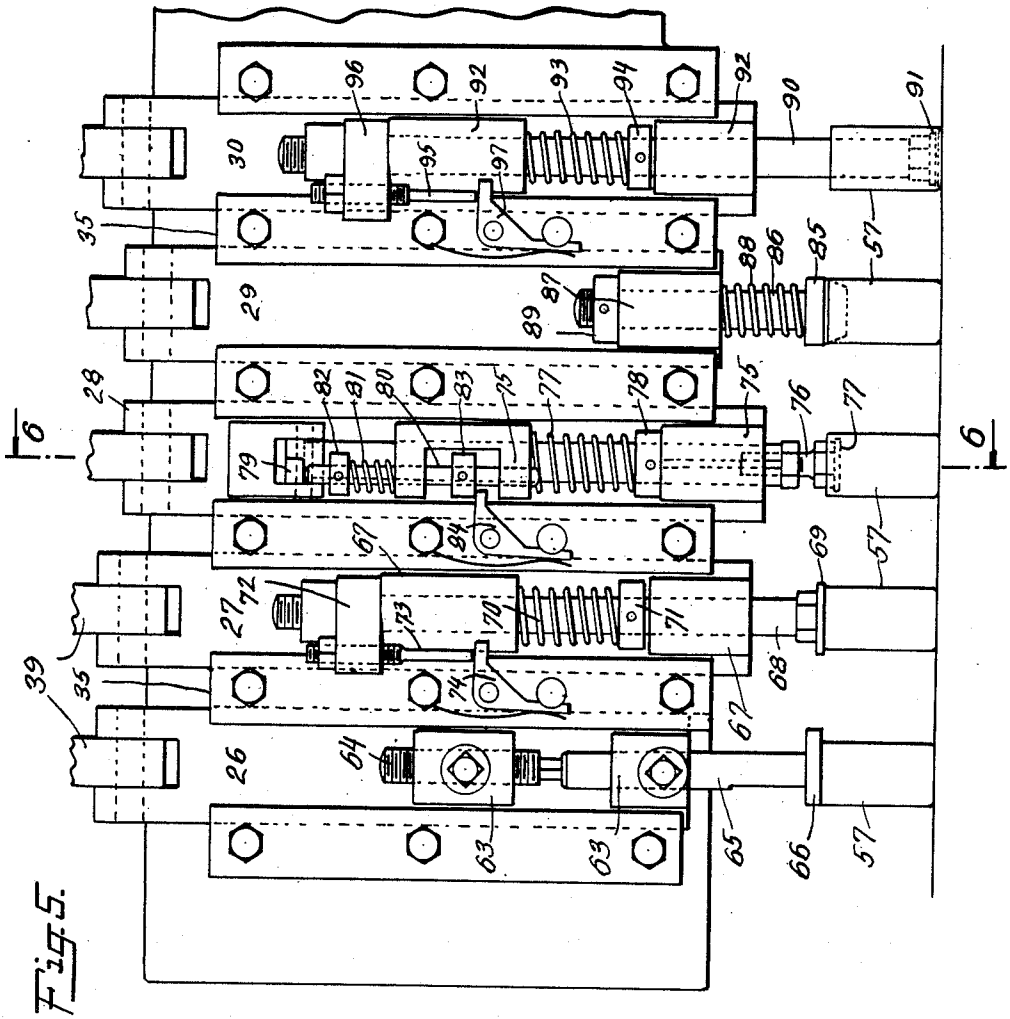


Fig. 5.



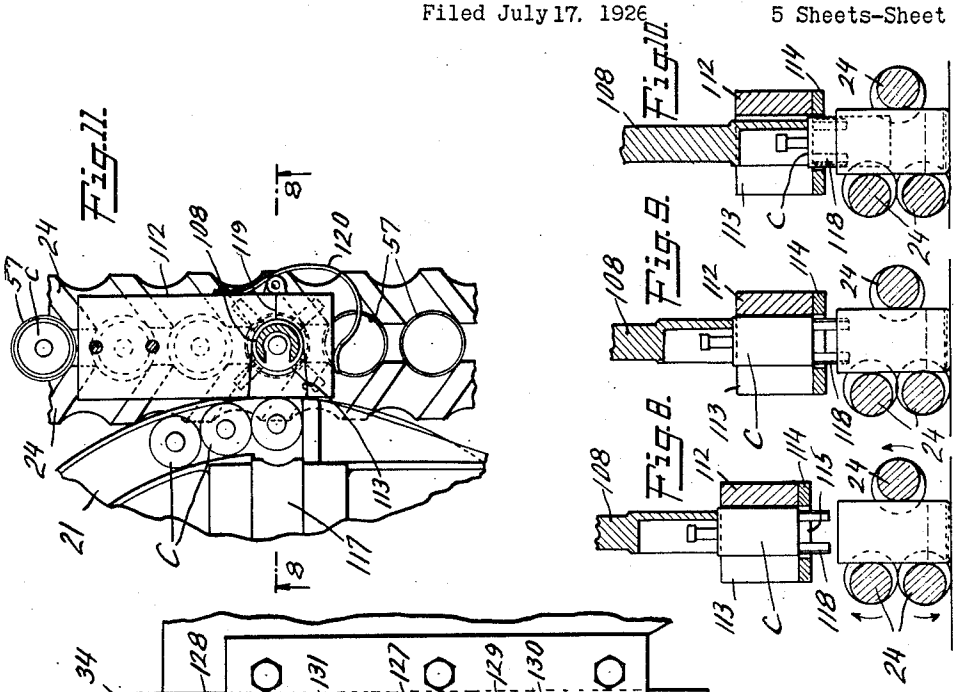
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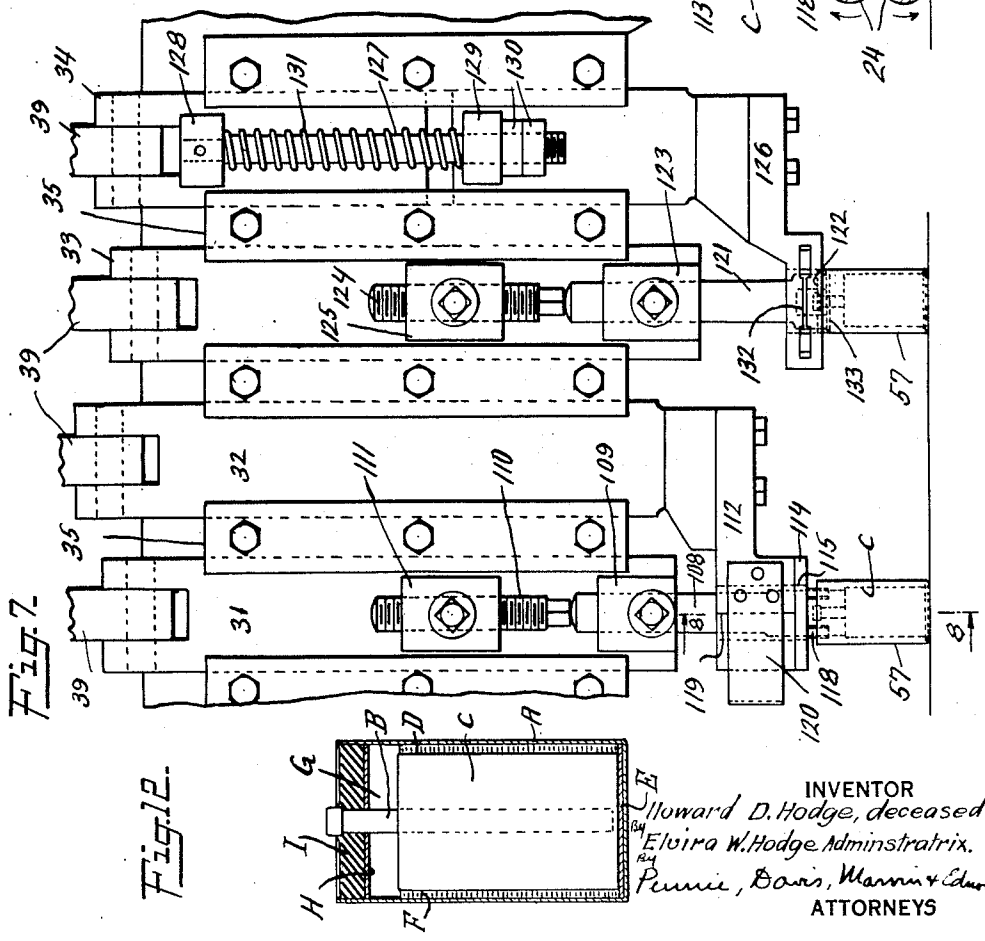
May 8, 1928. 1,669,054

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APPARATUS FOR ASSEMBLING GALVANIC CELLS

Filed July 17, 1926 5 Sheets-Sheet 5





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Patented May 8, 1928. 1,669,054

UNITED STATES PATENT OFFICE.

HOWARD D. HODGE, DECEASED, LATE OF BRIDGEPORT, CONNECTICUT, BY ELVIRA WELLS HODGE, ADMINISTRATRIX, OF BRIDGEPORT, CONNECTICUT, ASSIGNOR TO BURGESS BATTERY COMPANY, OF MADISON, WISCONSIN, A CORPORATION OF WISCONSIN.

APPARATUS FOR ASSEMBLING GALVANIC CELLS.

Application filed July 17, 1926. Serial No. 123,237.

This invention relates to apparatus for assembling galvanic cells.

The object of this invention is to provide a mechanical means for rapidly assembling the component parts of dry cells, thereby decreasing the amount of labor necessary for assembly. A further object is to make a more uniform and higher grade product than is possible with the hand assembling methods now commonly in use. The apparatus is so designed that all operations are plainly visible to the operator and defective work may be readily detected.

The accompanying drawings illustrate the preferred embodiment of the invention. Fig. 1 is a front elevation, Fig. 2 a plan view, and Figs. 3 and 4 side elevations of the improved machine. Figs. 5, 6 and 7 are details of the reciprocating devices used for assembly operation. Fig. 8 is a fragmentary section on the line 8—8 showing the beginning of the downward stroke of the plunger and core holder at the core inserting station, while Figs. 9 and 10 are similar sections of the plunger at various portions of the down stroke. Fig. 11 is a plan view of the means for feeding the cores to the core holder. Fig. 12 is a cross section of a type of dry cell which can well be assembled by the machine.

A cylindrical galvanic cell, the assembling of which is contemplated by the novel apparatus, is shown in cross section in Fig. 12. It consists of a can A, containing a depolarizing cathode core which consists of a carbon rod B, about which is firmly tamped a depolarizing mix C of carbon or graphite and a depolarizer, such as manganese dioxide, conducting salts and water. The cathode core may be naked or may be surrounded by a bibulous envelope D, of cheesecloth, tissue paper, or hardened dip such as is described in United States Patent No. 1,316,597, and may be insulated at the bottom by an attached paper washer or by folding under the bibulous envelope or may have an insulating bottom layer of paraffin or suitable wax E. In lieu of the bottom construction described, an insulating washer may be used at the bottom of the can and on which the core rests. A suitable gelatinous or pasty electrolyte F separates the core from the can. This electrolyte may be that described in United States Patent No. 1,292,764 and may be compounded as described in United States Patent No. 1,370,056. This novel apparatus offers special advantages when used in connection with the methods of the last two patents. An expansion space G above the core is topped by a waterproofed washer H supporting a wax or pitch seal I. In this novel apparatus empty cans, cores, liquid electrolyte, and water-proof washers are fed to the machine and the cells are assembled from these parts, requiring only a pitching operation for their completion.

The apparatus proper is mounted on an elevated bed 1, and is driven by means of a pulley 2 or by direct motor drive. Pulley 2 is mounted on a drive shaft 3, which is journaled in suitable bearings, and carries one element 4 of a control clutch. The driven element 5 of the clutch is carried by a sleeve 6 loosely mounted on the drive shaft. The sleeve also carries a gear 7 meshing with a gear 8 on a cam shaft 9. The driving element 4 of the clutch may be splined to the shaft to permit relative movement and may be provided with a groove 10 adapted to receive the ends of a yoke 11, carried by a movable rod 12 and controlled by a pivoted clutch lever 13. This lever projects through a slot 14 in the gear casing. A shaft 15 is driven from the cam shaft 9 by means of a vertical shaft 16. As shown, the shafts 9 and 16 are provided with bevel gears 17 and 18 meshing with each other, and the opposite end of 16 is likewise provided with a bevel gear 19 meshing with a bevel gear 20 on shaft 15. This shaft drives the various mechanisms such as the core feeder disk 21, electrolyte pump 22, can feeder 23, and lead-screws 24. These various devices are properly synchronized as explained hereinafter.

On shaft 9 are mounted cams 25, two of which are shown, actuating reciprocating devices or sliders 26 to 34, in vertical slides 35 on the frame of the machine. These sliders are also called stations hereinafter. The sliders are actuated positively by toggles 36 which are arranged in pairs above and below the cams 25, and pivotally mounted on the frame of the machine as at 37. The toggles of each pair are connected to each other

by links 38 and slides 26 to 34 are connected to the lower toggles by links 39. The various operations in the assembling of a flashlight except the feeding of the electrolyte paste are adapted to such a vertical reciprocating motion, and the paste pump is actuated by a horizontal reciprocating motion. The cams are so designed as to give the proper speed and throw for each of the reciprocating devices, the downward stroke being made while the cans are held stationary by lead-screw 24, with which the camshaft 9 is synchronized. At station 40 the paste electrolyte is injected into the can by means of pump 22 while the can is stationary.

The cans are carried forward singly for the various operations by means of the novel lead-screw 24, although other means may be used, such as chains or carrier-fingers. The lead-screw mechanism consists of three screws mounted as shown in Figs. 1 and 2 and Figs. 8 to 11, two screws being in the rear plane and one in the front for operating convenience and inspection.

The screws are so cut that when mounted as shown in Figs. 1 and 2 and 8 to 11, the corresponding arcs form a portion of a circle and a can of predetermined size will be firmly held and will not tip. With each revolution of the screws the can is advanced the pitch of the screw. In the drawings the reciprocating sliders 26 to 34 are wide enough so that they are spaced at twice the pitch of the screw. The cans are fed into the left end of the lead-screw, Fig. 1, by suitable means, as described hereinafter, and progress to the right and are discharged at the right onto discharge table 41. The lead-screws are actuated from shaft 15 through a gear 42 on the shaft meshing with a train of gears 42′ mounted on suitable stub shafts. Stub 43 is provided with means for giving an intermittent motion, preferably a Geneva movement, to stub shaft 44, though a ratchet arrangement or similar device may be used. A disk 45 is mounted on shaft 43 and carries a pin 46 adapted to enter radial slots 47 in a disk 48 carried by shaft 44. The intermittent movement of shaft 44 is transmitted to lead screws 24 by a gear 49 on the shaft which meshes with pinions 50 on the ends of the lead screws. The intermittent movement of the lead-screws 24 is so synchronized with the electrolyte pump and cams 25 actuating the reciprocating devices in slides 26 to 34, that the lead-screws are stationary during the squirting of electrolyte in the cans and during downward movement of the reciprocating sliders. The lead-screws rotate as indicated in Figs. 8 to 10 and move the cans forward their pitch distance during the upward travel of the sliders. In this way each can moves forward a screw pitch length during one revolution of the camshaft 9. The lead-screws are mounted in segmental pillow blocks 51 so shaped that they do not interfere with the forward movement of the cans from the can inserting slide 26 to the discharge table 41.

The number of stations shown may be increased or decreased over those shown in Fig. 1, depending upon the cell construction and the number of operations that it is desirable to perform. Can feeder 23 is driven in the direction of the arrow in Fig. 2 of the drawings. Shaft 15 is provided with a pair of pulleys 52 adapted to receive a belt 53 which passes over either of a pair of pulleys 54 mounted on a shaft 55. This shaft drives suitable gearing (not shown) arranged in a gearing casing 56 beneath the can feeding disk and connected to the disk to rotate it. Empty dry cell cans 57 are fed by the disk between the guide walls 58 and as they approach the end of the outer wall they are fed from the disk by a lever or finger 59. This lever is pivoted on the frame of the machine at 30, and its opposite end rides on a cam 61 carried by shaft 15. The lever is maintained in engagement with the cam by a spring 62. When the can is ejected from the disk by the lever 59 it is arranged over the space between the lead-screws as shown at the left in Fig. 1, and the first station lowers the can into the lead-screws so that it will be fed forwardly.

Slider 26, see Fig. 5, carries a pair of lugs 63 by which the adjustably mounted pusher is reciprocated. This pusher pushes the empty dry cell can 57 into the lead-screws 24.

The upper lug 63 carries an adjusting screw 64 which engages the upper end of push rod 65 carried by the lower lug 63. The lower end of this rod is provided with a head 66 of greater diameter than the can and adapted to engage the top of the can to force it down between the lead screws. At station 27, the reciprocating device inspects for "no can". Lugs 67, which are attached to slider 27, have rod 68 slidably mounted to reciprocate relative to the lugs. Rod 68 has a foot 69 attached to its lower end and a spring 70 surrounding it between upper lug 67 and a collar 71 attached to the rod 68. To the upper end of rod 68 is fastened collar 72 having attached to it a steel pin 73 which actuates dog 74 if no can is present in lead-screw 24 as will be described hereinafter. Dog 74, if actuated, disengages clutch 4 by electrical or other means and stops the machine. On the downward stroke of the slider 27 if a can 57 is present in the lead-screw 24, and if head 69 is so adjusted that it strikes can 57 just before the completion of the downward stroke, spring 70 is compressed and allows rod 68 to stop before the completion of the down stroke. Since collar 72 is attached to rod 68, dog 74 is not actuated if rod 68 does not complete

the downward stroke due to the presence of a can 57. If a can is not present rod 68 and collar 72 complete the downward stroke thereby actuating dog 74 to stop the machine by any suitable control means.

Station 28 inspects for the presence of an inverted can. Slider 28 is provided with upper and lower lugs 75 (see Fig. 6). A slider rod 76 is mounted in these lugs and is provided with a head 77 on its lower end of less diameter than the can 57. A compression spring 77 fits over rod 76 and is fixed between upper lug 75 and a collar 78 attached to the rod 76. An upward movement of rod 76 in respect to slider 28 results in the movement of rocker arm 79, with the consequent depression of rod 80, also slidably mounted in upper lug 75 against which it is held by means of spring 81, collar 82 and rocker arm 79. Collar 83 attached to rod 80 depresses dog 84 if rod 80 is depressed. The depression of dog 84 results in the disengaging of clutch 4 by electrical or other means, thus stopping the machine. If the can 57 has the open end up dog 84 is not actuated since rod 76 is not actuated with respect to slider 28.

Station 29 straightens or rounds the top of the can if it has been accidentally deformed. The can top must be round so that the core may be inserted at a later station. The can straightening tool 85 is mounted on rod 86 slidably mounted in a lug 87 attached to slider 29. Spring 88 on rod 86 between the tool 85 and lug 87 is sufficiently strong or is under sufficient compression to straighten the can top. Rod 86 is threaded on its upper end, and is adapted to be adjusted by a collar 89 arranged on the threaded portion and held in engagement with the top of lug 87 by spring 88.

Station 30 may have a device for inserting disks in the bottom of the can 57 if such a cell construction is used or it may be used for other operations. If a disk is to be inserted into the bottom of the can a rod 90 with a head 91 is slidably mounted in lugs 92 attached to slider 30. Spring 93 mounted over rod 90 is kept in contact with the upper lug by collar 94 and allows the rod to be displaced if a disk is at the bottom of the can 57. If a disk is missing, the rod 95 attached to rod 90 by collar 96 depresses dog 97 disengaging clutch 4 by electrical or other means, thus stopping the machine. The washers are fed to head 91 by means of hopper 98 and tube 99 and disk-feeding mechanism well known to those skilled in the art and further explained in the operations at stations 33 and 34.

The empty can, after leaving station 30 is ready for the paste electrolyte. As the can travels to the right in lead-screws 24 or other conveying device, it receives an injection of the liquid paste at station 40. Pump 22 consists of any convenient plunger pump or other device which will deliver a fixed volume of solution with each stroke during the pause of the can at station 40. It is provided with a plunger carried by a plunger rod 100 which is reciprocated by a crank 101. Crank 101 is provided with a head 102 slidably mounted in a radial groove in disk 103. This permits adjustment of the stroke of the plunger to vary the amount of electrolyte delivered. Disk 103 is carried by a shaft mounted in a bearing 104, and carrying a gear 105 meshing with a gear 106 on the shaft 15. The paste solution, which may be self-setting, is poured into container 107, from which it feeds into the measuring chamber of pump 22. If the paste solution has to be gelatinized by the aid of heat it is not necessary to continually feed fresh quantities of freshly mixed solution into tank 107 since such a paste solution will not gelatinize therein.

The can, containing the requisite amount of liquid paste solution advances to station 31 by means of lead-screw 24, where the cathode core is inserted into the can, the paste solution welling up about the sides of the core to form the electrolyte between the core and the can as shown in Fig. 12. This feature is important and justifies detailed explanation. Slider 31 actuates an adjustable plunger 108 which is held by lug 109 attached to the slider and adjusted by screw 110 mounted in upper lug 111. The bottom of plunger 108 is cut away as shown in Figs. 8 to 10 so that the pressure will come on the body of the core instead of on the carbon imbedded in it and furthermore will allow the core to slide into position from one side, as will be explained hereinafter. Slider 32 works core-presser foot 112 in conjunction with slider 31, the core-presser foot being attached to the bottom of the slider 32 as shown. The core-presser foot consists of a block with a slot 113 at one side which allows core C to be pushed into place over plate 114 which is provided with an opening 115 in alignment with the rear of the slot. The cores C are preferably fed into position by means of an ordinary feeder disk 21. The dial is rotated in the direction of the arrow by suitable gearing (not shown) arranged in a gear box beneath the dial and driven from shaft 15 by a train of gears 116. A pusher 117 is arranged radially of the dial and is reciprocated at proper intervals by any suitable means to feed the cores C with the presser foot in the position shown in Fig. 8.

Core-presser foot 112 has three or more (preferably four) fingers 118 projecting downward which are so positioned that the core cannot drop through between them but is frictionally held as is shown in Fig. 8. Fingers 118 are fastened to plate 114 around

the opening 115. The core is positioned in core-presser foot 112 while it and plunger 108 are stationary. After the core is positioned, plunger 108 starts its descent as does the core-presser foot. The steel fingers 118 which may be made of flexible or spring stock, enter the can as shown in Fig. 9. The descent of plunger 108 may be so timed that it starts pushing the core C between the fingers before or after the fingers enter the can or the core-presser foot reaches its lowest point. Notwithstanding the frictional contact of the fingers, the plunger pushes the core into the can as shown in Fig. 10. At the end of the downward stroke of the plunger, the core enters the electrolyte in the bottom of the can. The mechanism may be arranged so that the core is released from the fingers just before or just after entering the paste electrolyte, thereby allowing the core to settle by gravity through the electrolyte to the bottom of the can as shown in Fig. 7, the electrolyte welling up around the core. The last half of the downward stroke of the plunger is preferably slower than the first half to prevent mechanical damage to the core and squirting of the electrolyte, should it enter the electrolyte too rapidly. The speed of movement is dependent on the shape of the driving cams 25. The core presser-foot 112 may also be split at 119 and the two halves urged together by a spring 120. The two halves then grip the core and hold it in place, thereby allowing for a variation in core diameter. The friction of the fingers 118 contacting with the core is then determined by the spring compression acting through the core-presser foot.

The top washer H is inserted into the can at station 33, sliders 33 and 34 cooperating. The washer fits over the carbon of the core and is slightly larger in diameter than the inside diameter of the can. This variation in diameter allows the washer to be forced down to a fixed distance below the top of the can, thereby providing the necessary expansion or gas space G above the core and it also provides a base for the sealing wax or pitch I used to seal the cell. Slider 33 has plunger 121 with head 122. The plunger is mounted in lower lug 123, and may be adjusted by a screw 124 passing through upper lug 125 and engaging the head of the plunger. The head 122 has a recess to fit over the projecting carbon of the core. Slider 34 has a foot body 126 attached to it. The slider is cut in two parts and held together by means of rod 127, the upper end of which is fixed permanently to the upper portion of the slider by means of lug 128 and the lower end projects through a lug 129 attached to the lower portion of the slider. The lower end of the rod is threaded for an adjusting collar 130. A spiral compression spring 131 is placed around the rod between the two halves of the slider to keep them separated. This allows the foot body 126 to rest upon the cans without crushing them. The foot body 126 has a slot 132 through which the washers are pushed singly to a position above the cans, from which position the plunger head 122 pushes them into position in the can as shown at 133. Washers are delivered from a hopper 134 through a tube 135 and fed through slot 132. Suitable disk feeding mechanism is employed here and at the bottom of tube 99 of station 30, and they are actuated by a rock shaft 136 having a crank 137 connected to an arm 138 which is reciprocated by a cam 139 on cam shaft 9.

While the above operations complete the cell in so far as the above embodiment of the invention is concerned, it is obvious that, if necessary, additional operations may be carried out by adding more stations to the machine. The cell is finally carried forward by lead screw 24 to discharge table 41.

Through use of the machine above described a new method can be practiced, namely, that of introducing the self-setting electrolyte into the can, introducing a cathode into that electrolyte and centering that cathode in its final position within the can, all in exactly timed relation, a result not heretofore obtainable in commercial practice.

A self-setting electrolyte, such as that described in Hambuechen Patent No. 1,292,764, offers many advantages over electrolytes that have to be cooked to effect gelatinization, but its use requires care. If insertion of the cathode be delayed until the electrolyte has appreciably gelatinized the cathode will not sink by gravity to the bottom of the can. Likewise, if the washer is not inserted promptly after introduction of the cathode into the electrolyte the incipient hardening of the paste will interfere with ready centering of the cathode in the can, and in extreme cases, may result in breakage of carbons or deformation of the layer of hardened paste, and even shattering of the molded mix.

Working by hand, and on a factory basis, careful regulation of the elapsed time between insertion of the electrolyte, introduction of the cathode and addition of the washer is impossible. The greater the number of workmen, and the greater the speed of production, the greater is the variation in the product due to variations in these time intervals.

By the use of the machine above described very exact timing is possible. Furthermore, that time can be very short, not exceeding a few seconds. There is thus introduced into the manufacture of dry cells a precision not to be expected from hand operations. This precision in the timing is of particular im-

portance when a rapidly actuating self gelatinizing electrolyte is used between the cathode and the zinc can.

What is claimed:

1. In mechanism for inserting a dry cell cathode into a can the combination of a cathode holder, and friction fingers attached to said holder and adapted to frictionally engage the cathode to control its movement toward and into the can.

2. In mechanism for inserting a dry cell cathode into a can the combination of a spring pressed cathode holder, and friction fingers protruding beyond said holder and adapted to engage and control the movement of the cathode during its travel toward and into the can.

3. In mechanism for inserting a dry cell cathode into a can the combination of means for positioning and holding said cans, a cathode holder, a plunger for ejecting said cathode from said holder, and friction fingers carried by said holder and engaging said cathode to control the movement of the cathode when leaving the holder.

4. In mechanism for inserting a dry cell cathode into a can, the combination of means for positioning and holding the can, a cathode holder having fingers extending downward therefrom, and a plunger for ejecting said cathode from said holder, said fingers being so positioned with reference to the holder in the can that when the cathode is ejected from the holder into the can said fingers will be in frictional contact with the cathode and will control its freedom of movement.

5. In mechanism for inserting a dry cell cathode into a can the combination of means for positioning and holding said can, a split spring pressed cathode holder into which a cathode may enter from the side, a plunger for ejecting said cathode from said holder into the can, and means frictionally engaging the cathode to control its movement on leaving the holder.

6. In mechanism for inserting a dry cell cathode into a can the combination of means for positioning and holding said can, a cathode holder above said can and registering therewith, a plunger for ejecting said cathode through the bottom of said holder, fingers extending downward from said holder and contacting with said cathode and providing frictional resistance therewith during the course of the cathode from the holder into the can, and mechanism for lowering said holder and thereby inserting said fingers into the top of the can preparatory to introduction of the cathode into the can.

7. In mechanism for inserting a dry cell cathode into a can, the combination with a cathode holder, friction fingers carried thereby, means for positioning and holding the can, and a plunger for ejecting the cathode from said holder, said plunger being adapted to be actuated on the downward stroke at a speed greater during the first part of the stroke than during the last half of the stroke.

8. In apparatus for assembling dry cells the combination of means for advancing dry cell cans to consecutive stations and with an intermittent movement, a reciprocating plunger for inserting a cathode into each of said cans while it pauses at one of said stations, a cathode holder from which said cathodes are ejected by said reciprocating plunger, means frictionally engaging each cathode as it leaves the holder to control its delivery into a can, and means for feeding said cathodes into said holder.

9. In apparatus for assembling dry cells the combination of a plurality of lead-screws for advancing dry cell cans intermittently to consecutive stations, a reciprocating plunger for delivering a cathode into each of said cans while it pauses at one of said stations, a split spring pressed holder from which said cathodes are ejected in succession by said plunger, and fingers extending downward from said holder and frictionally engaging each cathode to control its delivery into a can.

10. In apparatus for assembling dry cells the combination of means for advancing dry cell cans to consecutive stations with an intermittent movement, mechanisms timed therewith for carrying out assembly operations while said cans are pausing at said stations, said timed mechanism comprising means for introducing into each can a measured quantity of electrolyte and slowly lowering a cathode therein, and means for placing washers over each cathode at a fixed distance below the top of its can.

11. In apparatus for assembling dry cells the combination of means for advancing dry cell cans to consecutive stations with an intermittent movement, mechanism for carrying out assembly operations of said cans while pausing at said stations, said mechanism including a plunger for placing a washer at a fixed distance below the top of each can, and a washer feeding mechanism associated with said plunger and actuated through a spring connected divided slider so that the machine will tolerate cans varying somewhat in height.

12. In apparatus for assembling dry cells the combination of means for advancing dry cell cans to consecutive stations with an intermittent movement, and mechanism for carrying out assembly operations while said cans are pausing at said stations, said mechanism comprising in operative sequence, means for flowing a measured quantity of electrolyte into each can, reciprocating means for gently introducing a cathode into each can of electrolyte and reciprocating means for

placing a washer over said cathode at a fixed distance below the top of its can.

13. In apparatus for assembling dry cells the combination with lead-screw mechanism for advancing dry cell cans intermittently to consecutive stations, and mechanism for carrying out assembly operations when said cans are pausing at said stations, said mechanism comprising in operative sequence, means for flowing a measured quantity of electrolyte into each can, means for inserting a cathode into each can of electrolyte, and means for placing a washer over each cathode at a fixed distance below the top of its can.

14. In apparatus for assembling dry cells the combination of means for advancing dry cell cans intermittently to consecutive stations, mechanism for carrying out assembly operations while said cans are pausing at said stations, said mechanism comprising in operative sequence, means for pumping a measured quantity of freshly mixed self setting electrolyte into each can, reciprocating means for gently lowering a cathode into each can of electrolyte, and reciprocating means for placing a washer over each cathode at a fixed distance below the top of its can.

15. In apparatus for assembling dry cells, the combination with lead-screw mechanism for advancing dry cell cans intermittently to consecutive stations, and mechanism for carrying out assembly operations while said cans are pausing at said stations, said mechanism comprising in operative sequence, means for flowing a measured quantity of electrolyte into each can, a reciprocating plunger for forcing a cathode into each can of electrolyte against the frictional resistance of cathode engaging fingers, means for placing a washer over each cathode at a fixed distance below the top of its can, and cooperating mechanism for feeding said washer, said feeding mechanism being adapted to cans varying somewhat in height.

16. In apparatus for assembling dry cells the combination with mechanism for advancing dry cell cans to consecutive stations intermittently, and mechanism for carrying out various operations while said cans are pausing at said stations, said mechanism comprising in operative sequence, a reciprocating head for rounding the tops of deformed cans, means for flowing a measured quantity of electrolyte into each can, means for inserting a cathode into each can of electrolyte, and automatic means for placing a washer over each cathode at a fixed distance below the top of its can.

17. In apparatus for assembling dry cells the combination with mechanism for advancing dry cell cans intermittently to consecutive stations, and mechanism for carrying out various operations while said cans are pausing at said stations, said mechanism comprising in operative sequence, a reciprocating head to test for absence of cans, a reciprocating head to test for inverted cans, a reciprocating head for rounding the tops of deformed cans, means for flowing a measured quantity of electrotlye in each can, reciprocating means for inserting a cathode into each can of electrolyte, reciprocating means for placing a washer over each cathode at a fixed distance below the top of its can, and mechanism for feeding said washers singly to said last named reciprocating means.

18. In apparatus for assembling dry cells comprising in combination a lead-screw mechanism for advancing dry cell cans intermittently to consecutive stations, means for feeding empty cans into said lead-screw mechanism, said means including a reciprocating head for positively placing said cans between the lead-screws, and cooperative mechanism for carrying out various operations while said cans are pausing at said stations, said last named mechanism comprising in operative sequence, a reciprocating head to test for absence of cans, a reciprocating head to test for inverted cans, a spring controlled reciprocating head for rounding the tops of deformed cans, reciprocating means for inserting a washer into the bottom of each can when desired, and mechanism for feeding said washer singly to said reciprocating means, means for flowing a measured quantity of electrolyte into each can, a reciprocating head for inserting a cathode into each can of electrolyte against frictional resistance from a cathode holder, reciprocating means for placing a washer over each cathode at a fixed distance below the top of its can, and mechanism for feeding said cathode washers singly to said last named reciprocating means, said feeding mechanism having a yielding mounting to allow for variations in the height of the cans.

19. In apparatus for assembling dry cells, the combination of mechanism for advancing dry cell cans to consecutive stations, a pump at one of said stations for delivering a measured quantity of electrolyte into a can while pausing at that station and a reciprocating plunger at another of said stations for inserting a cathode into a can while pausing at that station.

20. In apparatus for assembling dry cells, the combination of means for advancing dry cell cans to consecutive stations with an intermittent movement, and mechanisms timed therewith for carrying out assembling operations while said cans are pausing at said stations, said timed mechanism comprising means for introducing into each can a measured quantity of electrolyte and means for slowly lowering a cathode therein.

21. In apparatus for assembling dry cells, the combination of means for intermittently advancing dry cell cans to consecutive stations and mechanism for carrying out various operations while said cans are pausing at said stations, said mechanism comprising in operative sequence, a reciprocating head to test for inverted cans, means for inserting a measured quantity of electrolyte in each of said cans, and means for inserting a cathode in each of said cans.

22. In apparatus for assembling dry cells, the combination of means for advancing dry cell cans intermittently to consecutive stations and mechanism for carrying out various operations while said cans are pausing at said stations, said mechanism comprising in operative sequence, means for testing for absence of cans, means for inserting a measured quantity of electrolyte in each of said cans, and means for inserting a cathode in each of said cans.

23. In apparatus for assembling dry cells, the combination of means for advancing dry cell cans intermittently to consecutive stations and mechanism for carrying out various operations while said cans are pausing at said stations, said mechanism comprising in operative sequence, means for rounding the tops of deformed cans, means for inserting a measured quantity of electrolyte in each of said cans, and means for inserting a cathode in each of said cans.

24. In apparatus for assembling dry cells, the combination of means for advancing dry cell cans intermittently to consecutive stations and mechanism for carrying out various operations while said cans are pausing at said stations, said mechanism comprising in operative sequence, means for testing for the absence of cans, means to test for inverted cans, means for successively inserting a measured quantity of electrolyte in each of said cans, and means for inserting a cathode in each of said cans.

25. In apparatus for assembling dry cells, the combination of means for advancing dry cell cans intermittently to consecutive stations and mechanism for carrying out various operations while said cans are pausing at said stations, said mechanism comprising in operative sequence, means for testing for absence of cans, a reciprocating head to test for inverted cans, a reciprocating head for rounding the tops of deformed cans, means for delivering a measured quantity of electrolyte into each of said cans and means for inserting a cathode in each of said cans.

In testimony whereof I affix my signature.

ELVIRA WELLS HODGE.

Administratrix of the Last Will and Testament of Howard D. Hodge, Deceased.