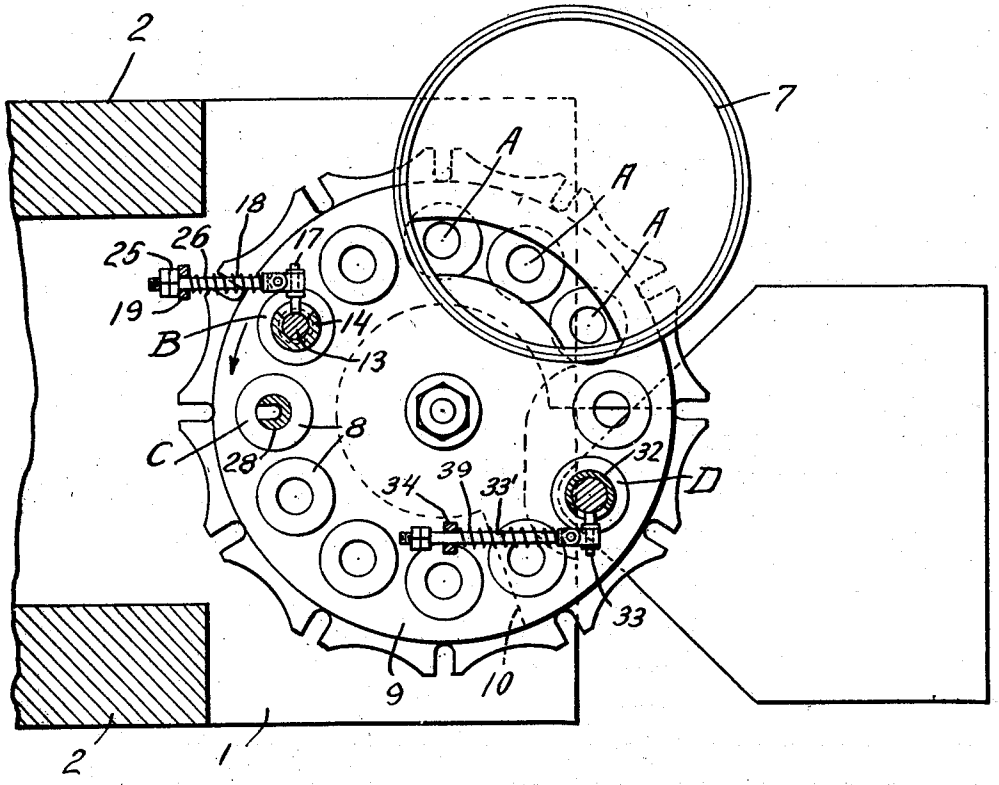
Nov. 18, 1930. J. M. HENDERSON 1,781,688

METHOD OF AND APPARATUS FOR MAKING DRY CELL CORES

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Fig. 1.



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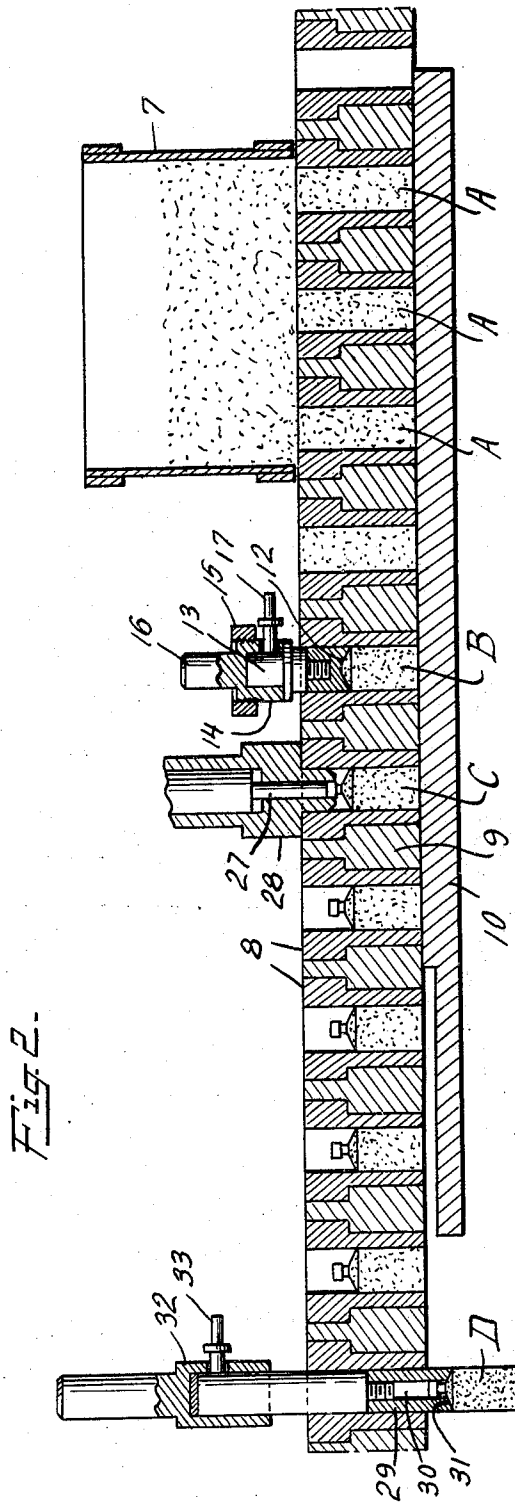


Fig 2.

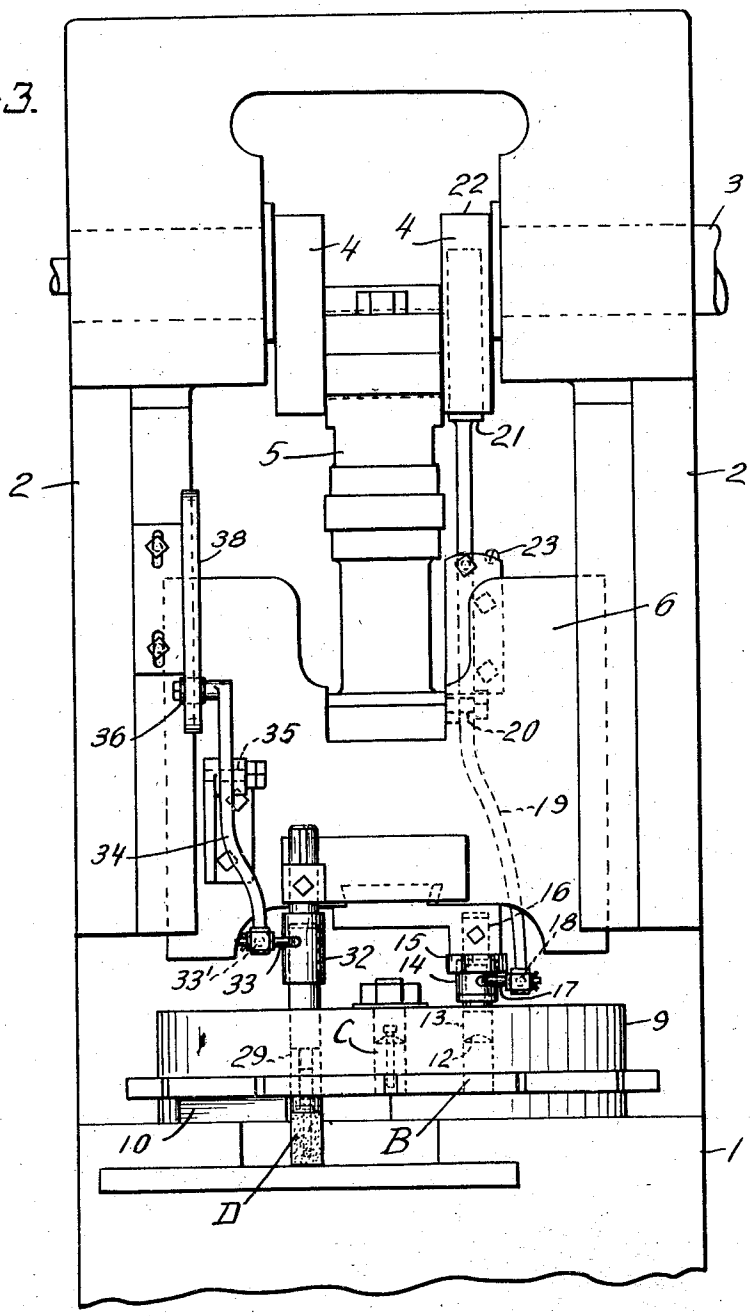
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METHOD OF AND APPARATUS FOR MAKING DRY CELL CORES

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Fig. 3.



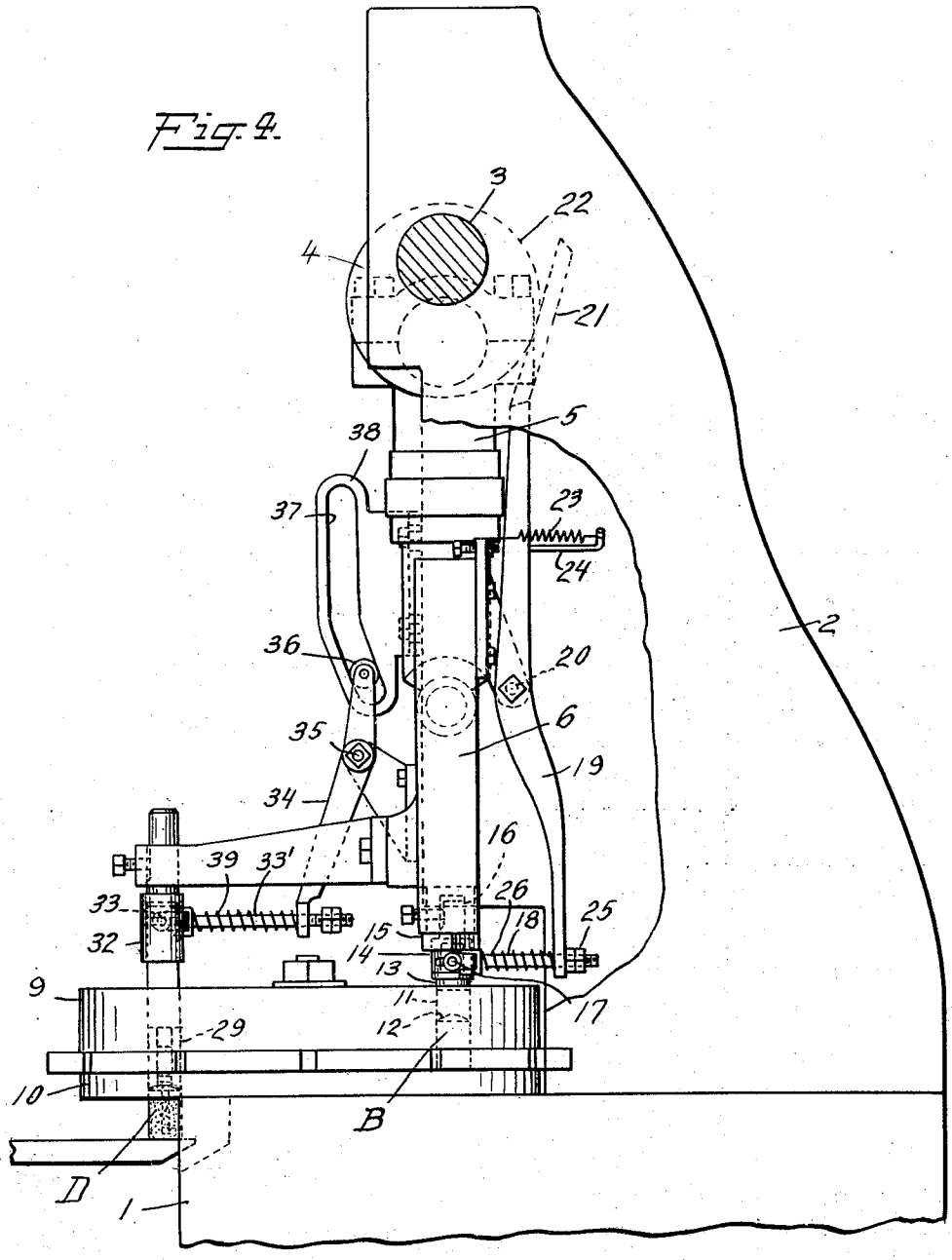
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METHOD OF AND APPARATUS FOR MAKING DRY CELL CORES

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Fig. 4.



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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR MAKING DRY-CELL CORES

Application filed December 21, 1927. Serial No. 241,585.

This invention relates to an improved method of tamping depolarizing cores for dry cells.

It is an object of this invention to provide a method for automatically preventing the depolarizing mix from adhering to the face of the tamping tool or knock-out punch during the manufacture of the core. It is a further object to produce a core having excellent adherence between the mix and the carbon rod at the top of the core and thereby decrease the contact resistance. A still further object is to permit the economical production of cores having convex tops and to provide a core having a top which is free of loose particles of depolarizing mix. Further objects will become apparent in the following specification and appended drawings in which:

Fig. 1 is a diagrammatic plan view, partly in section, of a core tamping machine having means for practicing the process of the present invention;

Fig. 2 is a schematic, vertical, sectional view of a battery tamping machine showing the manner and order in which the several operations are performed;

Fig. 3 is a front elevation of the machine shown in Fig. 1, and

Fig. 4 is a side elevation.

The depolarizing core of the Leclanché type bag-type dry cell is usually molded before introducing it into the zinc can. The core is made of a moist mixture of depolarizer, usually manganese dioxide, pulverized graphite, sal ammoniac, zinc chloride and water in sufficient amount to allow the core to be molded readily. A carbon rod having a brass cap may be molded into the core during the molding operation. However, my invention relates to a core made by molding the depolarizing mixture and then inserting the carbon rod as described in Hambuechen Patent No. 1,232,297. The moist depolarizing mix is placed in a suitable mold where it is compressed to form a coherent cylindrical core. The carbon rod is then inserted into the core after which the core is ejected from the mold. These operations may be carried out on a tamping machine as described in Patent No. 1,232,297 or they may be carried out on automatic machines that are power driven.

A core made as described is often defective. If the carbon rod is driven into a cylindrical core at a slight angle to its own axis a hole is formed at the top of the core which is larger in diameter than the rod. As a result there is poor contact and a high contact resistance between the depolarizing mix and the rod. This is detrimental to the finished dry cell because the high contact resistance increases the internal resistance, lowers the short circuit amperage or flash, and decreases its electrical output. The surface of the tamping tool contacting with the mix picks up the wet mix and soon becomes rough. The top surface of the core then becomes uneven and loose particles of mix adhere to it. These loose particles of mix are a source of potential injury to a dry cell because if they fall into the zinc can and contact therewith destructive local action results. This difficulty is accentuated by the tendency of the carbon rod to loosen the mix slightly at the top of the core. My invention overcomes these difficulties and is especially suitable for application to power driven core machines as distinguished from the hand operated machines. However, I do not restrict my invention to such machines as it may be used in hand operated machines as well.

In illustrating the invention, I have shown a well known type of press structure comprising a base 1, and side walls 2 at the rear of the base. The walls 2 provide bearings for a crank shaft 3 which may be driven by any suitable means (not shown). The cranks 4 are connected to the shaft to cause reciprocation of a connecting rod 5. The connecting rod is adapted to drive a gate 6 moving up and down in vertical guides provided in the side walls.

A hopper 7 is adapted to contain the depolarizing mix which is conveyed to the dies of the press in any suitable manner. The parts exposed to the depolarizing mixture are made of, or covered with, non-corrodible material. A series of cylindrical dies 8 are set in a dial 9 arranged on the base of the

machine so that the dies pass consecutively under the feed opening of the hopper 7 to receive charges of the depolarizing mix. The dies and the face of the dial are covered or faced with a thin covering of non-corrodible material. A stationary plate 10 of non-corrodible material is arranged beneath the dial and forms a bottom for the dies when the mix is being pressed therein. A portion of the plate may be cut away to permit imperfectly formed cores to drop out of the dies and completed cores to be ejected.

The dial may be given a step by step, rotating movement by suitable means (not shown) such as the well known Geneva motion. After the depolarizing mix has been placed in the die, it is subjected to three operations, namely, tamping, inserting the carbon pencil and ejecting the finished electrodes. In Fig. 2 of the drawings the parts of the machine are shown arranged in longitudinal alignment and after a die has been filled with the requisite quantity of the depolarizing mix from the hopper 7, as indicated at A, it passes to the second position and is tamped, as indicated at B. The die then passes to the third position where the carbon pencil is inserted, as indicated at C, and eventually reaches the fourth position where the completed core is ejected from the die by the knock-out punch, as indicated at D.

A tamping tool is carried by the gate 6 and is adapted to be reciprocated into each of the dies at the second position B while the dial is in a state of rest to properly tamp the depolarizing mixture. As shown (see Fig. 2) the tamping tool is provided with a conical lower face 12. The tamping tool is provided with a pin 13 which works in a socket in a head 14. This socket is threaded and is fastened by means of a nut 15 and a stud 16 in the gate of the press. An arm 17 extends through a slot in the socket 14 to permit the tamping tool to be twisted in the socket. This arm is in turn attached to an arm 18 to synchronize the twisting of the tamping tool with its reciprocating movement. Any suitable moving part of the machine may be employed to twist the tamping tool. On the downward stroke of the tamping tool the mix is compressed in the die against the bottom plate 10 to form a firm, hard, cylindrical slug of uniform density in the lower part of the mold. The pressure employed firmly wedges the core into the mold but the mix has a tendency to stick to the bottom face of the tamping tool with which it contacts, if the tool is not twisted at the proper time. Heretofore some tamping tools have been provided with flat faces from which the adhering mix may be readily removed by a scraper, but with a conically countersunk face this accumulated mix is difficult to remove from the face of the tamping tool. At any event, the machine must be stopped and production ceases during the cleaning operation. I have found that if the tamping tool is twisted sharply during the last part of its downward stroke and the first part of its upward stroke, or more specifically, at the moment of relieving the pressure of the tamping tool on the mix, the surface of the tamping tool remains clean and no time is lost in cleaning the tool. This is true where the tool is provided with a straight or countersunk face. The surface of the core is smooth and free of loose particles. To obtain this twisting movement the arm 18 is connected to a pivoted lever 19 which is pivotally mounted at 20 on the gate 6 of the machine and is provided with an engaging portion 21 at its upper end adapted to contact with an eccentric 22 on the drive shaft. The upper end of this lever is normally urged inwardly by a spring 23 connected to a stationary part of the machine and to an arm or bracket 24 carried by the lever. The lower end of this lever is provided with an opening to receive the arm 18 and is retained thereon by nuts 25. A spring 26 may surround the arm 18 to keep the lower end of the lever 19 normally in its outer position. When the arm 19 is rocked on its pivot the arm 18 is swung through an arc of a circle causing the tamping tool to be twisted in the head or socket 14.

After the mix has been tamped as described, the dial 9 is rotated to position the compressed core under the carbon inserting mechanism. The carbon rod is then pushed into the mix as shown in Fig. 2 of the drawings. The carbon inserting means consists of a plunger 27 operating in a head 28 to force the carbon pencil through the tamped mix cake. As the carbon inserting mechanism forms no part of the present invention a detailed description thereof is deemed unnecessary. After the carbon has been inserted the dial moves to the position D under the knock-out punch 29 whence the completed core is ejected. The knock-out punch is recessed, as at 30, to accommodate the projecting head 31 of the carbon pencil. The core is removed from the die by pushing on the depolarizing mix and not on the carbon. The punch may be provided with a flat face or may be countersunk as indicated at 31. In Figs. 2 and 3 of the drawings, the punch is shown at the bottom of its stroke. Since the mix cake is wedged tightly in the die by the tamping tool considerable pressure is necessary to push the core through the mold. The starting pressure is especially high. As a result, the face of the knock-out punch becomes covered with mix causing difficulties similar to those experienced with the tamping tool as heretofore described. I have found that these difficulties may also be avoided by twisting the knock-out punch on its de-

scent through the die, especially while it is in contact with the top of the core. The punch need not be twisted after the core has been ejected from the bottom of the mold. The punch 29 is mounted in a head 32 which is in turn carried by the gate 6. An arm or pin 33 is carried by the punch which passes through a slot in the head 32 (see Fig. 1). This arm is connected by means of a second arm 33′ to a pivoted lever 34 pivotally mounted on gate 6 as at 35 and provided with a roller 36 at its upper end. This roller travels in a slot 37 formed in a plate 38 carried by a stationary part of the machine so that during the downward movement of the gate the arm 34 is swung on its pivot. The lower end of the lever 34 is provided with an opening to receive the arm 33′ and the arm is surrounded by a spring 39 which engages one side of the lever. When the lever 34 is swung on its pivot, the arm 33 moves through an arc of a circle to twist the knock-out punch. The tamping tool 11 and the knock-out punch 29, being carried by the gate of the press are synchronized in their movement and the twisting of each of these tools, being controlled from a movable part of the machine, is synchronized with the particular tool to cause the twisting at the desired time with respect to that tool.

The twisting of the tamping tool and the knock-out punch as described makes it possible to use these tools with countersunk heads. The countersinking may be conical in shape. As pointed out the twisting of the tools cleans the surfaces of the tools contacting with the mix and obviates the necessity of shutdowns to clean the tools. In addition the convex top of the finished core adds depolarizing mix at a place on the core which adds to the discharge capacity without interfering with the expansion of the paste electrolyte used in the pasted type of dry cell well known to those skilled in the art. When the carbon is inserted into the core the mix may be disturbed and loosened adjacent to the carbon at the top of the core. The carbon also may be in poor contact with the mix as hereinbefore explained. I have discovered that the difficulties arising from the inserting of the carbon rod may be corrected during the ejection of the core from the mold by the knock-out punch. I have found that by making the angle of the cone in the knock-out punch less than the cone in the tamping tool the entire pressure of the knock-out tool is concentrated on the mix adjacent to the carbon. As a high pressure is necessary to eject the core from the mold, the deterimental effect on the mix caused by the insertion of the carbon is corrected. The mix is recompressed and in addition it is forced against the carbon so that it adheres tightly to the carbon especially at the upper part of the core. The contact resistance is thereby cut to a minimum. I have found that excellent results are obtained if the face of the countersinking of the tamping tool is at an angle of about 30° with a plane perpendicular to the axis of the tool and if the angle of the countersinking of the knock-out punch is about 20°. While I have described a countersunk cone having angles of approximately 30° and 20° I do not wish to limit myself to a cone of these angles, these being merely illustrative of my invention. I do not wish to confine to concave or conically countersunk tools the lessening of the angle of the knock-out punch as compared to the tamping tool so as to concentrate the pressure of the knock-out tool to the mix adjacent to the carbon rod, as this invention may be applied to tools which are flat or slightly convex.

The twisting of the tamping tool during the act of compressing the mix into a slug creates an advantage in addition to those mentioned above. If the tool is twisted during the period of compression and especially during the period of heavy compression, a slug having greater uniformity of density will be produced. The feed opening from hopper 7 may deposit the mix unevenly in the die, the larger the die in diameter the greater is the tendency toward an uneven deposit of mix. A tamping tool which does not rotate or twist as it descends will compress the mix as it is found and the resulting slug will be more compact in some places than in others. The twisting movement evens off the top and causes an adjustment of particles in the body of the mix to secure an even pressure at all points. It is thus seen that the twisting of the tamping tool produces a slug having uniform density throughout its mass. Likewise, the twisting movement of the knock-out punch tends to distribute evenly the pressure throughout the finished core and results in a core of more uniform density.

I claim:

1. Means for making a cylindrical dry cell core comprising an open top cylindrical mold with a removable bottom, a tamping tool having a conically countersunk face with the face of said cone at an angle of about 30° with a plane perpendicular to the axis of the tool, means for reciprocating said tamping tool in said mold to compress moist depolarizing mix previously introduced into said mold, means for twisting said tamping tool during the last part of its downward stroke and first part of its upward stroke, means for ejecting said core from said mold, said means comprising a cylindrical knock-out punch having a conically countersunk face with the face of said cone at an angle of about 20° with a plane perpendicular to the axis of said punch and having a recess to accommodate a carbon rod projecting upward from said mix, means for reciprocating said punch to push through and discharge

said core from the bottom of said mold, and means for twisting said punch during its downward stroke while contacting with said mix.

2. Means for making a cylindrical dry cell core comprising an open top cylindrical mold with a removable bottom, a tamping tool having a conically countersunk face, means for reciprocating said tamping tool in said mold to compress moist depolarizing mix previously introduced into said mold, means for twisting said tamping tool during the last part of its downward stroke and first part of its upward stroke, means for ejecting said core from said mold, said means comprising a cylindrical knock-out punch having a conically countersunk face, the face of said cone being at an angle with a plane perpendicular to the axis of said punch less than the angle of the cone in said tamping tool, said knock-out punch having a recess to accommodate a carbon rod projecting upward from said mix, means for reciprocating said punch to push through and discharge said core from the bottom of said mold, and means for twisting said punch during its downward stroke while contacting with said mix.

3. Means for making a cylindrical dry cell core comprising an open top cylindrical mold with a removable bottom, a tamping tool having a conically countersunk face, means for reciprocating said tamping tool in said mold to compress moist depolarizing mix previously introduced into said mold, means for twisting said tamping tool during the moment of relieving the pressure of said tamping tool on said mix, means for ejecting said core from said mold, said means comprising a cylindrical knock-out punch having a conically countersunk face, the face of said cone being at an angle with a plane perpendicular to the axis of said punch less than the angle of the cone in said tamping tool, said knock-out punch having a recess to accommodate a carbon rod projecting upward from said mix, means for reciprocating said punch to push through and discharge said core from the bottom of said mold, and means for twisting said punch during its downward stroke while contacting with said mix.

4. Means for making a cylindrical dry cell core comprising an open top cylindrical mold with a removable bottom, means for reciprocating a tamping tool in said mold to compress moist depolarizing mix previously introduced into said mold, means for twisting said tamping tool during the moment of relieving the pressure of said tamping tool on said mix, means for ejecting said core from said mold said means comprising a cylindrical knock-out punch having a recess to accommodate a carbon rod projecting upward from said mix, means for reciprocating said punch to push through and discharge said core from the bottom of said mold, and means for twisting said punch during its downward stroke while contacting with said mix.

5. In means for making a cylindrical dry cell core, a tamping tool having a countersunk face, means for reciprocating said tamping tool, means for twisting said tamping tool during the last part of its downward stroke and first part of its upward stroke, a cylindrical knock-out punch having a face countersunk more shallow than the face of said tamping tool, means for reciprocating said punch, and means for twisting said punch during its downward stroke.

6. In means for making a cylindrical dry cell core, a tamping tool and means for reciprocating said tool, means for twisting said tamping tool during the last part of its downward stroke and first part of its upward stroke, a cylindrical knock-out punch, means for reciprocating said punch, and means for twisting said punch during its downward stroke.

7. In means for making a cylindrical dry cell core, a tamping tool having a countersunk face, means for reciprocating said tamping tool and means for twisting said tamping tool during the last part of its downward stroke and first part of its upward stroke.

8. In means for making a cylindrical dry cell core, a tamping tool and means for reciprocating said tamping tool, and means for twisting said tamping tool during the last part of its downward stroke and first part of its upward stroke.

9. In means for making a cylindrical dry cell core, an open top cylindrical mold, a tamping tool, means for reciprocating said tamping tool in said mold to compress moist depolarizing mix therein, and means for twisting said tamping tool during the moment of relieving the pressure of said tamping tool on said mix.

10. In means for making a cylindrical dry cell core, a tamping tool and means for twisting the tamping tool during the moment of relieving the pressure of said tamping tool on said mix.

11. In an ejecting mechanism for dry cell cores a knock-out punch having means for concentrating the pressure upon the mix of the core adjacent the carbon rod therein.

12. In means for making a cylindrical dry cell core, a tamping tool having a countersunk face and a knockout punch having a countersunk face more shallow than the countersunk face of the tamping tool.

13. In means for making a cylindrical dry cell core, a knock-out punch having a countersunk ejecting surface and means for twisting said punch while contacting with said core.

14. The method of making a cylindrical dry cell core which comprises compressing

moist depolarizing mix to form a cylinder having a conical top, inserting a carbon rod into said cylinder, and recompressing the top of said core about the carbon rod with a force having a component inwardly directed toward said carbon rod.

15. The method of making a cylindrical dry cell core which comprises inserting a carbon rod into a cylinder of compressed depolarizing mix, and then recompressing the top of said core about the carbon rod with a force having a component inwardly directed toward said carbon rod.

16. The step in the method of making a cylindrical dry cell core of moist depolarizing mix which comprises twisting the tamping tool at the moment of relieving the pressure of said tamping tool on said mix.

17. The step in the method of making a cylindrical dry cell core of moist depolarizing mix which comprises twisting the tamping tool during the period of heavy compression between said tamping tool and said mix.

In testimony whereof I affix my signature.

JOSEPH M. HENDERSON.