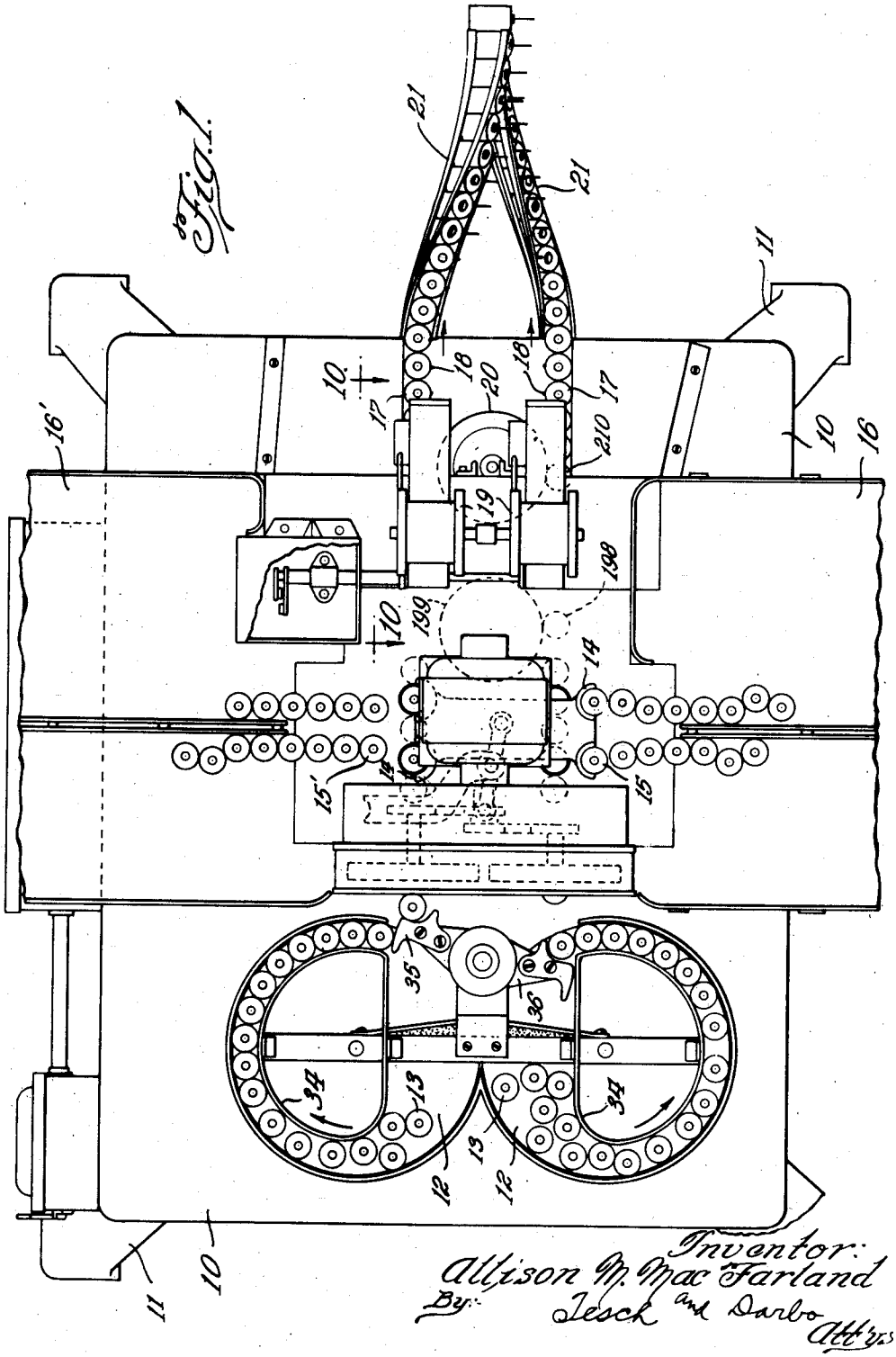
Feb. 24, 1942. A. M. MacFARLAND 2,274,490

DRY CELL MACHINE

Filed Dec. 24, 1938 4 Sheets-Sheet 1

Fig. 1.



Inventor:
Allison M. MacFarland
By: Jesck and Darbo
Att'ys

Feb. 24, 1942. A. M. MacFARLAND 2,274,490

DRY CELL MACHINE

Filed Dec. 24, 1938 4 Sheets-Sheet 2

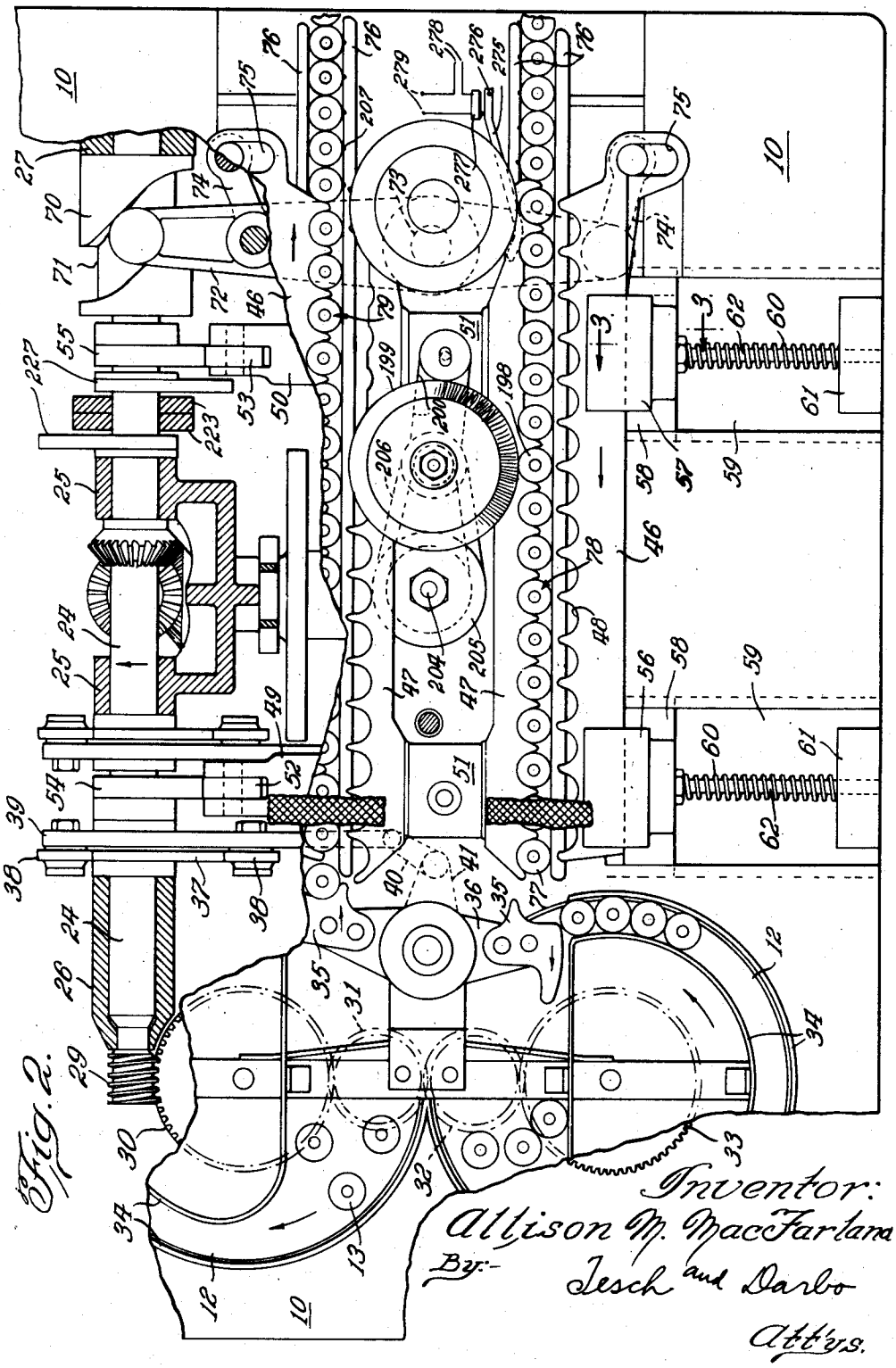


Fig. 2.

Inventor:
Allison M. MacFarland
By:- Jesch and Darbo
Att'ys.

Feb. 24, 1942. A. M. MacFARLAND 2,274,490

DRY CELL MACHINE

Filed Dec. 24, 1938 4 Sheets-Sheet 3

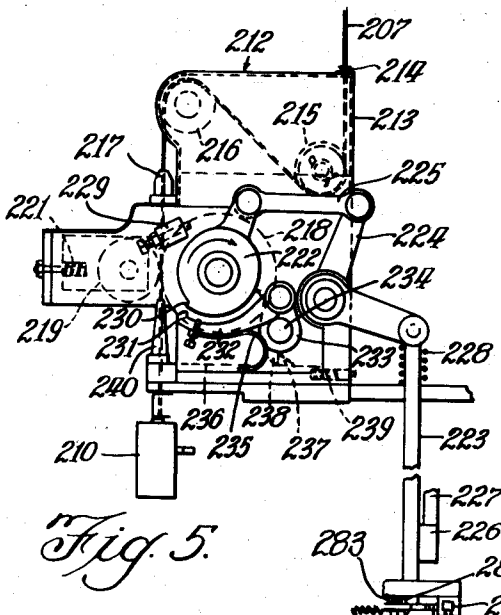


Fig. 5.

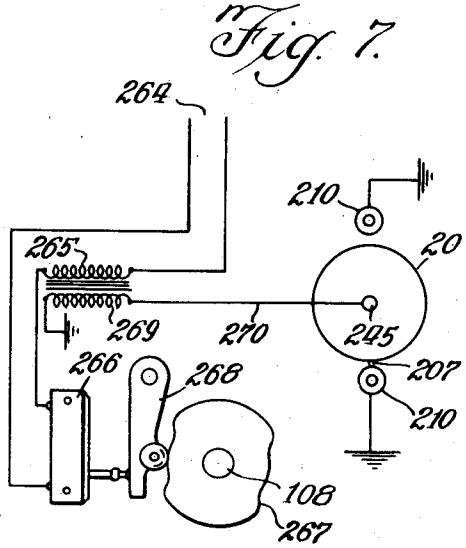


Fig. 7.

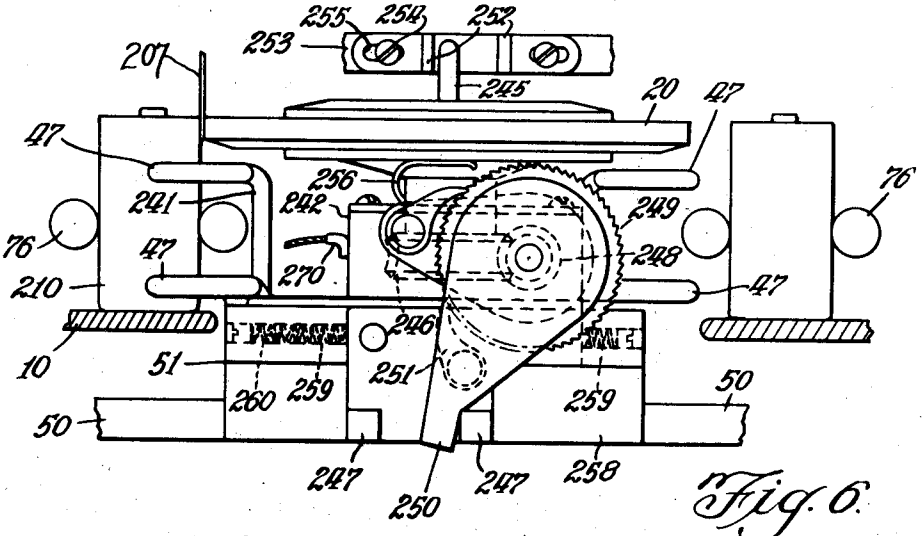


Fig. 6.

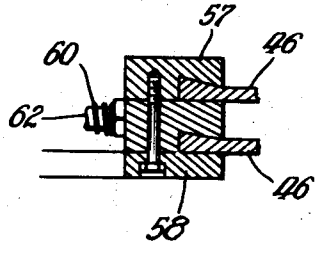


Fig. 3.

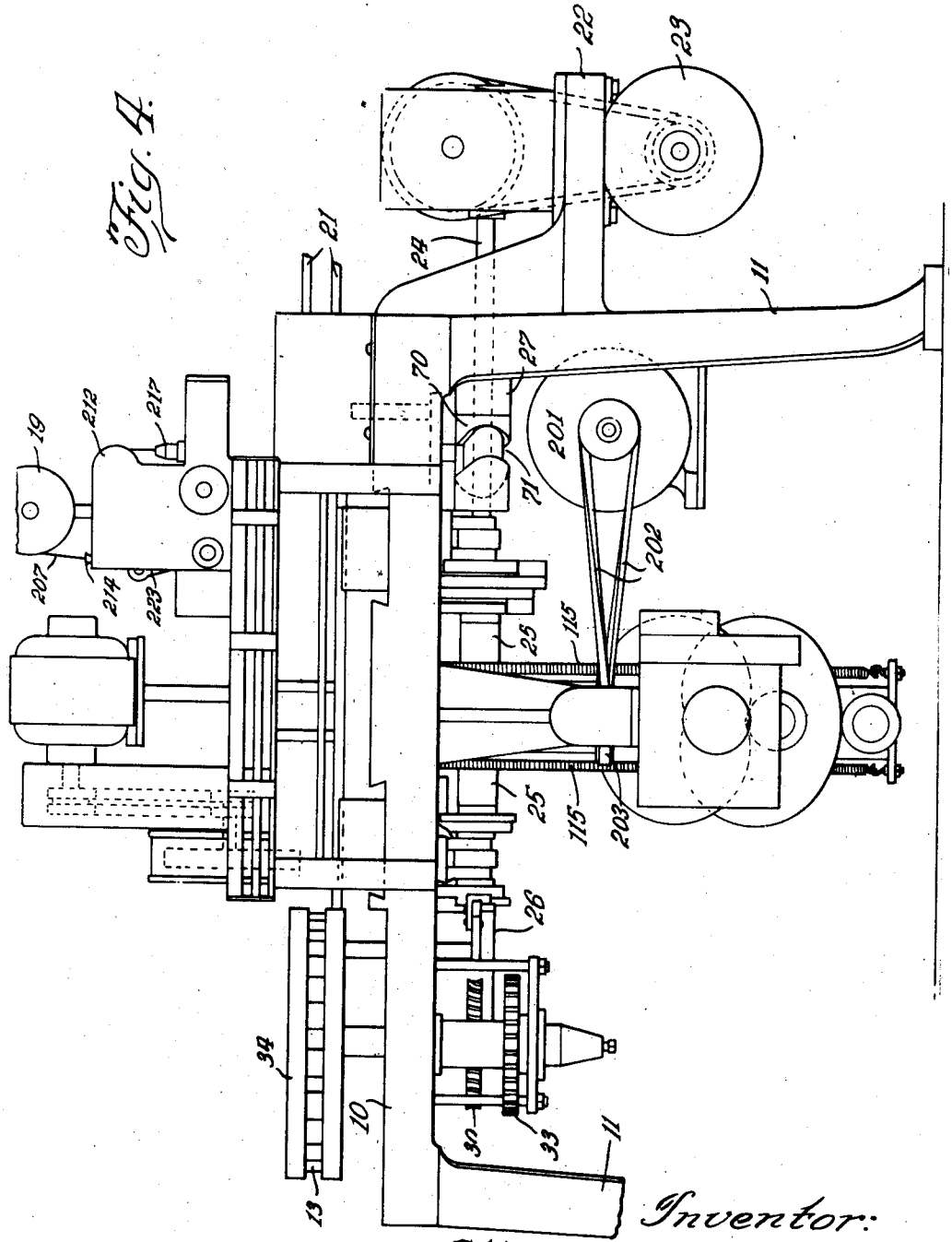
Inventor:
Allison M. MacFarland
By: Jesch and Darbo
Attys.

Feb. 24, 1942. A. M. MacFARLAND 2,274,490

DRY CELL MACHINE

Filed Dec. 24, 1938 4 Sheets-Sheet 4

Fig. 4.



Inventor:
Allison M. MacFarland.
By Jesch and Darbo
Attys.

Patented Feb. 24, 1942

2,274,490

UNITED STATES PATENT OFFICE

2,274,490

DRY CELL MACHINE

Allison M. MacFarland, Chicago, Ill., assignor, by mesne assignments, to Burgess Battery Company, Chicago, Ill., a corporation of Delaware

Application December 24, 1938, Serial No. 247,726

2 Claims. (Cl. 219—4)

This invention relates to machinery for the production of dry cells, and particularly to a machine for attaching metallic conductors to the cells to adapt the cells to be used in multiple cell batteries.

It is the object of the invention to provide a machine or mechanism in which the said function can be carried out in a reliable manner.

It is a further object of the invention to provide improved mechanism for performing such function which is efficient in operation and operates without attention and has a long useful life.

It is the object of the invention to provide a mechanism for attaching such conductors by fusing such metal of the dry cells to the surface metal of the conductors by electrically-generated heat, and to provide a mechanism which is resistant to the heat which is involved in such operations and may be used for long periods without deterioration.

Other objects and advantages will become apparent as the following description progresses, in which

Fig. 1 is a plan view of the machine;

Fig. 2 is a second plan view of the machine on an enlarged scale with portions broken away;

Fig. 3 is a fractional, sectional view taken along line 3—3 of Fig. 2;

Fig. 4 is a side elevational view of the machine;

Fig. 5 is a fractional side elevational view showing the mechanism for feeding the conductor material to the dry cells;

Fig. 6 is a view taken transversely of the machine and partly in section illustrating the mechanism for attaching the conductors to the cells; and

Fig. 7 is a diagrammatic view showing the means for applying the electrical heating energy during the conductor-attaching operation.

The general features of the machine are illustrated in Fig. 1. It comprises a flat-topped main frame 10 supported upon legs 11. A pair of rotating feed tables 12 are mounted upon frame 10. The operator first places the dry cells 13 on the feed tables. The cells are of the usual type having a positive terminal consisting of a central carbon rod having a brass cap and a negative terminal consisting of a cylindrical zinc container. From the feed tables 12, the cells are fed to a reciprocating mechanism for advancing them intermittently in two separate rows (not shown in Fig. 1). The cells of each row are operated upon individually by apparatus for testing separately their electrical potential and current delivery properties, and ejecting those which do not deliver predetermined minimum values. The details of this apparatus are not described herein. The upper parts or shoes of the ejecting mechanism are indicated by the numeral 14. The rejected cells 15 are lifted out of the line of advancing cells and pushed laterally upon a platform 16 above frame 10. The rejected cells 15' of the other row are delivered to a corresponding platform 16' on the other side of the machine. The satisfactory cells 17 continue to be advanced intermittently to a further station where a rotary brush 199 cleans the surfaces of the zinc containers, and then to a further station where the lead wires 18 are automatically welded to the zinc containers, the wire being fed downwardly from reels 19 to the cell and then pressed momentarily against the zinc containers by a disc-shaped electrode 20 which supplies electric heating energy to accomplish the welding. After this, the cells continue to be advanced intermittently along a pair of delivery compartments 21, these compartments being arranged so as to turn the cells from an upright to a horizontal position as they proceed, as shown in Fig. 1. At the ends of the compartments the cells are received upon a delivery table (not shown) where the operator may pick them up and dispose them as desired, or they may be fed to further automatic machinery adapted to assemble the cells into batteries. The mechanism and apparatus for operating on the different rows of cells are duplicates of one another, and are arranged so that one row is stationary for the various operations to be performed while the other row is being advanced.

Cell advancement and general operations

Referring to Figs. 2 and 4, the main frame 10 has a bracket 22 (see Fig. 4) extending from one end thereof and upon this bracket is supported a motor 23 which supplies the motive power for substantially the entire machine.

The power is transmitted from the motor 23 to a main shaft 24 by transmission mechanism which is not shown. The shaft 24 is mounted upon suitable bearings 25, 26 and 27 which are mounted on a bracket 28 depending from the frame 10, as shown in Fig. 5. The shaft revolves in the direction indicated by the arrow in Fig. 2.

The worm 29 upon the end of shaft 24 turns the worm gear 30 which drives the feed table 12 and causes it to revolve in the direction indicated by the arrow. A spur gear (not shown)

is mounted on the same shaft with worm gear 30 and through a suitable train of gears indicated at 31, 32 and 33, the movement of gear 30 is transmitted to the second feed table, which is caused to revolve in the opposite direction as indicated by the arrow thereon. Stationary guide bars 34 are supported above feed tables to guide the dry cells 13.

The cells 13 are placed in an upright position upon the feed tables and are moved by the latter into and along the channels formed between the guide bars to the ends thereof where reciprocating feed shoes 35 alternately advance one cell from each feed table in the longitudinal direction of the machine. Feed shoes 35 are mounted at the ends of a bar 36 which is mounted pivotally at its center and has an oscillating motion transmitted to it in synchronism with the rest of the machine by means of a cam 37 on shaft 24, a pair of cam followers 38, adapted to reciprocate crosswise of the machine, link 40, and a lever 41 fastened to the oscillating bar 36 and adapted to transmit motion to the latter. The shoes have concave surfaces adapted to hold the cells while moving them in the desired longitudinal direction.

From the point to which the cells are advanced by the feed shoes 35, they are further advanced intermittently in a longitudinal direction by racks 46, which are adapted to reciprocate longitudinally and transversely, and are held stationary at the different stations at which the operations are performed by other racks 47 which reciprocate transversely of the machine. These racks each have a series of semi-circular recesses, indicated at 48 on rack 46, shaped to conform with the cylindrical surfaces of the dry cells, and adapted to engage the dry cells as will be described. This type of mechanism is not new with this invention and the details are not all shown. The racks 47 are mounted upon the longitudinally extending base member indicated generally at 51, see also Fig. 11 and the latter is adapted to be reciprocated transversely by transverse bars 49 and 50. There are two racks 47 for each row of cells, as shown in Fig. 11, one engaging the cells near the top and the other near the bottom. The same is true of racks 46. Racks 46 are mounted near their ends on lugs 56 and 57, of which only one set is shown in Fig. 2, these lugs also being fixed to transverse bars 49 and 50. The edges of the racks 46 are mounted slidably in slots in the lugs, as illustrated in Fig. 3, to permit longitudinal motion of the racks relative to the lugs. The base portions 58 of the lugs are mounted slidably in transverse recesses 59 in the main frame 10 to permit transverse motion of the lugs. Transverse motion toward the right (when viewed in the direction of cell advancement) is transmitted to bars 49 and 50 by means of cam followers 52 and 53 which cooperate with cams 54 and 55 on shaft 24. Motion to the left is transmitted by compression springs 60 operating upon the lugs 56 and 57. For this purpose, lugs 61 are mounted in fixed position upon the frame 10 and rods 62 are mounted in the said lugs 56 and 57 and extend slidably into cooperating openings in lugs 61. The compression springs 60 are mounted over the rods 62 and exert a force on lugs 56 and 57 sufficient to move the bars 49 and 50 and the racks in the opposite direction as the surfaces of cams 54 and 55 recede.

During the time that racks 46 are in engagement with the dry cells, as shown in Fig. 2, they undergo longitudinal motion in such manner as to advance the cells. For this purpose shaft 24 has mounted thereon a cam 70 having a cam recess 71 therein adapted to impart an oscillating motion to bar 72 which is mounted pivotally on the frame at 73. A cam follower (not shown) is provided at the end of bar 72 and is adapted to cooperate with cam groove 71. Bars 72 are connected to racks 46 on both sides of the pivotal mounting 73 by means of link members 74. Transverse slots 75 in the ends of racks 46 cooperate with the link members 74 to permit the transverse motion of the racks.

The step-by-step advancement of the dry cells by means of the racks is accomplished in the following manner. The cells of each row are held against lateral movement by the longitudinally extending rails 76 which are fixed in position. In the position in which the machine is shown in Fig. 2, the racks 46 on the left side of the machine are approximately at the mid-point of their advance movement (the direction is indicated by the arrow) and the others are at the mid-point of their retractive movement. In its last previous motion, the right hand oscillating feed shoe 35 has moved the rearmost dry cell 77 into position to be engaged in the rearmost recess of right hand racks 47, and the racks 47 have subsequently moved transversely so as to engage cell 77 and hold it and the rest of the cells of this row stationary while the operations are performed at the different stations. The right hand racks 46 have receded from this row of cells, indicated generally by numeral 78, and are moving backward. With respect to the other row of cells 79 the left hand racks 46 have advanced to engage the cells and are moving them forward to their next succeeding stations, and are at approximately the mid-point of their forward movement. The cams on shaft 24 are arranged so that the transverse and longitudinal movements of the racks occur alternately, and upon completion of the longitudinal movement of racks 46, transverse bars 49 and 50 move all of the racks transversely and racks 47 engage the dry cells of row 79 and hold them in a stationary position while racks 46 engage the dry cells of row 78 and advance them to the next successive station.

Pin-wire attaching operation

As the dry cells are advanced to the station indicated at 198 and in Figs. 1 and 2, the upper portion of the zinc cans, on the side disposed toward the middle of the machine, are subjected to a brushing operation by means of wire brush 199. This brush is mounted on the end of arm 200 which is mounted pivotally at the other end on base member 51, and is operated by motor 201, see Fig. 4, by means of the pulley and belt system 202, 203, 204, 205 and 206. As the base member 51 reciprocates transversely, the arm 200 reciprocates with it and cooperates with belt 206 to press brush 199 against cells in both rows with resilient pressure. The brushing removes any coating of dirt or oxide which may be present and prepares a clean zinc surface for the attachment of the wire conductor 207, called pin-wire, which is used for connecting the cells together in a multiple cell battery.

As the dry cells are advanced in the machine, the next operation is the attachment of the pin-wires. This is accomplished by arranging the pin-wire adjacent the upper portion of the zinc can of each cell and momentarily pressing a disc

conductor, preferably of carbon, against the opposite side of the wire with resilient pressure and simultaneously passing electrical current from the disc through the wire and the adjacent portion of the zinc can whereby sufficient heat is generated at the junctions between these parts and in the wire to cause the wire to become welded to the zinc surface. The wire is usually of copper with a surface coating of tin, and the heat is such as to fuse the tin of the coating and the zinc of the can to cause the two to weld together.

The wire 207 for each row of cells is fed from the reel 19, mounted at the top of the machine (see Fig. 4), by means of mechanism contained in housing 212, and shown in detail in Fig. 5. The wire is fed downwardly into the housing 212 through an opening and guide member 214 in the top of the latter and passes around pulleys 215 and 216. The upper portion 213 of housing 212 is a container for a flux which may be a solution of ammonium chloride, zinc chloride and starch and the wire becomes coated with flux as it passes through the container 213. From pulley 216 the wire passes downwardly through a second guide member 217 and between two rollers 218 and 219, between which the wire is grasped by compression and caused to advance in a step-by-step movement a regulated distance at each step. Roller 219 is mounted in a bearing block which is urged toward roller 218 by means of spring 221, the compression of which may be regulated to control the compression exerted upon the wire. Roller 219 turns freely, and roller 218 is driven by an oscillating crank 222 mounted on the outside of housing 212 and connected to the roller 218 by mechanism which is not shown, but which may be of the usual type for driving the roller in one direction only and permitting the crank to move freely in the opposite direction. This may be a ratchet and pawl mechanism or a spring mechanism after the construction of so-called "free-wheeling" mechanisms. Crank 222 is oscillated by means of rod 223 through the interposition of bell crank lever 224 and link 225. A cam follower 226 and rod 223 is moved downwardly by cam 227 and upwardly by spring 228 mounted in compression about rod 223 and exerting pressure against lever 224. From the feeding mechanism the wire passes through a third guide member 240 and into adjacent relation to the zinc can of dry cell 210.

Means are provided for severing each length of wire as it is fed. Crank 222 has a projecting surface 230 which cooperates with the enlargement, or catch 231, at the end of lever 232 which is connected to lever 233, both levers being mounted pivotally at 234. The lever 232 is held against the surface of the crank by the spring 235. Mounted inside of housing 212 and moving with levers 232 and 233 is a bar 236 having a dog 237 thereon adapted to be engaged by a cooperating dog 238 on lever 233 to move bar 236 toward the right, as shown in Fig. 5 against the compression of spring 239. The cutting edge (not shown) is carried by the left hand end of bar 236. The lever 232 is engaged by the projecting surface 230 during the first part only of the stroke of crank 222 during which the crank 222 moves in the direction indicated by the arrow, which is the return stroke with respect to the feeding of the wire 213. The levers 232 and 233 during this time move cutting bar 236 toward the right as it is viewed in Fig. 5. The surfaces of crank 222 and lever 232 are shaped so as to cause disengagement before the completion of the return stroke, as shown in Fig. 5, and compression spring 239 moves the cutting bar 236 toward the left and the blade enters an opening in guide member 240 to sever the wire. Before the completion of the feed stroke, catch 231 snaps into engagement with projecting surface 230 again. Adjustable stop member 229 regulates the forward stroke of crank 222 and thus regulates the length of wire fed at each stroke.

The electrode 20 is a carbon disc, see Fig. 6, mounted upon the base 51 which is reciprocated transversely by transverse bars 49 and 50. The base 51 is supported upon and insulated from the rest of the machine by a member of electrical insulating material 258 which is fastened to transverse bars 49 and 50. The cell-holding racks 47 are mounted upon base 51 by means of supporting rods 241. A housing 242 is mounted upon base 51, in such manner that it is slidable transversely with respect to said base, the housing being urged to a mid-position by means of springs 259 which are contained in a transverse opening 260 in base 51. Carbon disc 20 is mounted upon an upright spindle 245 which is journaled in housing 242. Spindle 245 carries a worm gear 246 beneath carbon disc 20, and housing 242 carries a worm 248 adapted to cooperate with worm gear 246, and a ratchet 249 adapted to turn worm 248. Upon the same shaft carrying worm 248 and ratchet 249 is rotatably mounted a pawl mechanism comprising arm 250 and pawl 251, the pawl being carried by the arm and pressed by means of a spring against the surface of the ratchet and adapted to turn the latter in the well known manner. A second pawl 256 is mounted on the housing 242 and is adapted to prevent backward movement of ratchet 249 with backward movement of arm 250. Two stop members 247 are mounted in fixed positions upon the base 51, and two additional stop members 252 in adjustable positions upon stationary bar 253, which is mounted on the frame of the machine. The lateral positions of stops 252 may be adjusted by loosening the bolts 254, slots 255 being provided in the angular portions of the stop members for the purpose of permitting adjustment.

The mechanical operation of the carbon disc 20 is as follows. As the base 51 reciprocates laterally, it carries with it the housing 242, the movement of the latter being due to the force exerted by the springs 259. In its lateral movement, the edge of the disc engages the wire 207 and presses the latter momentarily against the dry cell 210. The wire 207 carries a coating of flux as described heretofore and during this moment electric energy is applied, as will be explained hereinafter, which causes the wire to be welded by heat to the zinc can of cell 210. The movement of the disc is stopped and with it the movement of the housing 242, springs 259 undergoing stress at this time. As the result of the stopping of the housing there is relative motion between it and the base 51. The ratchet being mounted upon the housing and the stops 247 upon the base, the arm 250 is caused to undergo a small rotary motion which it transmits by means of pawl 251 to the ratchet 249. Operation of the ratchet causes turning of worm 248 and worm gear 246 with the result that the carbon disc is rotated a small increment, this

being regulated to result in a circumferential movement of the edge of the disc a distance approximating the diameter of the wire 210. The stops 252 are adapted to stop the lateral movement of the carbon disc in the absence of a dry cell which may have been ejected, or which may be absent due to other causes, so that the relative movement between the base 51, and housing 242 and the resulting turning of the carbon disc, is obtained when the cell is absent as well as when it is present. The stops 252 are located so as to permit a slightly greater movement of the carbon disc than will take place in the presence of a dry cell. It is important that the carbon disc be rotated during operation so as to prevent the welding operation taking place at the same portion of its surface every time, which would result in the surface becoming overheated and destroyed at this point within a short time. By presenting a fresh welding surface each time the useful life of the carbon disc is prolonged many fold.

Means are provided for stopping the feed of the wire 207 in the absence of a dry cell, to prevent wastage of the wire and its accumulation in the machine. As has been pointed out above, the dry cell may be absent because it has not been fed by the operator or because it has been ejected by the testing mechanism described heretofore. The feed stopping means comprises a finger member 275, see Fig. 2, which is mounted pivotally at 276 on the machine and which is cooperatively associated with a switch 277 in an electrical supply circuit comprising conductors 278 adapted to supply electrical energy from a source indicated at 279 to a solenoid magnet 280, see Fig. 5, which is adapted to lock the wire feeding mechanism in the inoperative position. The armature 281 of the solenoid is connected to an arm 282 which, in turn, is fastened to a locking bar 283 which is adapted to be engaged in a notch 284 in the lower end portion of the rod 223 which operates the wire feeding mechanism. A tension spring 285 is also fastened to locking bar 283 and tends to draw said bar out of the notch 284.

The switch 277 is of the same character as the switches described heretofore and is normally in the closed position. The dry cells as they move in succession into position for the welding operation engage the finger member 275 and cause it to turn slightly on its pivotal support 276 and actuate the operating member of switch 277 to open the said switch. The solenoid magnet 280 remains deenergized and the locking bar 283 is held out of the notch 284 by spring member 285. When a dry cell is absent the finger member 275 is not turned and the switch 277 remains closed and magnet 280 is actuated to draw the locking bar 283 to the right and into the notch of operating member 223. This operating member is normally moved upwardly by spring 226, as has been described heretofore, but this upward motion is prevented when locking bar 283 is engaged in notch 284, and as a result wire 207 is not fed when a dry cell is absent from the welding position. The finger member 275 is shaped in such a way that it holds switch 277 open continuously when cells are present in each successive location, and allows the switch to close only when a cell is absent.

As in all of the operations described previously, the transverse movement of the carbon disc and the advancement of the dry cells 257 are synchronized so that the disc is pressed against the wire and the cell during the time that it is stationary. The electrical circuit for the welding operation, which is illustrated diagrammatically in Fig. 7, is arranged to close the circuit only momentarily but this period, nevertheless, is long enough to generate sufficient heat at the junction of the carbon disc and the wire, due to the electrical resistance at this junction, to fuse some of the zinc at the surface of the can and the tin coating of the wire together. The wire becomes embedded somewhat in the zinc and the latter forms fillets against the wire. The circuit is disconnected before the carbon disc undergoes its retractive movement so that the pressure is maintained between the wire 207 and the dry cell 210 while solidification and cooling of the metal occurs at the joint. The electrical energy supply comprises a source indicated at 264, a transformer primary 265 and a switch 266, of the character previously described and which is normally closed, connected in series. A cam 267 which is also mounted on shaft 108, rotates in synchronism with the machine to operate switch opening member 268 at the proper time. Electrical energy is conducted from the transformer 269 through conductor 270 to the carbon disc 20. The conductor 270 is connected to the housing 242, see Fig. 6, which is in electrical connection with the carbon disc through spindle 245. The electrical energy passes through the carbon disc, the wire 207, the dry cell can 210 and thence returns through the ground to the secondary 269. As has been described heretofore, the frame 10 upon which the dry cells are supported is connected to the ground. The apparatus is illustrated in the operative position in Fig. 7.

The parts are synchronized so as to maintain the circuit closed during the first portion of the time that the carbon disc presses against the wire and the cell. After the circuit has been disconnected the disc continues to press the wire and the cell together with the result that the latter cool and the metal which has become liquefied during the heating moment is permitted to solidify while the pressure is maintained, thus providing a permanent electrical joint. Experience with a machine of the character described shows that unsatisfactory joints are produced so seldom that this factor is negligible. The wire 207 may be in the form of flat strip metal instead of round wire.

As has been described heretofore, after the pin-wires have been welded to the cells the latter continue to be advanced by the machine forwardly between the rails 76 and into the compartments 21 where they are turned from an upright to a horizontal position and finally rolled out onto a delivery platform which is not shown, which may be integral or separate from the machine, where they are gathered and disposed for further use as desired.

I claim:

1. A machine for attaching elongated metallic conductors to the zinc containers of dry cells comprising means for advancing said zinc containers in succession in two rows in an intermittent movement and maintaining said containers momentarily stationary at stations substantially opposite one another, a disc-shaped carbon electrode mounted between said rows of containers and between a pair of said substantially opposite stations, means for inserting elongated conductors between said carbon disc and said containers, a source of electric energy, means for re-

ciprocating said carbon disc between said opposite stations and alternately into pressure engagement with the elongated conductor and zinc container on opposite sides of said disc, means for simultaneously momentarily connecting said pressure-engaged disc, conductor and container in series relation with said source of energy, and means for rotating said carbon disc so as to present a different surface to said conductor and container at the pressure engagement with each successive container in the same row.

2. In a machine for welding articles, means for advancing said articles in succession in two rows and maintaining said articles momentarily stationary at stations substantially opposite one another, a welding electrode between said substantially opposite stations, means for reciprocating said electrode between said opposite stations and alternately into pressure engagement with the articles located at said opposite stations respectively.

ALLISON M. MACFARLAND.