

July 19, 1949.

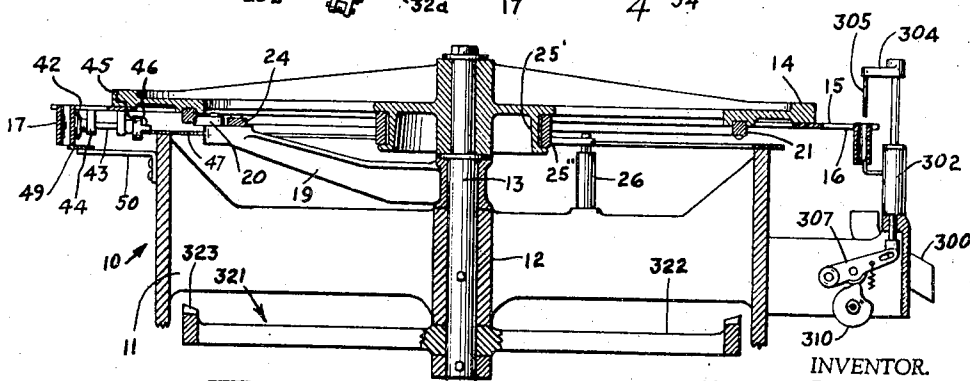
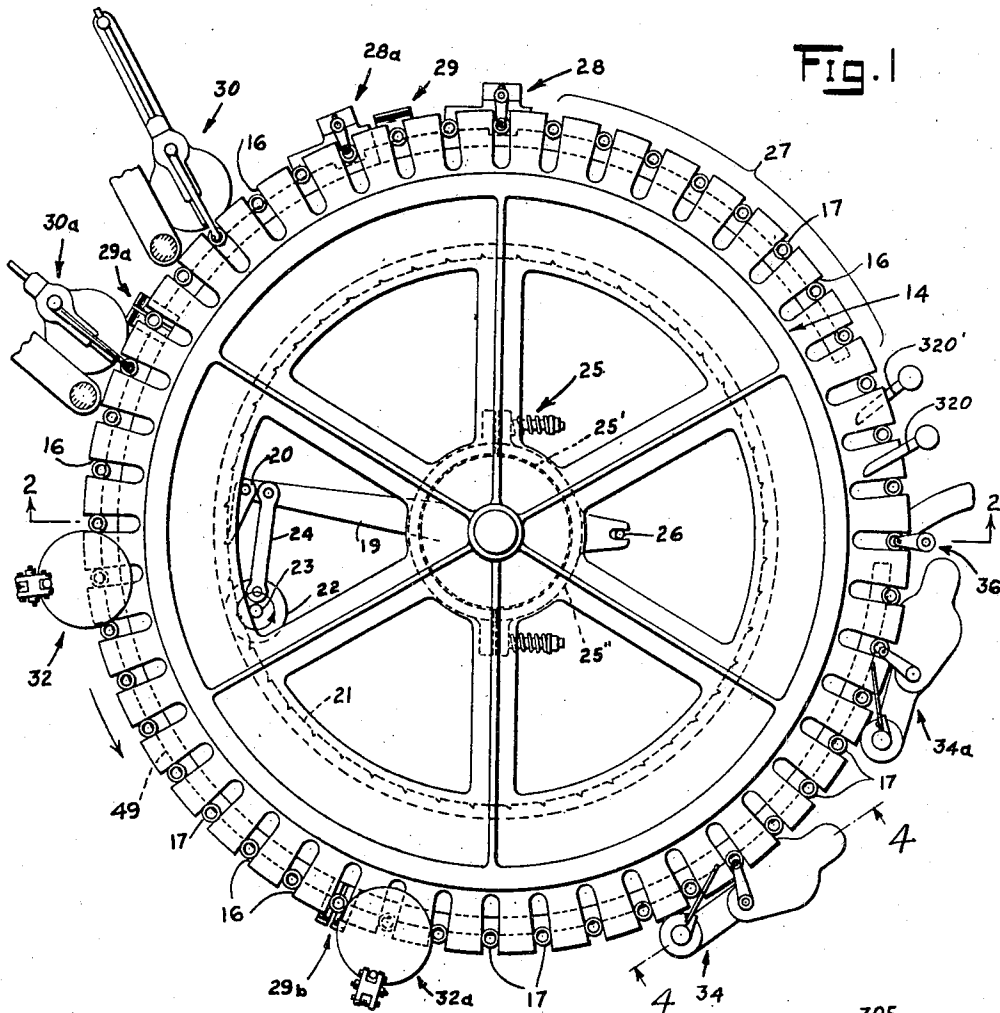
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2,476,707

AUTOMATIC MACHINE FOR ELECTRICAL CONDENSERS

Original Filed Sept. 28, 1942

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

Fig. 7

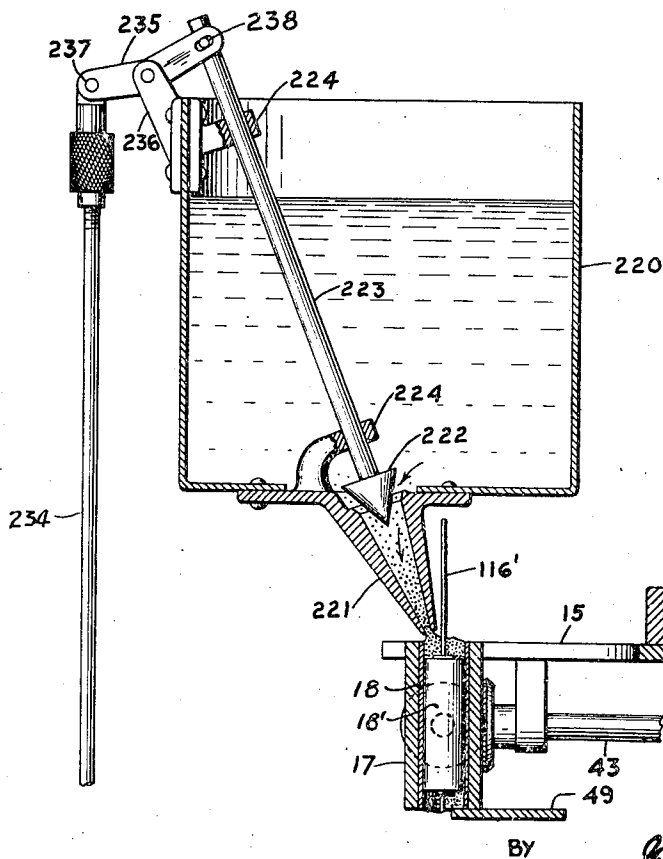
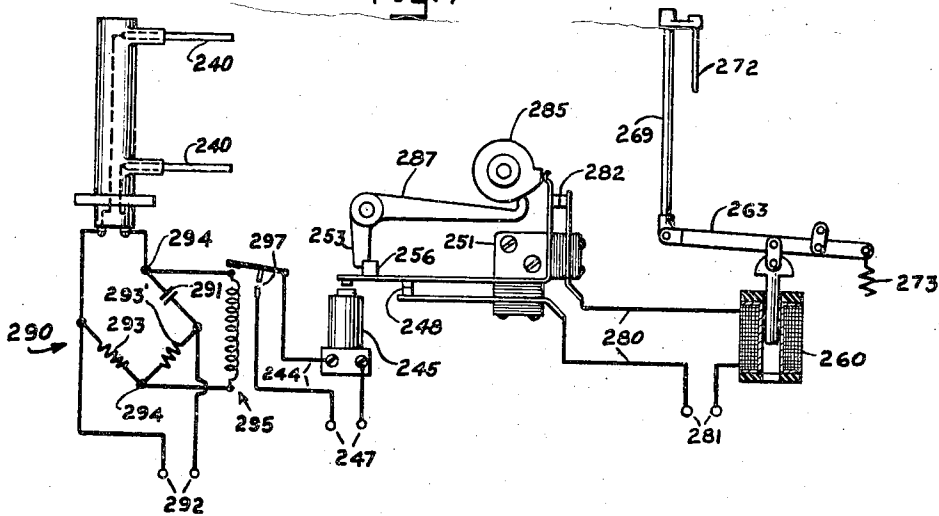


Fig. 3

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4 Sheets-Sheet 3

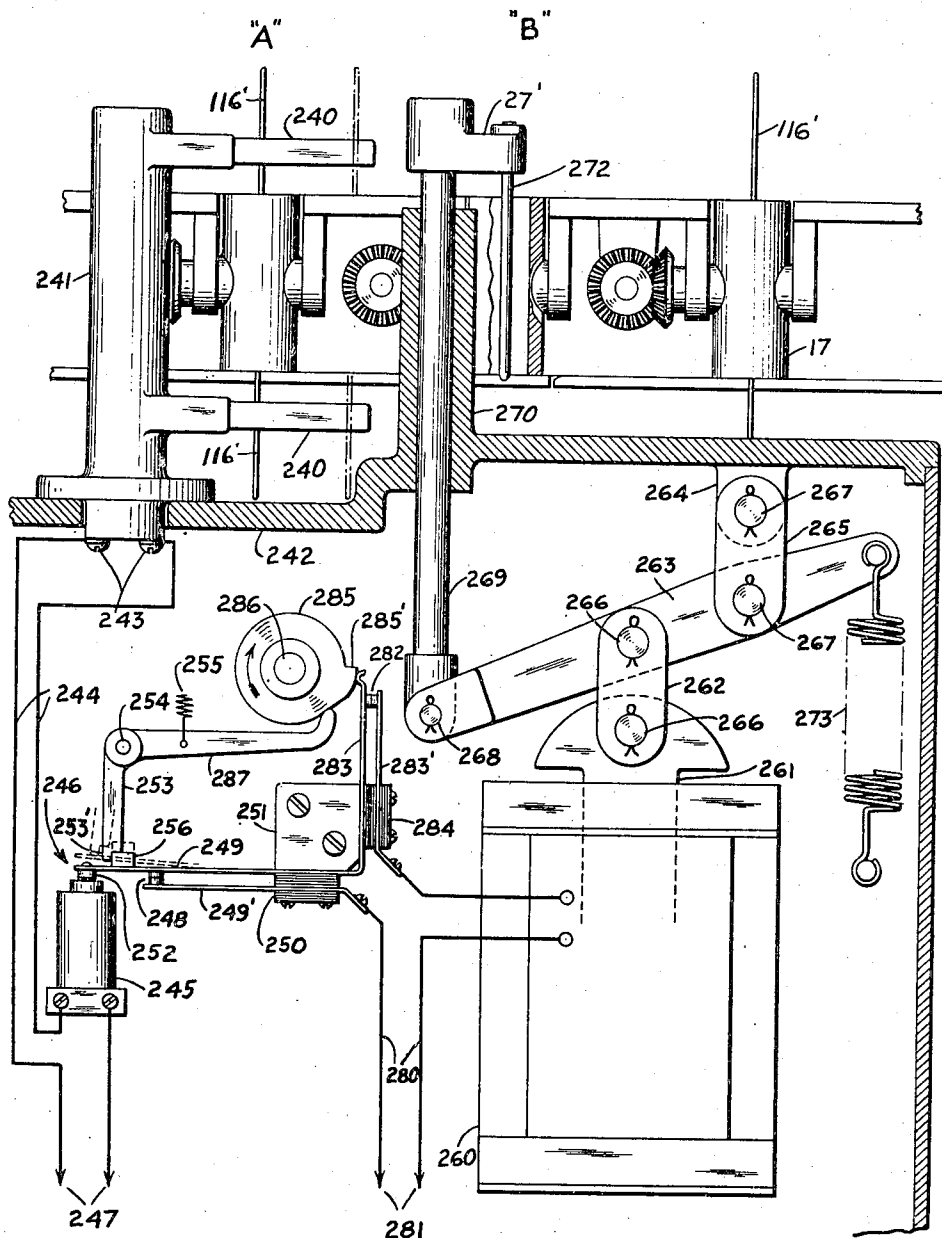


Fig. 4

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4 Sheets-Sheet 4

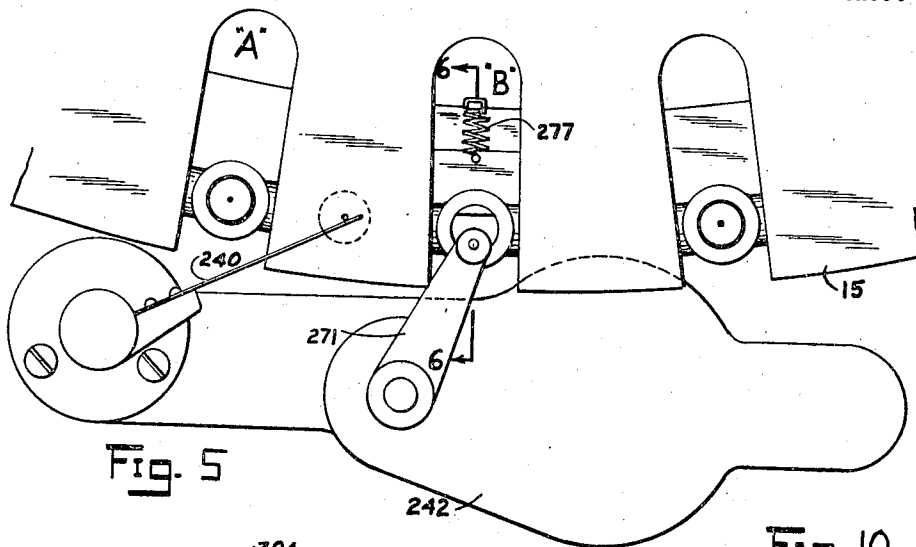


Fig. 5

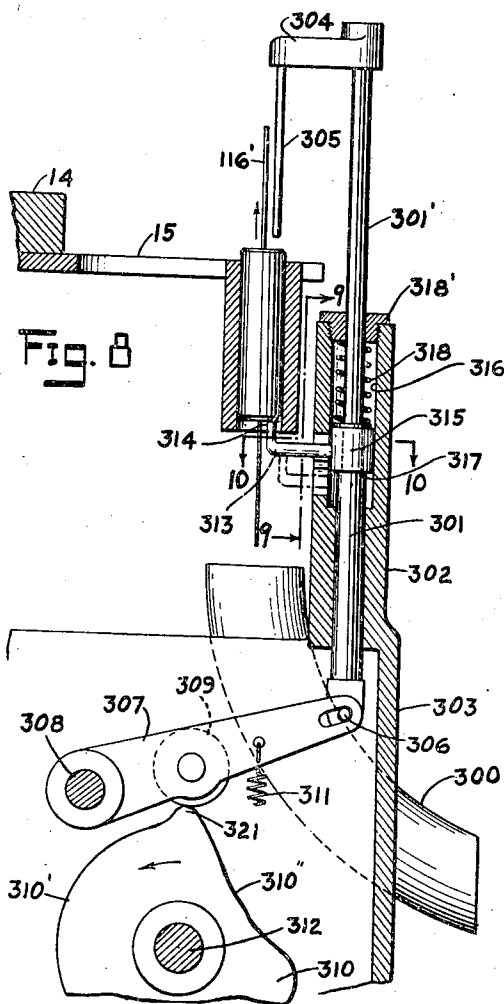


Fig. 8

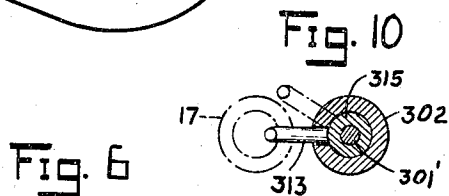


Fig. 6

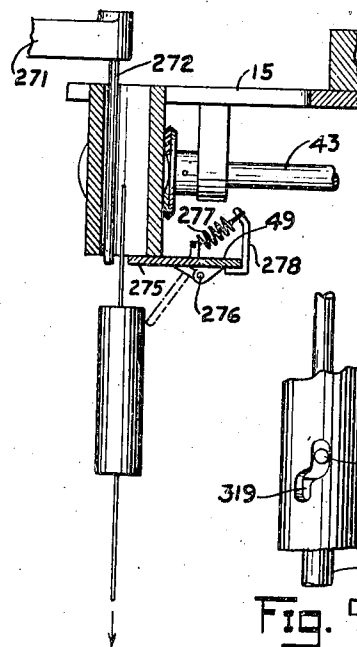


Fig. 9

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UNITED STATES PATENT OFFICE

2,476,707

AUTOMATIC MACHINE FOR ELECTRICAL
CONDENSERS

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Original application September 28, 1942, Serial
No. 460,016, now Patent No. 2,419,484, dated
April 22, 1947; Divided and this application
March 8, 1945; Serial No. 581,643

5 Claims. (Cl. 18—5)

1

This application is a division of my pending application Serial No. 460,016, filed September 28, 1942, now Patent No. 2,419,484, granted April 22, 1947, and entitled Condenser assembling machine. This invention relates particularly to novel testing and ejecting apparatus for such machines.

It is an object of my invention to provide a novel and improved mechanism which is operable automatically for testing reliably electrical condensers and sorting them according to prescribed characteristics.

It is another object to provide novel means in condenser assembling machines for cleaning the ends of the condensers from excess sealing material.

It is another object to provide a novel association of said last-stated means with a condenser ejecting mechanism whereby each condenser is cleaned automatically as an incident to the ejection thereof from the machine.

It is another object to provide improved ejecting apparatus for machines of the character described.

These and other objects and features of my invention will more fully appear from the following description and the appended claims.

In the description of my invention reference is had to the accompanying drawings, of which:

Figure 1 is a top plan view of a condenser assembling machine in which my invention is incorporated;

Figure 2 is a vertical cross sectional view taken substantially on the line 2—2 of Figure 1;

Figure 3 is a fractional vertical sectional view of the last sealing station of the said condenser assembling machine;

Figure 4 is a side elevational view, partly in vertical section on the line 4—4 of Figure 1, showing the station for testing the assembled condensers for short circuits.

Figure 5 is a top plan view of the testing station shown in Figure 4;

Figure 6 is a fractional vertical sectional view taken substantially on the line 6—6 of Figure 5;

Figure 7 is a view of structure and circuits of the station for testing the condensers for electrical capacity;

Figure 8 is a fractional vertical sectional view of the station for ejecting the finished condensers from the machine;

Figure 9 is a fractional vertical view as seen from the line 9—9 of Figure 8; and

Figure 10 is a fractional horizontal sectional

2

view taken substantially on the line 10—10 of Figure 8.

The general organization of the complete machine in which the present invention is incorporated and preferably employed is shown in Figures 1 and 2. This machine comprises a main frame 10 of a generally circular form as viewed from the top. This frame has radial webs 11 supporting a central bearing 12 in which there is journaled a vertical shaft 13. Carried by the shaft 13 above the frame is a circular table 14 comprising a central spider and a circular horizontal shelf 15 disposed about the periphery of the spider. In the shelf at equally spaced intervals are radial slots 16, and disposed in each slot is a tumbler 17. These tumblers are in the form of tubes having bores to receive snugly the shells 18 of the condensers.

In the operation of the machine, the table is advanced with an intermittent rotary motion in a counter-clockwise direction, the distance of each interval of advance being such as to move each tumbler 17 into the position previously occupied by the one immediately ahead of it. This intermittent advance of the table is effected by a ratchet mechanism comprising a lever 19 pivoted on the shaft 13 beneath the table and pivotally carrying a pawl 20 which engages a circular rack 21 mounted on the underside of the table. A reciprocatory movement of the lever such as will advance the table intermittently an interval at a time is effected by a rotating wheel 22 carried by a shaft 23 and coupled by a link 24 to the lever 19. A brake 25, which comprises a drum 25' and a brake band 25'' frictionally embracing the drum and held stationary to the frame by a post 26, serves to prevent inertia over-running of the table at the end of each advance and to hold the table stationary between successive advances.

As is described in the aforementioned parent case of this application the tumblers 17 are journaled to standards which extend downwardly from the shelf 15 at opposite sides of each slot 16. (This journalling is not herein necessary to describe in detail, nor to show, because the tumblers may for the purposes of the present invention be fixedly held to the shelf as will hereinafter appear). One trunnion of each tumbler is coupled by right-angle bevel gearing 42 to a shaft 43 which extends radially inwardly of the table and which is journaled in standards 44 provided on the underside of the shelf 15. A circular head 45 is pinned to the inner end of each shaft 43 and each head is provided on its inner face with a diametrical tongue 46. The shafts serve as a

means for turning the tumblers in the assembling operations of the machine. However, the shafts are normally held stationary by arcuate plates 47 which are secured to the top edge of the frame 10 in positions to bear slidably against the undersides of the tongues 46. For retaining the condenser bodies positively within the tumblers within portions of the path of travel of the bodies there are provided stationary plates 49, supported by the frame 10 through brackets 53, which lie below the tumblers and extend along the path of travel thereof. These stationary retaining plates are however ineffective at certain stations—i. e., have open spaces below the tumblers at certain places—to permit ejection of the condenser bodies from the tumblers as is hereinafter described.

The operation of the overall machine shown in Figures 1 and 2 is as follows: At the place designated by the bracket 27 in Figure 1, which is referred to as the "Loading station," the condenser shells 18 and bodies 18' (as shown in Figure 3) are inserted by hand into the tumblers successively, there being a shell and body inserted into each tumbler. Following the loading station and spaced at suitable intervals around the table are the stations which perform the separate operation by which the condenser parts are assembled and the finished condensers are tested and ejected from the machine. These stations appear in the following order as one proceeds from the loading station about the table in the direction of its advance: a first "Tinning station" 28 for applying solder to one end of each condenser body, a "Turning station" 29 for inverting each tumbler, a second "Tinning station" 28a for applying solder to the other end of each condenser body, a first station 30 for forming a terminal and applying and soldering the same to one tinned end of each condenser body, which station is referred to simply as a "Terminal-soldering station," a second "Turning station" 29a, a second "Terminal-soldering station" 30a for soldering a terminal to the other tinned end of each body, a first "Sealing station" 32 for sealing closed one end of each shell, a third "Turning station" 29a, a second "Sealing station" 32a for sealing closed the opposite end of each shell, a "Short-circuit testing station" 34 for testing the finished condensers for short circuits and ejecting those from the machine which test defective, a "Capacity-testing station" 34a for testing the condensers for capacity and ejecting those exceeding prescribed tolerance limits, and an "Ejecting station" 36 for discharging from the machine the condensers which have passed the testing stations.

For a detail description of the assembling stations of the complete machine reference may be had to the parent application abovementioned. The present invention is concerned primarily with the testing stations 34 and 34a, and the ejecting station 36, wherefore these stations are herein next described in detail.

When the condenser body and shell of each tumbler has passed the last of the assembling stations—which is the second sealing station 32a—the body has been sealed in the shell and has a pair of wire terminals 116' connected to the ends thereof, which project beyond the shells as shown at position A in Figure 4. At this position the assembled condenser is entering, with advance of the table 14, the short-circuit testing station 34. This station—which appears in Figures 4, 5 and 6—operates to test the condensers successively for short circuits during successive periods of advance

of the table. Whenever a condenser tests as being shorted, the testing means prepares an ejecting means for operation. This ejecting means is then put into operation during the next succeeding rest period of the table to eject the defective condenser from the machine.

Reference being had to Figures 4 and 5, it will be seen that as a condenser is carried from one rest position A to the next succeeding rest position B, the terminals of the condenser engage a pair of flexible conductor blades 240 which are supported in horizontal positions, one above and one below the shelf of the table 14, by an upright insulating post 241. This post is mounted on a housing 242 fractionally shown, it being understood that the housing 242 is suitably secured to the main frame 10 of the machine. The blades 240 lead respectively to a pair of terminals 243 at the bottom of the post, which are connected in a circuit 244 serially including the actuating coil 245 of a relay 246 and a pair of terminals 247 adapted to make connection with a suitable source of current. The relay coil actuates a switch 248 comprising an upper movable switch blade 249 and a lower semi-stationary blade 249' held insulated in horizontal positions by a stack 250 and bracket 251. The movable blade is biased upwardly, to maintain the switch normally open, but carries an armature 252 by which the blade is pulled down into closed position as the relay coil 245 is energized. Overlying the blade 249 is a vertical detent arm 253 pivoted at 254 and biased, by a spring 255, against the side of a block 256 provided on the top side of the blade. When the blade reaches closed position, the detent arm is snapped over the top of the block under the influence of the spring 255 to latch the switch 248 closed. A step 253' on the end of the detent arm serves by its impingement against the side of the block to define the operative position of the detent arm.

From the foregoing description, it will be seen that as a short-circuited condenser is carried from position A to position B, the relay coil 245 is energized to cause the switch 248 to be latched in closed position. This closing of the switch 248 serves to prepare the ejecting means for operation as is hereinafter explained.

The prime mover for the ejecting means comprises a solenoid 260. This solenoid has a vertically disposed armature 261 coupled by a link 262 to a lever 263 which is supported by a standard 264 through a link 265, the link 262 having pivotal connections 266 to the armature and lever and the link 265 having pivotal connections 267 to the lever and standard. The end of the lever adjacent the armature 261 is pivotally connected at 268 to a rod 269 which slides vertically in a long bearing 270 of the housing 242. To the upper end of this rod there is secured an arm 271 which overhangs the table and carries a downwardly extending pin 272 directly overhead the condenser at the rest position B aforementioned. The rod 269 is normally held in raised position, wherein the pin 272 is above the level of the tumblers 17, by a tension spring 273 acting on the lever 263 as is shown in Figure 4. When the solenoid 260 is however energized the rod 269 is propelled downwardly in opposition to the action of the spring 273 to cause the pin 272 to enter the tumbler at position B and push the condenser downwardly out of the tumbler.

At position B, a portion of the retaining plate 49 is cut away and a trap door 275 is provided in its place. This trap door, which is illustrated in Figure 6, is hinged to the retaining plate at

5

276 and normally held horizontally in closed position by a tension spring 277 connected between the door and a bracket 278 on the plate. The spring 277 however, yields to the pressure exerted against the door by a condenser being ejected, the trap door then springing back to closed position when the condenser being ejected has fallen free of the door.

The solenoid 261 has a circuit 280 serially including a pair of terminals 281 adapted to make connection with a suitable source of current, the switch 248 hereinbefore described, and another switch 282. This latter switch is of the same type as the switch 248, comprising a movable blade 283 and a semi-stationary blade 283' both held insulatedly in a stack 284 by the aforementioned bracket 254. To simplify the structure, the two movable blades 249 and 283 of the switches 248 and 282 are made integral with one another, the same being bent at right angles as is shown in Figure 4. The blade 283 is biased to open position but is actuated intermittently to closed position by a cam 285 having a hump 285' on the periphery thereof. This cam is secured to a shaft 286 from whence it receives one revolution of continuous rotation for each step of advance of the table 14. The cam is so timed that the hump 285' will engage the switch blade 283 and close the switch 282 during each rest period of the table. Should the switch 248 be open when the switch 282 is thus closed, no action will result from the closing of the switch. However, should the switch 248 have been latched closed in response to a short-circuited condenser having been conveyed from position A to position B, into contact with the blades 240, the subsequent closing of the switch 282 will close the circuit of the solenoid 260, thereby causing the solenoid to be energized and the defective condenser to be ejected from the tumbler while it is at rest at position B.

In the continuing movement of the cam 285 following the closing of the switch 282, the hump 285' comes into contact with a horizontal arm 287 provided on the detent arm 253 and cams the detent arm off from the block 256 to release the switch 248 to open position. This opening of the switch 248 restores the testing means to initial condition—a condition for reoperation—and completes one cycle of operations of the station. The opening of the switch 248 is timed to take place before the next succeeding condenser is brought into contact with the blades 240; thus, the station is rendered ready to test the next succeeding condenser and to again eject the same should it test defective.

The capacity testing station 34a is next in line following the short-circuit testing station just described. This station distinguishes from the short-circuit testing station principally only in the circuit connection between the blades 240 and the relay 246. In this case, the blades lead to one leg of a capacity bridge circuit 290 which may for example be of the type shown in Figure 7. This type of bridge circuit is well known, comprising a standard fixed condenser 291 in series with the blades 240 (across which the test condenser is applied) and a pair of terminals 292 for making connection with a source of A. C. voltage. Bridging the serial arrangement of these condensers are two resistors 293 and 293' connected in series, the resistors having relative values determined by that which the test condenser is to have in relation to the standard condenser 291.

6

As a typical example, the standard condenser 291 may have a value of capacity equal to that which the test condensers are to have, the resistors then having a unity ratio. When a test condenser deviates from the assigned value of the standard condenser, an unbalance voltage will appear across the junction terminals 294 between the condensers and resistors respectively. This voltage is utilized for actuating the relay 246 to close the switch 248 and prepare the ejecting solenoid 260 for operation.

The prescribed limit of tolerance which the test condenser may have is determined by the amount of unbalance voltage across the terminals 294 required to actuate the relay 246. For close tolerances, there may be provided a sensitive intermediate relay 295 between the terminals 294 and the relay 246. In this case the coil of this relay 295 is connected directly to the terminals 294 and the switch 297 of the relay—which is biased open—is connected serially in the circuit 244 in place of the blades 240 as in the short-circuit testing station. Any condenser under test deviating in capacity from that of the standard condenser 291 to such extent as will create an unbalance voltage across the terminals 294 sufficient to actuate the relay 295 will result in the switch 248 being latched closed. Such condenser will thus cause the solenoid 260 to be prepared for operation. When this condenser comes to rest position at its next succeeding stop position, the solenoid 260 will be actuated through the closing of the switch 282 by the cam 284 as aforescribed, and that condenser will be then ejected from the machine. Accordingly, this testing station will operate to sort the condensers according to prescribed limits of tolerance, this sorting being such that those condensers whose capacity falls beyond the prescribed limits are here ejected from the machine while the other condensers are carried on by the table to be later ejected by the ejecting station 36.

A feature of the ejecting station has particular importance in view of the manner in which the condensers are sealed at the ends by the sealing stations. The last sealing station 32a, which is fractionally shown in Figure 3, may therefore be herein next described.

It will be understood that both ends of each condenser are sealed in like manner, and that at the latter sealing station 32a the bottom end of the condenser will already have been sealed as shown in Figure 3. To seal the upper end a molten wax is poured into the top end space of the condenser shell from a container 220 through a snout 221, the container being supported above the shelf 15 and the snout being extended downwardly from the bottom of the container as shown. The discharge of the wax from the container is controlled by a metering valve 222 carried on the lower end of a long stem 223 which extends upwardly through the wax to the top of the container, the stem being slidably mounted in bearings 224 to move vertically to place the valve into open and closed positions. The valve is coupled through a rock lever 235 to a vertical rod 234, the lever 235 being pivoted to a standard 236 and pivotally connected at 237 and 238 to the rod 234 and stem 223 respectively. Once during each rest period of the table 14 the rod 234 is moved downwardly to open the valve 222 momentarily and cause a quantity of molten wax to be discharged into the top end space of the condenser shell. To assure that the end of the condenser will be sealed positively, enough wax is discharged to fill

the entire end space in the shell. In so doing, however, the wax may pile up as shown in Figure 3, and some may overrun the edges of the shell and cover the ends of the tumbler. It is a feature of the present invention to break off this excess wax as an incident to ejecting the finished condenser from the machine so that no wax will overhang the shell of the finished condenser.

The ejecting station 36 is positioned suitably beyond the capacity testing station as shown in Figure 1. This station is actuated intermittently during successive rest periods of the table to eject the condensers successively conveyed thereto. The ejecting operation is performed by pushing the condensers downwardly through their tumblers into a chute 300 which directs the condensers into a suitable container not shown. However, each condenser is displaced upwardly in relation to its tumbler before each ejecting operation. In view of the condenser shell snugly fitting the tumbler, any excess wax at the bottom end thereof is broken off as the condenser is so displaced upwardly, and any excess wax at the top end is broken off as the condenser is ejected downwardly from the tumbler.

The ejecting mechanism is shown in detail in Figures 8, 9 and 10, and comprises an upright plunger 301 mounted to slide vertically in a boss 302 of a housing 303 that is secured suitably to the side of the main frame 10. The plunger extends above the level of the table 14 and has an arm 304 secured to the upper end thereof which overhangs the table and carries a depending rod 305 positioned in line overhead with the bore of the tumbler at the ejecting station. The lower end of the plunger has a slidable pivotal connection 306 to a rock lever 307 which is pivoted at 308 to the housing. Journalled to the rock lever, between the pivots 306 and 308, is a roller 309 which rides on a cam 310 under the influence of a spring 311 acting on the lever to bias the plunger downwardly. The cam 310 is carried by a shaft 312 from which it receives one revolution of continuous movement for each step of advance of the table 14. This cam has a dwell 310' along a major peripheral distance thereof and a recession 310'' along substantially its remaining peripheral distance. The cam is so timed with the travel of the table 14 that the roller 309 registers with the dwell 310' while the table is being advanced, to hold the plunger stationary at normal level wherein the rod 305 is held raised above the level of the tumblers. When the table is at rest, however, the roller traverses the recession 310'' of the cam and causes the plunger to receive a downward reciprocation, under the action of the spring 311, to move the rod 305 into the tumbler and eject the condenser therefrom, the retaining plate 49 being here removed so as not to obstruct the path of the condenser being ejected.

To impart an upward displacement to the condenser before each ejecting operation just described, there is mounted on the plunger a lateral pin 313 which has an upturned finger 314. This pin is secured to a collar 315 which is within a cylindrical recess 316 extending down into the boss 302 and which slidably embraces an upper reduced-diameter portion 301' of the plunger. The collar is pressed downwardly against a shoulder 317, formed on the plunger incident to reducing the diameter of the portion 301', by a compression spring 318 interposed between the collar and a plug 318' threaded into the recess 316. The pin 313 extends through a slot 319 in the wall of the recess which is curved, as is shown

in Figure 9, to cam the pin back and forth about the plunger as a center as the collar 315 is reciprocated vertically, this camming of the pin being such as to place the pin directly below the tumbler at the ejecting station, with the finger 314 in line with the bore of the tumbler, when the collar is in raised position, and to place the pin off to the side of the tumbler, in the position shown by dash-dot lines in Figure 10, when the collar is in lowered position. On the cam 310, at a point just preceding the recession 310'', is a hump 321 which serves to raise the plunger above normal level and to place the collar 315 into raised position before each ejecting operation, the pin 313 being thus moved to cause the finger thereof to bear against the condenser to be ejected and displace it vertically. When the plunger is then next lowered the pin 313 is first retracted and spaced laterally of the tumbler and then the condenser is ejected downwardly out of the tumbler. When the plunger has been restored to normal level following an ejection operation, it will be held there by the dwell 310' of the cam 310 while the table is being advanced, after which the ejecting mechanism will be again actuated in the manner above described.

Between the ejecting station just described and the loading station there are provided a set of upper and lower stationary knives 320 and 320' which are positioned respectively in line horizontally with the upper and lower ends of the tumblers 17. These knives serve, as the tumblers pass thereby, to scrape the ends of the tumblers and thus remove any surplus wax which may have been deposited thereon at the sealing stations.

I have herein shown and described a preferred embodiment of my invention, but it will be understood that this embodiment is illustrative and not limitative thereof as the same is subject to changes and modifications without departure from the scope of my invention. Also, it will be understood that while I have generally described the present invention in connection with an automatic condenser assembling apparatus, the invention has useful commercial application as an independent machine for sorting condensers according to their electrical characteristics. For instance, upon feeding the condensers successively into the tumblers 17 of the table 14, those condensers which are short circuited are ejected at station 34, those whose capacities are not within a prescribed range are ejected at station 34a and those which have tested correct are ejected at station 36. This automatic sorting—together with the removing of the excess wax at the condenser ends as above explained—are carried out in an efficient and effective manner by an improved machine the novel features of which I endeavor to set forth according to the following

claims.

I claim:

1. In a machine of the character described: the combination of a conveyor having holders for condensers; means for successively ejecting said condensers from said holders; and means coupled to said ejecting means and actuated preliminary to the ejection of each condenser, for moving the condenser in a direction reversed from that in which the condenser is ejected.

2. In a machine of the character described including a tubular container for a condenser: the combination of means actuatable to displace the condenser in one direction in relation to its container; and means, actuated subsequent to the

actuation of said displacing means, for ejecting

9

the condenser in the reversed direction from said container.

3. In a machine of the character described including an open-ended container for a condenser: the combination of means actuatable to enter said container from one end and impart a limited movement to the condenser in relation to the container; means to retract said movement-imparting means from said container and displace it laterally away from the open end of the container; and means, controlling said retracting means and timed therewith to enter said container from the other end while said movement-imparting means is held displaced in retracted position, for ejecting the condenser from said container.

4. In a condenser assembling machine including an open-ended tubular holder for a condenser body and shell, and means for introducing a sealing material into the end spaces of said shell; the combination of a member movable into one end of said holder for displacing the assembled shell and body units relative thereto; a plunger movable into the other end of said holder for ejecting the unit therefrom; means for operating said member and plunger in sequence; and means associated with said plunger and actuated

10

upon operation of the plunger for displacing said member sidewise out of the path of the ejected unit.

5. In a condenser assembling machine including an intermittently advanced conveyor having tubular open-ended holders for condensers: a mechanism timed with said conveyor to operate during successive rest periods thereof and including means operated sequentially during each rest period for displacing a condenser in one direction relative to its holder and thereupon ejecting the condenser from the holder in the other direction.

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