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J. A. CAMPBELL
SORTING APPARATUS

2,615,567

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FIG. 1.

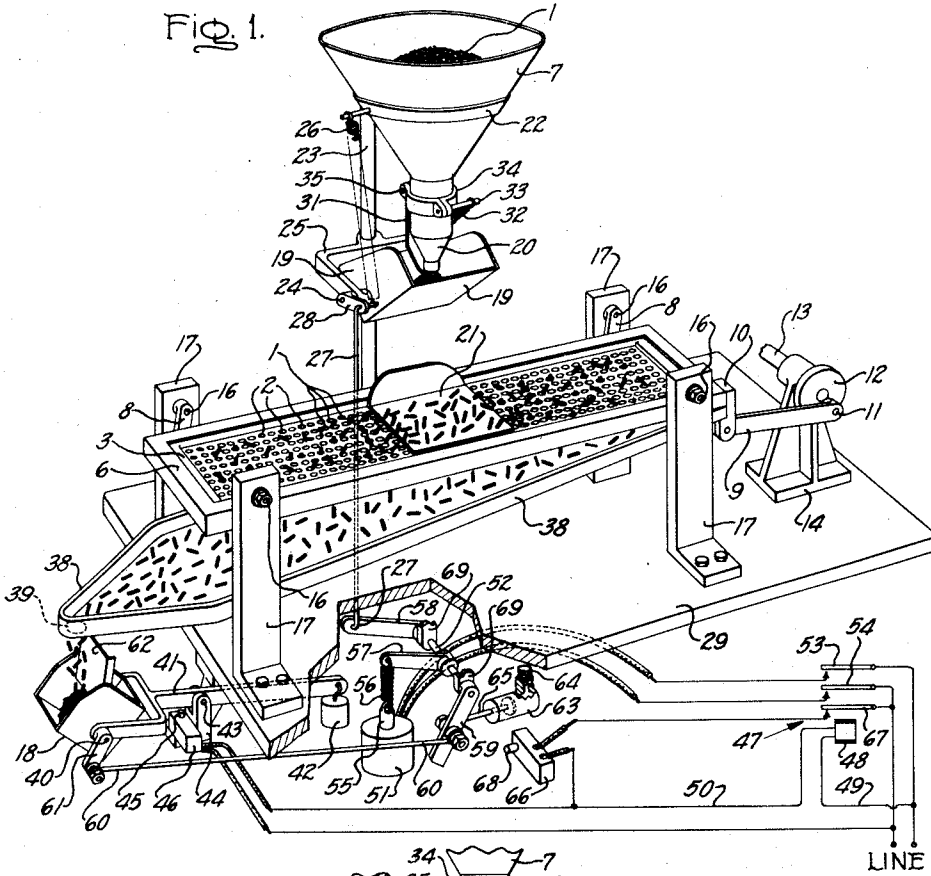


FIG. 2.

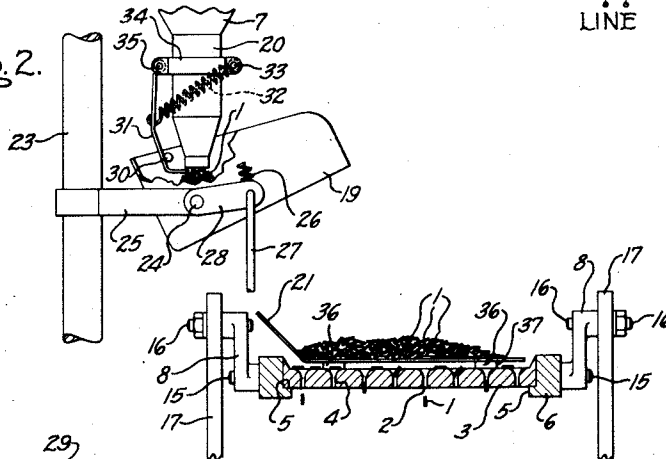
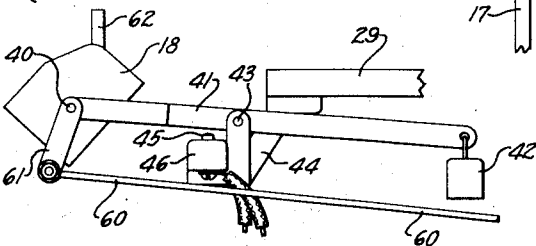


FIG. 3.



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UNITED STATES PATENT OFFICE

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SORTING APPARATUS

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4 Claims. (Cl. 209—73)

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My invention relates generally to sorting or screening apparatus, and more particularly to apparatus for automatically sorting pin-like cylindrical articles to segregate those articles which are defective in that they are deformed, as by being bent or burred.

My invention also has particular reference to automatically operated apparatus for inspecting cylindrical pins by causing said pins to pass through the limited-sized openings of an inspection tray or screen, and to apparatus of this type wherein means are provided for handling considerable quantities of pins without interruption.

One object of my invention is to provide apparatus for inspecting pins and other cylindrical articles by causing them to be shaken over the upper surface and through one or another of a multiplicity of accurately shaped openings in a tray. The inspection operation is controlled by the size and length of the barrel or bore of the openings in the tray which are just large enough to allow acceptable pins to pass through and which therefore block the movement of burred and bent pins. The openings in the tray are blocked by the defective pins and are cleared of pins after relatively long periods of operation of the apparatus in order to recover the productive capacity thereof.

Another object of my invention is to provide in combination with a tray-type sorting apparatus means for maintaining a thin layer of pins in the tray to insure efficient sorting. Inasmuch as the pins do not work into and pass through the openings in the tray at a uniform rate and some of the said openings are constantly being blocked by defective pins, a control must be provided to prevent an excess of pins from collecting on the tray. Such a manner of operating the apparatus is highly desirable, as the excess pins wedge into the openings in groups and block said openings so that the effectiveness of the tray is considerably reduced. An excess of pins is also objectionable inasmuch as the blocking of one opening contributes to the further overloading of the tray and still lesser effectiveness thereof. To attain this object I provide means for automatically limiting the amount of pins supplied to the tray in proportion to those passed through the openings thereof and discharged from the apparatus. By controlling the feed cycle from the volume of the output, I provide automatic compensation for the varied output due to the openings in the tray becoming plugged with defective pins.

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Other objects and advantages of the apparatus of my invention will appear from the following detailed description of a species thereof and from the drawing.

In the drawing, Fig. 1 is a combined perspective view and a diagrammatic wiring diagram of the apparatus for sorting relatively short wire-size pins used in the manufacture of radio tubes and the like; Fig. 2 is a side elevation, taken from a transverse section through the tray, of said tray, the adjacent portions of the support means therefor and the feeding means of said apparatus; and Fig. 3 is a front elevation of a bucket and associated weighing means for receiving the acceptable pins discharged by the tray.

The sorting function of the apparatus occurs when the pins 1 are caused to pass end foremost into the openings 2 in the tray 3 and is effected by the restricting properties of the limited passageway provided by the cylindrical walls of the lower barrel 4 of said openings 2. The tray 3 is carried on the inwardly extending shoulder 5 of the surrounding support frame 6 and is agitated back and forth in a generally longitudinal direction by the movements of the support frame 6 so that the pins 1, which are generally distributed over the upper surface thereof, are caused to pass end first into the flared upper ends of the openings 2. The pins 1 are automatically fed to the tray 3 from the funnel-shaped storage hopper 7 according to the needs of the apparatus and are shaken over the upper surface of the tray 3 by the constant motion of the tray 3 and the frame 6 which are rocked back and forth on the arms 8 located at the four corners thereof. The crank motion of the link 9, which is attached by a fastening 10 to one end of the frame 6 and which engages the offset pin 11 in the disc 12, creates movement in said frame 6 in accord with the rotative motion of said disc 12 which is attached to one end of the shaft 13. During the entire operative period of the apparatus the shaft 13, which is supported in a bearing in the support bracket 14, is under the constant rotative influence of means (not shown) preferably consisting of an electric motor and speed reducer, which means engages the end of said shaft 13 opposite from that carrying the disc 12.

The rocker arms 8, which pivot on the pins 15 extending from the frame 6 and the pins 16 extending from the uprights 17, impart to the tray 3 and the pins thereon a lifting as well as a hori-

zontally directed action causing the pins to separate readily from each other and to move freely over the perforated surface of said tray 3. This manner of agitating the tray 3 is preferable in that the pins 1 gather in groups in some of the pockets formed by the flared upper ends of the openings 2 in the tray and must therefore be agitated to break up the groups and shift the pins into other openings 2 before they can pass completely into respective openings 2. Inasmuch as ordinarily very few of the pins 1 are defective and so proportioned that they do not pass through the openings 2 of the tray 3, only a few of said openings are blocked during the normal operative period of the apparatus and a considerable number of openings 2 are in condition to care for the pins 1. On the other hand, a small burr or bend in the pins 1 is sufficient to prevent said pins from passing through the only slightly longer and larger barrels 4 of the openings 2 and causes them to be separated from the acceptable pins 1 which fall completely through the openings 2. After the productive capacity of the apparatus has been considerably reduced by the blocking of a goodly portion of the openings 2 in the tray 3, said tray 3 is lifted from the frame 7 and turned to an inverted position where it is cleared of defective pins 1. The defective pins 1 are dislodged from the tray 3 by a manually operated ram (not shown) forced into said openings 2.

In one particular application of the apparatus having to do with the sorting of pins 8 mm. in length and .040 inch in diameter, a tray 3 is used having two hundred and forty-eight openings 2 with a barrel 4 length of 10 mm. and a diameter of .043 inch. These particular pins 1 were made by a process which provides them with rounded ends and which, if improperly performed, renders them defective either by bending them or developing a burr thereon. A number of defective pins 1 normally sorted out by the apparatus is such that two to four hours of continuous operation occurs between periods when the tray 3 is removed and cleared.

The pins 1 that are to be sorted by the apparatus are placed in the hopper 7 and those pins 1 that are found to be acceptable pass to a container (not shown) placed below and to the left (Fig. 1) of the bucket 18 at that end of the apparatus. The hopper 7 has sufficient capacity for an extended period of operation and discharges pins 1 to the tray 3 in an automatic function of the apparatus which is carried out by dumping movements of the bucket 19. The pins 1 flow by gravity through the hopper 7 and the discharge snout 20 to the bucket 19 located permanently therebelow. The flow of pins from hopper 7 to bucket 19 is stopped by piling up of the pins in said bucket 19. These dumping movements of the bucket 19, in turn, provide for the periodic discharge of comparatively small quantities thereof onto the distribution plate 21 over said center portion of the tray 3 and provide a means of restricting the number of pins 1 on said tray 3 at any one time. The hopper 7 rests within the ring-shaped bracket 22 on the vertical support standard 23 and conducts the pins 1 by means of the snout 20 to the bucket 19 which is so balanced about oppositely positioned support pins 24 (only one appearing in the drawing) in the arms of the yoke 25 attached to said support standard 23 that it is not tipped by being loaded. Additional means of keeping the bucket 19 in this position is provided by the contrac-

tion force of a spring 26, extending between an end of the push rod 27 engaging the arm 28 on the pin 24 and a post on the bracket 22, and by the controlling force of said push rod 27 which extends to actuating means below the supporting table 29. At moments when the bucket 19 is dumped, a downward movement of the push rod 27 occurs and the resulting movement of the arm 28 and the pin 24 tip said bucket 19 so that the pins 1 therein spill out onto the plate 21 covering the center portion of the tray 3. The flow of pins 1 from the snout 20 of the hopper 7 is blocked off during the dumping movement of the bucket 19 as the pin 30 carried by the side wall thereof is moved away from the gate 31 at such times and the contraction force of the spring 32, which extends between a post 33 on the collar 34 surrounding the snout 20 and a projecting portion of the gate 31, swings said gate 31 about a supporting pin 35 held by the collar 34 so that it passes under the open end of said snout 20.

When the apparatus is initially started, the bucket 19 is tipped two or three times manually to deposit a working supply of pins 1 onto the distribution plate 21, after which the back-and-forth agitations of the tray 3 cause the pins 1 to gradually pass off opposite sides of said plate 21 and to circulate to the various openings 2 in said tray 3. The plate 21 functions both to assist distribution of the pins 1 over the surface of the tray 3 and to prevent large quantities of said pins 1 from filling and interfering with the function of those openings 2 directly below said plate 21. To this end, the plate 21 is mounted at the corners thereof on studs 36 which fit in correspondingly positioned openings 2 in the tray 3, and a shoulder 37 on the studs 36 keeps the plate 21 sufficiently spaced from the top surface of the tray 3 to allow the pins 1 to circulate freely therebetween. As the operation of the apparatus progresses, the acceptable pins 1 fall through the openings 2 in the tray 3 and onto the inclined chute 38 located below the full length thereof where they are again subject to the vibrations of this portion of the apparatus and travel down to the lowermost end of said chute 38 located over the discharge bucket 18. The chute 38 is attached to the supporting frame 6 for the tray 3 so that it vibrates in unison therewith and directs the pins 1 by means of its convergent lower end to the opening 39 where they fall therefrom to bucket 18 below.

The weight of the acceptable pins 1 collecting in the output bucket 18 is the basis for controlling the dumping movements of the input bucket 19, thereby replacing those pins 1 passing through the openings 2 in the tray 3 with a like number from the hopper 7. The control is effected when the number of pins 1 collected in the bucket 18, which is supported through studs 40 (only one being shown) extending from opposite sides thereof into the opposite branches of one end of the balance beam 41, is sufficient to tilt said beam 41. At such times, the pins 1 contained in the bucket 18 offset the counter weight 42 on the opposite end of the beam 41 and tip said beam 41 about the pin 43 carried by the support bracket 44 extending from the table 29 an amount causing it to engage and actuate the control pin 45 of the switch 46 on bracket 44. The remainder of the actuating means for the bucket 19 consists of the electrical relay 47 which has an actuating coil 48 permanently connected through wires 49 and 50 to the electric current supply line and switch 46, respectively, and the solenoid 51 which

provides for the rotation of the operating shaft 52 and the downward dumping movement of the rod 27. The actuation of the switch 46 completes a circuit therethrough to the coil 48 of the relay 47 and thereby causes the contact arms 53 and 54 to complete the connection of the solenoid 51 to the line. The solenoid 51, in turn, has an armature 55 connected by the helical spring 56 to the operating arm 57 on the operating shaft 52 and, when energized, moves said armature 55 so that the shaft 52 is turned sufficiently to cause the arm 58 thereon to effect the proper movement in rod 27.

In order that the bucket 18 and associated means be in condition to measure succeeding quantities of acceptable pins 1 and cause the repeated dumping movement of the bucket 19, means are provided for turning the bucket 18 to cause the pins 1 therein to be spilled therefrom. This motion of the bucket 18 is brought about in conjunction with the dumping movement of bucket 19 by the rotation of the operating shaft 52, which movement swings the arm 59 so that the rod 60 is moved longitudinally and the connected arm 61 and stud 40 move to produce the desired rotation in the bucket 18. When the dumping motion of the bucket 18 is completed, the bucket 18 is so positioned that the partition 62 therein is under the stream of incoming pins 1 and directs said pins 1 toward the back portion of said bucket 18. All but a few of these latter pins 1 are retained by the bucket 18 and contribute to the weight of the succeeding loading thereof.

Inasmuch as the action of the armature 55 of the solenoid 51 is quite rapid, means are provided in the dash pot 63 for slowing the rotation of the operating shaft 52 and the dumping movements of the buckets 18 and 19. This function of the apparatus prevents the buckets 18 and 19 from moving so rapidly as to throw the pins 1 some distance therefrom and is produced by slowly bleeding the air from the dash pot 63 through the opening controlled by the adjusting screw 64. The piston within the dash pot 63, which is attached to the table 29 in a manner not shown, is connected by means of rod 65 to the arm 59 on the operating shaft 52 and is capable of slowing the rotation of said shaft 52 as the more rapid motion of the armature 55 is taken up in stretching the spring 56.

The dumping interval of the buckets 18 and 19 is established separately in a manner eliminating as much as possible the injurious effect of the vibrations of the entire apparatus and assuring a definite period to said dumping interval. The means of establishing the dumping control is provided in the limit switch 66 which is connected in a shunt circuit around the switch 46 by the movement of the contact arm 67 of the relay 47 at the time switch 46 is actuated and is located at a fixed position on support means not shown below the table 29 so as to be actuated by the engagement of arm 59 on the operating shaft 52 with the control pin 68 at the limit of the dumping movement. By this time, all of the original loading of pins 1 in the buckets 18 and 19 have spilled therefrom and the breaking of the shunt circuit through switch 66 to the relay 47 has the effect of actuating said relay 47 and de-energizing the solenoid 51. The operating shaft 52 (which is mounted in a stationary bracket 69 only partially shown on the bottom surface of the table 29) is turned back to its former position and the buckets 18 and 19 are turned to their upright position by

the contraction force of the spring 32 located adjacent bucket 19. The reduced weight of the bucket 18 immediately after the start of the dumping operation causes the balance beam 41 to swing up from the control pin 45 of the switch 46 and to open the circuit therethrough so that the switch 66 in the shunt circuit is in full control of the relay 47. This movement of the beam 41 also prepares the apparatus for a succeeding cycle of operation.

To recapitulate briefly, it will be seen that I provide in combination with a screening or sorting tray 3, an automatic variable feed mechanism which periodically feeds a given quantity of pins from the input pan or bucket 19 to the upper surface of the tray only upon accumulation of a predetermined weight of the screened pins in a weight-responsive counter-balanced output pan or bucket 18 which collects the pins until their weight is sufficient to close a circuit that causes both buckets 18 and 19 to be tripped and emptied, thus automatically compensating for the varied output due to the holes in the tray 3 becoming plugged with defective pins.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Apparatus for sorting pin-like cylindrical articles comprising a tray having a multiplicity of openings therethrough permitting the endwise passage of acceptable articles and restricting the passage of deformed articles, feeding means including a tiltable bucket above said tray for periodically delivering a quantity of articles to the upper surface of the tray, means for agitating the tray, means located below the tray including a second tiltable bucket for receiving the cylindrical articles, and means connected to both of said buckets and actuated by an accumulation of a predetermined weight of articles in said second bucket for momentarily tilting both of the said buckets to discharge the articles therefrom.

2. Apparatus for sorting pin-like cylindrical articles comprising a tray having a multiplicity of openings therethrough permitting the endwise passage of acceptable articles and restricting the passage of deformed articles, a hopper located above the tray holding a supply of the cylindrical articles and having a discharge snout, a tiltable bucket located below the snout of the hopper and adapted to accumulate and periodically discharge a quantity of the articles to the tray, means for agitating the tray, means located below the tray including a tiltable bucket for receiving the articles, and means connected to both buckets and actuated by an accumulation of a predetermined weight of articles in the last-mentioned bucket for momentarily tilting both of said buckets to discharge the cylindrical articles therefrom.

3. Apparatus for sorting pin-like cylindrical articles comprising a tray having a multiplicity of openings therethrough permitting the endwise passage of acceptable articles and restricting the passage of deformed articles, a hopper located above the tray holding a supply of the articles and having a discharge snout, a tiltable bucket located below the snout of the hopper and adapted to accumulate and periodically discharge a quantity of the articles to the tray, means for agitating the tray, means located below the tray including a movable and tiltable counter-weighted bucket for receiving the articles, means connected to both of said buckets for tilting them and discharging the articles therefrom, and

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means controlled by the movement of the last-mentioned bucket upon accumulation therein of a quantity of the articles for momentarily tilting both buckets to discharge the articles therefrom.

4. In apparatus of the class described, the combination of a screening tray, storage means including an input pan means arranged above said tray to deliver material to be screened to the upper surface of the tray, a counter-balanced output pan means arranged below said tray to collect material screened therethrough, actuating means connected to tilt both said input and said output pan means and including electrical control means arranged in a circuit adapted to be closed only upon movement of said output pan means by virtue of collection therein of a predetermined weight of screened material to concomitantly tilt and empty both said pan means.

JOHN A. CAMPBELL.

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