May 31, 1949. F. H. LUCAS ET AL 2,471,489

METHOD OF AND APPARATUS FOR INSPECTING AND ASSORTING METAL DISKS AND THE LIKE

Filed Sept. 7, 1944 5 Sheets-Sheet 1

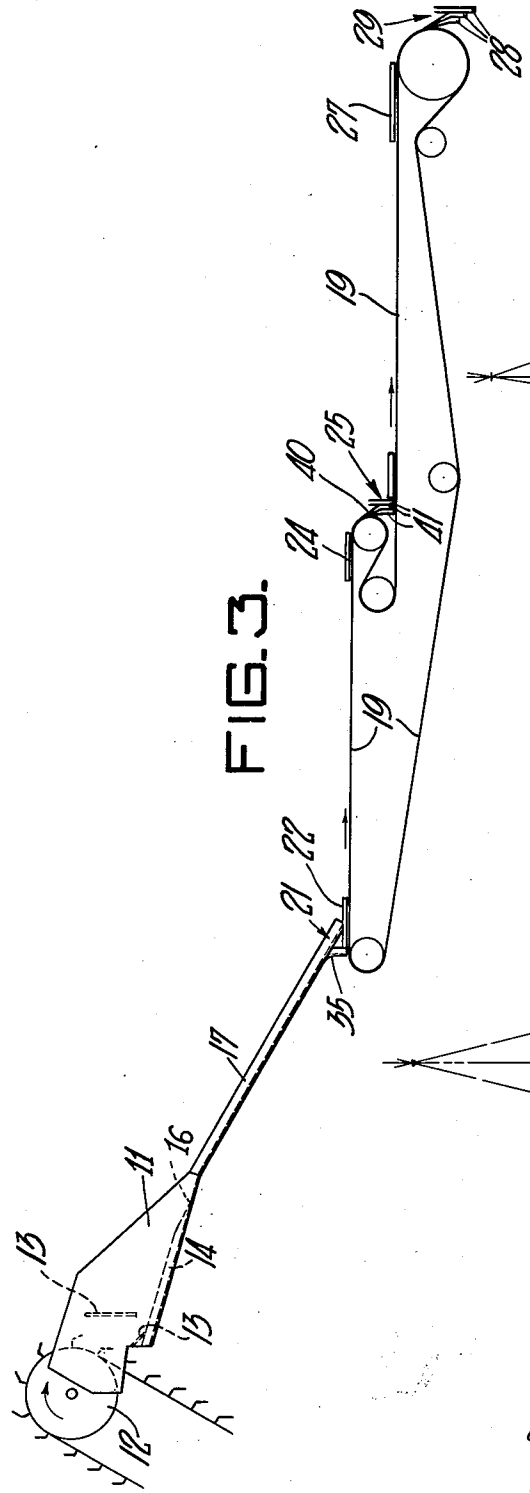


FIG. 3.

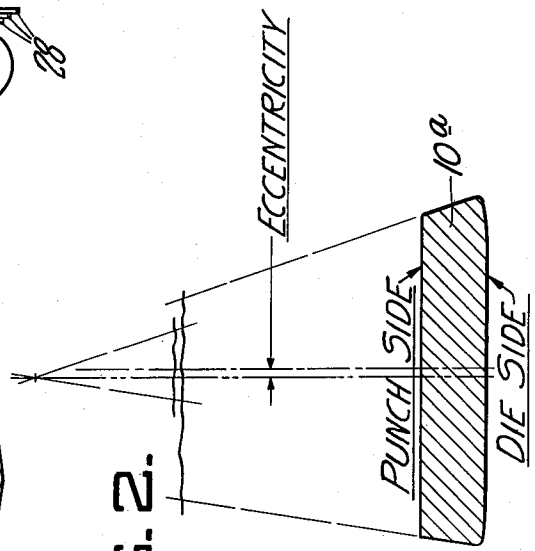


FIG. 2.

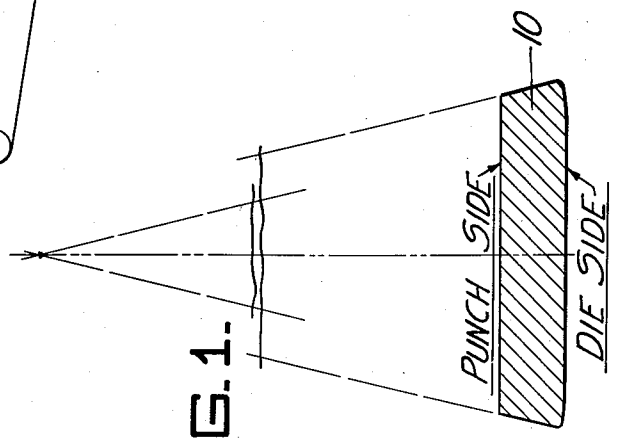


FIG. 1.

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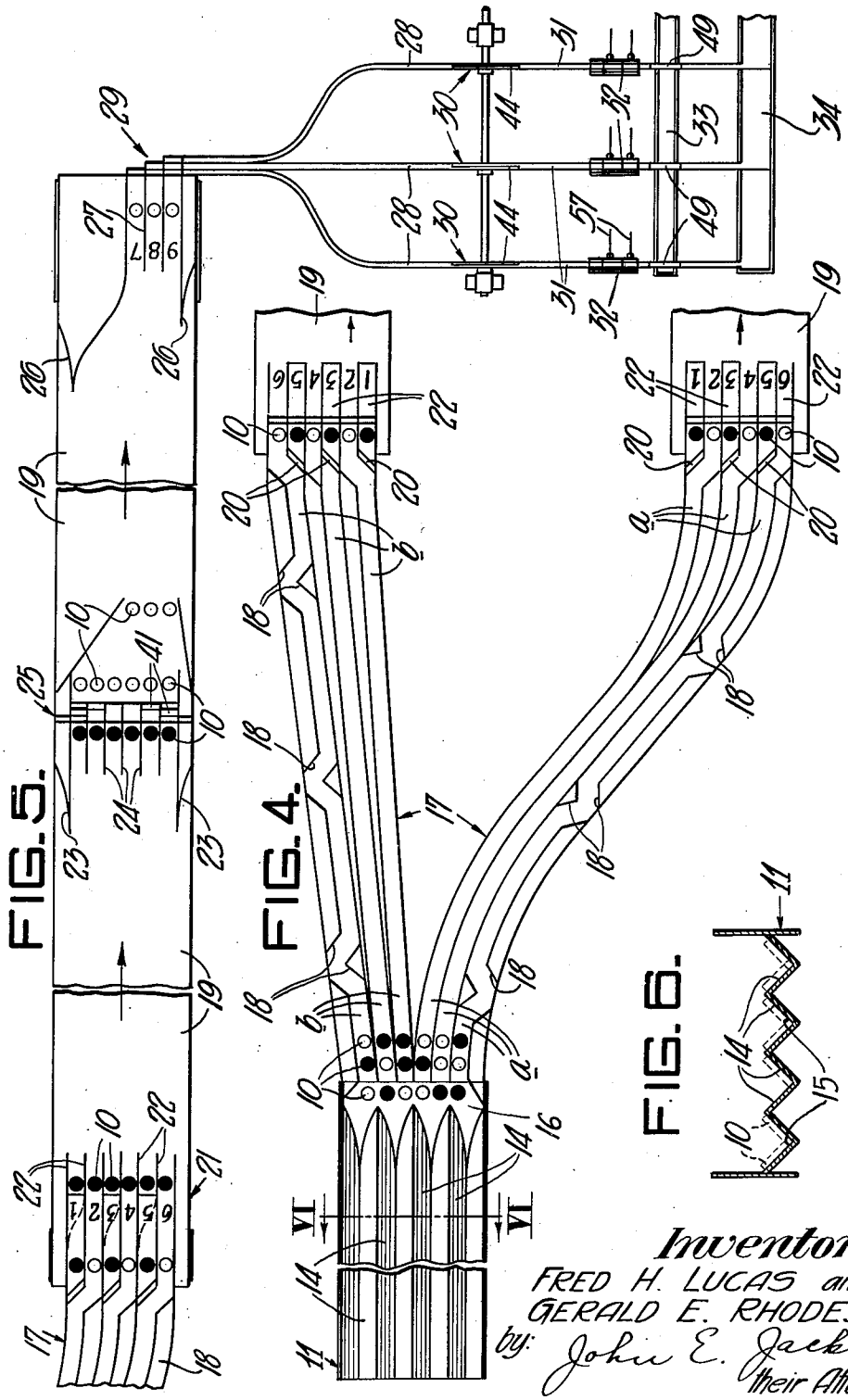


FIG. 5.

FIG. 4.

FIG. 6.

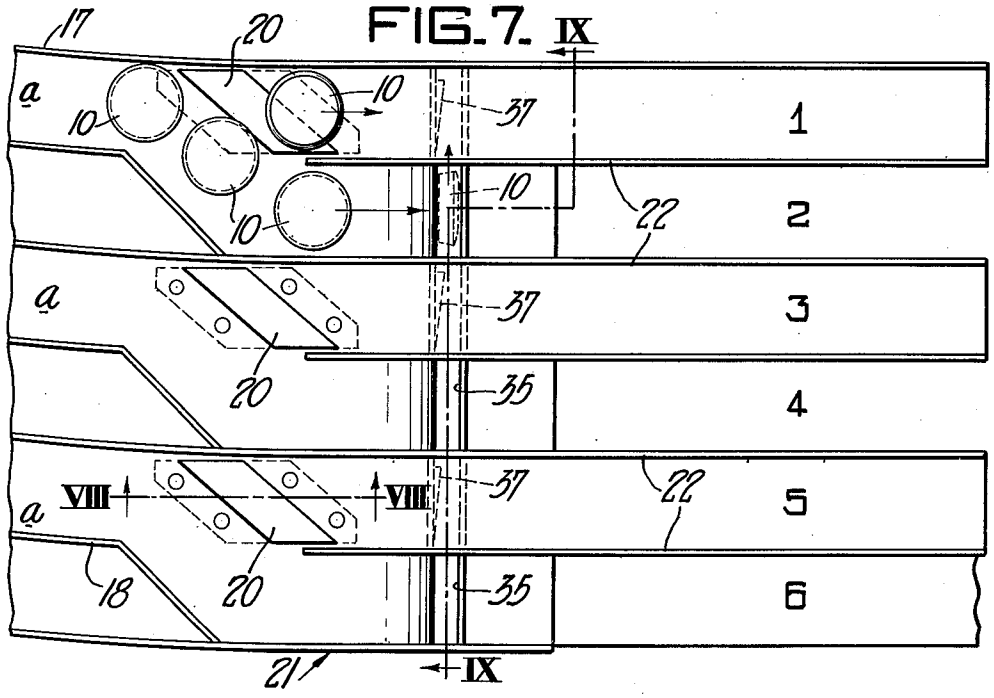
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METHOD OF AND APPARATUS FOR INSPECTING AND ASSORTING METAL DISKS AND THE LIKE

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FIG. 7.



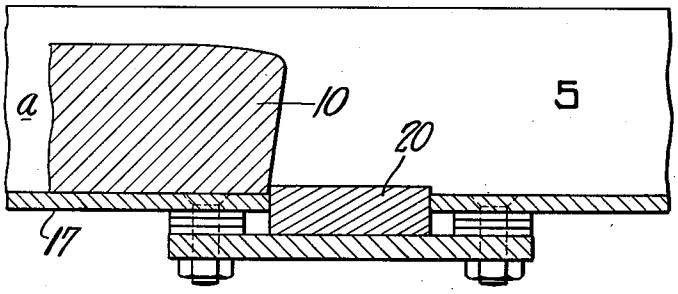


FIG. 8.

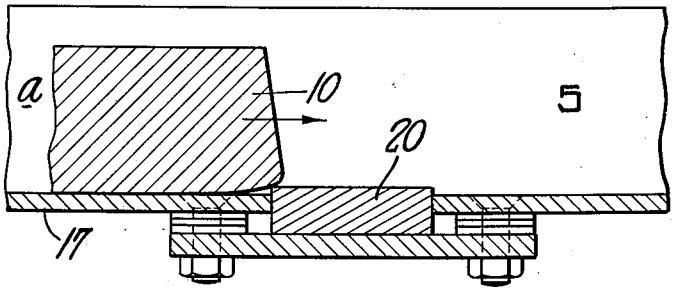


FIG. 8a.

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METHOD OF AND APPARATUS FOR INSPECTING AND ASSORTING METAL DISKS AND THE LIKE

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FIG. 10.

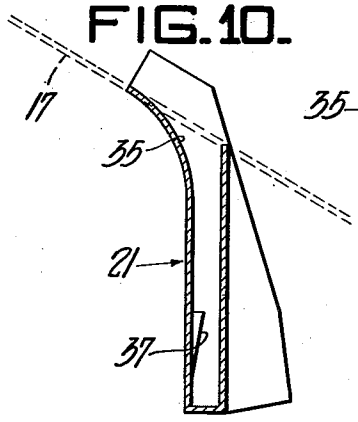


FIG. 9.

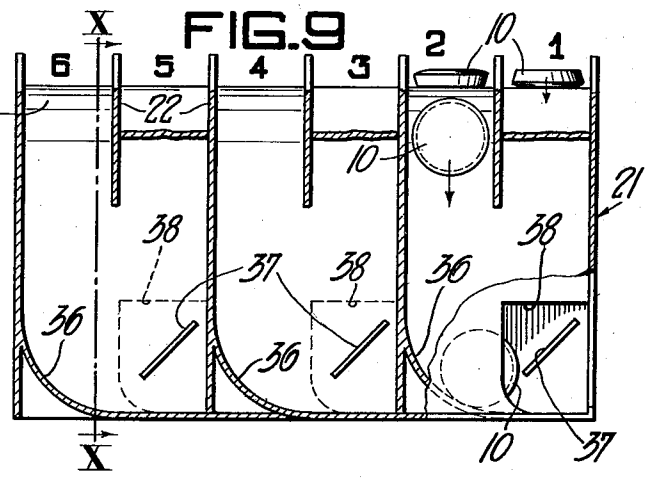


FIG. 11.

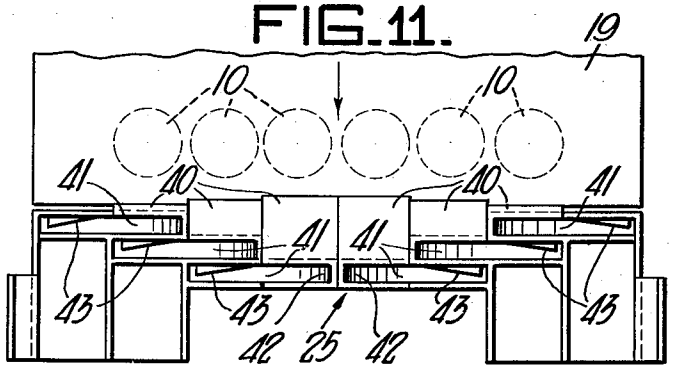


FIG. 13.

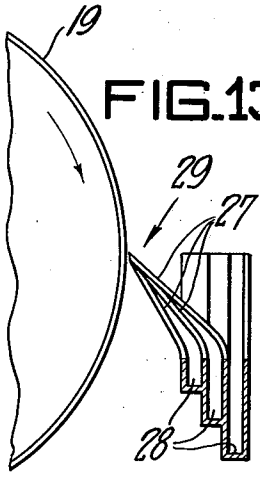
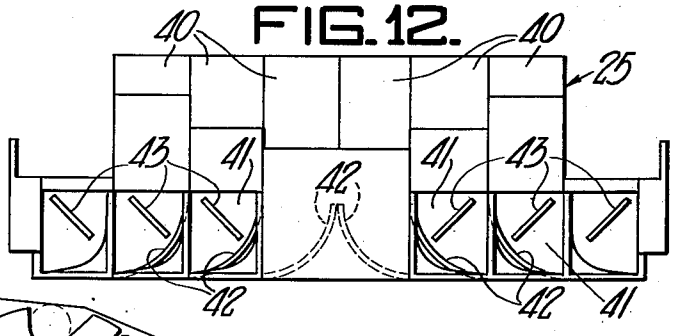


FIG. 12.



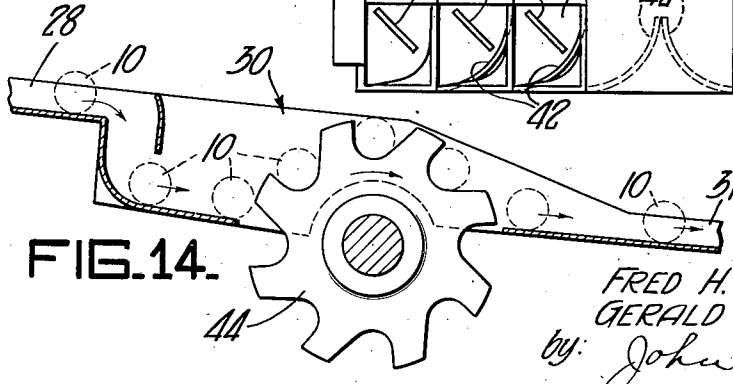


FIG. 14.

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METHOD OF AND APPARATUS FOR INSPECTING AND ASSORTING METAL DISKS AND THE LIKE

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FIG. 16.

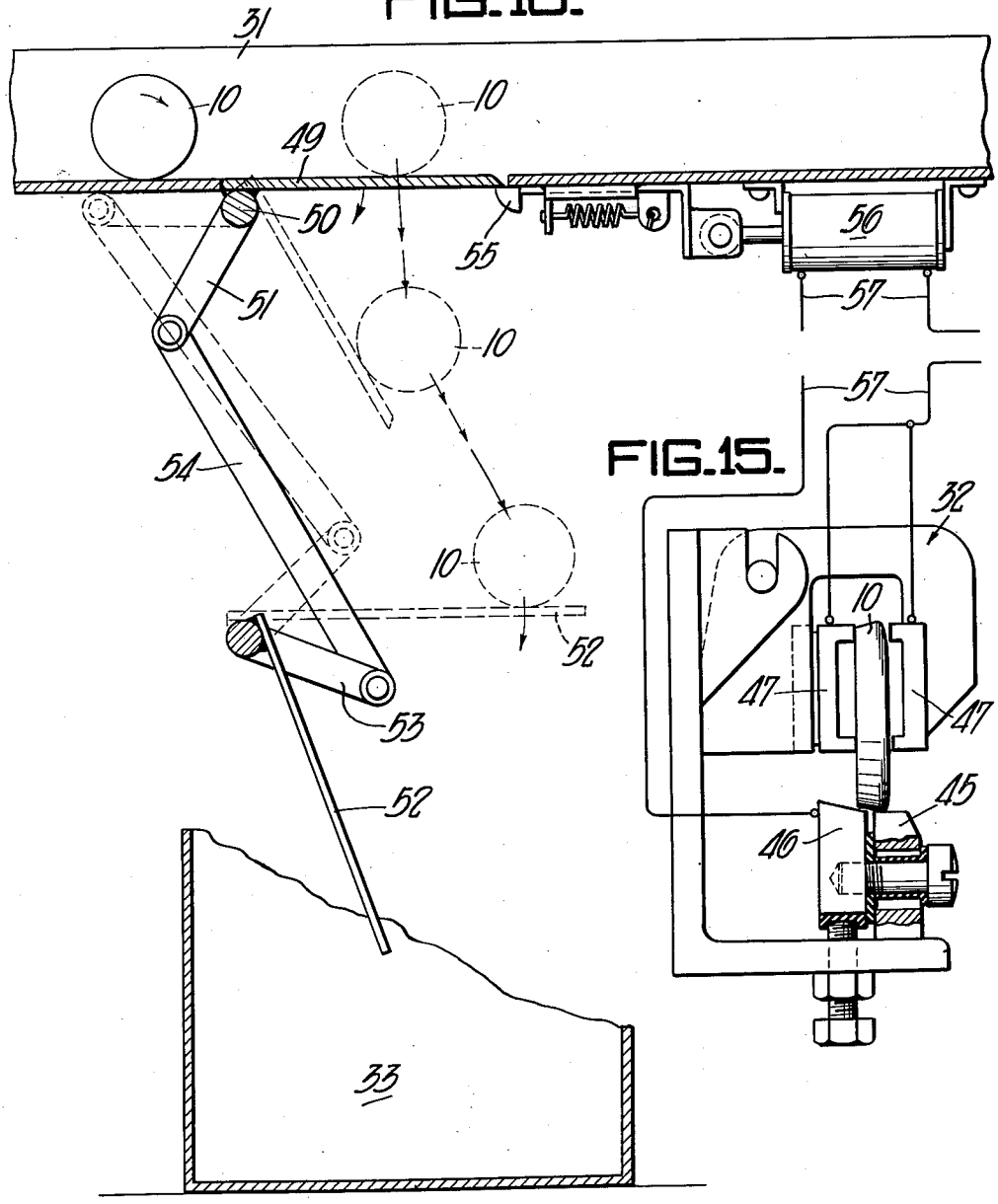


FIG. 15.

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Patented May 31, 1949 2,471,489

UNITED STATES PATENT OFFICE

2,471,489

METHOD OF AND APPARATUS FOR INSPECTING AND ASSORTING METAL DISKS AND THE LIKE

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Application September 7, 1944, Serial No. 553,072

11 Claims. (Cl. 209—82)

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This invention relates to improvements in the method of and apparatus for inspecting and assorting metal discs and the like, and has particular application to the inspection and assorting of punched metal discs for concentricity.

In the production of drawn cylindrical objects, such as cartridge cases, a circular blank is stamped or punched from flat stock, the periphery of which blank or disc is in the form of a truncated cone. In order to be properly drawn or formed, the faces of the disc must be concentric, but due to variations in the metal stock and wear upon the punching dies, eccentric discs are formed which must be segregated from the said concentric discs and rejected. Since in production, the discs are generally punched on gang or multiple punches in large numbers, the problem of inspection and of assorting for concentricity is of considerable magnitude.

Our invention contemplates the conveyance of the discs from an unassorted mass thereof through flatwise and edgewise positions to provide for a visual inspection of the disc faces and to gauge the discs for concentricity of said faces.

We further have in view the utilization of the difference in the character or configuration of the punch side and die side faces of the discs to assort said discs, and the deviation from uniformity of the truncated conical edges of the discs with respect to the central axes of the discs to segregate the eccentric from the concentric discs.

Further objects are to provide an improved method and apparatus for a controlled gravity travel of the discs; for selecting and inverting certain of the discs in flatwise relation; and for spacing and gauging the discs for concentricity in edgewise position, together with the rejection of discs for eccentricity.

Additional objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, wherein:

Figs. 1 and 2 are sectional views, respectively showing a concentric and an eccentric disc of the character to be inspected and assorted by our invention;

Fig. 3 is a diagrammatic elevational view illustrating the method and apparatus of our invention;

Fig. 4 is a plan view of the selector table;

Fig. 5 is a plan view of the inspection conveyor belt which receives the discs from said selector table;

Fig. 6 is an enlarged detail section taken on the line VI—VI of Fig. 4;

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Fig. 7 is an enlarged plan view of the delivery end portion of the selector table;

Figs. 8 and 8ª are enlarged detail sections taken on the line VIII—VIII of Fig. 7, illustrating the action of the selector bar;

Fig. 9 is a sectional view taken on the line IX—IX of Fig. 7, particularly showing the tripper or inverting device;

Fig. 10 is a section taken on the line X—X of Fig. 9;

Fig. 11 is a plan view of the delivery end of the upper course of the conveyor belt, showing a further tripper or inverting device;

Fig. 12 is an elevational view of the device of Fig. 11;

Fig. 13 is a detail sectional view showing the means for delivering the discs from the end of the lower course of said conveyor belt;

Fig. 14 is a sectional view through the spacing device;

Fig. 15 is an end view of the concentricity gauge; and

Fig. 16 is a sectional view through the reject gate, showing the actuating mechanism therefor.

Referring to the drawings, Figs. 1 and 2 show the punched discs to be inspected and assorted by the means and method of the present invention, Fig. 1 showing a concentric disc 10 whose periphery is in the form of a truncated cone equidistant from the disc axis. The disc 10ª of Fig. 2 is non-uniform, having an eccentricity, as illustrated, of the opposite faces or sides of the disc. In such a defective disc, the truncated conical periphery is not uniformly disposed about the central axis of the disc. Due to the formation of the discs in the punch, the upper or punch side thereof will be substantially flat, having a sharp peripheral corner or edge, whereas the under or die side will be slightly convex, having a rounded peripheral portion.

In the practice of our invention, discs are punched in the usual manner by means of gang or multiple punches, which discs are gathered in an unassorted mass and conveyed to an elevated hopper 11 as by means of a bucket conveyor 12. The discs are discharged between a pair of baffles 13 by which they are delivered onto an inclined grid 14, the latter having a receiving surface provided with longitudinal corrugations forming troughs 15 down which the discs roll by gravity as shown in Fig. 6, to be delivered flatwise upon an apron 16, from which apron the said discs slide flatwise onto an inclined selector table 17.

Selector table 17 is preferably divided into two divergent portions having series of channels or

ways, identified by the characters *a* and *b*, there being three channels in each of said table portions in the construction shown. The major portion of the discs are received into the four central channels *a* and *b* from the apron 16, the overflow from the latter being received in the outermost channels of the said series. The latter may be provided with deflector baffles 18 if desired, providing a tortuous path for the discs in order to retard the velocity thereof.

As the discs travel flatwise down the selector table in the said channels, it will be understood that they will be mixed, i. e., some with the die side up and some with the punch side up, which condition is illustrated in the drawings by shading those discs having their punch side up to distinguish the same from the other discs. In order to position and deliver all of said discs with their punch sides up upon the inspection conveyor belts 19, each of the channels *a* and *b* is provided with a selector 20 in the form of a diagonal bar projecting slightly above the floor of the table. As the discs come into contact with the said selector bars, those discs travelling on their rounded or die sides will pass thereover directly into discharge channels or ways 1, 3 and 5 in alignment with the said channels *a* and *b*, while those discs travelling on their flat or punch sides will engage and be deflected by said deflector bars laterally into the alternate discharge ways or channels 2, 4 and 6. The action of the selector bars 20 is more particularly illustrated in Figs. 7 and 8.

Those discs deflected by the selector bars 20 into channels 2, 4 and 6 pass through a tripper or inverting device, generally indicated at 21 in Fig. 3, the construction and operation of which device is hereinafter more fully set forth, the function thereof being to turn the said discs over with their punch sides up, so that with the discs originally so disposed in channels 1, 3 and 5, all of said discs are delivered onto the horizontal inspection conveyor belts 19 for initial visual inspection of the said punch sides. From the point of delivery of the discs in the aforesaid manner upon the spaced belts 19, the further inspection, assorting and gauging of said discs is effected by a similar process and apparatus, only one sequence of steps and apparatus being illustrated herein, as in Fig. 5, it being understood that the same is duplicated following each portion of the selector table 17.

Referring to Figs. 3 and 5, the belt 19 is preferably disposed with upper and lower horizontal receiving portions or courses disposed over suitable pulleys as shown. The discs are conveyed by the upper course of belt 19 in six rows as deposited thereon between a series of guides generally indicated at 22. The belt 19 is sufficiently wide to provide free marginal portions to which the inspector may remove discs considered to have defective punch sides, the rejected discs being deflected from the said marginal portions of the belt by means of guides 23 into a discard pit or container. The six rows of discs continue to the end of the upper portion of conveyor 19 where they are received between a series of guides 24, said discs falling by gravity from the end of said conveyor portion into a second tripper or inverting device generally indicated at 25 in Fig. 3, which device is hereinafter more fully described, the function thereof being to invert the discs and deliver the same upon a second and lower portion of the conveyor belt 19 with the die sides of said discs turned upwardly for inspection, the said discs travelling on said conveyor in three rows to be finally delivered into three ways or channels

7, 8 and 9 by suitable guides 27 at the end of said lower conveyor portion. 26 designates guides similar to guides 23 for deflecting rejected discs from the free marginal portions of said belt as before.

The discs are discharged on edge from said lower conveyor portion into a series of ways or channels 28, one for each of the ways 7, 8 and 9, by means of a collector or transfer device generally designated by the numeral 29. Spacing devices 30 are provided in the channels 28 for delivering the discs in spaced relation edgewise into extensions 31 of the channels 28 for passage of said discs through concentricity gauges 32, the said gauges and associated mechanism being operable to deliver eccentric discs 10^a to a transversely disposed reject chute 33 and to deliver concentric discs 10 to the final delivery chute 34.

The tripper or inverting device 21 is shown in Figs. 9 and 10, and comprises generally a depending upwardly open box-like structure or enclosure connecting the terminal portions of channels 2, 4 and 6 with downwardly arcuate guide portions 35 over which the discs fall by gravity into substantially vertical position within the lower portion of said structure. The latter is divided into compartments each having an arcuate bottom wall 36 receiving the discs from their respective channels, causing said discs to roll edgewise laterally to a portion beneath the next adjacent channel 1, 3 or 5.

As the discs roll laterally, they engage diagonal wedge-shaped cams 37 in the rear walls of each compartment, displacing or tilting the discs outwardly through discharge openings 38 in said compartments upon said discs striking vertical stops or walls 39, whereby the discs fall flatwise upon the upper course of the conveyor belt 19 in inverted position as hereinbefore described, the said belt being disposed adjacent the lower portions of openings 38. Since the discs are discharged directly beneath the channels 1, 3 and 5 which are conveying other discs directly from the table 17, the guides 22 are inclined laterally to displace the discs inverted by the device 21, into spaced relation with respect to said other discs upon the conveyor belt.

The tripper or inverting device 25 is generally similar to the tripper device 21, except that all six rows of discs are reversed thereby. As illustrated in Figs. 11 and 12, the discs fall from the upper course of the conveyor belt 19 down inclined ways 40 into separate compartments 41 having curved bottom walls 42, the compartments being spaced in the direction of travel of the conveyor and laterally from the center thereof, whereby the discs are rolled by said curved portions 42 in front of the next adjacent compartment where wedge-shaped cams 43 displace or tilt said discs outwardly and downwardly upon the lower conveyor course in inverted relation as before. In this form of the tripper device, the lateral displacement of one-half of the discs is to the left of the center and the other one-half to the right thereof.

Referring more in detail to the gauging device 32 of our invention, one is employed in each channel 28 preceded by a spacer 30 and followed by an automatic reject gate or trap for discarding eccentric discs. As shown in Fig. 14, the spacer includes a driven notched wheel 44 rotatably mounted to receive the discs edgewise in said notches or pockets as said discs roll down the channel 28. The discs are elevated and supported by said wheel for a portion of its rotation and

are deposited thereby into the channel 31 in spaced relation for passage through the gauge 32.

The gauge 32 includes a track 45 upon which the discs roll in edgewise relation as shown in Fig. 15, and a parallel track contact member 46, the latter being transversely inclined upwardly from track 45 and out of engagement with concentric discs, and more particularly the peripheries thereof adjacent the punch sides of such discs, as said discs roll through the gauge. Member 46 is insulated from the gauge and is adjustably mounted in relation to track 45 so as to provide an accurate contact for eccentric discs rolling on said track.

Spaced contact guide bars 47 are positioned on either side of the path of the upper portion of the discs as the latter roll along tracks 45 and 46, said bars being parallel to the tracks. As shown in Fig. 15, a concentric disc 10 will roll upright between the bars 47 in contact with one of the latter, and out of contact with member 46, but a slight eccentricity or unevenness of the periphery of a disc like disc 10a, will cause said disc to contact member 46, thereby making electrical contact through the disc between member 46 and one of said bars 47.

Spaced rearwardly of the gauge 32, we provide a reject trap or gate 49 in the bottom of the channel 31, said gate being pivoted at its forward edge as at 50 and having an arm 51 movable therewith. Beneath said gate is a pivotally mounted trigger 52 having an arm 53 movable therewith, the arms 51 and 53 being connected by a link 54.

The free end of the gate 49 normally rests upon a spring latch 55 which is operable by a solenoid 56 to release said gate, said solenoid being in circuit 57 with the member 46 and contact bars 47 so as to be energized upon the passage of an eccentric disc through the gauge. The gate and its linkage falls open by gravity and remains open until the rejected disc falls therethrough. The said disc strikes the trigger 52, elevated by the opening movement of the gate, with sufficient force to return the trigger and gate to normal position with the latter again engaging its latch 55. The rejected disc falls into the reject chute 33 below the said gate device.

By properly relating the spacing of the discs, as by controlling the speed of the spacer 30, the proper time interval may be obtained between discs for the action of said reject gate 49.

From the foregoing, it will be seen that our invention provides for the complete assorting, inspecting and gauging of the discs. Assorting or segregating the discs in accordance with the configuration of their sides or faces enables the subjection of one group thereof to the separate tripping or reversing operation whereby all the discs are aligned for inspection of like sides or faces.

Finally, the gauging and assorting of the discs for concentricity or eccentricity utilizing the variation or nonuniformity of the truncated conical peripheries thereof while conveying said discs edgewise, affords a highly practical and efficient method of selecting the usable discs or blanks for subsequent working.

Various changes and modifications are contemplated within the scope of the following claims.

We claim:

1. The herein described method of assorting punched metal discs and the like, consisting in conveying unassorted discs flatwise, separating the discs into groups in accordance with the configuration of the faces thereof upon which they

are supported during their flatwise travel, inverting the discs of one of said groups, erecting and rolling the discs in edgewise position, gauging the discs for concentricity by determining the variation in the angularity of the edges of the discs during their edgewise travel, and assorting said discs in accordance with said variation.

2. The herein described method of assorting punched metal discs and the like, consisting in conveying unassorted discs flatwise, separating the discs into at least one row, selectively displacing and separating those discs having their punch sides down from said row, inverting the separated discs, erecting and rolling all of said discs in edgewise position, gauging the discs for concentricity by the variation in the angularity of the edges of the discs during said edgewise travel, and assorting said discs in accordance with said variation.

3. The herein described method of continuously inspecting and assorting punched metal discs and the like, consisting in conveying unassorted discs flatwise, separating the discs into rows, selectively displacing and separating those discs having their punch sides down from said rows spaced from the first rows, inverting the separated discs, conveying all of said rows of discs with their punch sides up for visual inspection thereof, inverting all of said discs and conveying the same with their die sides up for visual inspection thereof, erecting and rolling all of said discs in edgewise position, gauging the discs for concentricity by the variation in the angularity of the edges of the discs during said edgewise travel, and assorting said discs in accordance with said variation.

4. In apparatus for assorting punched metal discs and the like, the combination with means for conveying unassorted discs flatwise, an upwardly projecting selector bar disposed diagonally across the path of said discs for separating and laterally displacing those discs travelling upon their punch sides, said selector bar permitting the passage thereover of those discs travelling on their die sides, means receiving and inverting the separated discs, a conveyor channel for supporting and rolling the discs in edgewise position, means for delivering said discs edgewise to said channel from the flatwise travel thereof, a concentricity gauge receiving the discs on edge from the channel, said gauge including means actuated by a variation in the angularity of the edges of said discs, means responsive to the gauge for segregating those discs actuating said gauge, and means for conveying the discs through said gauge to the gauge-responsive means.

5. In apparatus for assorting metal discs and the like, the combination with means for conveying unassorted discs flatwise, an upwardly projecting selector bar disposed diagonally across the path of said discs for separating and laterally displacing those discs travelling upon their punch sides, said selector bar permitting the passage thereover of those discs travelling on their die sides, means receiving and inverting the separated discs, a conveyor channel for supporting and rolling the discs in edgewise position, means for delivering said discs edgewise to said channel from the flatwise travel thereof, a concentricity gauge, means for delivering the discs from said channel edgewise to the gauge in uniformly spaced relation, said gauge including means actuated by a variation in the angularity of the edges of said discs, means responsive to the gauge for segregating those discs actuating said gauge, and means

for conveying the discs through said gauge to the gauge-responsive means.

6. In apparatus for assorting discs having truncated conical edges, a concentricity gauge including a track for rolling conveyance of the discs upon their edges, a contact guide member adapted to be contacted by the upper portion of the discs supported by the track, a track contact member spaced from the track, an electrical circuit including the contact guide member and track contact member and adapted to be closed through engagement of a disc therebetween, and means responsive to said circuit for segregating such disc from the other discs passing through said gauge.

7. In apparatus for assorting discs having truncated conical edges, a concentricity gauge including a track disposed for rolling conveyance of the discs on their edges, a pair of contact guide members parallel to the tracks and adapted to be contacted by the upper portion of the discs supported by the track, a track contact member parallel to and spaced from the track, an electrical circuit including the contact guide members and said track contact member, said circuit adapted to be closed through engagement of a disc with either of said contact guide members and the track contact member, and means responsive to said circuit for segregating said disc from the other discs passing through said gauge.

8. In apparatus for assorting discs having truncated conical edges, a concentricity gauge including a track disposed for rolling conveyance of the discs on their edges, a track contact member spaced from said track, said track contact member being transversely inclined upwardly from the track and being adjustable relative thereto, a pair of contact guide members above and parallel to the tracks and disposed to receive the upper portion of said discs therebetween, an electrical circuit including the contact guide members and said track contact member adapted to be closed through engagement of a disc with either of said contact guide members, and said track contact member and means responsive to said circuit for segregating said disc from the other discs passing through said gauge.

9. In apparatus for assorting and inspecting punched discs and the like, conveying means for supporting the discs flatwise for visual inspection, means for similarly orienting discs entering on said conveying means, means for inverting discs after a period of travel on said conveying means,

means for turning discs edgewise as they leave said conveying means, and means automatically responsive to eccentricity in edgewise discs for segregating eccentric discs from concentric discs.

10. In apparatus for assorting and inspecting punched discs and the like, conveying means for supporting the discs flatwise for visual inspection, means for similarly orienting discs entering on said conveying means, and means for inverting discs after a period of travel on said conveying means, said inverting means including an upwardly open enclosure depending below said conveying means, a guide for delivering discs edgewise to said enclosure at one side, an arcuate bottom portion in said enclosure to impart a rolling lateral motion to discs within the enclosure, a stop spaced from said arcuate portion, and a cam projecting from the enclosure wall to engage discs and push them flatwise, but inverted from original position.

11. In apparatus for assorting and inspecting punched discs and the like, conveying means for supporting the discs flatwise for visual inspection, orienting mechanism passing discs correctly oriented and including means for inverting discs incorrectly oriented prior to their entering on the conveying means, said inverting means including an upwardly open enclosure, a guide for delivering discs edgewise to said enclosure at one side, an arcuate bottom portion in said enclosure to impart a rolling lateral motion to discs within the enclosure, a stop spaced from said arcuate portion, and a cam projecting from the enclosure wall to engage discs and push them flatwise, but inverted from original position.

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Certificate of Correction

Patent No. 2,471,489. May 31, 1949.

FRED H. LUCAS ET AL.

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 6, line 24, after the word "rows" insert *into rows*; line 56, after "assorting" insert *punched*;

and that the said Letter Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of November, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.