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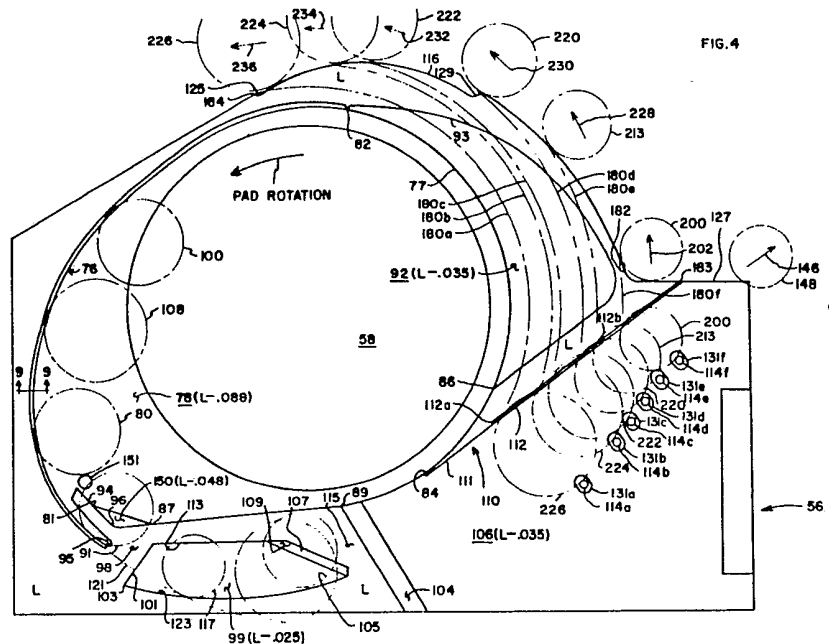
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## (54) Coin sorter

(57) The present invention provides a coin sorter (14) in which a sorting head (56) is positioned over a rotating pliable disc (54) and wherein coins are sorted by the combination of an outwardly extending tapered edge (76) and a series of pins (114a-114e) generally positioned in an outwardly extending line spaced from the tapered edge (76). The spacing between the line of pins (114a-114e) and tapered edge (76) increases with outward dimension, whereby coins of different diameter are urged over the tapered edge (76) by different pins (114a-114e) at different positions. The coins are then captured between the head (56) and pliable disc (54) and rotated to exit positions which are unique for each coin about the outside of the sorting head (56).



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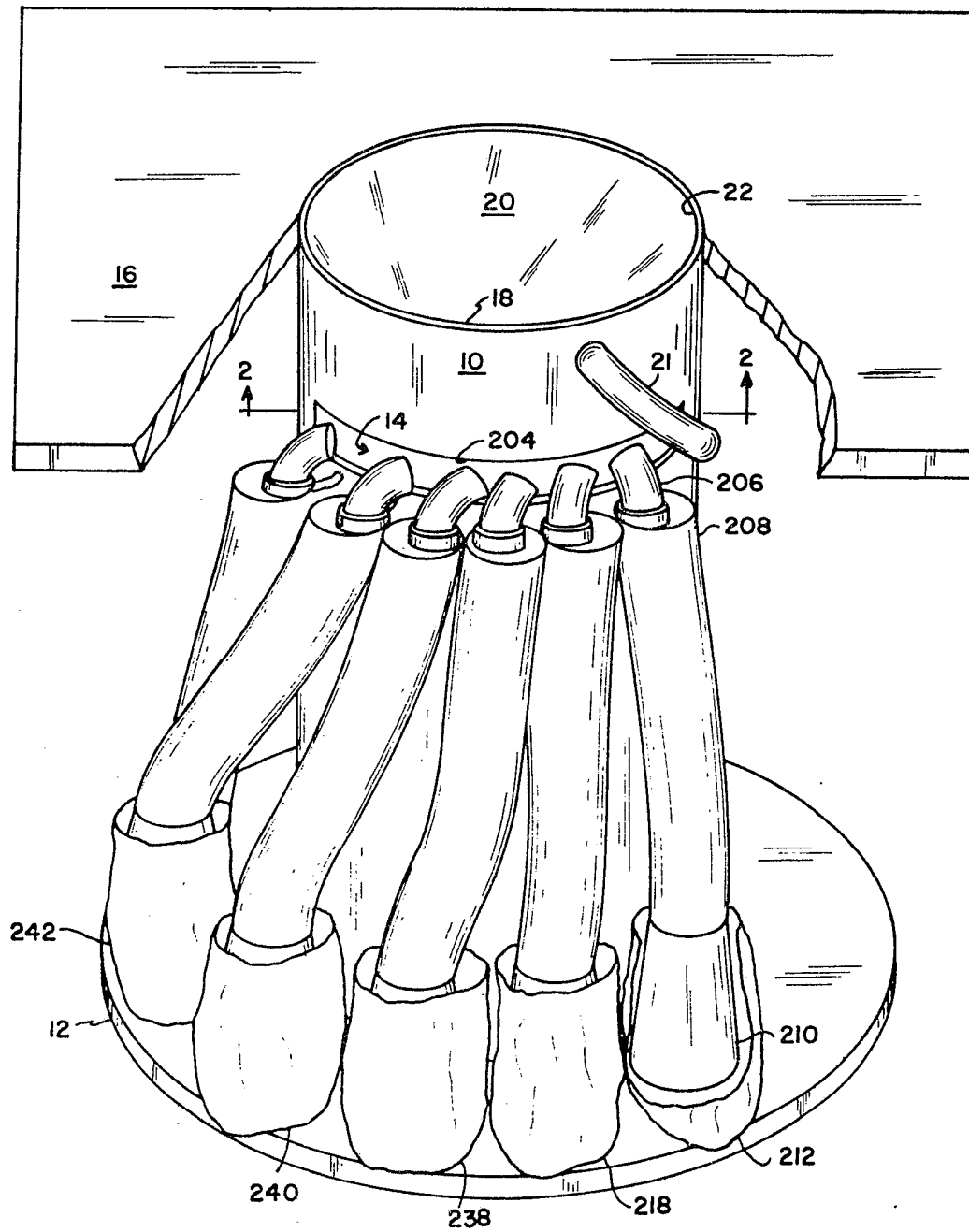


FIG. 1

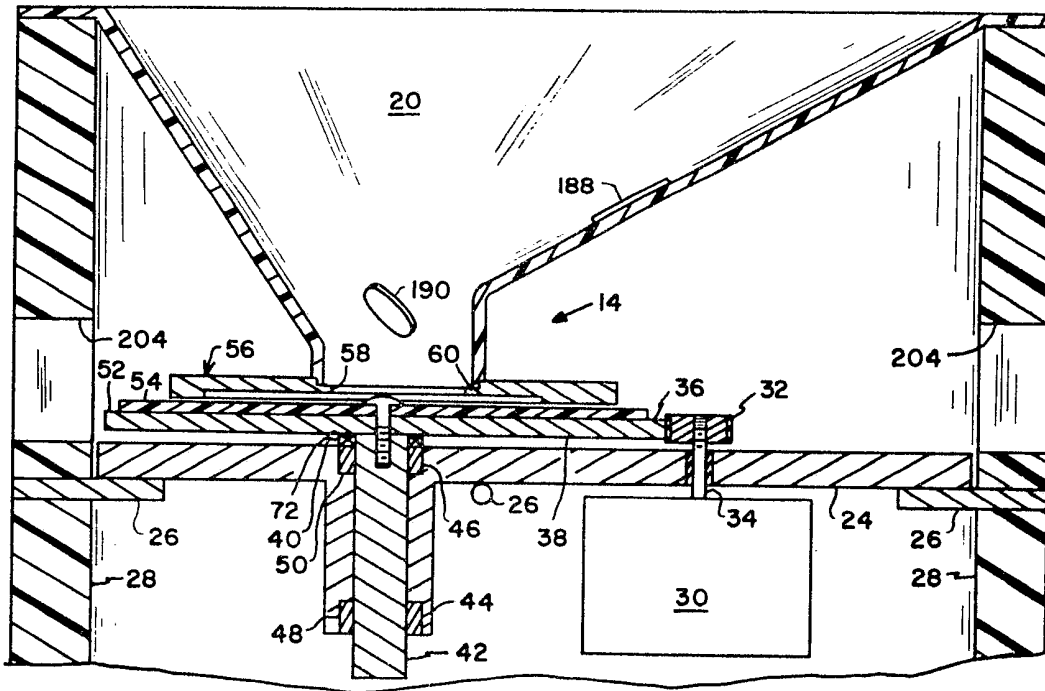


FIG. 2

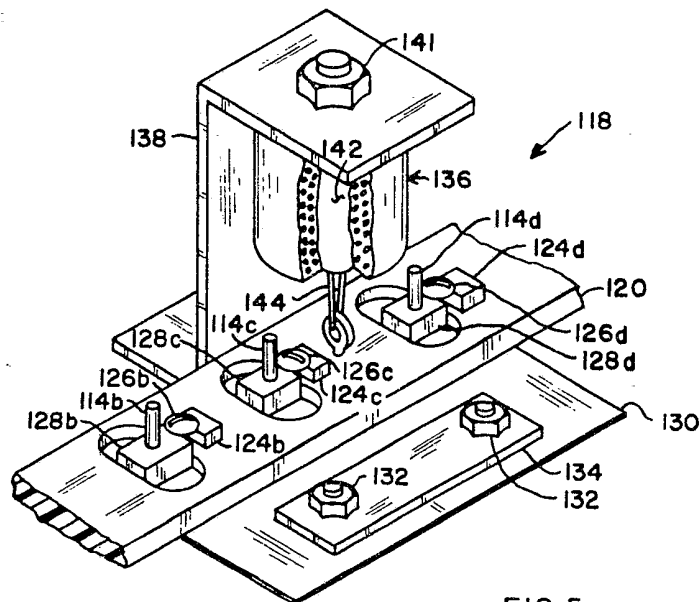


FIG. 5

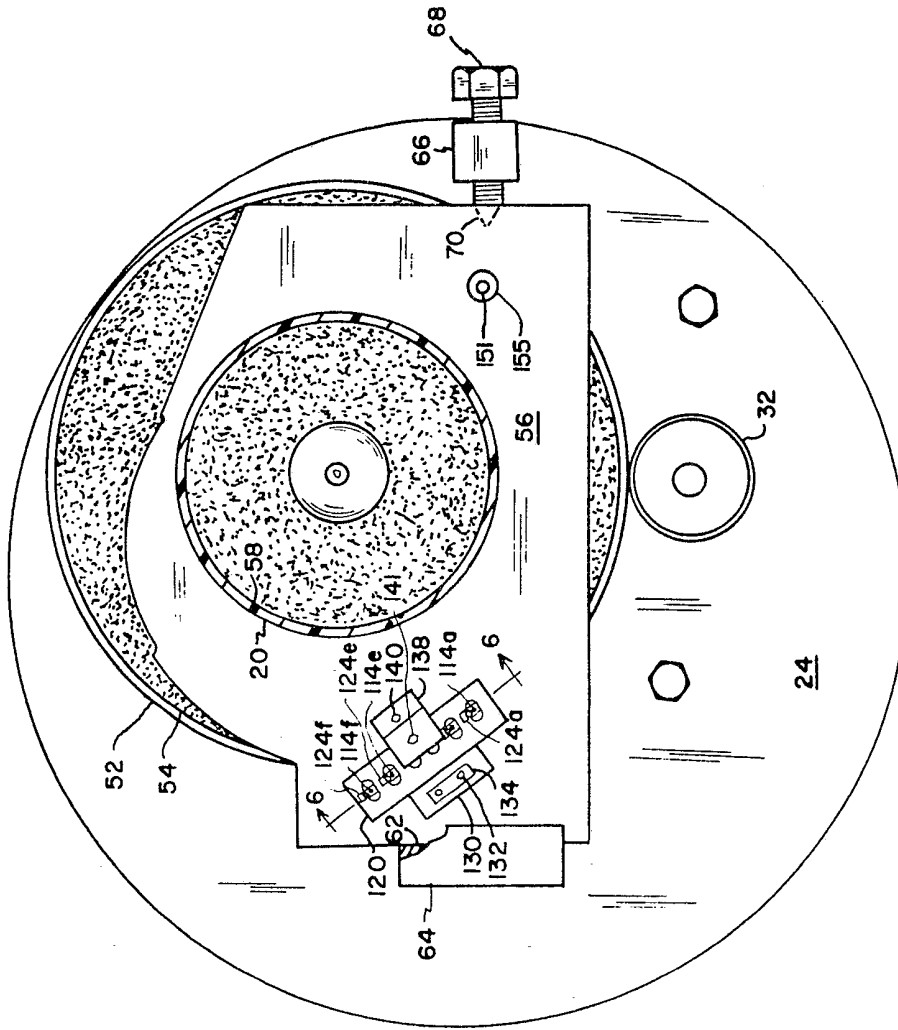


FIG. 3

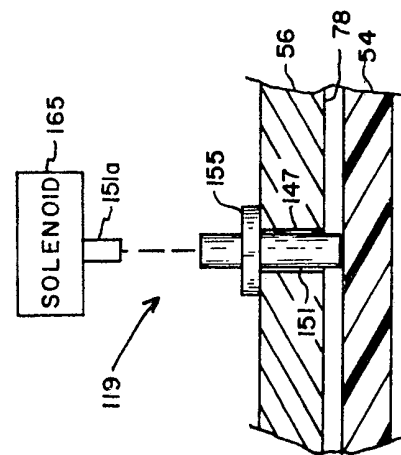


FIG. 8



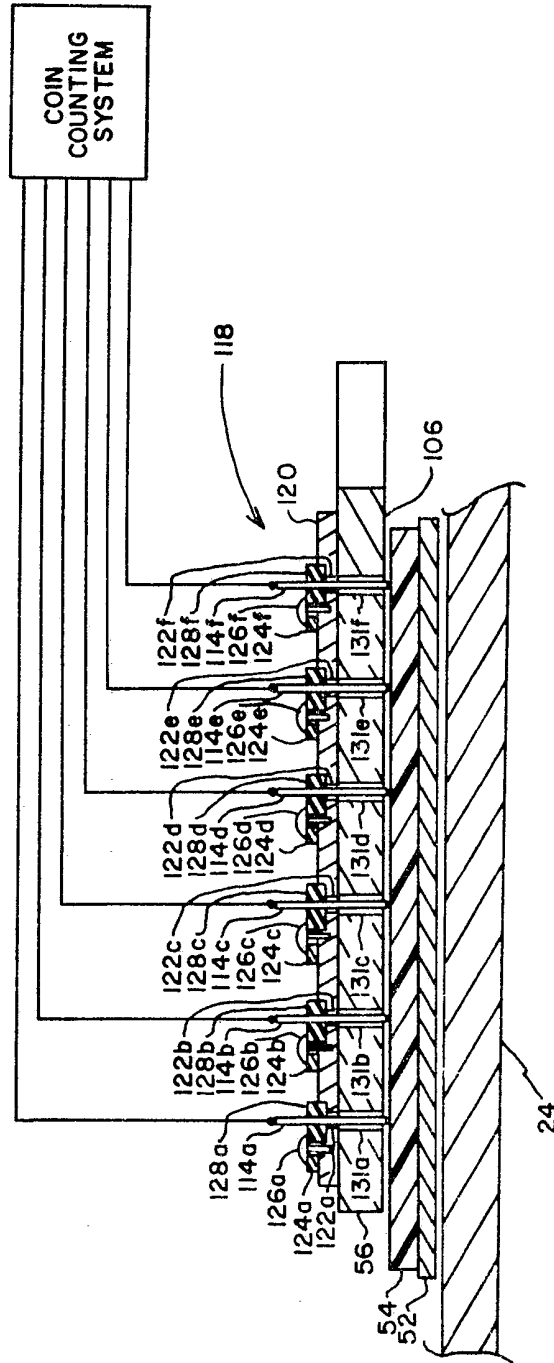


FIG. 6

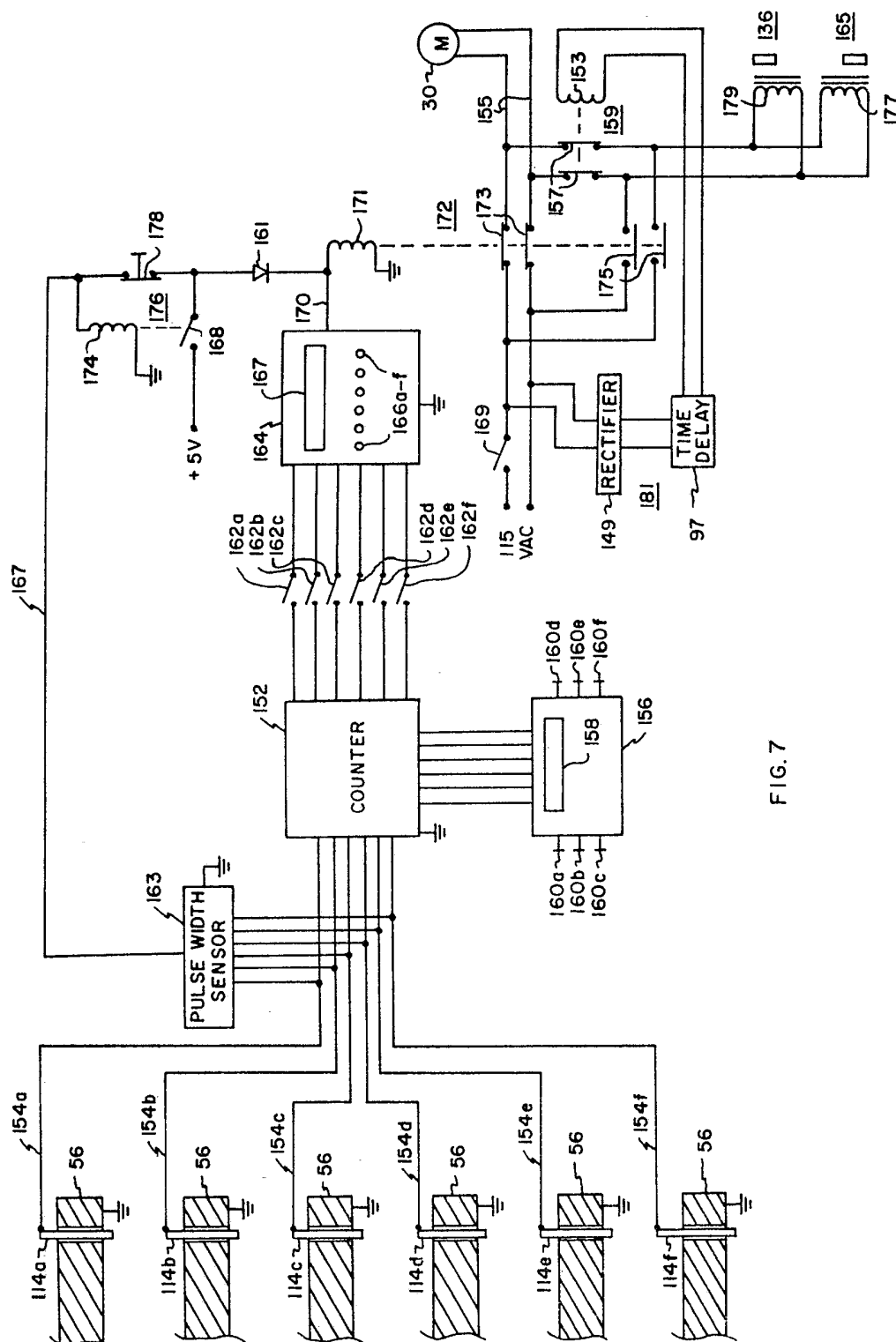


FIG. 7

## SPECIFICATION

## Coin sorter

5 This invention relates generally to coin handling equipment and particularly to a coin sorter.

Patents 4,086,928 and 4,444,212 illustrate coin sorters which employ annular sorting heads positioned over and adjacent to a rotating resilient disc, and coins are introduced through a central opening in a sorting head. The undersides of the sorting heads of these patents are configured to effect a single layer-single file of coins utilizing a ramp, Patent 4,086,928 utilizing the ramp for capturing coins so aligned for sorting and freeing others and directing them inward for recycling. Patent 4,444,212 employs, in addition, a secondary recess to assure that coins not in a single layer and single file are separated. Following the ramp and return recess, or recesses, a single file-single layer of coins are rotated at a discrete and constant radial position, and coins of different diameter are then sorted as a function of the unique position of their inner edge. In Patent 4,086,923, sorting and dispensing are accomplished by pressing the inner edge of a particular coin into the resilient surface at a discrete peripheral location by a plow device and for enabling the outer edge to freely rise and be hurled over a peripheral barrier. In Patent 4,096,280, the coins are held with their outer edge indexed at a fixed radial position by pressing them into a rotating resilient surface and ejecting different size coins by slots, the slots being positioned about the periphery of the device and are varied as to their radial location. In both instances, a constant outer radial position is used as a reference position for coins, and sorting and dispensing occur as a united function at a discrete position around a circular periphery.

45 Pertinently, U.S. Patent 4,607,649 discloses another device having an annular head positioned over a resilient rotating disc. It, too, employs a ramp and return recess for basically creating a single layer-single file of coins. In addition, it employs a secondary means of picking off double layered coins, this being in the form of a secondary recess which is somewhat similar to the approach employed in Patent 4,444,212. Significantly, Patent 55 4,607,649 employs an opposite edge referencing system wherein the inner edges of coins are referenced. This is accomplished by an outwardly spiralling, outwardly facing shoulder against which captured coins are urged by the rotating disc to move outwardly to a peripheral region. Then, sorting occurs along an outwardly facing shoulder which has only a slight spiral and extends substantially around the periphery of the sorter. Sorting is effected 65 by plow devices somewhat akin to those em-

ployed in the device of Patent 4,086,928, the difference being that, in Patent 4,086,928, the inner edges of coins are pressed downward, and in Patent 4,607,649, the outer edges are pressed downward. Sorting and dispensing are effected in the device of the latter patent by the inner edge of coins being pivoted upward into a dispensing slot, somewhat like employed in Patent 4,444,212, which guides an effected coin outward. This system requires that sets of the combination of a plow and a dispensing slot be positioned around the periphery, that it be a circular or spiral periphery and of a substantial size in order to accommodate a significant number of different diameter coins. In this respect, it is like the systems of Patents 4,086,928 and 4,444,212.

As to the general technique of positioning captured coins against an outer facing edge, the common applicant in this case, and in the first two references cited, first employed this technique in coin exit chutes for a sorter generally of the type illustrated in Patent 4,444,212 and which was offered for sale at least as early as 1979 and used this technique as a preprocessing arrangement in a coin handling device which functioned to select only one size coin, and thus was not a sorter, in early 1982 and which was offered for sale no later than October of 1982.

One problem with the sorters of the prior art is that their sorting surfaces consist of quite complex lands and recesses, which result in quite high machining costs. Further, insofar as is known by the applicants, none of the prior devices provide precise accuracy in supplying a desired number of coins of a given denomination into a denominational container without some overrun into that container. Still further, and as noted above, the prior sorters integrate the sorting and dispensing functions around the periphery of a circular device, and this requires substantial space.

Accordingly, it is the object of this invention to provide a coin sorter having a sorting head which is greatly simplified and one wherein precise control is effected over delivery of a selected number of coins of a given denomination. Further, it is the object of this invention to provide a sorter which does not integrate the sorting and dispensing function for a given denomination, but instead separates these functions, enabling a significant decrease in the size of a sorter.

In accordance with this invention, instead of guiding coins outward to a peripheral position around a generally circular sorting head or plate as in all of the cited art, wherein either the inner or outer edges of coins are referenced with respect to a circular or spiral reference, the applicants' device is non-circular and effects sorting prior to coins reaching the outer boundary of the sorting head. The coins are initially rotated on a resilient disc in a re-



gion under the head where a single layer of coins is free to rotate with the disc. Thereafter, a single layer-single file of coins is effected by a ramp and return recess, and the coins are thereafter captured between the resilient disc and a sorting head. Sorting is effected by intercepting them as they are caused to travel in a path outward along a tapered guide edge. Interceptions of different diameters of coin are effected by a plurality of discretely positioned obtrusions in this coin path. These obtrusions are the sorting elements or members, and they are spaced from the tapered guide edge a distance wherein the largest coin to be sorted is engaged between the first of the obtrusions and guide edge and is thereby urged across the guide edge. In descending order, smaller diameter coins are similarly engaged and forced across the guide edge as they travel outward along it. In this manner, each coin passes across the guide edge at a different radial position. The coins are then captured and are rotated at discrete radial positions until they are rotated free of the outer edge of the sorting head. By varying the configuration of the outer edge of the sorting head in terms of its being intercepted by coins, both the position and direction of exiting coins can be adjusted.

As a preferred feature of this invention, the sorting elements are pivotally mounted and are abruptly raised as a group upon the detection of a selected number of coins being dispensed. Thereafter, coins approaching and reaching the guide edge will simply follow it to a discrete exit which is separate from exits for sorted coins.

As another preferred feature of this invention, the sorting members would be discretely insulated and used as coin count detectors.

As another preferred feature of this invention, means are provided to stop the sorting process on the dispensing of a selected number of coins of a selected denomination, and any coins which are dispensed after this are guided back into a hopper, through which coins are generally introduced to the sorter. Coins which have not yet proceeded out of a region where they are free to rotate with the disc are blocked from progressing by the ramp. It is noted that Patent 4,564,036 discloses a system where the sorting function is halted upon the sensing of a selected count of dispensed coins. In it, however, coins are permitted to proceed beyond the region of free movement and to a return slot which normally is made inoperative by a ridge guide, enabling coins to simply normally pass over it. Then, when a selected count is detected, this ridge guide is withdrawn and coins reaching this return recess drop into it and are returned to the free well area of the sorter.

An embodiment of the invention will now be described by way of example only and with reference to the accompanying drawings,

in which:

*Figure 1* is a pictorial view illustrating in general the configuration of the coin sorter of this invention.

*Figure 2* is a sectional view taken along line 2-2 of Fig. 1.

*Figure 3* is a top view of the sorting head of the sorter and support.

*Figure 4* is a planar view of the underside of the sorting head of the sorter and illustrating operation of the sorter.

*Figure 5* is a detail of construction in the form of a pictorial view, this view being of a portion of a sorting pin assembly.

*Figure 6* is a view, partially sectional and partially schematic, illustrating the construction of the sorting pin assembly and its electrical connection to a coin counting system.

*Figure 7* is an electrical block diagram illustrating a coin counting system as contemplated by the invention.

*Figure 8* is a partial sectional view as seen along line 8-8 of Fig. 3 and additionally showing a solenoid connected to mechanical structure.

*Figure 9* is a sectional view as seen along line 9-9 of Fig. 4.

Referring to the drawings, and initially to Fig. 1, a circular pedestal 10 supported by a base 12 houses a coin sorting apparatus 14. A table top 16 is supported at the top 18 of pedestal 10, and it provides a work surface upon which coins may be placed and inspected prior to being supplied sorting apparatus 14. Funnel-shaped hopper 20 extends from the periphery of opening 22 in table 16 through which coins from table 16 are actually supplied sorting apparatus 14.

Sorting apparatus 14 (Figs. 2-4) includes a base plate 24 which rests on pins 26 extending through wall 28 of pedestal 10. A motor 30 is attached to the bottom of base plate 24 (by means not shown). A drive wheel 32 on motor shaft 34 frictionally engages the edge 36 of turntable 38 to drive it. Turntable 38 is supported by bearings 40 and is mounted on a shaft 42 which in turn is supported by bushings 44 and 46 affixed in shaft recesses 48 and 50. Turntable 38 is driven at a selected speed, for example, approximately 500 rpm, which typically provides a sorting speed in excess of 3,000 mixed coins per minute. Turntable 38 has a generally flat upper surface 52 upon which is affixed a flexible resilient pad 54.

Coin sorting head 56 is constructed having a hardened steel lower surface and having a central opening 58 about which is included a groove 60 (Fig. 2) into which is closely fit the bottom of hopper 20. Head 56 is supported on one side by a groove 62 in mount 64 (Fig. 3), in turn supported on base plate 24 by means not shown. A second mount 66 is positioned on an opposite side of sorting head 56. It, too, is attached to base plate 24 (by

means not shown), sorting head 56 being attached to mount 66 by a bolt 68 which has a tapered end 70 which enables sorting head 56 to be precisely horizontally mounted normal to the perpendicular axis of shaft 42 (Fig. 2). The spacing between sorting head 56 and resilient pad 54 is adjustable by the insertion of selected washers as shims 72 (Fig. 2) on the top of bearing 40 where turntable 52 rests, typically being adjusted to just avoid rubbing.

Fig. 4 illustrates the underside of sorting head 56 which is configured with lands and recesses which control the sorting process. A basic or reference land L, while varying in edge configuration, is flat and is positioned with a slight clearance, 0.001" to 0.005", above rotating pad 54 (Fig. 2) to avoid rubbing as stated above. It extends substantially around opening 58 of sorting head 56 (Fig. 4), and as one function it provides a radial limit for coins (shown in dotted line positions) in their outward movement on rotating pad 54. A first recess or recessed land 78 is generally formed in the underside of land L of head 56, it extending from hopper 20 outward to a generally arcuate, partially tapered edge 76 (Fig. 9) of otherwise vertical edge 77 of land L. Recessed land 78 is also marked L-.088 (indicative that it is recessed 0.088" upwards from the level of land L), just greater than the thickness of the thickest coin to be sorted.

Recessed land 78 extends around opening 58 and forms a cavity within which all coins are free to be moved radially outward by centrifugal force. This enables coins to follow in an arcuate path along edge 76 in the rotational direction of rotation of pad 54 as indicated by the arrow to a radially outermost position under land 78, as illustrated by coin 80. Edge 76 is constructed as shown in Fig. 9 having a tapered upper portion 69 (as it appears in operation, with head 56 inverted from the orientation shown in Figs. 4 and 9), which decreases bounce, and vertical portion 71, which prevents coins from moving outward under edge 76. Recessed land 78 is generally bounded on its outer periphery from point 82 to point 95, from point 87 to point 89, and from point 84 to point 86 by land L. From point 89 to point 84, the outer edge of land 78 is bounded by ramp 104 and land 106 (also designated as L-.030 as it is recessed 0.030" upward from land L). From point 84 to point 86 it is bounded by land L, and from point 86 to point 82 is bounded by recessed land 92, 0.030" above land L but 0.052" below recessed land 78.

Recessed land 92 generally functions to trap any coins which are bent or otherwise not properly processed, as will be described. After being trapped, they are guided back into center region 58 by edge 93 of land 92.

Edge 76 of land L extends counterclockwise

(as shown in Fig. 4) to downwardly (as when head 56 faces downward in operation) extending ramp 94. Ramp 94 terminates at point 96 into a land region 98 of land L. Land region 98 of land L forms a transition region wherein coins are captured at their radially outermost position established by edge 76, capture being between land region 98 and pad 54. A recessed land 150, which is 0.048" above land L and is thus also designated (L-.048), is positioned inward from ramp 94, and a portion of land L, to an edge 81 with land 78. Edges 81 presents a vertical shoulder which assists in the recirculation of coins not passing under ramp 94.

Coins are rotated under ramp 94 towards elongated recessed land 99 by rotating pad 54, which imposes a greater frictional effect on coins than the relatively slick steel surface of head 56. Recessed land 99, also designated L-.025, is recessed 0.025" above land L. Coins initially encounter, normal to their travel, a vertical edge 101, which edge generally extends radially, and coins are rotated across it with their outer edge generally following dashed line 121. As will be noted, dashed line 121 intersects with a vertical outer wall 123 of recessed land 99. This wall functions as a guide for the smaller of coins to be sorted (for example, dimes, pennies, nickels, and quarters of U.S. coinage) and is curved to form an inwardly facing, inwardly extending spiral. The opposite or inner wall 113 of recess 99 is vertical and spaced from wall 123 such as to facilitate a relatively slow angle for smaller coins as they pivot on the edge of wall 113 when their outer edge rises into recess 99. The outer edge of small coins rise sufficiently as to be engaged by wall 123 and are guided inward along it. The far side of recess 99 is bounded by wall 107 and is tapered downward with a ramp 109 which, in terms of direction of rotation of coins, extends backward from the outside to inside, to intersect with a far end of inner wall 113. A region 115 of land L extends around recessed land 99, and from the far edge of ramp 109 to a transition edge of ramp 104. Ramp 104 extends higher by 0.035" to recessed land 106, which is also labeled L-.035. It effects lessened pressure on coins which will enable them to be more readily moved outward from a normal circular path as required by the next manipulation of coins.

To examine coin movement by the structure thus far described, coins, such as coins 100 and 108, initially proceed clockwise and radially outward to edge 76 and then proceed along it, to the right in Fig. 4, to ramp 94. Ramp 94 effects a downward transition from recessed land 78 to a region 98 of land L, the coins being captured between relatively slick head 56 and relatively frictional pad 54 and are forced to move circularly as they make such a transition. As a result, the coins

are initially moved circularly with their outer edge along dashed line 121. The spacing between vertical edge 123 and opposite vertical edge 113 is such that the smaller coins referred to above are tilted and at their outboard edge tilted upward into recessed land 99 by pad 54 and, as illustrated by coin 117 (representative of a dime), the outer edge engages the inside of vertical edge 123, causing movement of these coins to be guided by edge 123 in a spiral path radially inward as they are rotated.

Next, the inward and forward region of the smaller coins pass downward under ramp 109 of edge 107 with rotation and are then flattened and fully captured by region 115 of land L which follows recess 99. This occurs at slightly different radial positions for different diameter smaller coins as they are further captured, the coins now being rotated at discrete fixed radial positions under region 115 of land L. As stated, this occurs for smaller coins (dimes, pennies, nickles, and quarters of U.S. coinage).

Larger coins (Susan B. Anthony dollars and half dollars of U.S. coinage) are simply captured under ramp 94 and rotated at a fixed radial position under recessed land 99, the larger coins possessing a diameter which enables them to be pressed flat between land L and pad 54 and their outer part to pass over recessed land 99. Thus, the larger coins are unaffected by recess 99 and are rotated under ramp 109 of land L at a fixed radial position toward ramp 104, while smaller coins are tilted into land 99 at their outboard edges and moved radially inward by edge 123 as they are rotated toward ramp 104.

The object of the inward movement of smaller coins is to limit the radial excursion of their inner edge (by limiting the outer travel of their outer edge), which inner edge would inherently, without special treatment, move farther outward than would the inner edge of larger coins since the outer edges of coins are initially referenced by their outer edge to edge 76. The purpose of the limitation is to generally bring together the paths of the forward edges of coins of different diameter to facilitate presorting manipulation, as will be further described.

The presorting manipulation referred to is effected after the coins pass upward under ramp 104 and to a position under land 106 which, as stated, is, for example, 0.035" above land L. The coins thus remain captured (all coins are assumed to have a thickness of greater than 0.035") and as captured are circularly rotated by pad 54. They are rotated until they strike vertical edge 111 of wall 110 of land L, this wall extending linearly as shown to the edge 127 of head 56. Edge 111 is positioned to intercept the forward edge of all size coins and, being vertical, it functions to block them from passing under it

and forces the coins to travel outward along it and wall 110. In order to make the head compact, it was discovered necessary to limit the length of vertical edge 111 of wall 110, and to do this, small size coins were moved inward as described so that they, as well as larger coins, would strike edge 111 within as short as possible a length of edge 111.

Next, mixed diameter coins, captured between recessed land 106 and rotating resilient pad 54, are thereby forced outward along wall 110 of land L and particularly along the outer tapered edge 112 of the wall. Edge 112 is tapered approximately 25° from vertical from point 112a to point 112b and 30° from point 112b to point 183 (this difference in slope will be discussed below). If a coin proceeding along this edge is further urged against it, the coin will tend to ride diagonally downward and under the wall and be captured between land L and pad 54. The 30° tapered portion of edge 112 assists smaller coins in passing under this edge. Urging of coins under tapered edge 112 is effected by discrete pins of pins 114a-114f when the pins are in a lowered position and a coin is engaged between tapered edge 112 and a pin. As will be noted, each pin is at a different distance from edge 112; and as shown in Fig. 4, the distance between a pin and edge 112 decreases with outward distance of location of a pin. By this configuration, each pin urges or forces a different diameter of coin under edge 112, and thereby the function of sorting in terms of diameter is achieved. Since most coinage systems employ different diameter of coins for different denominations, denominational sorting is thus achieved.

Figs. 3 and 5-8 illustrate the construction of sorting pin assembly 118 and stop pin assembly 119. Pin assembly 118 includes an insulative plate 120 having a plurality of openings 112a-122f. Pins 114a-114f are mounted in discrete metal blocks 128a-128f, which in turn are mounted over openings 122a-122f, with pins 114a-114f extending through openings 122a-122f. Bolts 126a-126f, in conjunction with shoulder insulating blocks 124a-124f, hold blocks 128a-128f and thus pins 114a-114f in place as shown in Fig. 6. Pins 114a-114f normally extend through openings 131a-131f in head 56 below the lower surface of land 106 and approach the surface of pad 54, being normally spaced (during sorting) approximately 0.001" from pad 54. Plate 120, on which the pin assemblies are mounted, is attached by bolts to spring steel member 130, which in turn is attached by attachment bolts 132 and plate 134 to head 56. By this arrangement, plate 120 and thus pins 114a-114f may be raised and lowered by the hinge action of spring steel member 130. Normally, spring steel member 130 biases plate 120, and thus pins 114a-114f, to a lowered position as de-

scribed for sorting operation. Plate 120 and pins 114a–114f are selectively raised by solenoid 136, which is mounted on a mounting bracket 138 by nut 141, and bracket 138 is attached by bolt 140 to head 56. Solenoid 136 includes a plunger 142 which is coupled by link 144 to plate 120. When power is applied to solenoid 136, plunger 142 is retracted, pulling plate 120 and thus pins 114a–114f upward to a raised position above pad 54. When they are raised, coins reaching the region below the pins exit along the straight edge of wall 110 and the line of arrow 146 and as illustrated by coin 148 in Fig. 4. Alternately, the solenoid may be mounted to the top surface of sorting head 56, with the plunger connected to a rocker arm (not shown) which is vertically coupled to plate 120. In this case, the solenoid, when energized, would pull the rocker arm horizontally, lifting plate 120 and pins 114a–114f vertically as described.

As an optional feature, means are provided for blocking the passage of coins over and beyond ramp 94, and thus sorting of coins, after a selected number of coins of a particular denomination has been delivered. This eliminates the necessity of completely emptying the sorter after a run to obtain a selected number of coins of one denomination. To accomplish this, a stop pin assembly 119 (Figs. 3 and 8) is employed having a pin 151 which extends through an opening 147 in head 56. When lowered, pin 151 is spaced to approximately 0.001" of pad 54 and is positioned as shown in Fig. 4 just adjacent ramp 94. A collar 155 extends around a central region of pin 151 and limits the downward travel of pin 151 by its engagement with an upper surface of head 56. Pin 151 is operated by solenoid 165, being coupled to the armature of the solenoid by pin 151a through means which are not shown. Pin 151 is coupled to pin 151a as diagrammatically shown in Fig. 8. Normally, when solenoid 165 is unpowered, pin 151a, and thus pin 151, is maintained in a raised position; and when power is applied, pin 151 is lowered to the position shown in Fig. 8. Pin 151 is lowered simultaneous with the raising of pins 114a–114f, and pin 151 provides a barrier which prevents coins from riding under ramp 94, blocking the further outward flow of coins and halting the sorting process. Vertical wall 71 of edge 76 (Figs. 4 and 9) presents a barrier to coins which would otherwise move around the outside of stop pin 151. Coins which are in the central region of the sorter and in recess 78 remain there. Coins which are moving between pin 151 and point 183 are moved by pad 54 along edge 110 and ejected from under head 56, as illustrated by coin 148 in Fig. 4. These coins, usually two to six, then enter a coin return chute 21 (Fig. 1) having an entrance (not shown) positioned to intercept coins

ejected along edge 110. Chute 21 is configured to return these coins to hopper 20 for resorting. Head 56 is configured such that coins are dispensed with sufficient velocity to effect this movement. The operation of pin 151 prevents emptying the sorter of all coins following the raising of pins 114a–114f and the turning off of motor 30. While motor 30 is turned off at the same time as the operation of pins 114a–114f are raised, rotating pad 54 may coast, and a significant number of coins may exit along edge 110. Stop pin assembly 119 significantly reduces this number.

As described above, sorting of coins is effected when a particular one of pins 114a–114f forces a coin under edge 112 at a unique point along edge 112 as a function of the spacing of that pin from edge 112. Thus, sorting of coins is achieved by the different combinations of wall pin dimensions and their location, sorting thus being accomplished at what are actually different radial positions. As they pass under edge 112, the coins are captured at their discrete radial position by the combination of land L and pad 54. They then follow a discrete circular path as shown in Fig. 4 as a function of their diameter. To ensure this, the configuration of land L is such that some portion of it always presses on and retains the capture of a coin at a discrete radial position as the coins are rotated along the paths of lines 180a–180f until they pass under outer edge 116 of land L and are dispensed. The less steep edge of edge 112, from point 112b to point 183, being 30° rather than 25° as it is from point 112a to point 112b, assists in smaller coins being forced under edge 112 and reduces their dwell time on one of the sorting pins, particularly pins 114e and 114f.

As a particular distinction from the sorters of the prior art referred to above, dispensing is in the inverse order along the edge of plate 56 to that of sorting. In other words, while large coins are sorted first, they are the last to be dispensed. Dispensing occurs in the region between point 183 and point 184, which is configured to spread or space dispensing as desired. As shown, edge 116 is turned inward from point 183 and then generally circles outward to point 182, where the arc of the edge reverses, then follows a generally circular arc until it reaches point 184. If desired, notches, such as notches 129 and 125, immediately reduce or increase the curvature of edge 116, providing a way to adjust the exit point of a selected diameter coin without adjusting the point of sorting. With this configuration together with the capture of each different denomination of coin at a different radial position, each coin is released by land L at a different circumferential position as illustrated in Fig. 4.

Referring to Fig. 7, operating power for

sorting operation is provided through switch 169 and normally closed contacts 173 and leads 155 to motor 30. In order to ensure that operating speed for motor 30 and thus rotating resilient disc 54 is achieved before actual sorting is commenced, there is provided time delay circuit 181. This circuit includes a rectifier 149 which rectifies the 115 volt A.C. input voltage at switch 169 and then feeds the rectified voltage to time delay unit 97. This unit is conventional and may consist of a resistance-capacitance charging circuit wherein a capacitor is charged, with time, through a resistor, and when the voltage on the capacitor reaches a selected value, this value, as an output, energizes coil 153 of relay 159. Relay 159 is a double pole, single throw relay having normally closed contacts 157. When switch 169 is closed, the normally closed contacts 157 initially supply power through contacts 173 to coils 179 and 177 of solenoids 136 and 165 and sorting is prevented. After the delay interval of delay circuit 181, e.g., approximately two seconds, rotating disc 54 will have reached operating speed, and the output voltage of the delay circuit will have risen to sufficient voltage to operate relay 159 to open contacts 157. This removes power from solenoids 136 and 165 to a sorting mode. Thus, initially, pins 114a-114f are pulled up by solenoid 136 and pin 151 pushed down by solenoid 165. Thereafter, time delay circuit 181 operates to disable relay 159, allowing the pins to reverse their position and sorting operation to commence.

The control of the sorting process, and particularly the halting of sorting after a selected number of coins of one denomination pass through the sorter, is controlled by the electrical system shown in Figs. 6 and 7. Each of insulated pins 114a-114f is connected to coin counter 152. Coin counter 152 is of a conventional type for counting events, and in this case, each instance of the encounter of a given diameter of coin with a discrete pin. When this occurs, a closed electrical or continuity circuit is effected between a pin and head 56, which typically would lower the voltage applied by counter 152 to one of leads 143a-154f from +5 volts to zero. This effect is achieved in coin counter 152 via one of leads 154a-154f and a common ground connection between the sorter head and coin counter 152. Thus, with this configuration, coin counter 152 senses an electrical impulse each time that a coin strikes an associated pin, and thus, coin counter 152 is configured to separately count each denomination of coin. It then provides a count for each denomination of coin to coin count storage and totalizer 156, which conventionally multiplies each count of each denomination by the denominational value of a coin and then makes available at readout 158 a total dollar amount of a particular coin and the total dollar amount

of all coins counted. Additionally, totalizer 156 includes conventional circuitry for displaying on readout 158 a coin count for each coin. A selection of either a total value or a discrete coin count is typically provided by control buttons 160a-160f.

There is illustrated as a separate set of electrical outputs of coin counter 152 discrete outputs for each denomination counted which are supplied through selector switches 162a-162f to count select 164.

Count select 164 is basically a digital comparator wherein one would enter a select number representative of the number of a given denomination of coin (or dollar amount) that is desired as an output from a sorting function. Thus, if it were desired to stop the sorting process when there were 1,000 dimes processed through the sorter, 1,000 (or dollar amount) would be entered in count select 164, as by toggling one of decade select buttons 166a-166f to enter a number for each decade. This number would then be placed in memory and displayed by readout 167. When the selected count occurs from the operation of the sorter, there would be parity or identity between the selected count and an output of coin counter 152, and count select 164 would produce an electrical output, e.g., +5 volts, on lead 170. This output is coupled to coil 171 of relay 172 which, when energized, opens normally closed set of contacts 173, turning off motor 30 and closes normally open set of contacts 175, which energizes coil 177 of solenoid 165 and coil 179 of solenoid 136. Solenoid 165 then lowers pin 151 (Figs. 4 and 8) to stop the flow of coins being sorted while solenoid 136 causes plate 120 (Figs. 3-7) to be raised upward, raising pins 114a-114f and thus enabling the few coins between pin 151 and pins 114a-114f to be recycled via chute 21 to hopper 20. Additionally, coin select 164 may include circuitry for enabling an operator to sequentially select for the dispensing of selected numbers of several denomination coins, and a halt signal would be provided as each of the selections was reached during a sorting procedure which would be halted and restarted until the last of the selected dispensations is effected. Where several selections are to be made, the appropriate ones of switches 162a-162f would be closed.

Alternately, relay 172 would include a double throw contacts which would provide for a higher voltage to be initially impressed upon solenoids 136 and 165 to effect quick closing and then a lower voltage to be applied as a holding voltage.

In the event that a coin becomes jammed between edge 112, and one of pins 114a-114f, as would be the case when a bent or damaged coin, or foreign coin, is introduced into sorter 14, circuitry is provided to operate the solenoids, which prevents the

feed of further coins for sorting and ejects the offending coin. To accomplish this, the count detection signals from pins 114a-114f are fed to a pulse width sensor 163. As noted above,

5 such a signal is a zero voltage pulse dropping from a normal 5-volt state. Pulse width sensor 163 senses when such a pulse persists for longer than the longest anticipated dwell of a coin on a pin in normal operation. For  
10 example, this might be approximately 3 milliseconds. Such circuitry, for example, might include an inverter in each lead from a pin, and this inverter would then translate a zero voltage pulse occurring when a coin hits a pin  
15 to, for example, a 5-volt pulse for the period of time of dwell of a coin on a pin. Then, each of the outputs of these inverters would be fed through an isolating diode to a timing capacitor connected in parallel with a discharg-  
20 ing resistor. Thus, voltage on the capacitor would increase with time that a coin bridged between a pin and head 56 and discharged in between times. In any event, pulse width sensor 163 would be operated to provide an oper-  
25 ating voltage on lead 167 and across relay-coil 174 of relay 176 when a jam condition occurs.

Relay 176 is arranged in the circuitry as a latching relay, there being supplied a holding  
30 voltage for coil 174 through normally open contacts 168 and normally closed switch 178. When coil 174 of relay 176 is operated by pulse width sensor 163, it pulls closed con-  
35 tacts 168 which then they apply a positive voltage, for example, +5 volts, through isolat- ing diode 161 to coil 171 of relay 172. As a  
40 result, relay 172 is operated to open contacts 173 and close contacts 175, halting the out- ward flow of coins to pins 114a-114f and  
45 causing the pins to be raised and stop the sorting process. Since, however, rotating disc 54 will not immediately stop the outward movement of coins, including a jammed coin, the latter would exit to chute 21 and hopper  
20 after power to motor 30 is interrupted.

In order to restart operation, first, switch 169 would be operated open, and then nor-  
50 mally closed switch 178 would be operated open, removing power from coil 171 of relay 172, readying the system for continuing the sorting sequence being performed. It is to be  
55 noted, however, that since the offending coin removed by the process just described has been counted, the procedure followed by the operator should probably be to redo the sort- ing sequence halted by this coin. Alternately,  
circuitry may be included to compensate in the count select circuitry for an overcount.

To examine the overall operation of the  
60 sorter, and assuming that it is desired to de- posit a selected number of coins of a particu- lar denomination in a bag, the switch or switch- es 162a-162f would be closed, and the  
65 number of numbers (of different denomination coins) would be inserted in count select 164

as described and would be indicated by dis-  
play 167. Next, switch 169 would be closed, and motor 30 would be turned on. Time delay  
70 circuitry 181 would briefly apply power, through relay 159, to solenoids 136 and 165, disabling sorter 14 until rotating disc 54 reaches operating speed as described. After  
75 this occurs, time delay 97 removes power from solenoids 136 and 165, allowing sorter 14 to commence operation. Coins of different denomination, for example, a mix of half dol-  
80 lars, Susan B. Anthony dollars, quarters, nickles, pennies and dimes (U.S. denomina- tions), would be emptied into hopper 20 (Figs. 1 and 2) which would then funnel coins onto  
85 the center region of rotating pad 54 as illus- trated by coins 188 and 190 of Fig. 2. Coins are then urged under recess 78 (Fig. 4) by centrifugal force from rotating pad 54 (e.g.,  
90 coins 80, 100, and 108) and travel circularly until they are generally aligned in a single file along edge 76 of land L. Then they ride under  
95 ramp 94 (coin 91) where coins are pressed down into resilient pad 54 and are thus cap- tured and moved circularly toward recessed  
100 land 99. Upon encountering recessed land 99, smaller coins are moved inboard by edge 123 and thus to ramp 104, while coins having a larger diameter pass over land 99 and are  
105 moved at a constant radial position from ramp 94 to ramp 104. Next, all coins pass under ramp 104 and thus to land 106 where they strike edge 111 of Land L and are then  
110 moved outward and along edge 112. As shown in Fig. 4, coins move along edge 112 until a coin strikes one of the series of pins 114a-114f. As will be noted, when this oc-  
115 curs, this coin is urged under the slope of edge 112 and is then captured by land L and rotated circularly, being discharged at a dis- crete location around edge 116 of head L as  
described.

The smallest coin 200, e.g., a dime, follow-  
115 ing the direction of arrow 202, would move through slot 204 (Fig. 1) and then through L- shaped coupling 206, tube 208, funnel 210, and into bag 212. In the same manner, the next largest coin, for example, a penny, would  
120 be moved outward through slot 204 down- ward through a like assembly into a bag 218. In the same manner, the next larger coins,  
125 coins 220, 222, 224, and 226 (for example, a nickel, quarter, Susan B. Anthony dollar, and half dollar) would move in the direction of ar- rows 228, 230, 232, 234, and 236 and then  
130 in a like manner into bags 238, 240, and 242. This process proceeds until count select 164 senses that a desired number of coins of the selected denomination have passed into a bag for that denomination. Upon reaching the  
selected count, count select 164 sends an electrical output to relay 172. This cuts off  
power to motor 30 and supplies power to solenoids 136 and 165, which lowers pin 151  
and raises pins 114a-114f which prevents

any other coins from moving outward from the hopper and causes sorting to cease. Residual coins outside of the central hopper are passed by return chute 21 into hopper 20 to be resorted in a new cycle. Power switch 169 is then opened, returning pins 114a-114f and stop pin 151 back to a sorting mode. When sorting is to be resumed, the operator enters a desired number (if not already entered as described above) into count select 164, operates switch 169 to supply power to motor 30, and fills hopper 20 with coins, and operation will again be effected as described.

Bent coins reaching or otherwise riding along edge 111 may be forced by rotating pad 54 under this edge, in which case they are rotated under land L and directly into recessed land 92 where they encounter edge 93 and are returned to central opening 58. With the motor stopped, a bent coin would then be removed. Bent or foreign coins which become jammed between one of pins 114a-114f in edge 112 would be ejected as described above. This would result in the coin being recycled via chute 21 to hopper 20. The operator would then locate and remove the offending coin from hopper 20.

From the foregoing, it is to be appreciated that the applicants have provided a significantly new and improved coin sorter. It enables a precise dispensation of coins, and at the same time enables the position of dispensation of particular coins to be adjustable independent of the function of sorting.

#### CLAIMS

1. In a coin sorter of the character having a plate closely facing a rotating, generally planar, resilient disc, and said plate having an interior opening through which coins are loaded onto said disc, having outer edges forming a boundary of said plate, and having configured on a side facing said disc which vary in width, and in clearance from said disc, and including means for effecting a single layer, single file, movement of a group of different diameter coins as said coins are rotated by said disc, and said plate comprising:

an elongated edge of a said surface, said last-named surface lying proximate the surface of said disc, and said elongated edge extending outward toward a said outer edge of said plate for intercepting a said single layer, single file of coins urged against said edge by the rotation of said disc, and at least a substantial length of an outer portion of said elongated edge being a tapered edge, tapered generally toward and in the direction of rotation of said disc;

sorting means including a plurality of sorting members generally spaced from said elongated edge, and discrete ones of said sorting members being differently spaced from said elongated edge as a function of the difference in diameters of coins to be sorted, whereby a

coin of a discrete diameter is rotated by said disc and moved to a position where it is engaged between a said sorting member and said tapered edge and is thereby urged by said rotating disc across said tapered edge, this being at a discrete radial position which differs for coins of different diameter; and means operative on coins passing across said tapered edge for rotating coins in a captured mode at discrete radial positions as a function of coin diameter to different positions of said outer edge of said plate and discharge.

2. A coin sorter as set forth in claim 1 wherein said sorting means comprises means for first engaging the largest coin to be sorted and last engaging the smallest coin to be sorted.

3. A coin sorter as set forth in claim 1 wherein said plurality of sorting members comprises a series of pins, each at a different spacing from said elongated edge, and said pins being positionable adjacent said disc.

4. A coin sorter as set forth in claim 1 wherein said elongated edge is generally straight.

5. A coin sorter as set forth in claim 1 wherein: an inner portion of said elongated edge is of a lesser angle with respect to a plane perpendicular to said generally planar resilient disc than is said outer portion of said elongated edge; and

said coin sorter further comprises means for intercepting the flow of selected smaller coins of said group toward said elongated edge and moving inward their paths to said elongated edge, whereby the paths of all coins of said group strike a said inner portion of said elongated edge.

6. A coin sorter as set forth in claim 5 wherein said inner portion of said elongated edge is generally normal to said generally planar resilient disc.

7. A coin sorter as set forth in claim 3 further comprising circuit means, in turn including electrical means coupled to each said pins for counting coins engaging said pins.

8. A coin sorter as set forth in claim 7 wherein: said circuit means includes means for providing a signal responsive to a selected number of a selected diameter of coin having been counted;

said sorter includes pin positioning means responsive to said signal for abruptly increasing the spacing of said pins from said disc, whereby coins would thereafter bypass said pins; and

said sorter includes a coin exit outward of said elongated edge, whereby, upon the occurrence of a said signal and the operation of said pin positioning means, coins reaching said elongated edge would move outward along it to said exit.

9. A coin sorter as set forth in claim 8

further comprising means responsive to said signal for blocking flow of coins to said elongated edge.

10. A coin sorter substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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