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Black

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[54] **CENTRIFUGAL COIN SORTER**

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[52] **U.S. Cl.** ..... **133/3 A**

[51] **Int. Cl.** **G07d 3/06**

[58] **Field of Search** ..... 133/3, 3 A; 209/82

[56] **References Cited**

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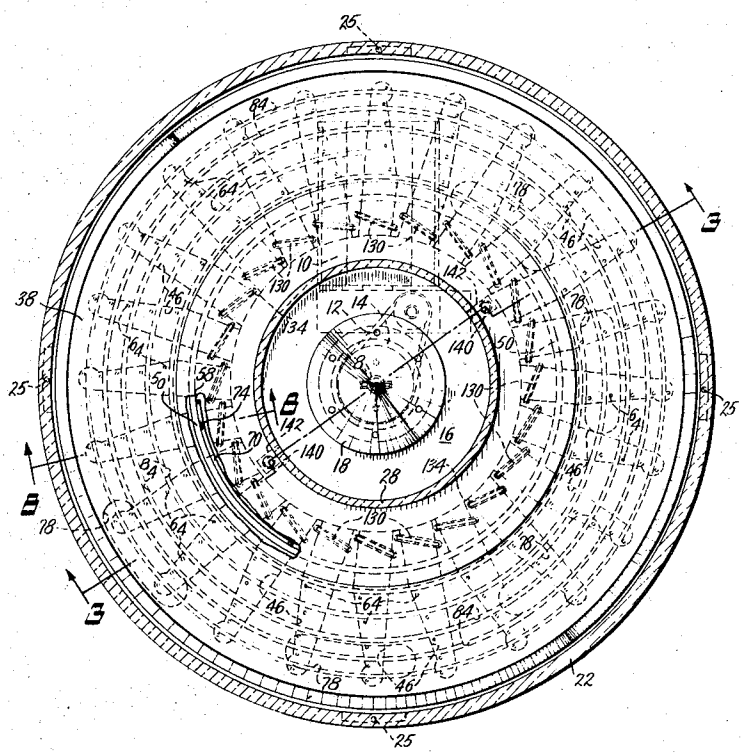
Attorney, Agent, or Firm—Bacon & Thomas

[57] **ABSTRACT**

A whirling horizontal disc receives bulk coins of random denomination, near its center, and centrifugal force causes the coins to slide outwardly on the disc. A stationary shear ring lets only a single layer of coins move under it into the entrance ends of radial channels on the disc where they are arrested against an annular barrier shoulder. A single stationary cam adjacent the shoulder lifts an edge of only one coin in each channel entrance to clear the shoulder and permits only one coin to enter each channel by centrifugal force at each revolution of the disc. The channels define outwardly tapered coin paths so that the coins will be stopped at radial positions determined by their diameter or denomination and they are then discharged at a fixed station where coins of the same denomination are counted and accumulated in a receiver until a predetermined number have been accumulated. A gate then deflects coins of that denomination to a second receiver and the counting process is repeated. Means are provided for preventing centrifugal and other forces acting on the coins at said shoulder to cause them to pile up upon each other.

14 Claims, 10 Drawing Figures



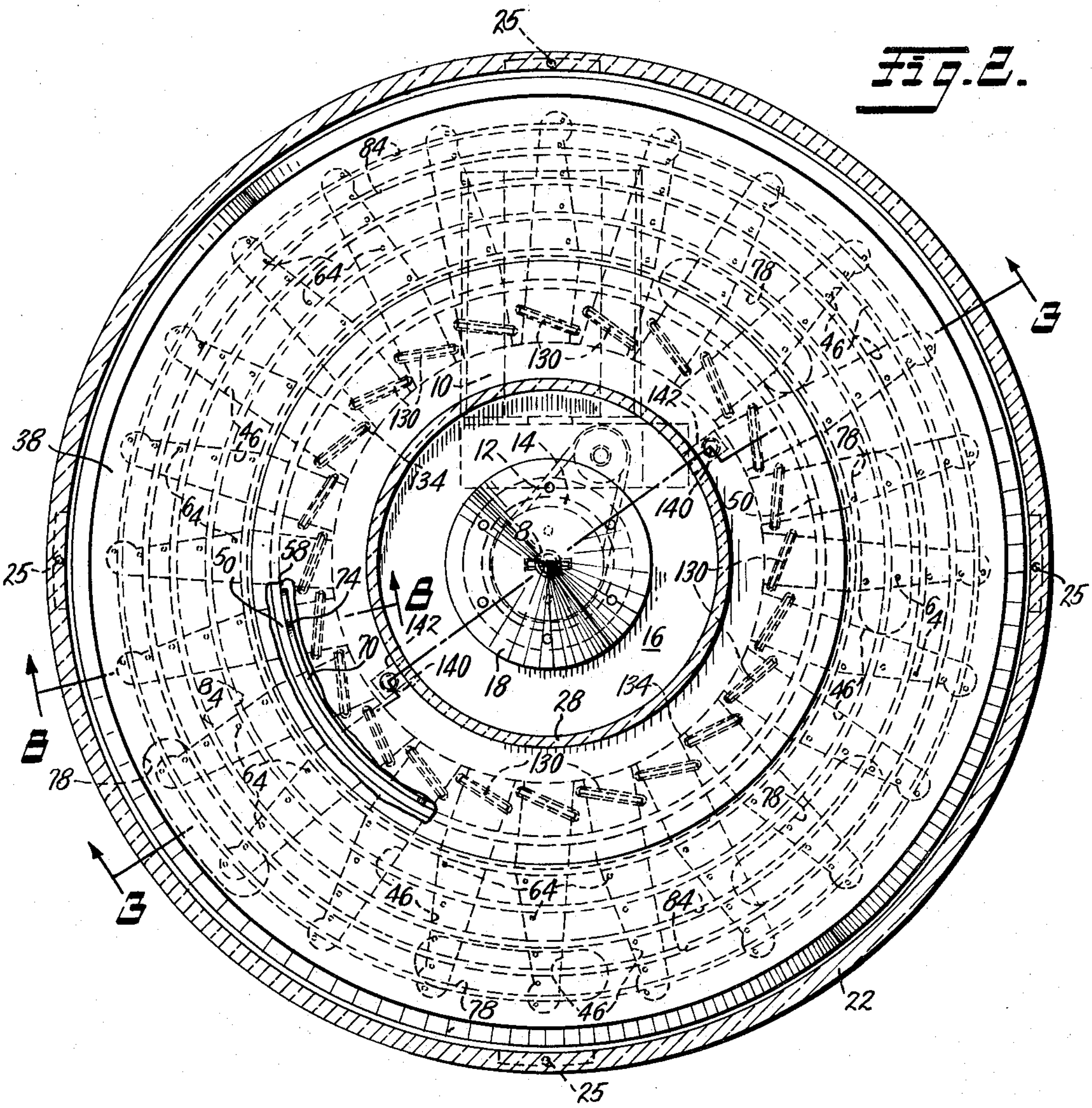

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Fig. 2.

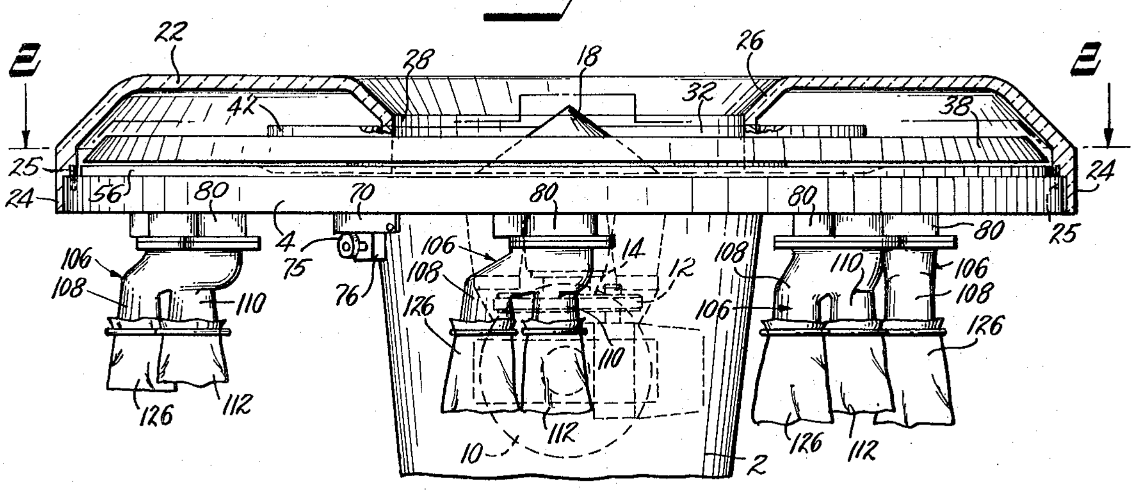
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Fig. 1.

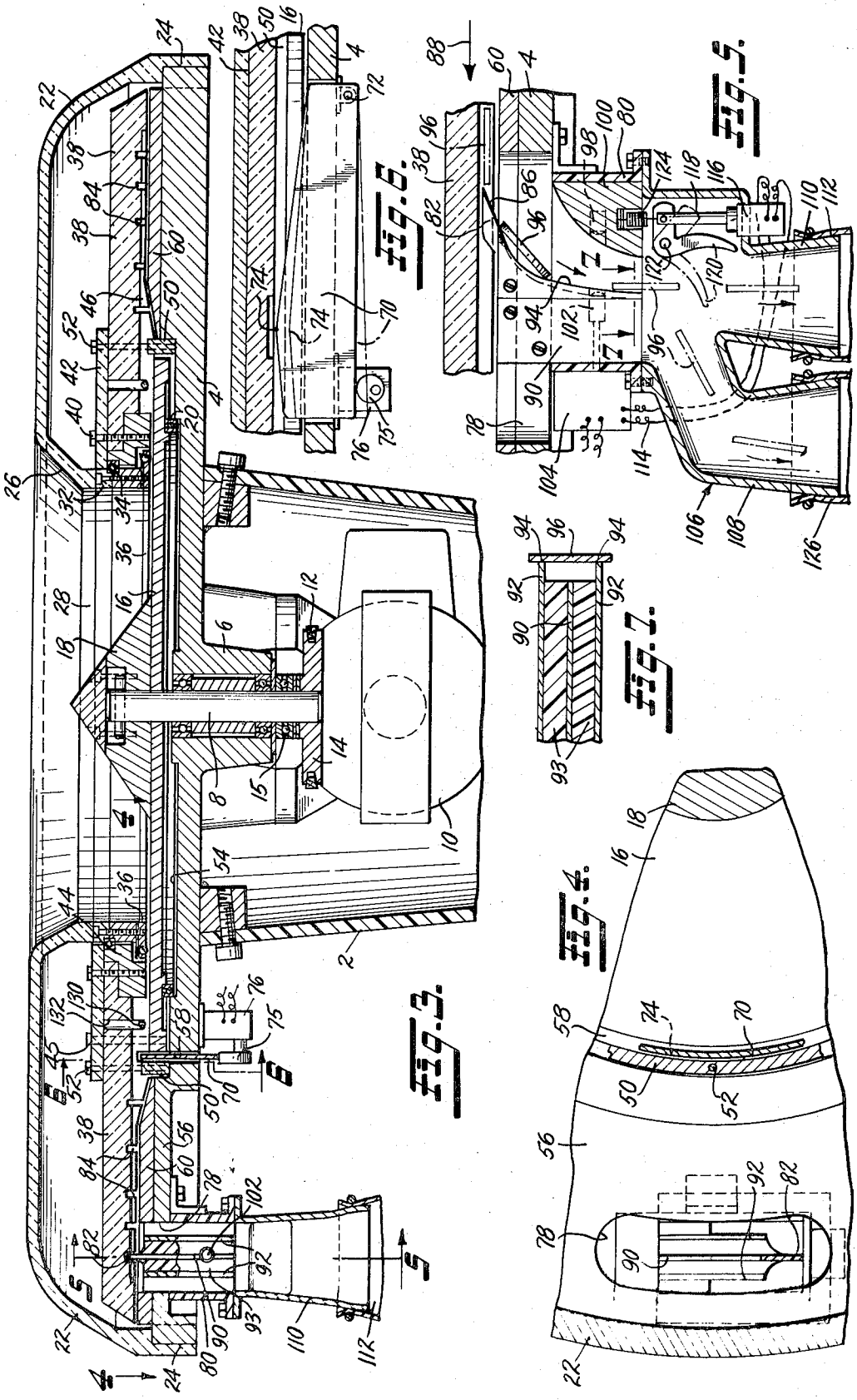


FIG. 8.

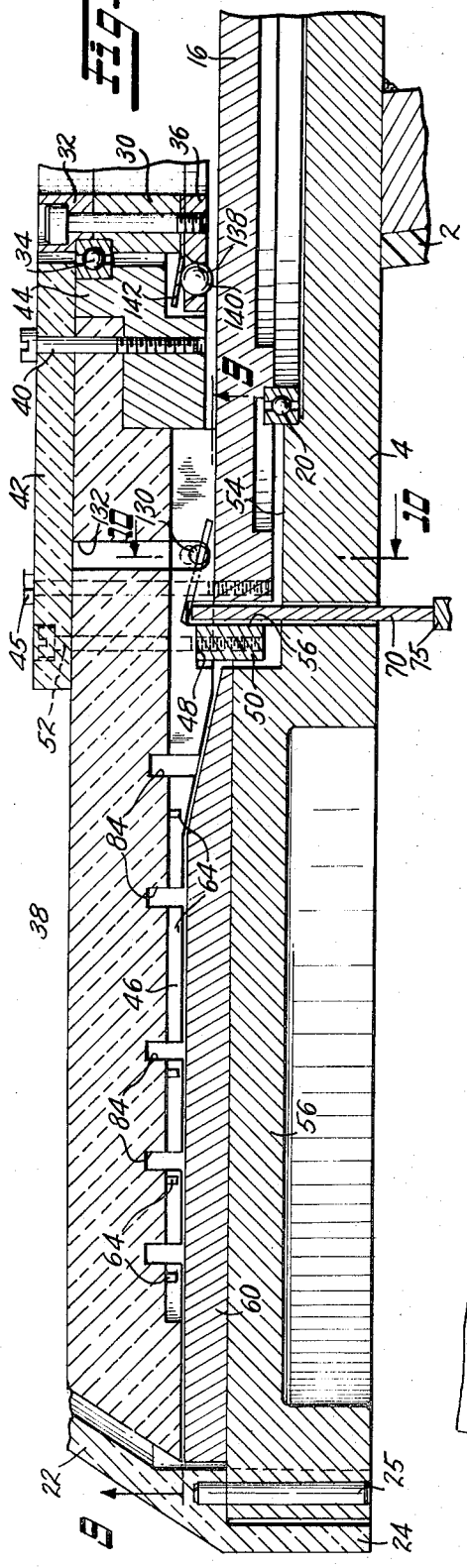


FIG. 10.

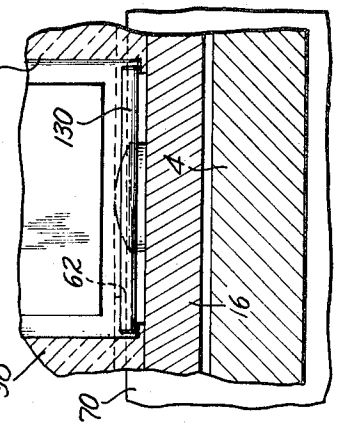
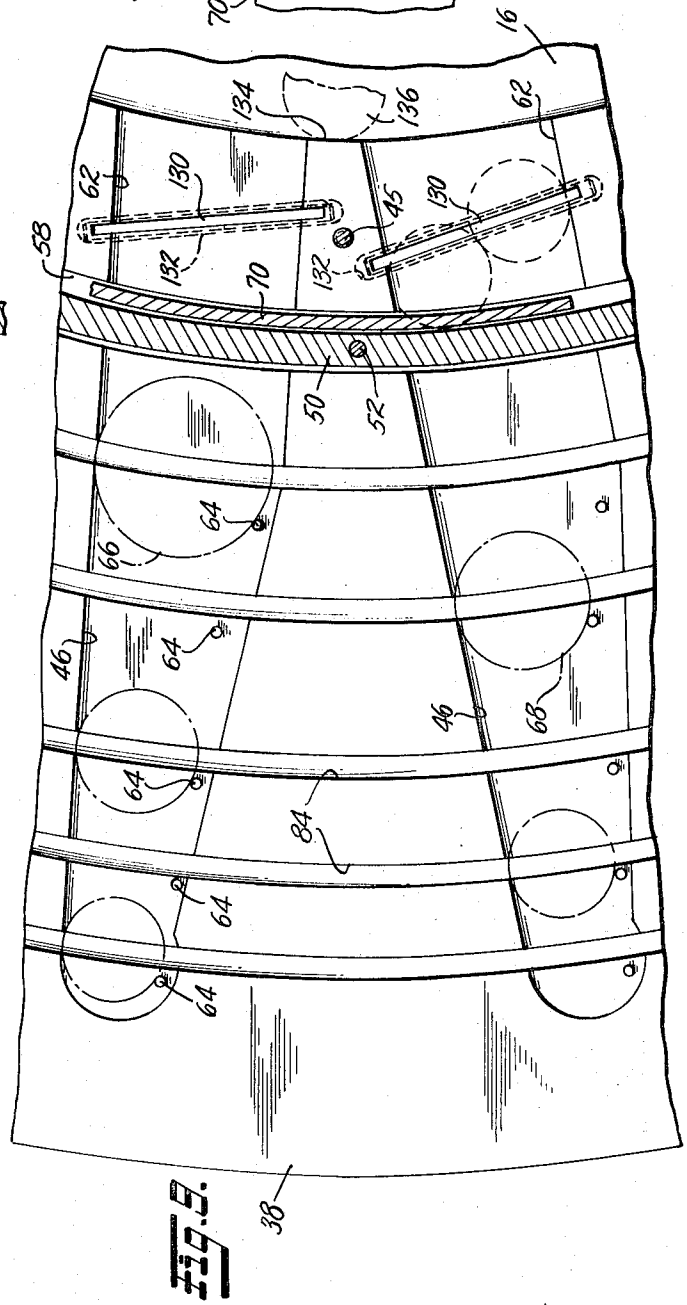


FIG. 9.



CENTRIFUGAL COIN SORTER

BACKGROUND OF THE INVENTION

This invention is in the field of coin sorting machines and relates particularly to a high speed coin sorter utilizing centrifugal force to move the coins.

Coin sorters employing revolving discs having radial coin paths thereon have been proposed, wherein the radial coin paths taper from one end to the other and coins placed in the channels reach a position corresponding to their diameter or denomination at a specific radial position. However, such prior devices employed tilted discs where the coins were moved along their paths by gravity and were thus limited to relatively low speeds of operation. There have also been proposed machines wherein coins were caused to move outwardly on a disc by centrifugal force but such prior proposals were subject to malfunctioning by "piling up" of coins and were further limited in their speed of operation to relatively low speeds.

SUMMARY OF THE INVENTION

The present invention employs a disc spinning at relatively high speeds and on which coins are deposited near the center thereof to be thrown out in all directions. Means ensure that the coins assume a single layer and they are projected outwardly against an annular shoulder where they are arrested temporarily. A multiplicity of outwardly tapered channels are formed in the disc and a single stationary cam is positioned adjacent the shoulder to engage the outer edge of a coin restrained by the shoulder, at the entrance of the successive channels, as the disc and coins rotate past the cam. The cam lifts the outer edge of the coin to the top of the shoulder and centrifugal force throws it over the shoulder and out into the channel which defines a tapered path for the coin so that the coin is stopped at a radial position depending on its denomination. The channel portion of the disc rotates over a stationary table having openings therein at the different radial positions corresponding to various coin denominations. Fingers in the openings deflect the coins at that radius downwardly to discharge where counting means count the coins of that denomination which are then accumulated in a receiver. When a predetermined number of coins have been accumulated in the receiver, a deflecting gate operates to deflect further coins of that denomination into a second receiver for the accumulation of a second number of coins, thus providing time to replace the receiver in which the first group were accumulated and thus permit continuous operation of the device. The machine includes means responsive to the speed of rotation of the disc to disable the cam referred to so that no coins are permitted past the annular shoulder when the disc is rotating at low speed, as when starting or stopping.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary elevational view of the coin sorting machine of the present invention with certain parts shown in section;

FIG. 2 is a horizontal sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is an enlarged fragmentary vertical sectional view, taken on the line 3—3 of FIG. 2;

FIG. 4 is an enlarged fragmentary horizontal sectional view taken on the line 4—4 of FIG. 3;

FIG. 5 is an enlarged fragmentary vertical sectional view, taken on the line 5—5 of FIG. 3;

FIG. 6 is a fragmentary vertical sectional view, taken on the line 6—6 of FIG. 3;

FIG. 7 is an enlarged fragmentary horizontal sectional view, taken on the line 7—7 of FIG. 5;

FIG. 8 is a further enlarged fragmentary vertical sectional view, taken on the line 8—8 of FIG. 2;

FIG. 9 is a horizontal sectional view taken on the line 9—9 of FIG. 8; and

FIG. 10 is a fragmentary vertical sectional view taken on the line 10—10 FIG. 8.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring first to FIGS. 1, 3 and 8, a hollow base pedestal 2 has a generally horizontal stationary table 4 mounted thereon. A central boss 6 on table 4 houses anti-friction bearings in which a short shaft 8 is journalled. A motor 10 mounted within the pedestal 2 drives through suitable gearing to an output pulley (not shown) which drives a belt 12 trained about pulley 14 fixed to the lower end of shaft 8. A thrust bearing 15 is mounted between pulley 14 and boss 6. The shaft 8 extends upwardly above the table 4 and has fixed thereto a disc member 16 comprising the central portion of a rotary disc structure. Also fixed to the shaft 8 and disc portion 16 is an upwardly pointed central cone structure 18. Suitable anti-friction bearings 20 support the outer portion of disc member 16 for rotation about the central portion of table 4.

A cover member 22 of the annular shape shown is provided with an outer peripheral flange 24 by which the cover member is positioned with respect to the outer periphery of the table 4 and extends inwardly thereover to a central, downwardly tapered hopper portion 26. Pins 25 (FIG. 8) hold the cover 22 in position on the table 4. The hopper portion 26 terminates at a central discharge opening 28 concentric to the shaft 8 and is removably keyed to a downwardly extending ring 30 by pins (not shown) and thus restrains said ring 30 from rotary motion. The ring 30 is supported by the rotating disc assembly via an anti-friction bearing 34 which is secured to said ring by a clamping ring 32 bolted to it. At its lower end the ring 30 supports an annular ring 36 serving as a shear ring spaced upwardly from the upper surface of disc member 16. The spacing between the ring 36 and the disc 16 is such that the thickest coin to be sorted may pass freely under the ring and such that only one of the thinnest coins to be sorted can pass thereunder. Thus, coins may pass under ring 36 in only a single layer of coins.

An outer disc member 38 is of annular construction and is held, by bolts 40, in fixed relation to a cover ring 42 and a hub member 44 and by bolts 45 to the upper surface of central disc portion 16. The hub member 44 engages the outer race of bearing 34 carried by rings 30 and 32.

The disc member 38 thus becomes a unitary part of the rotating disc assembly with disc member 16. Member 38 is provided in its under surface with a multiplicity of generally radially extending channels 46 extending from the inner periphery of the disc member 38 to a position spaced inwardly from the outer periphery of that disc member, all as clearly shown in FIGS. 8 and 9. By way of illustration, twenty-four such channels are

shown. The disc member **38** is further provided with a circumferential groove **48**, the "bottom" of which is spaced from the upper surfaces of the channels **46** and in which an annular barrier ring **50** is positioned and secured to the disc member **38** by bolts **52**. As shown, the table member **4** is provided with a depressed central portion **54** into which the barrier ring **50** extends, the outer portion **56** of table **4** being at a higher elevation than the portion **52**. While the barrier ring **50** is shown and described as being fixed to disc member **38** to rotate therewith it will be obvious that it could be fixed to table **4** and be nonrotatable. It is to be noted that the barrier ring **50** is spaced radially outwardly from the outer peripheral edge of the central disc portion **16** to define a slot **58** therebetween. The channels **46** open downwardly through the bottom face of the disc portion **38** and an annular fixed table member **60** is carried by the table portion **56** with its upper surface in position to substantially close the downwardly open channels **46**.

Each of the channels **46** defines at its inner end an entrance chamber portion **62** inwardly of the shoulder defined by barrier ring **50**, which shoulder extends upwardly above the upper surface of disc member **16**. Outwardly of the barrier ring **50** the channels **46** are provided, as shown, with one straight side and a plurality of pins **64** therein. The pins **64** are so spaced from the straight side of the channels **46** that the innermost pin will engage and arrest the largest coin **66**, while the next size coin **68** moves therepast but is arrested by the next innermost pin **64**. Obviously, the smaller the coin, the farther outwardly it will move in a channel **46** before being arrested by a pin **64** at a radial position corresponding to the denomination of that coin. The employment of a straight side in the channels and the pins **64** is merely illustrative of a presently preferred embodiment. Clearly, the side of the channels opposite the straight side could be of stepped formation, both sides could be straight and taper together, or other suitable means could be provided to arrest the coins of each denomination at a particular radial position.

A stationary cam member **70** is pivotally mounted on the base structure, as at **72** (see FIG. **6**) and extends upwardly in the channel **58** previously described between barrier ring **50** and the outer edge of central disc portion **16**. FIG. **6** shows the normal operating position of the cam **70** wherein a high point **74** extends upwardly slightly above the upper surface of barrier ring **50**. The cam **70** is normally held in the upper position shown in FIG. **6**, for example, by a rotary eccentric cam element **75** carried by a rotary solenoid **76**. When the solenoid **76** is actuated, the cam **75** is rotated to a position where cam **70** is dropped to the dotted line position shown, thus lowering its high point **74** to a level no higher than the upper surface of disc member **16**. The purpose for this structure will be described in greater detail later.

As best seen in FIG. **1**, the table **4** and the annular table portion **60** are provided with a plurality of elongated openings **78** therethrough at radial positions corresponding to the different radial positions at which coins of different denominations are arrested, each opening being circumferentially spaced from the others. Thus, when the disc **38** rotates with coins arrested in the channels thereof, each coin will, as the disc assembly revolves, pass over that opening **78** at its particular radial position. However, since the disc will be rotating at high speed, centrifugal force will normally hold the coins against their arresting means so that they may not drop quickly through the openings **78** by gravity alone. To ensure discharge of each coin from its channel **46**, the table **4** is provided with deflector means to be described.

As best seen in FIGS. **3**, **4**, **5** and **7**, flanged fittings **80** border each of the elongated openings **78** to define a downwardly extending chute member. Within each chute member is mounted a deflecting finger **82** extending upwardly above the surface of table member **60** and into a corresponding annular groove **84** in the annular outer disc member **38** so that the disc may rotate with the deflecting finger **82** extending upwardly above the surface of table member **60** to an upper level slightly above the top surfaces of channels **46**. It is to be understood that each deflector finger **82** is provided with a relatively sharp forward end and downwardly sloping cam surface **86** (see FIG. **5**), and is in position to engage approximately the center of the leading edge of a coin arrested by a pin **64**. Thus, as the disc member **38** rotates in the direction of the arrow **88** of FIG. **5** any coin at the radial position shown will be engaged by the finger and forcibly deflected downwardly. The finger **82** is part of a plate **90** to which two spaced plates **92** are fixedly mounted in laterally spaced relation at the outer faces of spacer members **93**. The plates **92** are provided with curved forward edges **94**, as best shown in FIG. **5**, and serve to maintain a coin **96** in the oriented position shown in FIG. **5**, as it is deflected downwardly by the edges **94**. A suitable light source **98** is mounted in a block **100** within one end of the flanged fitting **80** and directs a beam of light toward the assembly shown in FIG. **7** where it will be interrupted each time a coin **96** is deflected downwardly along the edges **94**. A photocell **102** is carried by the structure of FIG. **7** in position to receive the light beam from light source **98**. A counter device **104**, which may be of any suitable or known construction, is actuated by the photocell **102** each time the light beam from light source **98** is interrupted to register a count in the counter device.

Secured to the flanged fitting **80** is a generally Y-shaped fitting **106** having a pair of tubular discharge portions **108** and **110** spaced apart from each other but closely adjacent each other. As shown, the shape of the parts is such that a coin **96** guided downwardly by the edges **94** will drop through element **110** into a suitable bag or other receiver **112**, releasably mounted on the tubular member **110**. It is normally desired to count a predetermined number of coins of any particular denomination and accumulate that number as a separate group of coins. The counter **104** may be set in any known manner so that upon accumulation of the desired "full count" therein current is sent thereby, through conductors **114**, to a solenoid **116**, the armature **118** of which is connected to a gate **120** pivotally mounted at **122**. A spring **124** normally urges the gate **120** and solenoid armature **118** to the full line position shown in FIG. **5**. However, when a receiver **112** has received a predetermined number of coins, the solenoid **116** is energized to swing gate **120** to the dotted line position in which it deflects all subsequent coins laterally into the tubular member **108** to be deposited in a second bag or receiver **126**. The solenoid **116** is maintained in that condition of energization until the desired number of coins have been accumulated in receiver **126**, at which time the current to solenoid **116**

is shut off and spring **124** returns the parts to the full line position to start accumulating another group of coins in the receiver attached to the tubular member **110.** Thus, when the desired number of coins has been deposited in one receiver, the machine automatically stops delivering coins to that receiver and deflects them toward a second receiver and thus an operator is given an opportunity to remove the first receiver or bag **112** and replace it with an empty receiver during the interval of time that coins are being collected in the second receiver.

It is contemplated that suitable controls, not shown, be provided for starting and stopping the apparatus, for indicating the accumulated desired number of coins in each of the receivers and for indicating any malfunction of the apparatus. Such devices and counters of the type referred to are known in the art and may be provided by those skilled in the art without further description.

In operation, the device may be provided with any suitable means for feeding loose coins of random denomination into the hopper portion **26.** Those coins then fall upon the cone **18** and the upper surface of the central disc portion **16** and are deflected by cone **18** in all radially outward directions. With the disc **16** rotating at high speed those coins are thrown outwardly along the surface of disc **16** and are forced to a single layer of coins by shear ring **36** and outwardly until they are arrested by the barrier ring **50.** Before the coins reach the barrier ring **50,** however, they must enter the entrance ends of channels **46,** as shown at **62** in FIG. **9.** The width of the entrance portion **62** is such that each will loosely receive a coin of the largest denomination but cannot receive two coins of the smallest denomination in side-by-side relation. For example, two coins of the smalleet denomination are shown in dotted line in FIG. **9** and it is evident that only one of them can abut the shoulder defined by barrier ring **50,** and the edge of only that one coin will pass over the upper edge of cam **70.** Due to the high centrifugal forces developed, coinS radially inwardly of those bearing against the barrier ring **50** may exert sufficient pressure to cause coins in the entrance portion **62** to "pile up", that is, to slip over each other with one upon another particularly if the edges of the coins are worn or somewhat rounded. To prevent such occurrence the disc portion **38** is provided with a plurality of elongated metal rods **130,** each guided by suitable channels **132** in the disc member **38** for free vertical movement under the influence of gravity. The channels **132,** however, do not extend through the bottom of the disc member **38** and the rods **130** are normally held spaced above the top surface of disc member **16** a distance generally the same as the distance between ring **36** and disc **16,** so that single coins may pass freely beneath them. Thus, the weight of the rods **130,** there being one extending across each entrance portion **62,** prevents the buckling of the layer of coins under the influence of centrifugal force or other disturbing forces exerted by the coins behind those at the barrier **50.**

As also shown in FIG. **9,** the entrance ends of channels **46** are somewhat spaced apart and an inner edge surface **134** (of disc member **38**) is Presented to the outwardly flowing coins. In some instances, a coin such as that shown at **136** in FIG. **9** may rest against the surface **134** and, thus obstruct other coins from entering either adjacent channels or otherwise disrupt the free flow of coins, including the possibility that it may remain there and not be counted. To remedy any possible interruption of coin flow due to described circumstances, the shear ring **36** is provided with one or more openings **138** (see FIGS. **1** and **8**) in each of which a ball **140** is positioned and urged downwardly by a leaf spring **142.** Thus, the balls **140** tend to constantly agitate the coins radially inwardly from the barrier ring **50** to prevent any coin from becoming "stuck" on the surface **134.**

It will be apparent that coins in the entrance portions **62** of the channels **46** will be arrested by the inner face or shoulder of barrier ring **50** until the outer edge of that coin reaches and rides up the sloping upper edge of cam **70.** As it rides up that edge, it is tilted, as shown in dotted line in FIG. **8,** until it outermost edge is above the upper edge of the barrier ring **50,** the rods **130** being freely movable to permit such tilting and centrifugal force acting on such tilted coin as the same reaches the high point **74** of cam **70** will cause that coin to fly outwardly over the barrier ring **50** into a channel **46.**

Since there is only a single cam **70** in the apparatus, it will be obvious that only one coin can be released from the central portion of the rotating disc into any one channel **46** at each revolution oF the disc. FIG. **1** shows the relative angular positions of cam **70** and discharge openings **78,** and it is apparent that, as the high point of cam **70** releases a coin to the channel **46** outwardly thereof, that channel has passed all of the discharge openings **78.** Thus, the coin can fly outwardly and reach its arrested position before it reaches the first discharge opening **78** for the largest denomination of coins.

Obviously, the rotary disc must be rotated at relatively high speed for the described apparatus to function properly. At low speeds the coins might not reach their denominational position in channels **46** before they reach the first of the discharge openings **78.** For this purpose it is contemplated that the rotary solenoid **76** be responsive to the speed of rotation of the disc assembly and in such manner that the cam **70** iS in its upper position shown in FIG. **6** only when the disc assembly is rotated at a predetermined speed. Below that speed suitable control means (not shown) will actuate the rotary solenoid **76** to lower cam **70** to its lowermost position and no coins can then be released by cam **70** from the central portion **16** of the disc to the outer annular portion **38.** It is also contemplated that manually operable means be provided for lowering cam **70** whenever an operator deems it advisable to stop the delivery of coins to the sorting channels.

It has been found that apparatus constructed in accordance with the foregoing description operates reliably at extremely high speeds not heretofore achieved by any previously known coin counting and sorting apparatus. For example, such a machine has been successfully operated at speeds over 150 r.p.m., sorting over 4,000 coins per minute. Much higher speeds are possible.

While a single specific embodiment of the invention has been shown and described, it is to be noted that other embodiments will become apparent to those skilled in the art. For example, the channels **46** could be arranged to open through the top surface of disc **38,** rather than being open at the bottom, and deflector fingers similar to the fingers **82** could be arranged to de-

flect the coins upwardly to discharge. Again, for example, a second cam, second set of discharge holes, associated counting mechanisms and receivers could be provided to give twice the sorting capacity without increasing the speed of rotation of the disc.

I claim:

1. A centrifugal coin sorting machine comprising:

A base structure;

a substantially horizontal disc mounted for rotation about a central vertical axis on said base structure and drive means for rotating said disc about said axis;

directing means for directing loose coins of random denomination downwardly onto the central portion of said disc and for directing said coins in all radial directions outwardly from said axis whereby centrifugal force causes said coins to move radially outwardly on said disc; and

sorting means on the outer annular portion Of said disc comprising radially spaced means for arresting outward movement of said coins at different radial distances corresponding to the denominations of respective coins, and further radially spaced means for receiving coinS from respective arresting means.

2. A machine as defined in claim 1 wherein said directing means comprises a generally circular hopper having a discharge opening substantially concentric to said axis and a generally conical deflector mounted centrally on said disc with its apex directly upwardly into said discharge opening.

3. A centrifugal coin sorting machine comprising:

a base structure;

a substantial'y horizontal disc mounted for rotation about a central vertical axis on said base structure and drive means for rotating said disc about said axis, whereby centrifugal force acting on loose coins on said disc causes said coins to move radially outwardly of said disc;

a stationary annular member over said disc generally concentric to said disc and having a lower edge portion spaced from the upper surface of said disc a distance to permit any single coin to pass thereunder but to prevent the passage thereunder of any coin resting on top of any other coin, whereby only a single layer of coins can move outwardly under said annular member; and

sorting means on the outer annular portion of said disc comprising radially spaced means for arresting outward movement of said coins at different radial distances corresponding to the denominations of respective coins, and further radially spaced means for receiving coins from respective arresting means.

4. A centrifugal coin sorting machine comprising:

a base structure;

a substantially horizontal disc mounted for rotation about a central vertical axis on said base structure and drive means for rotating said disc about said axis, whereby centrifugal force acting on loose coins on the central portion of said disc causes said coins to move radially outwardly;

sorting means on the outer annular portion of said disc for arresting outward movement of said coins at different radial distances corresponding to the denominations of respective coins;

said sorting means comprising a multiplicity of generally radial channels in the outer annular portion of said disc, each channel defining a coin path of outwardly diminishing width whereby coins of different denominations are stopped at respectively different radial positions;

transfer means for releasing only a single coin to move from said central portion of said disc into each of said channels at each revolution of said disc; and

radially spaced means, each arranged to receive coins of a single denomination from said channels.

5. A machine as defined in claim 4 wherein said transfer means comprises barrier means having an annular inwardly facing shoulder extending upwardly above the upper surface of the central portion of said disc, defining the boundary between said outer annular potion and said central portion of said disc, whereby said barrier means arrests outward movement of coins on said central portion of said disc; and at least one stationary cam adjacent said barrier means, on the inner side thereof, and arranged to engage and lift the outer edge of a coin bearing against said shoulder, as said disc rotates, to an elevation above said shoulder so that centrifugal force causes said coin to move over said barrier to said outer annular portion of said disc and thus transfer coins at said cam to said outer annular portion in single coin sequence.

6. A machine as defined in claim 5 including means for selectively moving said cam out of the path of coins on said disc to thereby prevent transfer of coins to said outer annular portion of said disc.

7. A machine as defined in claim 5 including upwardly yieldable means on said disc, closely above the upper surfaces of coins engaging said barrier means to prevent centrifugal force from causing coins adjacent said barrier means to rise and rest one upon another at said barrier means.

8. A machine as defined in claim 7 wherein said yieldable means comprise freely movable elongated weighted bodies extending generally tangentially of said axis, guide means on said disc guiding said bodies for generally vertical movement, and means limiting downward movement of said bodies to positions spaced upwardly from said disc.

9. A machine as defined in claim 5 wherein said channels are formed in the bottom face of said outer annular portion of said disc and extend over said barrier means to said central portion of said disc, the portions of said channels inwardly of said barrier means being of a width to permit only a single coin therein, of any denomination, to engage said shoulder of said barrier means.

10. A machine as defined in claim 4 wherein said outer annular portion of said disc is an annular member arranged with its lower surface abutting the upper surface of the outer edge portion of said central portion and secured thereto, said channels opening downwardly through said lower surface;

said base structure having a stationary upper surface portion underlying said channels and over which coins in said channels slide as said disc rotates; and

said radially spaced means comprising openings through said surface portion, at said different radial positions, through which coins at said different radial positions are discharged and accumulated according to denomination.

11. A centrifugal coin sorting machine comprising:
a base structure;
a substantially horizontal disc mounted for rotation about a central vertical axis on said base structure and drive means for rotating said disc about said axis, whereby centrifugal force acting on loose coins on the central portion of said disc causes said coins to move radially outwardly;
sorting means on the outer annular portion of said disc for arresting outward movement of said coins at different radial positions corresponding to the denominations of respective coins;
said sorting means comprising a multiplicity of generally radial channels in the outer annular portion of said disc, each channel defining a coin path of outwardly diminishing width whereby coins of different denominations are stopped at respectively different radial positions;
said channels opening downwardly through the lower surface of said outer annular portion;
said base structure having a stationary upper surface portion underlying said channels and over which coins in said channels slide as said disc rotates; and
openings through said surface portion, at said different radial positions;
deflector fingers on said base structure, extending upwardly through said openings to engage coins in said channels and deflect the same downwardly through said openings.

12. A machine as defined in claim 11 wherein said deflector fingers each include guide means for directing said deflected coins along a predetermined discharge path, in predetermined orientation, to an accumulating receiver; and counting means for counting coins moving along said predetermined path.

13. A machine as defined in claim 12 including a second accumulating receiver adjacent each of said first-named receivers, and movable gate means on said base structure adjacent said predetermined path, said gate means being movable between a first position wherein discharged coins move therepast to said first-named receiver, and a second position wherein discharged coins are further deflected to said second receiver.

14. A machine as defined in claim 13 including means responsive to achievement of a predetermined count by said counting means for moving said gate means from one of said positions to the other.

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