

[54] **FOREIGN PARTICLE INSPECTION MACHINE**

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Related U.S. Application Data

[63] Continuation of Ser. No. 869,144, Oct. 24, 1969, abandoned.

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[51] Int. Cl. **B07c 5/342**

[58] Field of Search **356/197, 198; 209/111.7, 111.5, 73; 250/223 B; 198/22; 221/175, 136; 214/1 BB**

[56] **References Cited**

UNITED STATES PATENTS

2,798,605 7/1957 Richards 209/111.5 UX

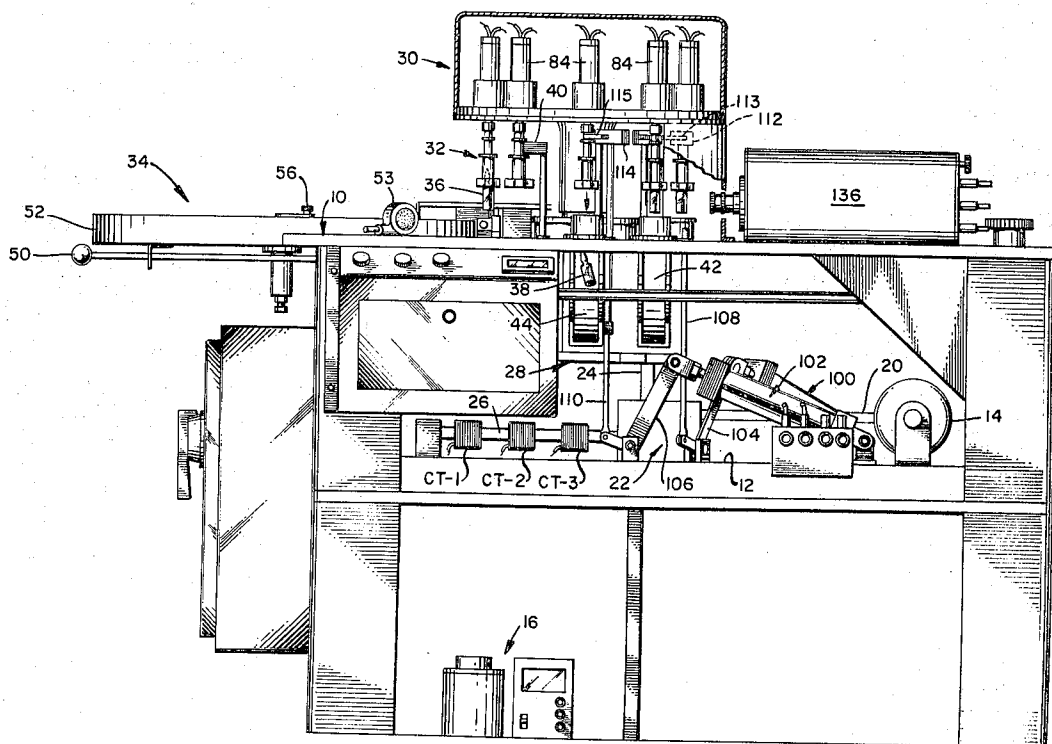
3,146,887	9/1964	Mottin et al.	209/73
3,217,877	11/1965	Honjyo et al.	356/197 X
3,453,804	7/1969	Taylor et al.	221/175 X
3,528,544	9/1970	Noguchi et al.	209/111.7 X

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[57] **ABSTRACT**

Liquid filled containers to be inspected are stored upright on a rotating disc which feeds them between funnel defining walls to a V-shaped opening in a slide block movable radially in timed relationship with an intermittently driven turret. The turret has a plurality of chucks for receiving the containers, and an elevating mechanism raises a container upwardly into each chuck at a machine infeed station. Each container is then spun at one or more succeeding stations to cause the liquid to swirl therein, after which rotation is stopped at an inspection station and successive video frames recorded to detect differences due to particles moving in the still swirling liquid. Logic circuitry must then generate a positive "accept" signal for discharge at one machine station. Any container not so accepted will be discharged at a succeeding station.

19 Claims, 9 Drawing Figures



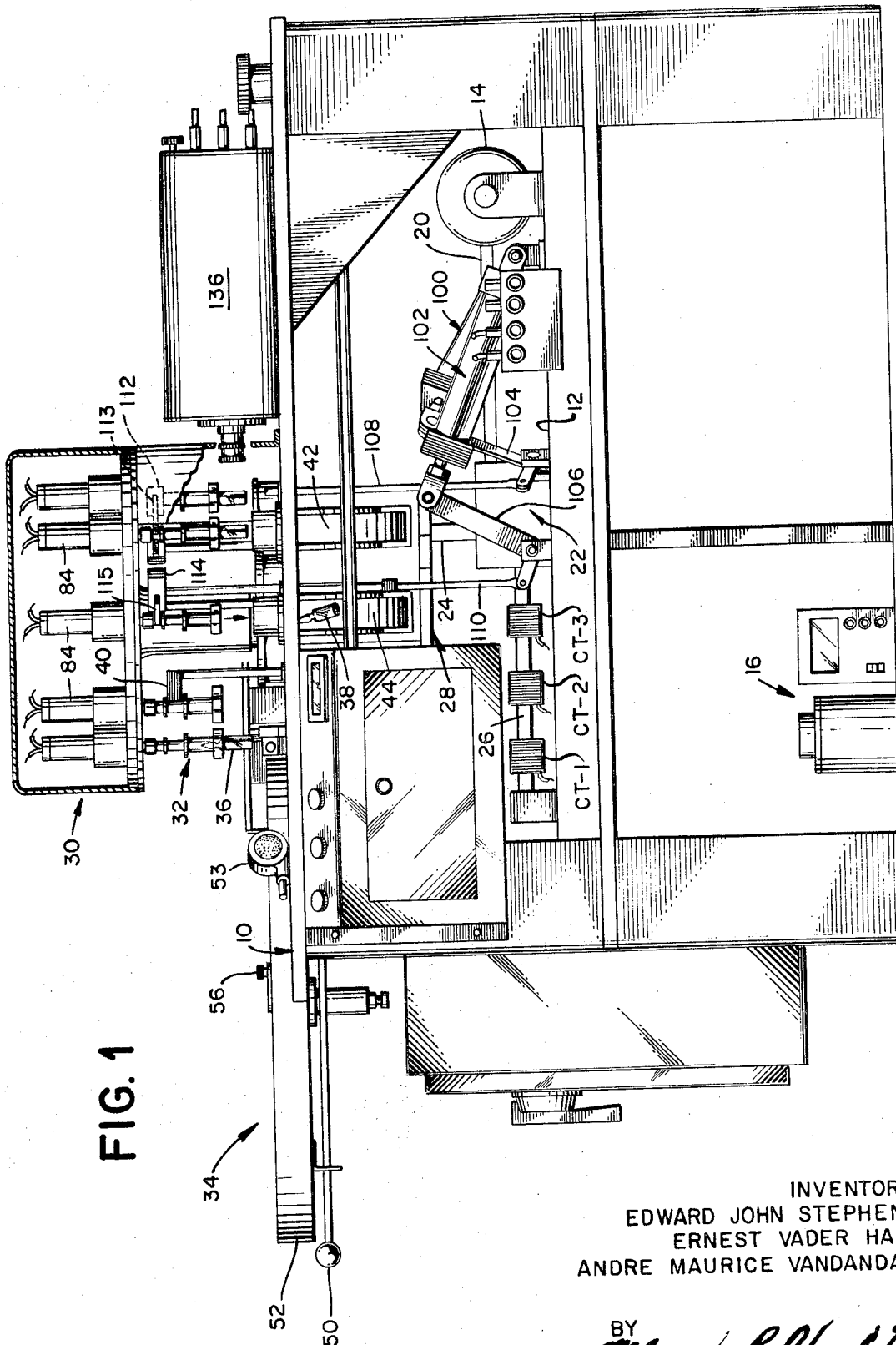


FIG. 1

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FIG. 2

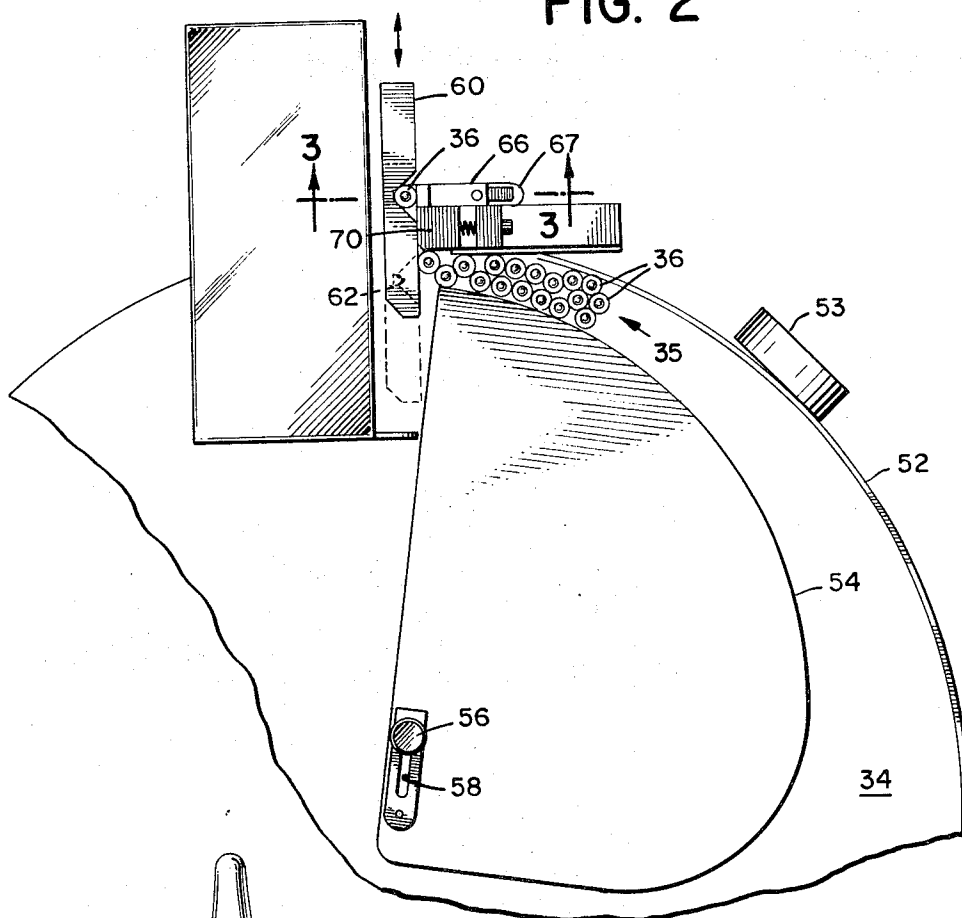
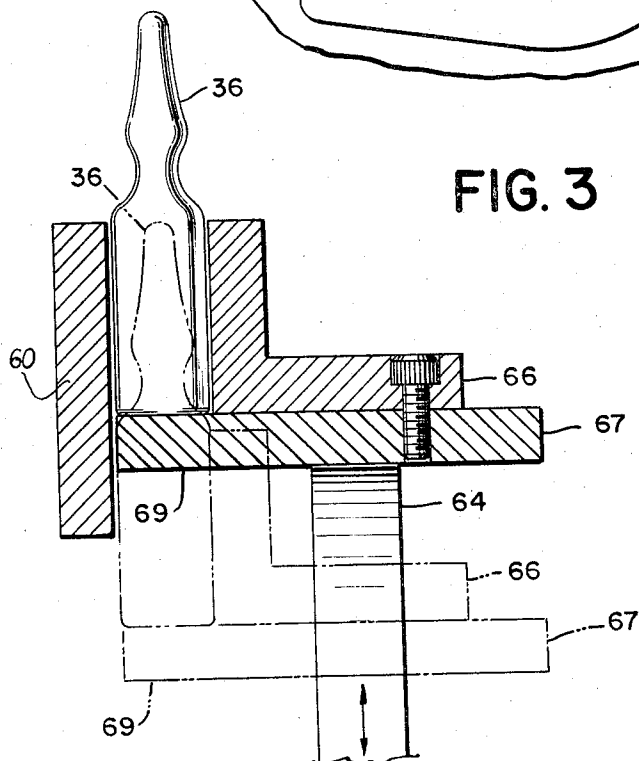


FIG. 3



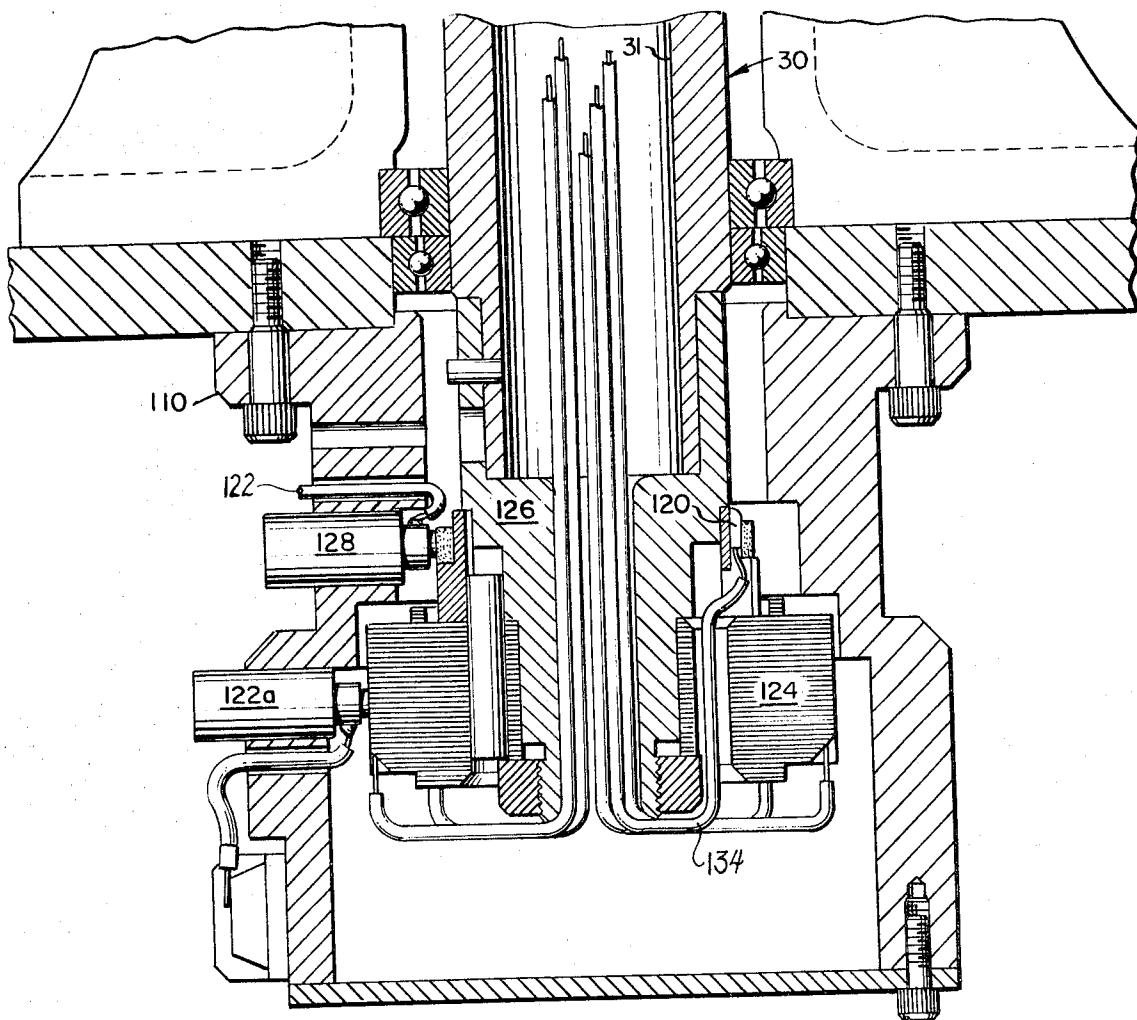
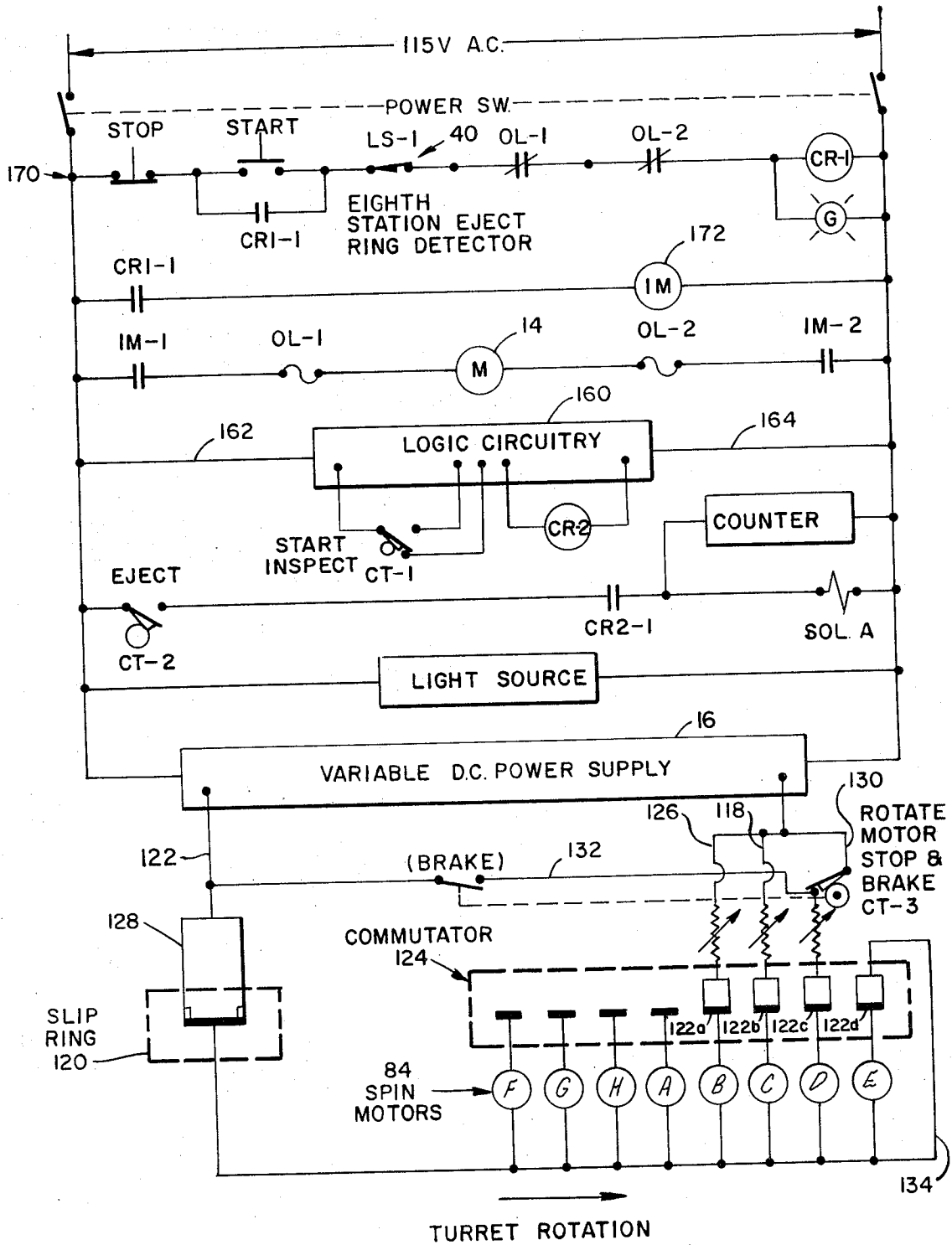


FIG. 4

FIG. 7



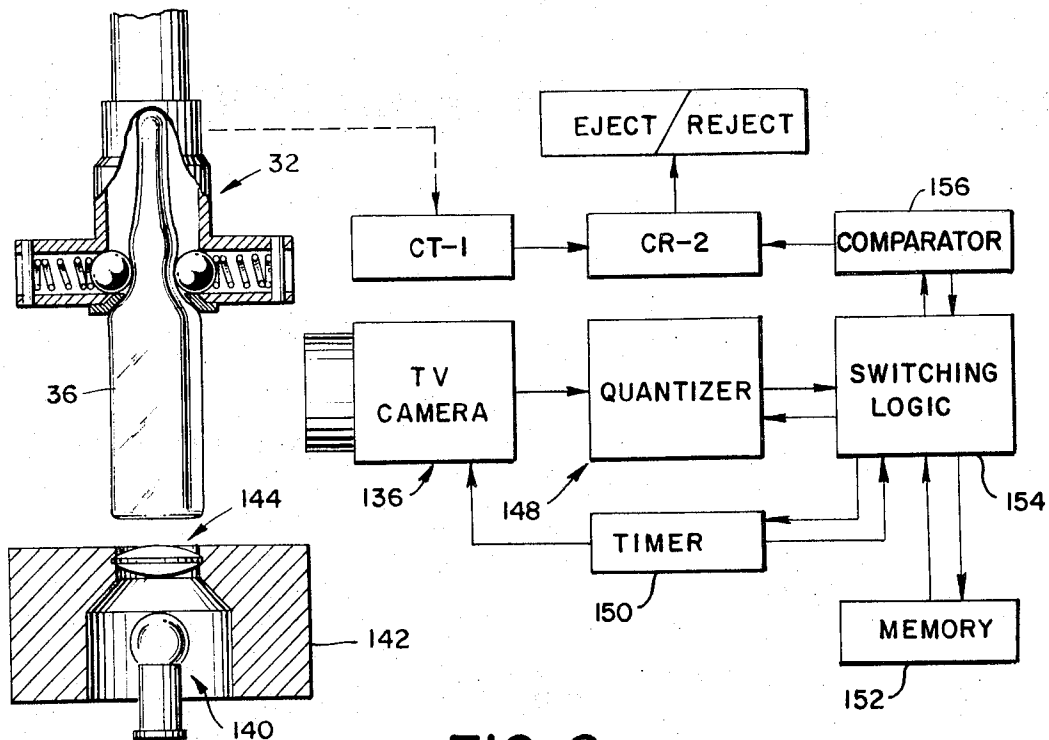


FIG. 8

FOREIGN PARTICLE INSPECTION MACHINE

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of application Ser. No. 869,144 entitled FOREIGN PARTICLE INSPECTION MACHINE, filed Oct. 24, 1969, said application being in the names of Edward John Stephens, Ernest Vader Hart and Andre Maurice Vandandaigue, and now abandoned.

BACKGROUND OF INVENTION

This invention relates to the inspection of liquid filled containers for the presence of foreign particles, and deals more particularly with a machine capable of detecting minute particles of a size which is considered objectionable in pharmaceutical ampoules or the like.

One rather common method of inspecting such containers is to manually rotate the hermetically sealed transparent ampoule in a twisting motion which causes the liquid contents to swirl around in the ampoule. The ampoule is then visually checked for foreign material moving with the swirling liquid. U. S. Pat. No. 2,635,194 issued to Kellogg et al in 1953 shows and describes a device for aiding one engaged in such a tedious inspection task. In the patented device the ampoule is held against driven rollers and rotated briefly to cause the liquid contents to swirl. A beam of light is passed transversely through the container to be picked up by a photocell. The photocell is linked to an indicator circuit for energizing a buzzer or other warning device when the level of illumination is altered to some predetermined extent by a particle of sufficient size. Other devices, of a more automated nature have been proposed as shown in U. S. Pat. Nos. 3,217,877 and 3,146,887 issued to Honjyo et al and Mottin et al respectively, but these machines have all depended upon the ability of one or more photocells to detect the particles as a result of the scattering of light due to movement of the particles in the swirling liquid.

The principal object of the present invention is to provide a machine for automatically inspecting individual ampoules for the presence of foreign particles by video means, which machine is capable of storing these ampoules upright, of advancing them seriatim to an infeed station where a turret-type handling fixture holds them and spins each of them briefly to cause the liquid therein to swirl so that the video means can record, in successive frames, at least two signals which are then compared electronically. The result is then used to discharge the defective ampoules at a reject station, and to deposit the acceptable ones at another machine station for subsequent handling.

SUMMARY OF INVENTION

In an inspection machine wherein the liquid contents of hermetically sealed ampoules are to be checked for the presence of foreign particles means is described for storing a plurality of such containers, and for feeding each of these toward an infeed station where each container is chucked for indexed movement in a turret and for spinning each container momentarily, and for taking successive video pictures of each container as the liquid therein continues to swirl. Logic circuitry then generates an "accept" signal depending upon the results of an electronic comparison between two or more of these video frames and the acceptable liquid filled containers are discharged from said turret and chuck at

ore machine station while the defective ones are removed at a succeeding machine station.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is an elevational view of a machine which embodies the present invention.

FIG. 2 is a plan view of the means for storing containers and for advancing them toward the infeed station of the machine of FIG. 1.

FIG. 3 is a vertical sectional view taken on line 3—3 of FIG. 2 showing the means for elevating each container at the infeed station, said means being shown in full lines and in broken lines to indicate the relative motion thereof.

FIG. 4 is a vertical sectional view through a lower portion of the turret shown in the FIG. 1 machine.

FIG. 5 is an elevational view partly in section showing one of the chuck means provided in the turret, and also showing a container aligned therewith prior to being elevated by the mechanism of FIG. 3.

FIG. 6 is an elevational view similar to FIG. 5 but showing the container secured in the chuck means.

FIG. 7 is a schematic electrical diagram of the control circuitry for operating the machine of FIG. 1.

FIG. 8 is a schematic functional diagram of the logic circuitry shown in FIG. 7.

FIG. 9 is a horizontal sectional view taken on the line 9—9 of FIG. 5 showing the lower end of the chuck means.

DETAILED DESCRIPTION

Turning now to the drawings in greater detail, FIG. 1 shows in elevation an inspection machine incorporating the present invention, and comprising a counter height table 10 supported on a conventional frame. A generally horizontally extending shelf 12 is provided for supporting an electric motor 14. A variable source of electrical power is provided for a purpose to be discussed in greater detail with reference to Fig. and is indicated generally at 16 in FIG. 1. The electric motor 14 is drivingly connected through a drive belt 20 to a gear box 22 having a vertically upwardly extending output shaft 24 and a horizontally extending output shaft 26. The output shaft 24 operates an intermittently driven turret, indicated generally at 30, through a conventional geneva drive, indicated generally at 28, so that a plurality of angularly spaced chuck means 32 provided in the turret 30 are indexed between a plurality of corresponding machine stations, with a short dwell interval at each such station. The gear box output shaft 26 operates three limit switches CT1, CT2 and CT3 in timed relationship with rotation of the intermittently driven turret 30. The functions of these limit switches will be described in greater detail hereinbelow with reference to the schematic view of the machine's control circuitry shown in FIG. 7.

Still with reference to FIG. 1, a rotary table or disc, indicated generally at 34, is provided for storing a plurality of containers, or ampoules, for inspection and for advancing these containers to an infeed station associated with the turret 30. One such ampoule 36 is shown at said infeed station, and is there held by one of the chuck means 32 for indexing movement in a clockwise direction as viewed from above through four successive machine stations so as to be presented in front of a television camera 136 which camera generates successive video signals of the ampoule for inspection by the

method disclosed in a co-pending application entitled "Article Inspection By Successively Televised Images" filed May 20, 1968 and assigned to the assignee herein. Depending upon the output signal from the circuitry described in detail in the above mentioned patent application, and summarized briefly with reference to FIG. 8 herein, the inspected ampoule is either discharged at the next succeeding station and dropped into the normal discharge chute 42, or is deposited at the next succeeding machine station, as shown by the ampoule 38 in the reject chute 44 of FIG. 1.

FIG. 2 shows a portion of the rotating circular table, or disc 34, upon which a plurality of ampoules are adapted to be stored, and which advances these ampoules to the infeed station of the machine. The rotary table 34 is adapted to be continuously driven in a counter-clockwise direction as viewed from above in the direction of the arrow 35, and the speed thereof may be adjusted by the knob indicated generally at 50 in FIG. 1 through a conventional device (not shown). As shown in FIG. 2 a peripheral fence 52 is provided around at least the right hand half of the rotating table or disc 34, and an arcuately shaped radially outwardly protruding center fixture or guide 54 cooperates with the facing wall of the fence 52 so as to define a funnel shaped passageway into which the containers or ampoules are urged by the rotating table. Thus, these containers are fed in a packed grouping toward the infeed station, indicated generally by the ampoule 36. The fixed guide 54 is adjustable in position by means of the hand knob 56, which knob extends through a slot 58 provided for this purpose in the guide 54 and has a lower portion threadably received in a fixed block (not shown) in the fixed frame of the machine. This adjustably located fixed guide 54 permits this machine to conveniently accommodate containers or ampoules of varying size.

A slide block 60 is provided at the infeed station for moving each ampoule radially outwardly with respect to the rotary table, being movable between the broken line and the solid line positions shown in FIG. 2. A V-shaped opening 62 is provided in the slide block 60 to receive one of the ampoules as it is fed or advanced by the rotating disc 34, and the ampoule in this opening 62 is thus adapted to be shifted radially from a first position adjacent the peripheral edge of the disc 34 to a second position off the disc wherein the ampoule 36 is located below one of the chuck means 32 provided in the rotatable turret 30. This position will be referred to herein as the infeed station of the machine.

In accordance with the present invention means is provided for elevating each ampoule at said infeed station for insertion in one of said chuck means 32 during the dwell interval of the associated turret, and in timed relationship with radial reciprocating movement of the slide block 60. FIG. 3 shows a rotary cam 64, driven from the same motor 14 as used to drive the turret 30, and operable to raise a cam follower block 66 upwardly from the broken line position shown in FIG. 3 to the solid line position wherein the ampoule 36 is adapted to be releasably secured by the chuck means 32. The cam follower block 66 preferably has a lower plate 67 which is so shaped that its inner end 69 is adapted to be slidably received in the V-shaped opening 62 of the radially reciprocable slide block 60. A spring loaded device 70, best shown in FIG. 2, may be provided for assuring that the ampoule 36 in the V-shaped opening

62 of the slide block 60 is adapted to remain in position during radial movement of the slide block 60 as described above.

In order to prevent jamming of the ampoules in the funnel shaped opening defined between the peripheral fence 52 and the guide 54, and in order to prevent toppling of these ampoules as they are advanced toward the infeed station of the machine, a small vibrator unit 53 of conventional construction is peripherally mounted on the fence 52 at the location shown in FIG. 2.

FIGS. 5 and 6 show in detail the construction of each of the chuck means 32 for releasably retaining the ampoules 36, 36 in the turret as the latter follows the indexing movement referred to above. The elevating mechanism shown in FIG. 3 is adapted to lift each ampoule at the infeed station in the direction suggested by the arrow 37 of FIG. 5 so as to releasably retain the ampoule in the chuck means as shown in FIG. 6. While a pharmaceutical ampoule of conventional shape is shown in the presently preferred embodiment, it will be apparent from the description to follow that the chuck means 32 might be adapted for use in inspecting containers of somewhat different external configuration. Each chuck means 32 comprises a holder 80 which has a downwardly open lower portion in which the upper end of the ampoule is adapted to be received as suggested in FIG. 9. Radially movable spring loaded ball elements 82, 82 are carried in cylindrical openings provided for this purpose in the holder 80 for frictionally engaging the upper end of the ampoule, and more particularly for engaging the necked down portion 39 thereof characteristic of the ampoule shown so as to cause the ampoule to rotate with the holder 80 at selected stations in the turret. Spin motors 84, 84 are mounted in the turret 30 and each such motor 84 has an output shaft 86 to which the holder 80 is secured for accomplishing this spinning motion. Suitable means to be described is provided for operating these spin motors at selected machine stations, and for braking said motors electrically so that the still swirling liquid causes foreign particles contained therein to be sensed by the camera 136 at the inspection station.

Turning now to a more specific description of the chuck means 32, each unit has an elongated tubular portion 88 the upper end of which is carried by the drive shaft 86 of the spin motor 84, and a lower portion which is secured to the holder 80 by suitable means, as for example by a welded connection. A pair of clamping screws 89, 89 are adapted to secure the upper end of the tubular member 88 to the lower end of the shaft 86. A plug, or plunger 90, is slidably received in the tubular member 88, and has a lower end portion which is adapted to be engaged by the upper end of the ampoule 36 as the latter is received in the holder 80. After engaging the plug 90, the ampoule neck portion 39 is clamped by the spring loaded ball elements 82, 82. An annular collar 92 is provided on the lower end of the holder 80 to define an opening of accurate size and shape for receiving the ampoule 36, and this collar 92 is preferably of such a size as to snugly receive the shoulder portion 37 of the ampoule 36 so that the ball elements 82, 82 engage the neck portion 39 of the ampoule 36 so as to securely hold the ampoule 36 in the chuck means 32 by urging the shoulder 37 against the collar 92. Thus, the ampoule 36 is accurately aligned

in the chuck means with the center line thereof for the inspection operation to be described.

Still with reference to the chuck means 32 of FIGS. 5 and 6, the plunger, or plug 90, carries a pin 94 which pin has its end portions extending through the elongated slots 96, 96 in the tubular member 88, and the outermost ends of the pin 94 are secured in an annular collar 98 slidably received on the outside of the tubular member 88. As so constructed and arranged, insertion of the ampoule 36 in the chuck means 32, as indicated by the arrow 37 in FIG. 5, causes the plug 90 to be raised from its FIG. 5 position to that shown in FIG. 6. Conversely, when the ampoule 36 is to be discharged or rejected from the chuck means 32, downward movement of the collar 98, as for example by downward pressure on its upper flange 99, causes corresponding downward movement of the plug or plunger 90, to urge the ampoule 36 out of the chuck means 32, and out of its position between the ball elements 82, 82 for either discharging the ampoule normally or rejecting it should it be a defective container.

As best shown in FIG. 1, the normal discharge station is associated with the discharge chute 42, and the reject station for discharging defective ampoules is associated with the chute 44, containing the unacceptable ampoule 38 shown sliding down the chute after having been released from the associated chuck means 32 thereabove. Operation of the chuck means at each of these stations is controlled by operation of an air cylinder as indicated generally at 100 and 102 respectively. The air motor 100 is associated with the normal discharge station and is adapted to release an ampoule from an associated chuck means 32 through a bell crank 104 and push rod 108. A bifurcated member, indicated generally at 112, is mounted at the upper end of the push rod 108 and carries a horizontally movable, and spring loaded member 113, for engagement with the flanged portion 99 of the annular collar 98 of the chuck described above. The air cylinder 102 also has a bell crank 106 associated therewith for operation of a vertical push rod 110 which is associated with a bifurcated member 114 provided at the upper end thereof, and a horizontally movable member 115 is adapted to act upon the flanged collar 99 so as to reject an ampoule at the rejection station as shown at 38. The air motor 100 is controlled by a conventional solenoid valve through the circuitry shown in FIG. 7, and more particularly by the solenoid A. The air motor 102 is controlled by a cam actuated switch (not shown) through a solenoid valve to reject any ampoule reaching the reject station.

Turning now to a more complete description of the means for selectively spinning each chuck means, at least during the dwell interval at one of the said machine stations, so as to cause the liquid to swirl at the inspection station FIG. 7 shows a variable DC power supply 16 for selective operation of eight spin motors 84, 84 indicated schematically by the reference letter A-H inclusively. A slip ring 120 and associated brush means 128 is continuously connected to one of the two conductors associated with each of the spin motors. The slip ring 120 is mounted for rotation with the turret 30 and the brush 128 is fixed in a housing 110 best shown in FIG. 4. The conductor 122 associated with the brush 128 being stationary and the conductor 134 moving with the turret. The operation of these spin motors is controlled by annular segments of a commutator

124 through associated brushes 122a, 122b, 122c and 122d shown schematically in FIG. 7. The physical configuration of the slip ring 120 and its brushes 128, as well as the commutator 124 and one of its brushes 122a, is shown in detail in FIG. 4 wherein the slip ring 120 is secured to the exterior of an annular shaft extension 126 of a hollow shaft 31 associated with the rotating turret 30. The shaft extension 126 also carries commutator 124 and the rotating conductors associated therewith are shown in FIG. 4 to have a generally U-shaped configuration in that they extend around the lower end portion of the extension 126 and thence upwardly through the hollow shaft 31 to each of the various spin motors 84, 84 best shown in FIG. 1. Each of the distinct annular segments of the commutator are insulated from one another, and one or more of the brushes, 122a through 122d inclusively, are adapted to selectively energize each such annular segment so as to energize the associated spin motor 84 as the motor and chuck means dwell at the machine stations depicted schematically in FIG. 7.

More particularly, at the instant of time depicted in FIG. 7 spin motor A indicates the infed or load station for the ampoules, and spin motor B the next succeeding station at which that motor is electrically connected through conductor 126 to the variable DC power supply for energizing that particular spin motor. A potentiometer is preferably provided in the line 126 for adjusting the speed of spin motor B. Spin motor C at the next succeeding machine station also involves spinning of the ampoule through the conductor 118 associated with the brush 122b. The turret station associated with spin motor D also allows that ampoule to be rotated during a portion of the dwell interval at said station, but is preferably braked through a limit switch CT3 just prior to the next indexing movement of the turret which movement will present that ampoule at the inspection station, indicated generally by spin motor E. Spin motor D is connected to the power supply 16 through conductor 130, an adjustable potentiometer, and brush 122c. However, just prior to indexing movement of the turret 30 for advancing the ampoule associated with spin motor D to the inspection station, limit switch CT3 moves to its alternate position and that spin motor D is braked through the conductor 132. Conductor 134 from the slip ring 120 is also associated with the inspection station itself and assures that no rotational movement of the ampoule being inspected is possible, and, therefore, only the liquid contained therein continues to move so that motion of any foreign particles can be detected by the camera 136.

Turning now to a more complete description of the logic circuitry and associated means for inspecting the contents of the swirling liquid at the inspection station, FIG. 8 shows schematically a method and means for inspecting articles by successively televised images similar to that described in a co-pending application entitled "Article Inspection By Successively Televised Images" filed May 20, 1968 under Ser. No. 730,377 and assigned to the assignee herein. As described in the above mentioned patent application, and as shown schematically in FIG. 8, means is provided for illuminating the transparent container 36 from beneath. Said means preferably comprises a source of light, indicated generally at 140, which may be shielded as shown schematically at 142, and which is preferably focused so as to pass a beam of light upwardly through the interior of

the container 36. Ideally this light beam is of such width and sufficiently collimated that the container walls are not appreciably illuminated. Rather, only foreign particles contained in the liquid are illuminated as they are carried around in a generally circular path as a result of the swirling action created by the previous spinning of the ampoule by the chuck means 32. This focusing is accomplished by inserting a lens system 144 which focuses the beam of light emanating from the source 140 so it passes only through the lower wall of the container 36, thereby presenting a relatively dark or black background for the television camera 136 in order to provide a contrast for the illuminated particles contained therein. These particles will cause a scattering of the light so that some light will be reflected or scattered by the particles of right angles to the upwardly directed light beam so as to reach the television camera 136.

The camera 136 comprises a conventional component of the system and is adapted to produce a video output when triggered by the timer 150. The video output signal is altered into pulse form by a quantizer 148. Electronic switching logic 154 handles each particular camera frame, or its corresponding pulse, sending it either to the memory device 152, or directly to the comparator 156. In accordance with the invention described in the above mentioned patent application the switching logic 154 receives a signal from the timer and serves the function of synchronizing the successive voltage pulses for timed delivery to the comparator. For example, an initial voltage output, reduced to pulse form, from the camera might be supplied, through the switching logic, to the memory device 152, and a subsequent voltage pulse synchronized therewith through the timer and fed through the switching logic 154 directly to the comparator 156, with the initial pulse being simultaneously recalled from the memory device and fed to the comparator 156 for an electronic subtraction operation used to generate a reject signal. The said signal is stored by control relay CR2 for use at an appropriate time in the machine cycle for rejecting or ejecting the ampoule at one or another of the two successive stations in the machine referred to above with reference to the discharge chute 42 and the reject chute 44.

The logic circuitry of FIG. 8 is indicated schematically in the overall electrical schematic of FIG. 7 at 160. The conductors 162 and 164 energize the logic circuitry and the output thereof is indicated schematically as operating the control relay CR2 which in turn operates the contacts CR2-1 for energizing solenoid A which operates a valve (not shown) for providing the air to air motor 100 when an acceptable ampoule is detected. The actual start of the inspection cycle is determined through limit switch CT1, also shown in FIG. 1, for achieving this inspection at the proper point in time during the dwell period of the ampoule at the inspection station. The actual eject signal to the solenoid A is however postponed until limit switch CT2 is closed, so that the point in time during which an acceptable ampoule is discharged is achieved at the appropriate point in time during the dwell of the turret. The rejection of unacceptable ampoules is accomplished through a cam switch which is sequentially energized each time that the turret is indexed to a particular machine station. In other words, a positive output is required from the logic circuitry in order to pass an acceptable ampoule, and any ampoule not so passed is

subsequently rejected at the next succeeding station in chute 44. Thus, a fail safe operation is assured, only acceptable ampoules being passed by the machine rather than following the usual approach of assuring that only unacceptable ampoules are rejected.

With further reference to FIG. 7, a limit switch LS1, indicated generally at 40, is shown on line 170 of the schematic in order to de-energize the main control relay CR1 opening its contact CR1-1 and de-energizing the motor relay 172. Thus, LS-1 must be closed to close contacts M-1 and M-2 for energizing the main electric motor 14 of the system. The switch LS1 is shown in FIG. 1 to be provided at the eight machine station, intermediate the reject station, and the infeed station. Thus, LS1 is so located at this eight machine station as to detect the condition of the annular collar 98. If the collar is raised, indicating that an ampoule has somehow been retained in the chuck means 32 at this point during the machine cycle, the entire machine is shut down in order to avoid jamming by attempting to raise another ampoule into that chuck at the infeed station.

We claim:

1. In a machine for inspecting transparent containers for the presence of foreign particles in the liquid contents thereof, the improvements comprising a turret having a plurality of angularly spaced chucks for releasably retaining said containers, means for rotating said turret intermittently so that each chuck is indexed between a plurality of machine stations with a short dwell interval at each such station, rotary table means for storing a plurality of upright containers and for advancing them toward an infeed station, means defining a funnel shaped passageway into which said containers are urged by said rotary table while en route to said infeed station, radially reciprocable means having an opening to receive a container from said funnel shaped passageway for shifting such container outwardly off the rotary table, cam means for elevating each container so shifted and while it is at said infeed station and in timed relationship with said turret drive so as to lift each container in turn into said chuck where it is releasably retained for movement with said turret.

2. The combination defined in claim 1 further characterized by means for selectively spinning each chuck to cause the liquid to swirl therein, means at an inspection station for generating a signal indicative of the condition of said containers contents with respect to the presence of foreign particles, and means for stopping said spinning chuck to allow the liquid contents only to swirl at said inspection station.

3. The combination defined in claim 2 wherein each of said chuck means comprises a holder rotatably supported in said indexable turret and having a lower opening adapted to receive the upper end of said container, and radially movable elements carried by said holder for frictionally engaging the upper end of the container to cause it to rotate with said holder in response to said selective chuck spinning means.

4. The combination defined in claim 3 wherein each of said chuck means further includes an axially reciprocable plunger for engaging the upper end of the container to release it from said holder and from the influence of said radially movable elements.

5. The combination defined in claim 4 further characterized by means for releasing inspected containers at a discharge station, said means comprising a verti-

cally reciprocable release member mounted in said machine, and wherein said chuck means further includes a radially outwardly extending flange collar slidably mounted on said holder and connected to said plunger for movement therewith, and means for moving said release member downwardly in timed relationship with said turret indexing movement.

6. The combination defined in claim 5 further characterized by second means for releasing inspected containers at another machine station in addition to said discharge station, said second means including a second release member, and means for moving said second release member at said another station, and at least one of said means for releasing containers at one of said machine stations operating in response to said container content signal to operate one of said plungers for releasing a container directly from said container content signal, said other means for releasing containers operating cyclically to release every container reaching that station.

7. The combination defined in claim 2 wherein said means for selectively spinning each chuck comprises a plurality of electric motors each of which is drivingly connected to one of said chuck means and each of which has a pair of conductors associated therewith, a control shaft upon which said turret is rotatably supported in said machine, a slip ring on said shaft, a fixed brush for said slip ring, a commutator on said shaft and having at least as many distinct conductive angular segments as said turret has electric motors, and a fixed brush for said commutator, said pair of electric motor conductors being connected to said segments respectively to allow selective energizing of said spin motors.

8. The combination defined in claim 2 further characterized by means for illuminating the container from below at said inspection station to illuminate any foreign particles present in the swirling liquid, said means comprising a source of light so located as to direct light upwardly through the bottom of said container.

9. The combination defined in claim 7 further characterized by at least one additional fixed brush associated with said commutator, and means for selectively connecting said additional brush to the same electric potential as that of said slip ring associated brush to brake said spin motor prior to said inspection station.

10. The combination defined in claim 9 wherein said means for selectively connecting said additional brush to said slip ring brush includes a two position limit switch operable in response to rotation of said turret to electrically connect said additional brush to said commutator brush when said spin motor is not being braked.

11. In a machine for inspecting transparent containers for the presence of foreign particles in the liquid contents thereof, a turret having a plurality of angularly spaced chuck means for releasably retaining said containers, means for rotating said turret intermittently so that each chuck is indexed between a plurality of machine stations with a short dwell interval at each such station, means for storing a plurality of upright containers in said machine, means for advancing these containers to an infeed station, means operable in timed relationship with said turret for elevating each container at said infeed station for insertion in one of said chuck means during said dwell interval, means for selectively spinning each chuck means to cause the liquid to swirl therein, video means at an inspection station for gener-

ating successive video signals of each container after it has stopped spinning but before the liquid contents have stopped swirling, means responsive to said successive video signals for producing a signal indicative of the condition of said container's contents with respect to the presence of foreign particles, means for normally releasing containers at a discharge station in response to such a container content condition signal and for holding containers for subsequent release at a reject station, said means for storing said upright containers and for advancing them to an infeed station comprising a rotary table having a fixed peripheral fence and an arcuately shaped radially outwardly extending guide co-operating with said fence to define a funnel shaped passageway into which said containers are urged by said rotating table to feed said containers one at a time to said infeed station, said means for elevating each container at said infeed station including a rotary cam driven in timed relationship with said turret drive, radially reciprocable means defining an opening to receive a container in its upright condition in a first position and to move it radially outwardly to a second position off the table, a cam follower block movable vertically upwardly in response to rotation of said cam for lifting a container at said second slide block position so that it can be releasably retained in one of said chuck means.

12. The combination defined in claim 11 wherein each of said chuck means comprises a holder rotatably supported in said indexable turret and having a lower opening adapted to receive the upper end of said container, and radially movable elements carried by said holder for frictionally engaging the upper end of the container to cause it to rotate with said holder at said selective spinning station.

13. The combination defined in claim 12 wherein said radially movable means in said holder comprises at least two spring loaded elements, and wherein each of said chuck means further includes an axially reciprocable plunger for engaging the upper end of the container to release it from said holder against the bias of said spring loaded elements, and said means at said discharge station for releasing containers being operable to urge said plunger downwardly.

14. The combination defined in claim 13 wherein said means at said discharge station comprises a vertically reciprocable release member mounted in said machine, and wherein said chuck means further includes a radially outwardly extending flange collar slidably mounted on said holder and connected to said plunger for movement therewith, and means for moving said release member downwardly in timed relationship with said turret indexing movement.

15. The combination defined in claim 14 further characterized by a second release member, and means for moving said second release member at said subsequent reject station to operate one of said plungers for releasing a container.

16. The combination defined in claim 11 wherein said means for selectively spinning each chuck means at least during the dwell interval at one of said machine stations comprises a plurality of electric motors each of which is drivingly connected to one of said chuck means and each of which has a pair of conductors associated therewith, a control shaft upon which said turret is rotatably supported in said machine, a slip ring on said shaft, a fixed brush for said slip ring, a commutator

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on said shaft and having at least as many distinct conductive angular segments as said turret has electric motors, and a fixed brush for said commutator, said pair of electric motor conductors being connected to said segments respectively to allow selective energizing of said spin motors during at least said dwell interval at said one machine station.

17. The combination defined in claim 11 further characterized by means for illuminating the container from below at said inspection station to illuminate any foreign particles present in the swirling liquid, said means comprising a source of light, and a lens system for focusing said light entering the bottom of said container.

18. The combination defined in claim 16 further

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characterized by at least one additional fixed brush associated with said commutator, and means for selectively connecting said additional brush to the same electric potential as that of said slip ring associated brush to brake said spin motor prior to said inspect station.

19. The combination defined in claim 18 wherein said means for selectively connecting said additional brush to said slip ring brush includes a two position limit switch operable in response to rotation of said turret to electrically connect said additional brush to said commutator brush when said spin motor is not being braked.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,765,533 Dated October 16, 1973

Inventor(s) Edward John Stephens, Ernest Vader Hart and
Andre Maurice Vandandaigue

It is certified that error appears in the above-identified patent
and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 63, "clrcuitry" should be --circuitry--.

Col. 2, line 1, "ore" should be --one--.

Col. 2, line 10, "sectional" should be --sectional--.

Col. 2, line 39, "Fig. " should be --Fig. 7--.

Col. 3, line 58, "drive" should be --drive--.

Col. 6, line 20, "menas" should be --means--.

Col. 8, line 28, "menas" should be --means--.

Signed and sealed this 11th day of June 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents