United States Patent

Howard

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[54] CLOCK MECHANISM ACTUATED BY SUCCESSIVELY SUPPLIED BALL WEIGHTS

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[51] **Int. Cl.** **G04b 45/00**

[58] **Field of Search** 58/1, 2, 29, 30, 129, 130, 58/144

[56] **References Cited**

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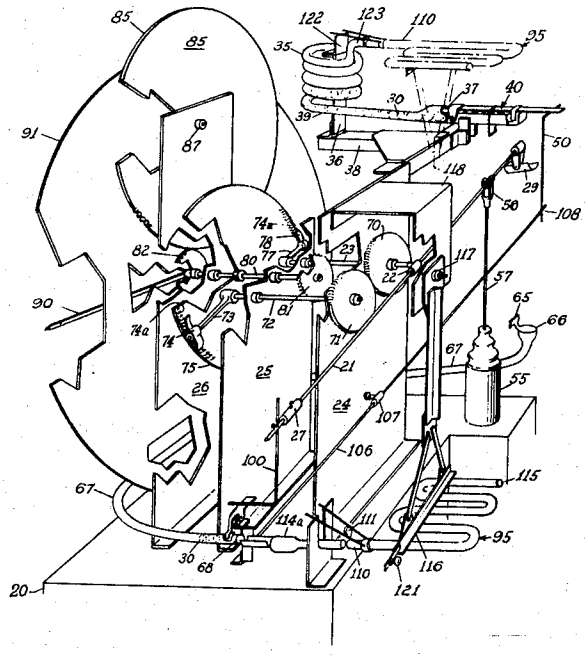
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[57] **ABSTRACT**

A clock mechanism actuated by a large number of separate ball weights which are fed individually from a supply chamber into a cup on a counterweighted pivoted motion arm or balance lever. The weight of each successive ball overcomes the counterweight of the lever and swings it about its pivot until the ball cup moves to a position where the ball drops from the cup and permits the lever to swing back to its counterbalanced position. The lever is connected to suitable mechanism so that this movement of the lever produces a predetermined advance of indicators of the clock to indicate correct time. The balls discharged successively from the ball cup are collected and supplied to the ball supply chamber for re-use in actuating the indicator mechanism.

10 Claims, 6 Drawing Figures



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SHEET 1 OF 2

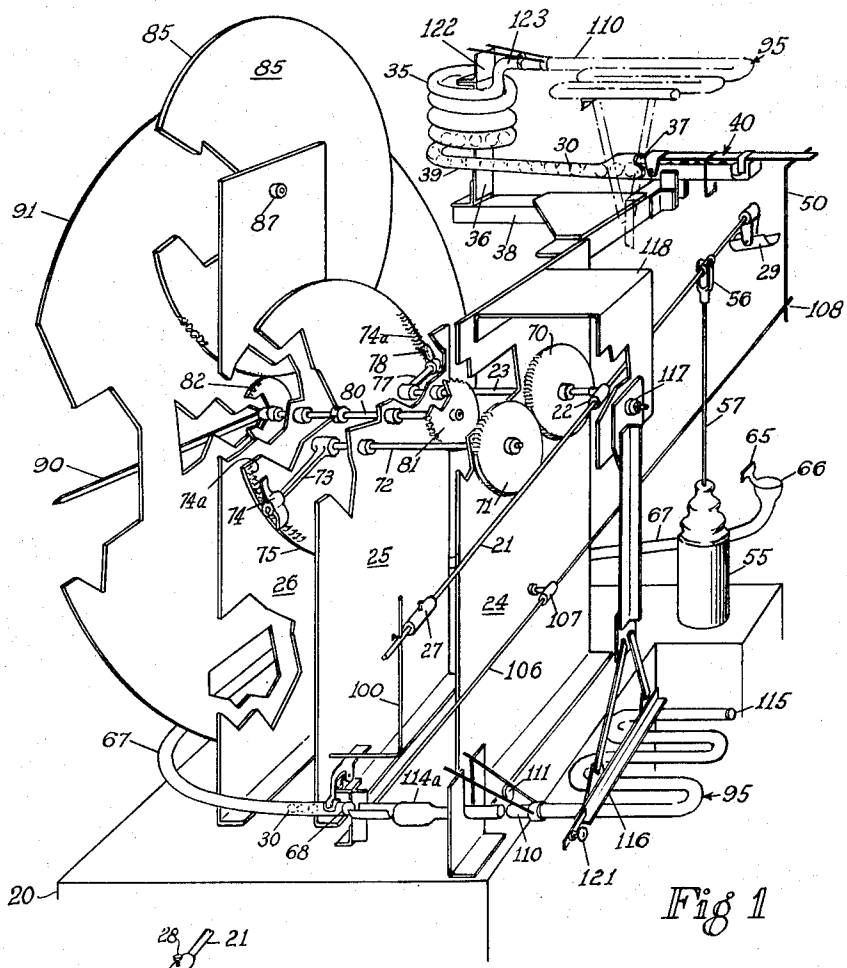


Fig 1

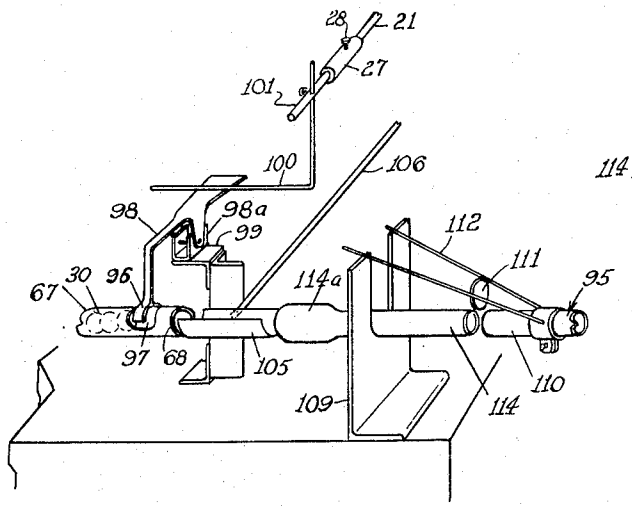


Fig 2

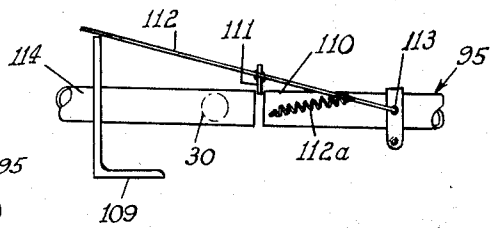


Fig 3

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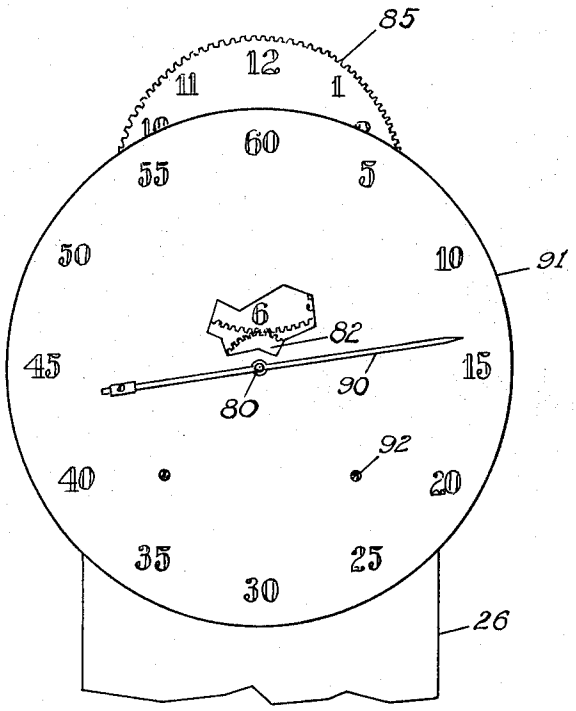


Fig 4

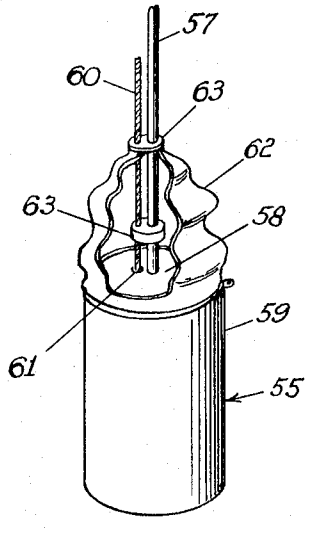


Fig 5

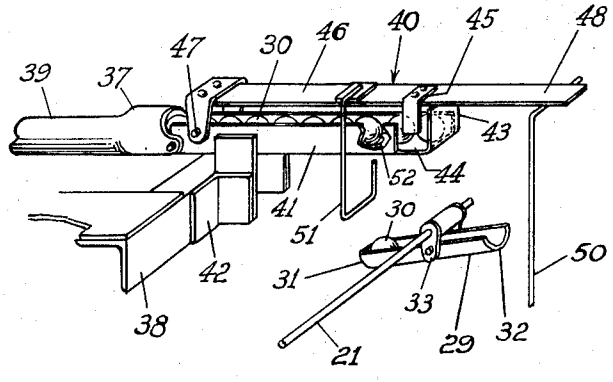


Fig 6

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CLOCK MECHANISM ACTUATED BY SUCCESSIVELY SUPPLIED BALL WEIGHTS

The present invention provides a completely different type of mechanism for actuating a clock. As indicated, it includes the feeding of ball weights individually into cooperation with the indicator mechanism to produce its movement. It permits a completely different clock design. The design of the clock is preferably such that the movement of the balls and associated mechanism can be seen so as to be interesting to the observer. The mechanism is such that simple inexpensive parts are employed and are so arranged as to eliminate heavy points of wear. Thus, the parts of this mechanism will have long wear but if they need to be replaced, they can be replaced by other than highly skilled craftsmen.

The best mode contemplated in carrying out this invention is illustrated in the accompanying drawings in which:

FIG. 1 is a perspective view, partly cut away, of the clock.

FIG. 2 is a perspective view showing part of the ball return mechanism and the mechanism for actuating the ball-ejector unit.

FIG. 3 is a side elevational view showing the gate mechanism for the ball-return unit.

FIG. 4 is a front elevational view, partly cut away, of the indicating mechanism of the clock.

FIG. 5 is a perspective view, partly cut away, showing the dash-pot unit.

FIG. 6 is a perspective view showing the ejector unit for the ball supply chamber.

With specific reference to the drawings, all of the clock mechanism is shown mounted on a base plate 20 in FIG. 1. Preferably, the mechanism is not enclosed or is enclosed within a transparent housing so that the mechanism in action can be seen.

The main actuating member of the clock mechanism according to this invention is the counterbalanced motion arm or lever 21. This arm is in the form of an elongated rod which is pivoted for swinging or oscillating movement in a vertical plane by being fixed at 22 to a rotatable shaft 23. The shaft 23 is mounted in a horizontal position for rotation about its axis in upstanding support plates which are fixed in parallel vertical planes on the base plate 20. These plates 24 and 25 are associated with a taller plate 26 which is also fixed on the base plate 20 and is disposed parallel to the plate 25 and forwardly thereof. The arm 21 has mounted on one end a counterweight in the form of a sleeve 27 which can be axially adjusted along the rod and be fixed in adjusted position by means of a set screw 28. The opposite end of the rod 21 carries a cup 29 for receiving individual ball weights 30 successively. This cup is shown best in FIG. 6 and is trough-shaped having a closed end 31 and an open end 32. It is pivoted for vertical swinging movement to the rod 21 in a plane transversely of the axis thereof by means of a yoke 33. The trough-shaped cup 29 is so pivoted that it is unbalanced so that the closed end 31 normally swings downwardly, as indicated in FIG. 6, so that a ball 30 supplied thereto will assume a position at the lower closed end of the cup.

The balls 30 may be of any suitable material but must be uniform so that they will all be of an exact weight for proper actuation of the clock. They are initially disposed in a ball supply chamber. This chamber is preferably in a transparent tube 35 so that the balls will be visible therein. The tube 35 is preferably of spiral form and is supported by an upstanding support 36 carried by a shelf 38 supported by the plate 24. The tube 35 may be extended from the position shown to be more readily visible from the front side of the clock. The lower portion 39 of the tube is inclined so as to feed the balls 30 therein successively toward its discharge end 37 where a ball ejector unit 40 is located, as indicated in FIGS. 1 and 6.

This unit 40 is designed to eject one ball 30 at a time into the trough shaped cup 29 when it is in its initial upper position as determined by the counterweight 27 on the arm 21. The balls 30 will continue to roll into the unit 40 from the tube end 37 as they are ejected individually therefrom. This unit 40

comprises a trough-shaped ball magazine 41, supported from the shelf 38 by a support 42, in alignment with the discharge end 37 of the tube 35 in slightly downwardly inclined position. Its outer end is closed at 43 but it has a laterally directed outlet 44 near its closed end. This outlet 44 is normally closed by a depending gate 45 carried by a ball ejector head 46. The head 46 is pivoted at its inner end, at 47, to the magazine 41 and extends along and above the magazine to provide an extension 48 projecting beyond the closed end 43 of the magazine. This extension is connected at its outer end to a downwardly extending kicker wire 50 which is moved vertically, in a manner to be described later, to swing the head 46 upwardly about its pivot 47. Upward swinging of the head 46 moves the gate 45 upwardly to clear the discharge outlet 44 so that a ball 30 can roll therethrough and drop into the closed end 31 of the trough-shaped cup 29. At the same time that gate 44 is raised, a stop wire 51 is raised through an opening 52 in the bottom of the trough-shaped magazine 41 so as to move in front of the ball following the one being discharged through the outlet 44 to hold back it and all the following balls, during the ejection of the leading ball in the magazine. This wire is carried by and depends from the head 46 and is arranged so as not to interfere, during its vertical movement, with the magazine. When the head 48 is returned to its lower position, wire 51 is withdrawn downwardly from the magazine and gate 45 is closed as indicated in FIG. 6.

As each ball 30 drops into the cup 29, it rests in its closed end 31 and its weight is sufficient to overcome the counterweight 27 and swing the cup end of the arm 21 downwardly. To control this downward movement so that it occurs at a proper speed to move the clock mechanism to properly indicate time, a dashpot unit 55 is provided, as shown in FIGS. 1 and 5, and is connected to the cup end of the rod 21 by means of a clevis 56 on the upper end of its upstanding piston rod 57. The lower end of the piston rod 57 carries the piston 58, as shown in FIG. 5, for vertical movement in the cylinder 59. The piston 58 will fit the cylinder 59 with close tolerance but the fluid in the cylinder will flow past it during its up and down movement in the cylinder. To control speed of movement of the piston 58 in the cylinder 59, a needle valve 60 is provided which has a tapered lower end for cooperating with a complementally tapered valve flow orifice 61 in the piston 58. The top of the cylinder 59 is sealed by a dust-proof seal consisting of a bellows sleeve 62 which extends up around the piston rod 57. The needle valve 60 is threaded into lugs 63 on the lower portion of the rod 57 for vertical adjustment and its upper end projects from the sleeve 62. Thus, by selective adjustment of the needle valve, the resistance of the fluid in the cylinder 59 to downward movement of the piston 58 can be varied, thereby controlling the speed of the downward movement of the piston 58, in response to the supply of a ball 30 into the cup 29, which produces downward swinging movement of that end of the motion arm 21.

The cup end of the motion arm 21 will swing downwardly under the influence of the ball weight 30, as indicated above, until the closed end 31, of the cup-shaped trough 29 strikes a stop member 65 (FIG. 1) provided at the upper end of a funnel-shaped inlet 66 on a ball-receiving tube 67. This will pivot the closed end 31 of the member 29 upwardly and its open end 32 downwardly so that the ball 30 will roll into the inlet 66 and then on into the tube 67. The tube 67 is preferably transparent and extends around the front of the clock so that it can be seen readily, being supported in inclined relationship toward its outlet end 68 by the plate 26. As soon as the ball weight 30 rolls from the trough-shaped cup 29, the counterweight 27 will act to swing that end of the arm 21 downwardly to move the cup upwardly again into position to receive a ball from the ejector unit 40. The cup will be accurately stopped in this position by the piston 58 moving to its uppermost position in the cylinder 59.

Downward swinging movement of the cup end of the arm or lever 21 in the manner described rotates the shaft 23 about its axis which, in turn, rotates the gear 70 (FIG. 1) keyed thereon

in a counter-clockwise direction (as viewed from the front of the clock.) The gear **70** meshes with and rotates the gear **71** in an opposite or clockwise direction. The gear **71** is keyed on the rear end of a shaft **72** which is rotatably mounted in bearings carried by the plates **24** and **25** to be parallel to the shaft **23**. The forward end of this shaft **72** has an arm **73** keyed thereon with a "down" ratchet **74** mounted on its outer end for engagement with the ratchet teeth **74a** on the rear side of a ratchet gear **75**, it being understood that this ratchet is so balanced that the lower toothed end normally engages the ratchet teeth. Thus, downward swinging of the cup end of motion arm **21** will produce rotation of the ratchet gear **75** in a clockwise direction. Upward movement of the cup end of the arm **21** will rotate the shaft **23** in a clockwise direction. This shaft has fixed on its forward end an arm **77** which carries on its outer end an "up" ratchet **78** for engaging the teeth **74*a*** on the gear **75**, this ratchet being balanced so that its upper toothed end normally engages the ratchet teeth. Thus, upward movement of the cup end of the arm **21** also produces clockwise advance of the gear **75**. It will be noted that the gear **75** is keyed on the forward end of a shaft **80** which is carried for rotation in bearings on the plates **25** and **26** and is disposed in parallel relationship to the shafts **23** and **72**. The rear end of this shaft has a gear **81** keyed thereon which may drive other mechanisms (not shown) of certain type clocks, such as additional visible members provided in grandfather and grandmother clocks.

The forward end of the shaft **80** has a gear **82** keyed thereon which meshes with and drives an hour dial **85** which has hour-indicating numerals (FIG. **4**) on its front surface successively visible at the front of the clock. The dial **85** is rotatably mounted by a shaft and bearing **87** on the upper end of the support plate **26**. Thus, upward or downward swinging of the cup end of the arm **21** drives the hour-indicating dial **85** to advance it step-by-step in a clockwise direction. The ratio of teeth on the drive gear **82** and the hour dial **85** is selected to advance the dial at proper hour-indicating speed. In addition, a minute hand **90** is keyed on the outer end of the shaft **80** and is disposed forwardly of and in cooperative relationship with a minute-indicating dial **91** at the front of the clock. This dial is mounted in a fixed position by bolts and spacers **92** in the plate **26**. The size of the dial **91** is such and it is so calibrated relative to the advance movement of the pointer **90**, that the pointer will indicate proper time in minutes.

The balls used in the manner described above to actuate the time-indicating mechanism are returned to the ball supply chamber **35** by the ball return unit **95** illustrated in FIGS. **1, 2** and **3**. This action will, in effect, be the same as rewinding or reenergizing the usual clock mechanism. Control of the feed of the used balls **30** from the discharge end **68** of the inclined tube **67** for passage into the unit **95** is under the control of a gate **96** (FIGURE **2**) and an actuating lever **98** which extends through an opening **97** into the tube **67**. The actuating lever **98** is arranged for vertical swinging movement on a pivot bracket **98*a*** which is mounted on supporting member **99** attached to the base **20**. To open the gate, the outer end of the lever **98** is engaged by a trigger wire **100** which is mounted for vertical adjustment at **101** on the counterweighted end of the motion arm **21**. Thus, when the counterweighted end of the arm **21** swings downwardly, the wire **100** strikes the lever **98** and opens the gate **96** to permit a ball **30** at the discharge end **68** of the tube **67** to roll from the tube. As soon as the arm **21** rises, the gate **96** will again close, to interrupt discharge of any ball **30** moving to the discharge end **68**.

When a ball **30** rolls from the discharge end **68** of the tube **67**, it rolls into a ball-receiving trough **105** which is carried on the outer end is atapted to actuate the a kicker arm **106** which is adapted to actuate the ball ejector unit **40**. The arm **106** is pivoted for vertical swinging movement to the plate **24** (FIG. **1**) at **107** and its opposite end is pivotally connected to the lower end of the wire **50** at **108**. The weight of a ball **30** in the trough **105** will cause the trough to drop slightly, since the arm **106** is balanced about the pivot **107**. This will swing the arm **106** about its pivot **107** slightly to move the wire **50** upwardly and, as previously indicated, this will actuate the ejector unit **40** to eject one ball therefrom into the cup **29** to actuate the motion arm **21**. The trough **105** is inclined toward a tube **114**, carried by a bracket **109** on the base **20**, so that a ball will roll from the trough into the tube, since its wide-mouth inlet end **114*a*** will be substantially aligned therewith even when the trough drops slightly to actuate the ejector unit **40**. The tube **114** is inclined so that a ball that rolls thereinto will roll on to the discharge end thereof which is aligned with the inlet end of the tube **110**, of the ball return unit **95**, which is also preferably transparent. At the inlet end of the ball catcher tube **110**, which is preferably of serpentine form, there is provided a gate **111** which is vertically movable between the adjacent ends of the aligned tubes **114** and **110** as shown in FIG. **2**. This gate is carried by the wire fingers **112**, pivoted to the tube **110** at **113**. For swinging movement in either direction a beyond-center snap action spring **112*a*** is associated with the fingers **112**. When the tube **110** swings to its lowermost position, in a manner to be explained, the outer ends of the fingers **112** engage the bracket **109** and lift the gate **111** to allow a ball **30** to roll from the tube **114** into the tube **110**. When the tube **110** is raised, the gate **111** will close to retain the balls in the tube **110**.

The tube **110**, in ball-receiving position, as shown in FIG. **1**, will be inclined so that the balls **30** will readily roll thereinto from the trough **105** and on to the opposite closed end **115** thereof. The tube **110** is mounted on a support **116**, pivoted at **117** to a bracket **118** fixed to plate **24** for movement in a vertical plane. The support **116** has a handle **121** carried at one end thereof by means of which the unit **95** may be swung about the pivot **117**. When unit **95** is swung upwardly to the position shown in broken lines in FIG. **1**, the gate fingers **112** will strike the bracket **122** on the inlet end of the tube **35** and move in a reverse direction to open the gate **111**. At this time, the end of the tube **110** will be in alignment with the inlet end **123** of the tube **35** and all the balls **30** in the tube **110** will roll into the tube **35**. Then the tube **110** may be returned to its lowermost position, as shown in full lines in FIG. **1**, where the gate **111** will be opened by the fingers **112** again contacting bracket **109**. The gate **111** will automatically close during swinging movement of the tube **110** but will be positively opened at its upper and lower positions.

The number of balls **30** used in energizing the clock will be selected to keep the clock operation for a desired period of time. The unit **95** may be actuated at will to replenish the balls in the tube **35** to keep the clock operating constantly.

In summarizing, the operation of this clock mechanism, assuming that a supply of balls **30** is in the tube **35** and that the ball ejector unit **40** is actuated to release a single ball and permit it to drop into the cup **29** which will be on the adjacent raised end of the motion arm **21** as shown in FIG. **21**, the sequence of operations will be as follows. The weight of the ball in the cup **29** will overcome the counterweight of the arm **21** and will move the cup end of the arm downwardly. The speed of this downward movement will be controlled by the dashpot **55**, the needle valve **60** of which has been previously set as described above. The arm **21** will continue to move downwardly until the cup **29** strikes the lug **65** and the cup is pivoted to discharge the ball **30** into the wide mouth **66** of the tube **67**. Immediately upon discharge of the ball, the cup end of the arm will start to move upwardly and return to its original position shown in FIG. **1**. Vertical swinging movement of the arm **21**, as indicated, will actuate the indicating mechanism so as to turn the hour-indicating dial **85** and the minute hand **90**, as previously described. Each ball **30** which successively enters into the tube **67** will roll around to the discharge end **68** thereof. As the counterweighted end of the arm **21** moves to its lowermost position, the trigger wire **100** strikes the lever **98** to open the gate **96** and allow the ball to roll across the trough **105** so as to move the kicker arm **106** slightly downwardly. As previously indicated, this will exert an upward push on the wire **50** to actuate the ejector unit **40** and

allow another ball to drop from the unit into the cup **29**, which, at this time, will have been returned to its uppermost position shown in FIG. **1**. Thus, the balls are successively released by the unit **40** to actuate the arm **21** at proper intervals which are determined by release of the balls from the cup **29**.

After the balls **30** successively pass through the trough **105**, they enter the ball return unit **95** where they collect in the tube **110**. When it is desired to return the collected balls into the supply tube **35**, the tube **110** is swung around the pivot **117** to its uppermost position indicated in FIG. **1**. As the tube **110** moves from its lowermost position where the gate **111** is open, the gate closes and stays closed to retain the balls therein until the tube reaches its uppermost position where the gate is again opened by the fingers **112** striking the bracket **122**. Then, since the inclination of the tube **110** will be reversed, as compared to its inclination when in its lowermost position, the balls **30** will roll out of the tube **110** and into the tube **35**.

It will be apparent from the above that this clock mechanism is actuated by a series of ball weights which can be observed in their movement and which result in movement of the clock mechanism which will also be interesting to the observer. Simple, inexpensive parts are employed and are so arranged as to eliminate heavy points of wear. Thus, the parts of the mechanism will last for long periods of time, but if they need to be replaced, they can be replaced by other than highly skilled craftsmen.

Having thus described my invention, what is claimed is:

1. A clock mechanism comprising indicating mechanism, means for actuating said indicating mechanism, said means comprising a motion arm, means for operatively connecting said motion arm to said indicating mechanism, said motion arm being pivoted intermediate its ends for vertical oscillating movement and being counterweighted at one end to normally raise its opposite end, a weight-receiving cup at said opposite end, means for feeding individual weights successively into said cup to overcome the counterweight of the arm and move the cup end downwardly, and weight-receiving means located to receive a weight discharged from said cup when the cup end of the arm reaches a predetermined downward position and then begins its return upward movement.

2. Clock mechanism according to claim **1** including yieldable means connected to said motion arm to resist and control the speed of downward movement of the cup end of said arm.

3. Clock mechanism according to claim **2** in which said yieldable means comprises a fluid-type dashpot connected to the cup end of said motion arm and having an adjustable flow-valve to set the speed of downward movement of said cup end of the arm.

4. Clock mechanism according to claim **2** in which said weight-feeding means comprises a supply chamber for the individual weights and an ejector unit for controlling the successive ejection of the weights therefrom into said cup, and control means controlled by downward return movement of said counterweighted motion end of said arm to its initial position resulting from discharge of a weight from said cup, to actuate said ejector unit.

5. Clock mechanism according to claim **4** in which the weights are in the form of balls, said supply chamber being in the form of a tube for holding a supply of balls and feeding them by gravity to a discharge outlet where said ejector unit is located, said means for receiving the weights comprising a tube for receiving and feeding the ball weight discharged from said cup to an outlet end, a release gate at said end having means contacted by the counterweighted end of said motion arm to open it and release a ball weight, and said control means comprising trigger means actuated by said released ball weight to actuate said ejector unit.

6. Clock mechanism according to claim **5** in which said trigger means comprises a weight-receiving pocket carried by a kicker arm which is operatively connected to said ejector unit and is moved by the weight as it moves into said pocket.

7. Clock mechanism according to claim **6** in which the pocket is inclined so that the weight will roll therethrough, and a weight-collecting chamber normally in cooperation with said pocket for receiving and accumulating the successive weights.

8. Clock mechanism according to claim **7** in which said ball weight supply chamber tube has an inlet and said weight-collecting chamber is in the form of a tube having an opening, a movable gate for controlling said opening, and means for normally holding said gate open when said weight-collecting tube is in cooperation with said pocket, said tube being inclined toward a closed end, said weight-collecting tube being movable to an inverted position to its opening in cooperation with said inlet of said weight-supply tube and to reverse the inclination of said collecting tube so that the balls will roll toward said gate, and means adjacent said supply tube for opening said gate to permit the balls to roll into said inlet of the supply tube.

9. Clock mechanism according to claim **1** in which the means for connecting said motion arm to said indicating mechanism comprises a ratchet gear keyed on a shaft which provides the pivot for said motion arm which is keyed thereon, and a pair of ratchet devices connected to said shaft for respectively engaging said ratchet gear to drive it in a clockwise direction only upon rotation of said shaft in opposite directions by swinging of said arm in opposite directions about said shaft, said indicator mechanism being connected to and actuated by said ratchet gear.

10. Clock mechanism according to claim **1** in which said weight-receiving cup is pivoted to the end of said motion arm for receiving one of the weights supplied from said chamber, said weight-receiving means comprising a pocket, and means for engaging said cup as the cup end of the arm moves near the extent of its downward movement to move the cup to discharge the weight into said pocket.

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