Nov. 9, 1926. 1,606,400

G. L. CHENEY

AUTOMATIC LABORATORY FILTER

Filed Feb. 24, 1925 2 Sheets-Sheet 1

Fig. 1.

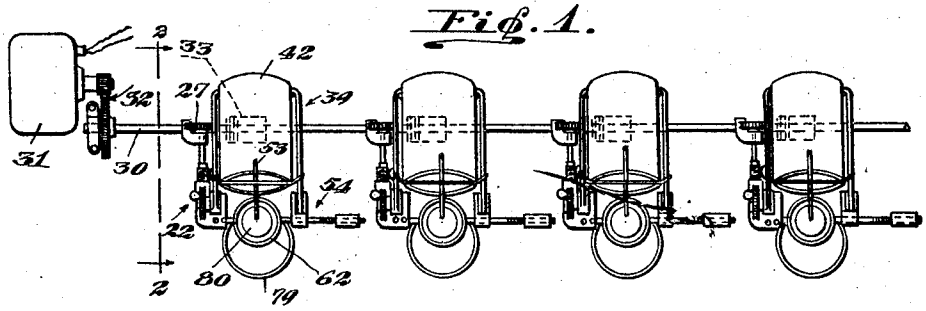


Fig. 2.

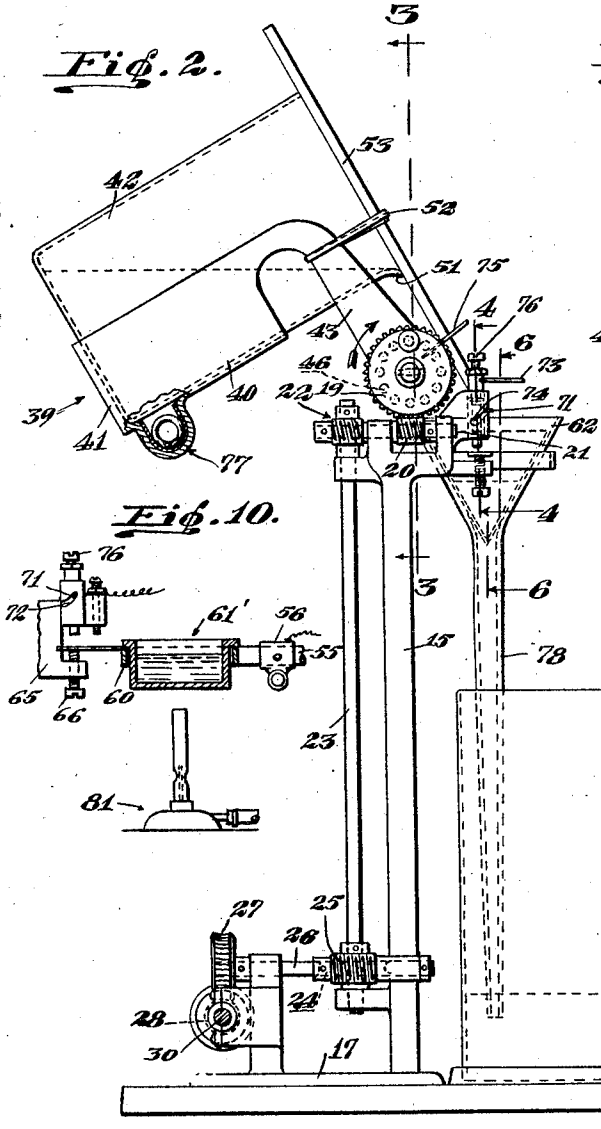


Fig. 3.

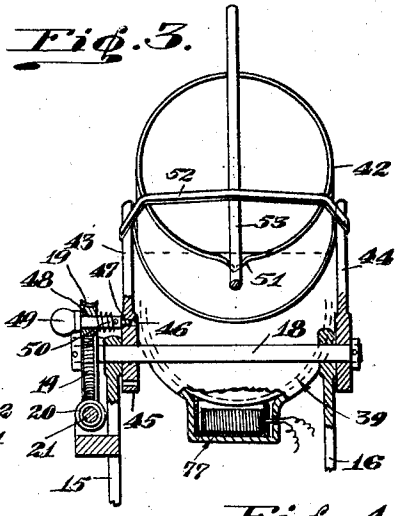
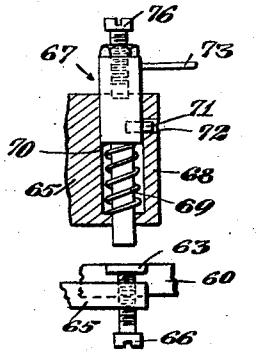


Fig. 10.

Fig. 4.



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Fig. 5.

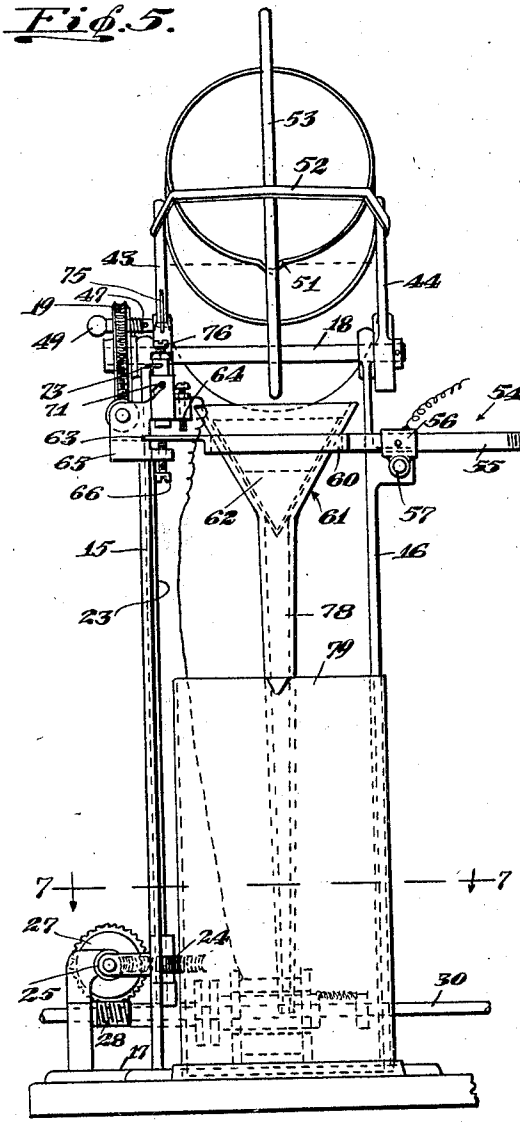


Fig. 6.

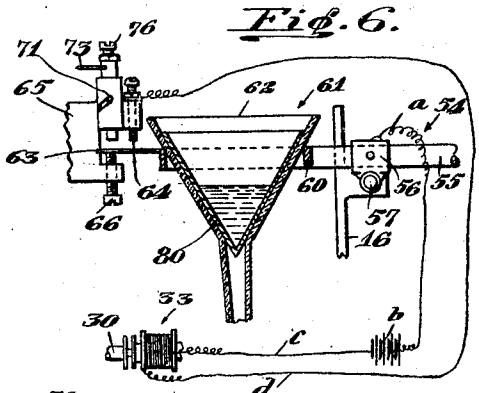


Fig. 7.

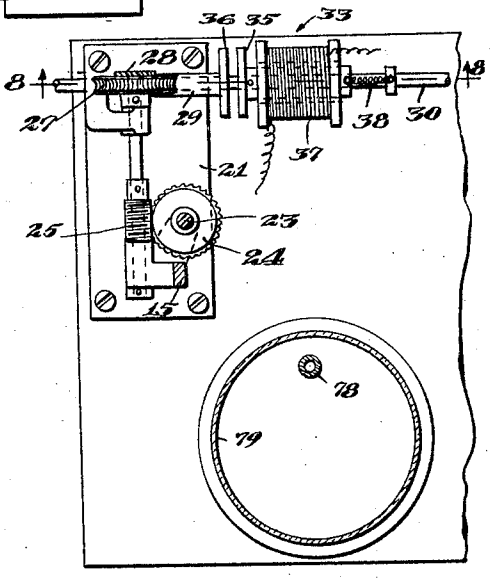


Fig. 8.

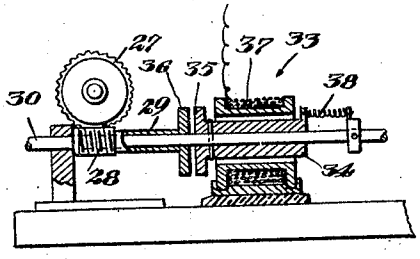
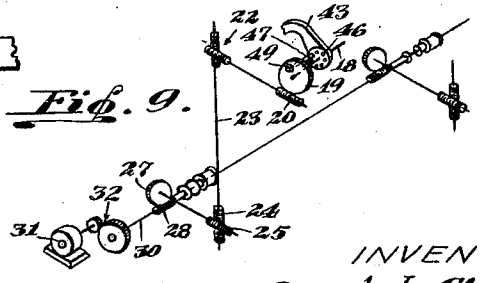


Fig. 9.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC LABORATORY FILTER.

Application filed February 24, 1925. Serial No. 11,201.

This invention particularly pertains to an apparatus which is especially adapted for use in laboratory operations in pouring a liquid from one receptacle into another, and has as its primary object the provision of a mechanically operated means for effecting the pouring operation adapted to be automatically controlled to regulate the flow or feed of a liquid from a beaker in filtering, decanting, evaporating and washing operations, and the like, thereby performing such operations mechanically instead of manually, as is now generally practiced in laboratory work, thereby effecting a saving of time and labor and obviating a tedious manual operation in laboratory practice.

Another object is to provide a mechanically operated apparatus of the above character which is adapted to be readily adjusted to meet varying conditions.

Another object is to provide an automatically actuated pouring mechanism which is capable of functioning with great precision and accuracy and is thereby rendered efficient and dependable in its operation.

Another object is to provide a pouring mechanism which is particularly advantageous for use in slow or long-continued operations.

A further object is to provide a means in a mechanism of the above character whereby the liquid being poured may be heated and maintained at various predetermined temperatures as occasion may require.

The mode of carrying out the foregoing objects, as well as such objects and advantages of the invention as may subsequently appear, is hereinafter described and is illustrated by way of example in the accompanying drawings in which the several views depict constructions and arrangements of elements and parts whereby the invention may be carried into effect.

Referring to the drawings the several views are as follows:—

Figure 1 is a plan view of an apparatus showing the invention as applied to an automatic gang filter;

Figure 2 is a view in side elevation as seen on the line 2—2 of Figure 1;

Figure 3 is a view in vertical section and elevation as seen on the line 3—3 of Figure 2;

Figure 4 is a detail in section and elevation as seen on the line 4—4 of Figure 2;

Figure 5 is a view in front elevation of the device shown in Figure 2;

Figure 6 is a fragmentary detail in vertical section and elevation as seen on the line 6—6 of Figure 2;

Figure 7 is a view in plan and horizontal section as seen on the line 7—7 of Figure 5;

Figure 8 is a detail in vertical section as seen on the line 8—8 of Figure 7;

Figure 9 is a view illustrating the operation of the mechanism in diagram;

Figure 10, Sheet 1, is a fragmentary detail in front elevation illustrating the invention as applied in evaporating operations.

Referring to the drawings more specifically, 15 and 16 indicate a pair of uprights or standards mounted on a base 17 upon the upper ends of which standards is journalled a rock shaft 18 adapted to be driven from any suitable source of power, being here shown as fitted with a worm wheel 19 meshing with a spiral gear 20 fixed on a rotary shaft 21 journalled in suitable bearings on the standard 15 which shaft 21 is connected by gears indicated at 22 with a vertical shaft 23 supported in suitable bearings on the standard 15. The lower end portion of the vertical shaft 23 is fitted with a worm wheel 24 meshing with a spiral gear 25 on a horizontal rotary shaft 26 supported in suitable bearings adjacent the base 17 and fitted with a worm wheel 27 meshing with a spiral gear 28 fixed on a sleeve 29 loosely mounted on a drive shaft 30, and which drive shaft is adapted to be rotated continuously independent of the sleeve 29 by means of a motor 31 or other suitable source of power through the medium of transmission gears 32. The sleeve 29 is adapted to be placed in operative connection with the shaft 30 to be rotated with the latter, and thereby effect a slow turning movement of the worm

wheel 19 through the medium of the driving connections leading from the sleeve 29 to said worm wheel, just described. Interconnection of the sleeve 29 with the shaft 30 is effected by means of an electro-magnetic clutch 33, particularly shown in Figure 8, which clutch embodies a tubular core 34 splined on the shaft 30 to rotate therewith and to have movement longitudinally thereon. The core 34 is formed with a friction disk 35 on one end thereof which is adapted to be moved in and out of engagement with a complementary disk 36 formed on the sleeve 29, and when in engagement with the disk 36 operates to effect rotation of the sleeve 29 on rotation of the shaft 30. The core 34 is encircled by the coils 37 of an electro-magnet, on the energization of which the core is moved longitudinally on the shaft 30 in opposition to a spring 38, into engagement with the sleeve 29 the spring operating on deenergization of the magnet to retract the core 34 and dispose it in its normal position out of engagement with the sleeve 29. The manner of effecting energization of the magnet coils 37 will be later described.

Pivotally mounted on the rock shaft 18 is a beaker carrier 39 comprising a semi-cylindrical tray 40 having an end wall 41 in which tray a beaker 42 is adapted to be positioned with the bottom of the beaker seating on the end wall 41 of the tray and with the side wall of the beaker resting in the curved side wall of the carrier. The carrier further includes a pair of spaced arms 43 and 44 which extend from one end of the tray in fixed relation thereto and are bent to extend outwardly in parallel relation substantially at right angles to the tray, and have their outer ends journalled on the rock shaft 18 the arm 43 being formed with a disk 45 extending parallel to the worm wheel 19 adjacent the latter. The disk 45 is formed with an annular row of apertures 46 adapted to be engaged by a spring pressed pin 47 mounted to slide longitudinally in an opening 48 formed in the worm wheel 19, whereby an adjustable connection is effected between the worm wheel 19 and the carrier. The connecting pin 47 is formed with a head 49, which projects from the outer face of the worm wheel 19 whereby the pin may be readily grasped and retracted in opposition to a spring 50 to withdraw the inner end of the pin out of engagement with an aperture 46 and whereby the pin may be readily engaged with any one of said apertures 46. This arrangement permits connection of the carrier 39 with the worm wheel 19 in various positions relative to the axis of the rock shaft 18 so that the carrier 39 with the beaker 42 thereon may be quickly disposed at various inclinations to the horizontal, and whereby the beaker may be readily initially disposed in a position such that a slight rotary movement of the worm wheel 19 will act to tilt the beaker to a position that will permit the contents of the beaker to flow from the spout 51 thereof; the beaker being positioned in the carrier 39 with the spout 51 arranged at the lowermost portion of the mouth of the beaker. As a means for holding the beaker in place on the carrier, a resilient band or strap 52 is engaged with the arms 43 and 44 and carried over the open end of the beaker and engaged with a rod 53 arranged diametrically across the open end of the beaker and seating on the margin of the spout 51; the rod 53 projecting beyond the margin of the spout and serving as a conveyor of the liquid flowing from the spout, and acting to prevent the liquid from flowing from the spout onto the outer surface of the beaker by capillary attraction.

Pivotally mounted on the standard 16 adjacent the upper end thereof is a balanced rocker arm 54 which embodies a shank 55 carrying a sleeve 56 pivoted at 57 on the bracket carried by the standard 16; the rod 53 having a threaded outer end portion 58 on which is screwed a counterweight 59. The inner end of the rod 55 connects with an annulus 60 adapted to serve as a support for a receptacle 61, into which the liquid poured from the beaker is delivered from the lower end of the rod 53. This receptacle 61 may comprise a funnel 62, as shown in Figures 1, 2, 5 and 6, where the apparatus is to be employed for filtering, washing, or decanting purposes, or may constitute a crucible 61', as shown in Figure 10, where the apparatus is to be employed for evaporating purposes. The rocker arm 54 is designed to normally extend substantially horizontal; the weight 59 being adjusted on the shank 55 to establish such a balanced condition of the rocker arm as to normally maintain the rocker arm in a predetermined position. Movement of the arm 54 is employed to automatically control the flow of liquid from the beaker, and to this end is adapted to control energization of the electro-magnet coils 37. For this purpose the arm 54 is fitted with a switch contact finger 63 here shown as carried on the annulus 60 and which contact finger is electrically connected in an electric circuit in which the electro-magnet coils 37 are connected, through a conductor *a*; here shown as leading to one terminal of a battery *b* or other source of electrical supply and from the other terminal of which battery leads a conductor *c* connecting with the electro-magnet coils 37. The other terminal of the magnet coils 37 connect with a conductor *d* leading to an adjustable contact point 64 arranged to effect electrical connection with the finger 63 on upward movement of the latter through the influence of the weight 59. The contact 64 is here

shown as comprising a screw which is carried on and insulated from a bracket 65 affixed to the upper portion of the standard 15. Means are provided for limiting downward movement of the inner end portion of the arm 54 carrying the annulus 60 which is here shown as comprising a set screw 66 screwed in a projection on the bracket 65 and extending vertically beneath the finger 63 in such position that the finger in moving downwardly under a load imposed on the receptacle 61 will abut against the upper end of the screw 66 and thereby stop and limit downward movement of the receptacle-carrying end portion of the arm 54, in which position the contact finger 63 will be spaced from and out of electrical connection with the contact point 64. Means are provided for locking the contact finger 63 out of electrical connection with the contact point 64 so that the circuit through the magnet 37 will not be closed on removing the load from the receptacle-carrying end of the arm 54. This means is illustrated in Figure 4 and is here shown as embodying a bolt 67 reciprocally and turnably mounted in a guideway 68 formed on the bracket 65; the bolt 67 extending vertically with lower end projecting downwardly from the guideway and terminating above the finger 63. The bolt is normally disposed in a retracted position by means of a spring 69 arranged interiorly of the guideway 68 and bears upwardly against a shoulder 70 on the bolt in such manner as to yieldably oppose downward movement of the bolt. Projecting from the side of the bolt is a pin 71 which extends into an inclined slot 72 formed in the guideway 68, and carried at the upper end portion of the bolt projecting above the guideway 68 is a handle 73 by which the bolt may be manually rotated so as to cause the pin 71 to advance longitudinally of the inclined slot 72 and thereby cause the bolt to be moved longitudinally either up or down. The lower end of the slot 72 extends horizontally to provide a shoulder 74 adapted to engage the pin 71 to hold the bolt in its lowermost position in opposition to the spring 69.

Means are provided for automatically depressing the bolt 67 to effect depression of the contact finger 63 and thereby break the circuit through the electro-magnet 37 so as to stop turning movement of the worm wheel 19 when the latter reaches a predetermined position and thus prevent excessive movement of the beaker-carrier 39. This means is here shown as comprising a pin 75 projecting from the margin of the disk 45 formed on the arm 43 of the carrier 39; the pin 75 and the bolt 67 being so arranged in relation to each other that the pin 75 on forward rotation of the rock shaft 18 and the disk 45 may move into contact with the upper end of the bolt and on continued movement of the pin effect depression of the bolt. As a means for adjusting the moment of contact of the pin 75 and the bolt, a set screw 76 is screwed into the end of the bolt with the head thereof disposed in the path of travel of the pin 75. Means may be provided for heating the contents of the beaker 42 to maintain such contents at various predetermined temperatures above normal; which means is here shown as comprising an electric heating element 77 consisting of electrical-resistance and conductive coils carried by the beaker carrier 39, and which coils may be connected into an electric circuit in any desired manner through a rheostat in the manner common to heating appliances, and not necessary to be here shown.

In employing the invention as a filter or in decanting or washing operations the funnel 62 is arranged with the stem portion 78 thereof extending downwardly into a jar 79, or other suitable receptacle into which the liquid poured from the beaker 42 is delivered, and the funnel 62 is fitted with a suitable filter lining 80 as shown in Figure 6.

Where the apparatus is to be employed in evaporating operations, a burner 81 or other suitable heating device is arranged beneath the crucible 61' so as to direct heat against the underside of the latter.

The apparatus previously described is obviously adapted to be employed and operated singly, but a plurality of the devices may be assembled and operated from a single drive shaft, as shown in Figure 1, in which four of the pouring mechanisms are illustrated as arranged to be actuated, either singly or collectively, from the main drive shaft. Obviously, any suitable number of the pouring devices may be disposed to be actuated from a single drive shaft, as occasion may require. By thus providing a series of the pouring devices a number of filtering, decanting, washing or evaporating operations may be carried on at one time.

In the operation of the invention, the material to be poured is placed in the beaker 42 and the latter is secured in position on the carrier 39; whereupon the carrier is inclined according to the depth of the liquid in the beaker to bring the surface level of the liquid on such plane that a slight tilting of the beaker will effect a flow of the liquid through the spout 51. In effecting tilting of the carrier 39 in this initial positioning of the beaker, the connecting pin 47 is retracted in opposition to the spring 50 out of engagement with one of the apertures 46 in the disc 45, so that the carrier may be swung to the desired inclined position around the axis of the rock shaft 18; whereupon the pin 47 is engaged with an aperture opposite thereto; thus effecting interconnection of the carrier with the worm wheel 19. The weight 59 is then ad-

justed on the threaded end portion 58 of the shank 55 so as to depress the outer portion of the rocker arm 54 in opposition to the load of the receptacle 61, so that the finger 63 will be moved into an electrical connection with the contact member 64 and thereby close the electrical circuit through the coils 37 of the electro-magnet and thereby effect energization of the latter and thus cause the splined core 34 to advance and move the disk 35 thereon into engagement with the disk 36 on the sleeve 29. Rotation of the shaft 30 will then operate through the transmission mechanism leading therefrom to the worm wheel 19, to effect slow rotation of the latter in the direction indicated by the arrow *a* in Figure 2, thereby slowly increasing the tilt of the beaker so that the liquid content thereof will be slowly discharged and caused to flow along the rod 53 into the receptacle 61. The counter-weight 59 is so adjusted on the rocker arm 54 as to maintain the contact finger 63 against the member 64 until a predetermined volume of the liquid is accumulated in the receptacle 61; whereupon the load thus imposed on the inner end portion of the rocker arm 54 will move the latter in opposition to the counter-weight 59 and thereby cause the finger 63 to move away from the contact member 64 and thus break the circuit through the magnet 37 to deenergize the latter. The spring 38 will then retract the core 34 and thereby throw the latter out of operative connection with the sleeve 29 so that movement of the latter and its connections will be stopped and thereby bring the beaker 42 to rest until the volume and consequent load of the liquid in the receptacle 61 is diminished to such extent that the counterweight 59 will act to again elevate the contact finger 63 into connection with the contact point 64 and thereby cause further tilting of the beaker in the manner before described.

The operation is thus continued until the desired quantity of the contents of the beaker are discharged; the beaker being tilted upward when so desired, to effect complete emptying of the contents thereof into the receptacle. In most instances the apparatus may be left unattended as tilting of the beaker will be automatically discontinued after it has reached such position that the contents thereof will be emptied therefrom by the action of the pin 75 operating through the bolt 67 to move the contact finger 63 so as to break the circuit through the coils 37 of the controlling mechanism. But, should the attendant at any time desire to stop further tilting movement of the beaker, and to place the apparatus out of operation, he may do so by manipulating the stem 73 on the bolt 67 to advance the latter to such position that it will lock the contact finger 63 in its circuit breaking position against the abutment screw 66.

It is to be noted that the worm wheel 19 by reason of being engaged by the worm 20 will be held against retrograde movement whereby the load of the carrier 39 imposed on the wheel 19 will not effect rotation thereof.

After the carrier has been advanced to effect the desired discharge of the contents thereof, the carrier is restored to a retracted position by disengaging the pin 47 therefrom and allowing the carrier to gravitate downwardly to the desired initial position whereupon the pin 47 is again engaged with the carrier to effect connection between the worm wheel and carrier, as before described.

I claim:

1. In an apparatus of the character described, a beaker, a carrier therefor, means for effecting rocking movement of said carrier to tilt said beaker and effect discharge of the contents therefrom, a receptacle arranged to receive materials discharged from the beaker, a support for said receptacle movable under the weight of a predetermined load imposed thereon, and means whereby movement of said support will automaticilly control movement of said carrier.

2. In an apparatus of the character describer, a container for materials to be poured, means for imparting a tilting movement to said container to effect discharge of the materials therefrom, a receptacle arranged to receive the materials discharged from said container, a rockable support for said receptacle adapted to move under a predetermined load of materials discharged from the container, means for yieldably opposing movement of said support under the load of materials imposed thereon, adapted to be adjusted to vary its opposing action, and means controlled by said support for governing tilting movement of said container.

3. In an apparatus of the character described, a container for materials to be poured, a pivotal carrier therefor, means whereby said carrier may be initially disposed and held in various positions around its pivotal axis, power operated means for slowly advancing said carrier to tilt the container to effect discharge of the contents therefor, a receptacle arranged to receive materials discharged from the container, a support for said receptacle movable under the weight of a predetermined load imposed thereon, and means whereby movement of said support will automatically control movement of said carrier whereby the discharge of materials from said container will be controlled.

4. In an apparatus of the character described, a container for materials to be

poured, a pivotal carrier therefor, means whereby said carrier may be initially disposed and held in various positions around its pivotal axis, power operated means for slowly advancing said carrier to tilt the container and effect discharge of the contents thereof, a receptacle arranged to receive materials discharged from the container, a support for said receptacle movable under the weight of a predetermined load imposed thereon, means whereby movement of said support will automatically control movement of said carrier whereby the discharge of materials from said container will be controlled, and means operable when said carrier has reached a predetermined position to automatically stop movement thereof.

5. In an apparatus of the character described, a pivotally supported carrier, a revoluble wheel, means for connecting said carrier to said wheel in various positions in relation thereto, power operated means for rotating said wheel including means for holding the wheel against retrograde movement, a container on said carrier, and load responsive means for automatically controlling movement of said wheel operable to regulate the discharge of materials from said container.

6. In an apparatus of the character described, a pivotally supported carrier, a revoluble wheel, means for connecting said carrier to said wheel in various positions in relation thereto, power operated means for rotating said wheel including means for holding the wheel against retrograde movement, a container on said carrier, means for automatically controlling movement of said wheel operable to regulate the discharge of materials from said container, and means for limiting the movement of said wheel in one direction whereby excess tilting of the container will be inhibited.

7. In an apparatus of the character described, a container carrier, a pivotal support for said carrier, a worm wheel arranged with its axis of rotation aligned with the axis of the pivotal mounting of said carrier, said carrier and worm wheel being mounted to move independent of each other, means for detachably connecting said carrier to said wheel in various positions in relation thereto, a worm gear meshing with said worm wheel, means for rotating said worm gear to effect rotation of the worm wheel, and load responsive means for controlling said last named means.

8. In an apparatus of the character described, a tiltable container carrier, a rotary element, means for connecting said carrier to said rotary element whereby movement of said element will effect movement of said carrier adapted to be manipulated to permit movement of the carrier independent of said element, and means for driving said rotary element, means whereby the connection of said carrier to said element may be effected at various points around the axis of the former.

9. In an apparatus of the character described, a tiltable container carrier, a rotary element, means for connecting said carrier to said element whereby rotation of the element will effect movement of the carrier, a drive shaft, transmission mechanism connecting said drive shaft to said rotary element, a normally disengaged clutch embodied in said transmission mechanism, an electro-magnet adapted when energized to effect engagement of said clutch, a switch for controlling the flow of electric current to said magnet, and load responsive means operable under a predetermined load to open said switch.

10. In an apparatus of the character described, a tiltable container carrier, a vertically movable receptacle support, yieldable means for normally maintaining said support in an uppermost position adapted to permit downward movement of the support under a predetermined load, means for closing said electric circuit when the receptacle support is in its uppermost position adapted to open the circuit on depression of the support, and means operable when the electric circuit is closed for tilting said container carrier.

11. In an apparatus of the character described, a tiltable container carrier, a vertically movable receptacle support, yieldable means for normally maintaining said support in an uppermost position adapted to permit downward movement of the support under a predetermined load, means for closing an electric circuit when the receptacle support is in its uppermost position adapted to open the circuit on depression of the support, means operable when the electric circuit is closed for tilting said container carrier, and means actuated by movement of said container carrier for effecting depression of said receptacle support to open the electric circuit when the container carrier reaches a predetermined position.

12. In an apparatus of the character described, a tiltable container carrier, a vertically movable receptacle support, means normally maintaining said support in an uppermost position adapted to permit downward movement of the support under a predetermined load, means for closing an electric circuit when the support is in its uppermost position adapted to open the circuit when the support is depressed, means operable when the electric circuit is closed for slowly tilting said container carrier, and means for limiting the tilting movement of said container carrier in one direction operable to depress said receptacle support.

13. In an apparatus of the character described, a tiltable container carrier, a vertically movable receptacle support, means normally maintaining said support in an uppermost position adapted to permit downward movement of the support under a predetermined load, means for closing an electric circuit when the support is in its uppermost position adapted to open the circuit when the support is depressed, means operable when the circuit is closed for slowly tilting said container carrier, and means for limiting the tilting movement of said container carrier in one direction operable to depress said receptacle support, said last named means being adapted to be manually operable to lock said support in a depressed circuit opening position.

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