May 5, 1925.

1,536,589

A. W. KEEN

APPARATUS FOR SUPPLYING MATERIALS IN A DESIRED RATIO OF WEIGHTS

Filed May 3, 1924

3 Sheets-Sheet 1

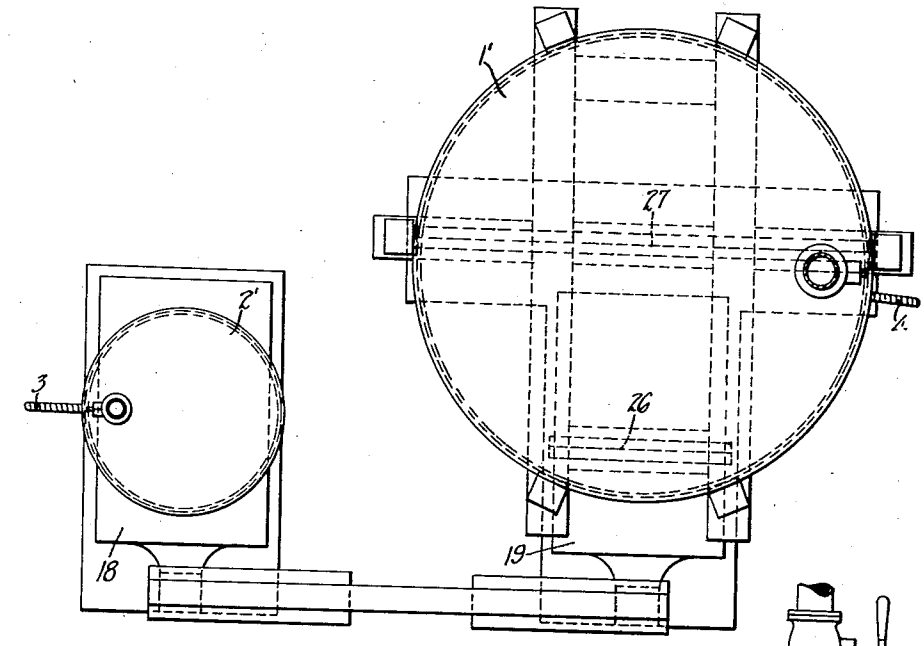


Fig. 2.

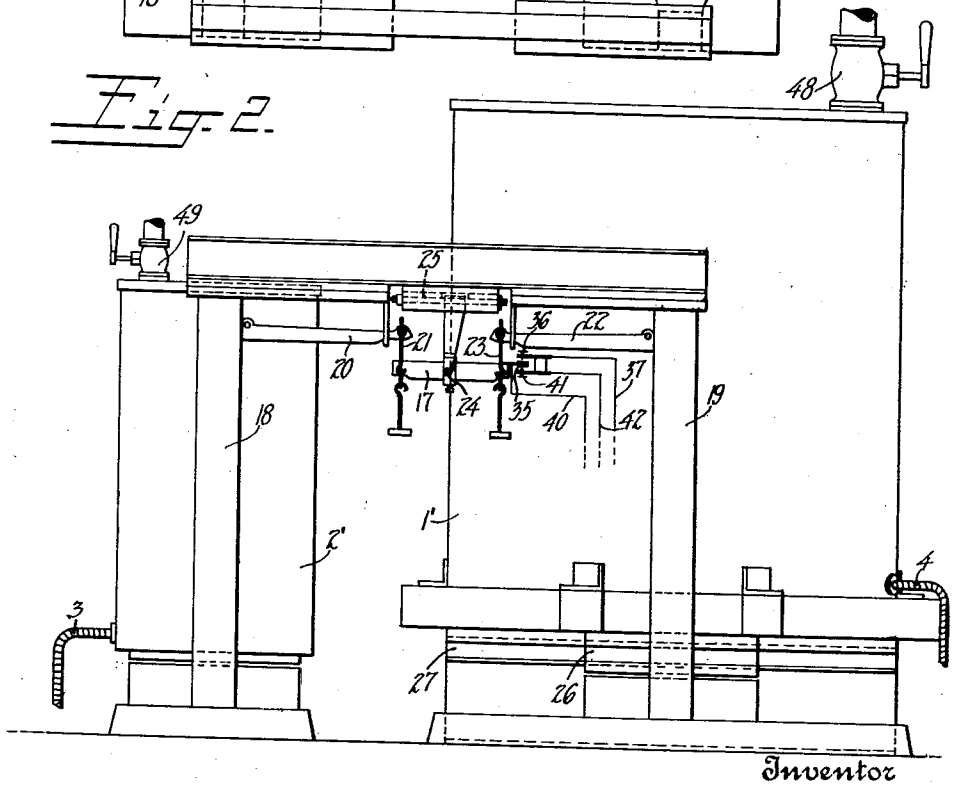


Fig. 1.

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By his Attorney
Ernest Hoffman

May 5, 1925.

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3 Sheets-Sheet 2

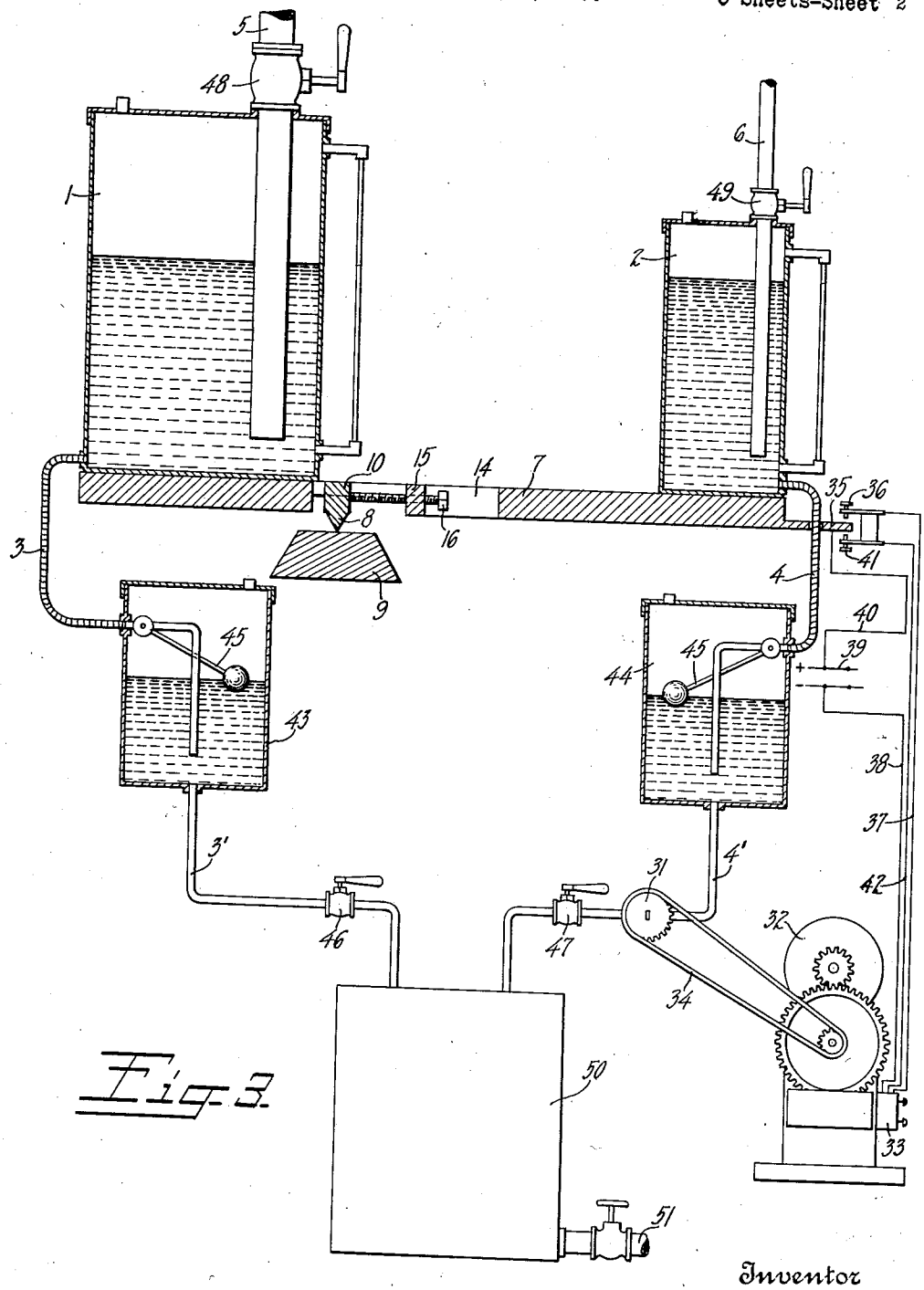


Fig 3.

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1,536,589

APPARATUS FOR SUPPLYING MATERIALS IN A DESIRED RATIO OF WEIGHTS

Filed May 3, 1924

3 Sheets-Sheet 3

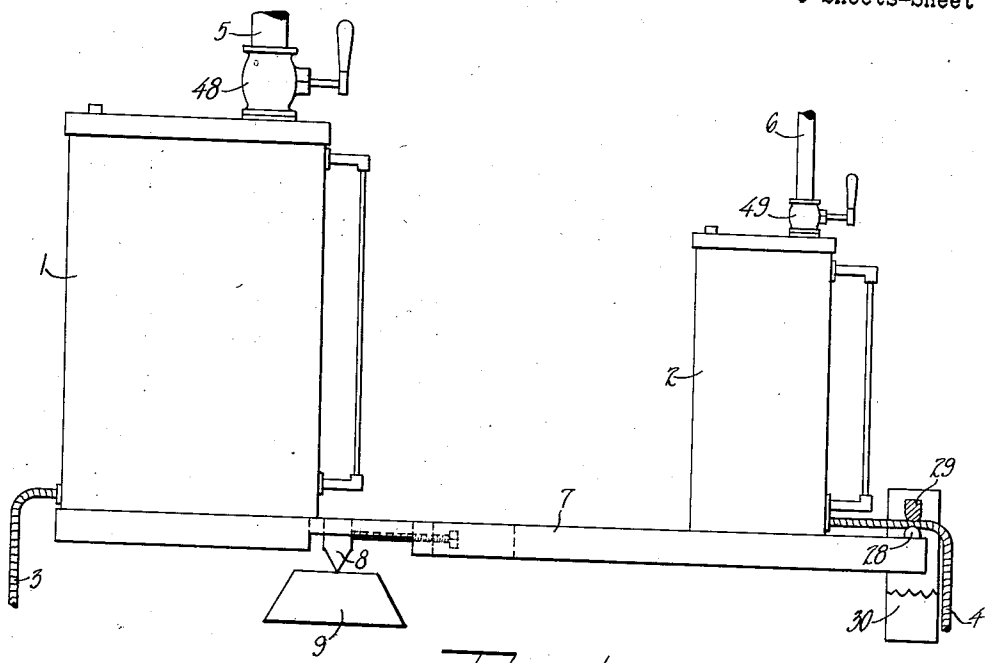


Fig. 4.

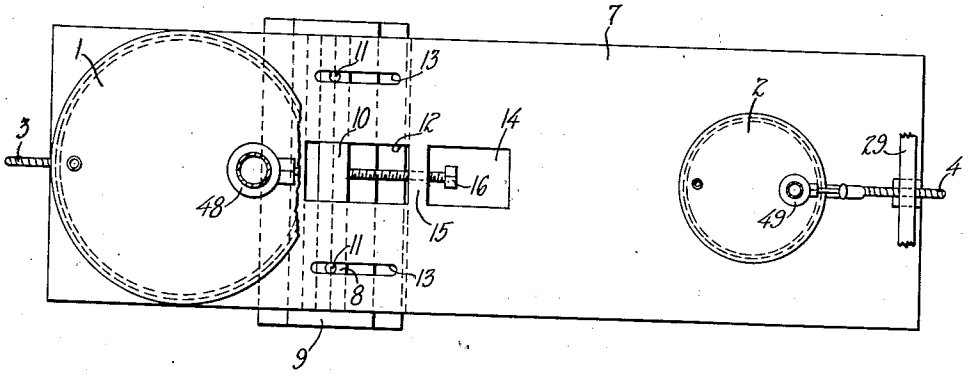


Fig. 5.

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By his Attorney

Patented May 5, 1925. 1,536,589

UNITED STATES PATENT OFFICE.

ALEXIS W. KEEN, OF NEW YORK, N. Y., ASSIGNOR TO GENERAL RUBBER COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

APPARATUS FOR SUPPLYING MATERIALS IN A DESIRED RATIO OF WEIGHTS.

Application filed May 3, 1924. Serial No. 710,720.

To all whom it may concern:

Be it known that I, ALEXIS W. KEEN, a citizen of the United States, residing at New York city, county of New York, and State of New York, have invented certain new and useful Improvements in Apparatus for Supplying Materials in a Desired Ratio of Weights, of which the following is a full, clear, and exact description.

This invention relates to apparatus for supplying materials in a desired ratio of weights, and more particularly to apparatus that will, when once set into operation, supply the materials in the desired ratio automatically as a continuous operation. In many manufacturing processes and elsewhere it is often necessary or desirable to mix materials together or to otherwise subject them to treatment in fixed proportions by weight to insure the required accuracy of the mixture. Materials that are most conveniently handled in apparatus of the present type are liquids and comminuted materials that will flow through a pipe or other passageway with comparative freeness. Likewise, gases, or gases and liquids or comminuted materials may be somewhat similarly mixed. In supplying such materials in proportions by weight rather than by volume many errors are presented, such for instance, as errors caused by changes in temperature which would occur if the materials were mixed in proportions according to their volumes.

Referring to the drawings forming part of this specification,

Figure 1 is a portion of an apparatus in elevation involving the present invention;

Figure 2 is a plan view of the portion of the apparatus shown in Figure 1,

Figure 3 is a view partly in section and partly in elevation of an apparatus embodying the present invention showing a modification of the portion of the apparatus shown in Figure 1,

Figure 4 is a portion of an apparatus in elevation of a modified form involving the present invention, and

Figure 5 is a plan view of the portion of the apparatus shown in Figure 4.

The apparatuses shown more or less diagrammatically in the drawings comprise the receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, means for regulating the flow through one of the conduits, and means for controlling the regulating means which is operably responsive to a variation in the ratio of weights of the materials in the receptacles.

The drawings show but two receptacles 1 and 2, which provide for the mixing of two materials only, but the invention is not so limited, the principles involved therein being capable of application to the mixing of three or more materials contained in three or more receptacles as will later more fully appear. The receptacles 1 and 2 are provided with the communicating conduits 3 and 4 respectively for supplying the materials in the desired weight ratio, one of them being provided with suitable means for regulating the flow therethrough as will presently appear. These conduits are shown leading from the receptacles whereby the supply which is maintained in the desired weight ratio is taken from the receptacles. These conduits could, however, if desired, lead to the receptacles for supplying the materials thereto in the desired fixed ratio, and the invention is intended to be of sufficient breadth to include both these possibilities. In the present instance however, as before remarked, the conduits intended for supplying the materials in a fixed ratio lead from the receptacles and other conduits 5 and 6 communicate with the receptacles for supplying materials thereto as desired from any convenient source with which they are connected by flexible connections (not shown) to permit the receptacles to freely move as will later more fully appear, the conduits 3 and 4 being for the same purpose likewise made flexible.

The preferred means for controlling the regulating means broadly considered comprises a lever or balance that is adapted to be tilted in response to a variation of the ratio of weights of the materials in the receptacles. Figures 3–5 show a very simple construction of this feature, the lever 7 being shown merely as a balance which supports the two receptacles 1 and 2 at its opposite ends and is provided between its ends with a fulcrum 8 having its knife edge supported on a base 9. The fulcrum is made relatively movable along the lever for adjustment of the lengths of the lever arms to produce a balance when the desired ratio of

weight exists in the materials in the receptacles. While there are many ways of accomplishing this a simple device is shown in Figures 3 to 5. The fulcrum is provided with a block 10 and pins 11—11 projecting upwardly from its upper surface to slidably engage slots 12 and 13—13 formed in the lever. The lever is provided with an opening 14 in line with the slot 12 and the wall 15 separating the two is taped to receive an adjusting screw 16. The end of the screw is secured to rotate in the fulcrum and the head is conveniently positioned in the opening 14 whereby it may be easily turned to move the fulcrum in either direction as desired.

Figures 1 and 2 show a lever 17 of a somewhat different type than lever 7 although involving the same principle and performing the same function. Like lever 7 each end of the lever 17 operably responds to a variation in the ratio of weights of the materials in the receptacles but in the present instance instead of being a simple lever the construction might be conveniently termed a compound lever. The two receptacles 1'—2' in this instance rest upon the platforms of the two devices 18 and 19 which much resemble ordinary platform scales. The arm or beam 20 of the scale 18 is secured to one end of the lever 17 by link 21, and the arm or beam 22 of scale 19 is secured to the other end of the lever 17 by link 23. The lever 17 is provided with a fulcrum 24 which is suspended from an adjusting screw 25 which by proper manipulation in an obvious manner will relatively move the fulcrum along the lever in a manner substantially similar to that already described regarding the fulcrum 8 and for the same purpose, namely, for adjustment of the lengths of the lever arms to produce a balance when the desired ratio of weights exists in the materials in the receptacles.

Where a receptacle is too large or heavy to be conveniently supported upon the platform of the scales or end of the balance it may be supported in part upon such member as illustrated in Figures 1 and 2. Here the receptacle to the right is partly supported upon a knife edge 26 supported on the platform of the scale 19, the remainder of the weight being supported by a knife edge 27 resting on the floor. The knife edge 27 should be on the far side of the center of mass of the material in the receptacle from the knife edge 26 so that the scale 19 will always support part of the weight of the material and will respond to any change therein.

There are various ways of regulating the flow through one of the conduits for restoring the weight ratio supply when same has been caused to vary. Figures 4 and 5 show a very simple way of accomplishing this. Here a jaw 28 is secured to the end of the balance 7 beneath the flexible conduit 4 which may conveniently be made of rubber, and a jaw 29 is secured to any fixed member as the posts 30 above the conduit 4 to coact with the jaw 28. From this construction it will be readily seen that, when the material in the receptacle 2 flows too freely and the ratio is thus disturbed, the lever arm at the right will ascend thereby pinching the tube 4. This will retard the flow through the tube which will continue until the then excessive flow through conduit 3 will restore the balance of the lever whereupon the materials will again flow in the desired weight ratio. Obviously a similar device may be provided at the other end of the lever 7 to function in a similar manner when the material from receptacle 1 is flowing therefrom too rapidly. Or as shown in the drawings the tube may be somewhat pinched normally so that under conditions the reverse to those first presumed the lever will tilt to further open the tube and thereby restore the ratio. By this simple device a very sensitive regulating means is provided for maintaining the desired weight ratio in the materials being supplied from the receptacles.

Figure 3 shows another way of regulating the flow through one of the conduits. In this instance the conduit 4' which is in substance a continuation of the conduit 4, as will later more fully appear, is provided with a control valve 31 which may be turned in either direction to increase or diminish the flow to restore the ratio in a similar manner as has just been described in connection with the embodiment shown in Figures 4 and 5. This regulating means however is not directly connected with the lever as is the regulating means in Figures 4 and 5, but requires an intermediary for operably connecting the regulating means and controlling means therefor. While the regulating valve should be responsive to the tilting of the balance or lever, the invention is not limited to any particular means for operably connecting these two features and this may be accomplished by the employment for instance of pneumatically or electrically operated instrumentalities. In the present instance an electric motor 32 and electrical circuits 33 are employed. The motor is connected to the valve 31 by the sprocket and chain connection 34, and is of a type that may be driven in either direction so that the valve 31 may be operated to either further open or further close it.

A metal conductor 35 is extended from the lever 7 and an electric circuit is made through this conductor, the contact post 36, conducting wire 37, motor 32, conducting wire 38, electrical supply 39 and wire 40. A second circuit is formed through the me-

tallic conductor 35, contact post 41, connecting wire 42, motor 32, conducting wire 38, electrical supply 39 and wire conductor 40. It will thus be seen that when the lever 7 tilts upwards one of the circuits will be formed and the motor will be driven in one direction and when the lever tilts downwards the other circuit will be formed and the motor driven in the opposite direction, thereby controlling the regulating valve 31 to either further open or further close the conduit 4'.

The construction shown in Figures 1 and 2, like that shown in Figure 3, may be used in connection with various means for regulating the flow through the conduit, and with various means acting as intermediaries between the regulating means and the lever 17. In the present instance it is shown with the electrical connections similar to those shown in Figure 3 and may be employed in connection with the regulating valve and motor there shown.

When it is desirable to continue the supply of the materials during the time required in replenishing the receptacles auxiliary receptacles such as the receptacles 43 and 44 shown in Figure 3 may be employed. These receptacles receive the materials flowing through the conduits 3 and 4 which are provided with the constant level float valves 45. The auxiliary receptacles are further provided with the outlet conduits 3' and 4' which are furnished with the hand valves 46 and 47, the supply conduits 5 and 6 being likewise provided with hand valves 48 and 49. The conduits 3' and 4' are shown in communication with a tank 50 which has the outlet conduit 51, the tank being shown merely to indicate any use to which the materials flowing in the desired ratio may be put.

It has been previously stated that while the description is more particularly confined to the mixing of two materials the principle may be extended to include other materials. For instance, if three materials are to be mixed in a desired weight ratio the device already described will suitably mix two of the materials and to include the third material a second balance or lever should be employed, the fulcrum of the balance or lever 7 resting on one arm of this lever and the receptacle containing the third material being supported on the end of the other arm. This latter arm should be provided with an electrical equipment similar to that with which the arm of lever 7 is provided to control the valve which should be provided for the conduit of this third receptacle. In such a device two of the conduits will be provided with regulating means, and by placing the new fulcrum in the proper position relative to the weight of the materials supported on the ends of the lever arms of the second lever, the three materials may be caused to flow in any desired ratio. The combination thus described is theoretically identical to attaching the three vertices of a triangular plate to the three ends of the balances, the ratio of the three materials being determined by the position of the fulcrum point in this triangle. For including other materials the system would be continued in a similar manner.

The operation of the apparatus shown in Figure 3 is as follows:—It has been stated in the foregoing description that the receptacles 1, 2, 1' and 2' contain the materials in the desired weight ratio, and a similar statement is made in the claims. This is intended to mean that the receptacles contain suitable quantities of the materials, taking into consideration the weights of the receptacles and other parts supported by the fulcrum, whereby the position given the fulcrum will result in maintaining a balance when the materials are flowing from the receptacles in the desired weight ratio. Of course the weight of the mechanical parts remains constant and would therefore introduce a serious error in the operation of the apparatus if the materials were only supplied to the receptacles in the weight ratio at which they are taken therefrom and no provision were made to correct the error. Therefore, one or the other of the receptacles must be supplied with a quantity of liquid, or other means provided, that will effect the correction of the error for each setting of the fulcrum. And this condition is presumed to exist when using the statement mentioned above in the foregoing description and in the claims. For when this condition exists the receptacles may be filled with the materials "in the desired weight ratio." This is the effective material and it is this material referred to in the claims and elsewhere as being contained in the receptacles. In operating the apparatus a simple way of proceeding to supply the receptacles with the desired quantities of materials and at the same time to correct the error, is to set the fulcrum so that the effective lengths of the two arms of the lever will be in an inverse ratio to the amounts of material to be delivered. The valves 46 and 47 are then closed and the valve 48 opened to fill the receptacle 1 to the desired height, the receptacle 43 being likewise filled until the float valve 45 closes upon the material in the auxiliary receptacle 43 reaching the desired level. When the receptacle 1 has reached the required height the valve 48 is closed and the valve 49 opened, and the receptacle 2 and the auxiliary receptacle 44 filled in a similar manner as was the receptacle 1 and auxiliary receptacle 43 until a balance has

been obtained in the lever 7 whereupon the valve 49 is closed. The valves 46 and 47 are then opened and the motor 32 set for operation.

The materials then flow from the two auxiliary receptacles through the conduits 3′ and 4′ into the mixing tank 50, the material flowing simultaneously from the receptacles 1 and 2 through the conduits 3 and 4 and into the auxiliary receptacles 43 and 44 to replenish the material flowing therefrom thereby maintaining the constant levels. This continues until it is necessary to refill the receptacles 1 and 2. The valve 48 is then again opened and the receptacle 1 filled as before whereupon the valve 48 is closed and the valve 49 opened until the receptacle 2 is filled to a sufficient height to produce a balance of the lever 7 whereupon the valve 49 is closed. During this refilling operation the materials in the auxiliary receptacles 43 and 44 continue to flow into the mixing tank 50 and it is desirable during this refilling operation to stop the motor 32 so that the regulating valve 31 will remain at its last set position. During this short period of refilling the receptacles the continuity of the flow will not be interrupted and it will remain in substantially the desired weight ratio. When the receptacles have been refilled the motor is again set for operation and the system thereby placed in a position to automatically readjust itself to correct any irregularities in the flow ratio.

During the flow of the materials, should the material flow too freely from one of the receptacles, as for instance the receptacle 1, the balance will be destroyed and the lever will tilt in this particular instance, downward at the right. The metallic conductor 35 will thereupon engage the post 41 and close that circuit to the motor which will effect a further opening of the valve 31, thereby increasing the flow from the receptacle 2. This will restore the balance of the lever 7 which will open the circuit again, the two materials then flowing in the desired weight ratio. Should, on the other hand, the material through the conduit 4′ from the receptacle 2 flow too freely the ratio and balance will be destroyed and the lever will tilt upward at the right. This will bring the metallic conductor 35 into contact with the post 36 closing the second circuit to the motor which will operate the valve 31 to further close the conduit. This will retard the flow through conduit 4′ until the flow through conduit 3′ has had an opportunity to restore the balance and the desired ratio whereupon the circuit will be broken and the materials will continue to flow in the desired ratio. It will thus be seen that the motor will be operated at the closing and opening of the respective circuits as the desired ratio of flow is disturbed to automatically restore it. While the auxiliary receptacles 43 and 44 serve to make the system a continuously operating one even through the period required to replenish the receptacles 1 and 2 they also have a material stabilizing effect which tends to make the motor more uniform in its operation and thereby relieve it of much of the work it would otherwise be called upon to perform. While the operation has been described mainly in connection with the apparatus shown in Figure 3, it is believed that the operation of the apparatus shown in Figures 1 and 2 and 4 and 5 are so similar to that of Figure 3, that further description is unnecessary.

As many apparently widely different embodiments of the invention may be made without departing from the spirit thereof, it is to be understood that I do not intend to limit myself to the specific form of the invention as set forth except as indicated in the appended claims.

Having thus described my invention what I claim and desire to protect by Letters Patent is:—

1. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, means for regulating the flow through one of the conduits, and means for controlling the regulating means operably responsive to a variation in the ratio of weights of the materials in the receptacles.

2. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, means for regulating the flow through one of the conduits, and a lever adapted to be tilted to control the regulating means in operable connection with the receptacles whereby said lever is tilted in response to a variation in the ratio of weights of the materials in the receptacles.

3. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits leading from said receptacles for supplying the materials therefrom in the desired weight ratio, means for regulating the flow through one of the conduits, and means for controlling the regulating means operably responsive to a variation of the ratio of weights of the materials in the receptacles.

4. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in

the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, means for regulating the flow through one of the conduits, and a lever adapted to be tilted to control the regulating means having the fulcrum between the ends thereof and each end operably connected with a receptacle whereby a variation in the ratio of weights of the materials in the receptacles in either direction will cause the lever to tilt in a corresponding direction to regulate the control to restore the ratio of weights.

5. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, means for regulating the flow through one of the conduits, a balance lever adapted to be tilted to control the regulating means in operable connection with the receptacles whereby said lever is tilted in response to a variation of the ratio of weights of the materials in the receptacles, and a fulcrum relatively movable along the lever for adjustment of the lengths of the lever arms to produce a balance when the desired weight ratio exists.

6. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying materials in the desired weight ratio, means for regulating the flow through one of the conduits, means for controlling the regulating means operably responsive to a variation in the ratio of weights of the materials in the receptacles, and intermediate means operatively connecting the controlling means with the regulating means.

7. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying materials in the desired weight ratio, means for regulating the flow through one of the conduits, means for controlling the regulating means operably responsive to a variation in the ratio of weights of the materials in the receptacles, electrically operated means, and an electric circuit for operating said electrically operated means, said electrically operated means being in operative connection with the said regulating means and the said circuit being in operable connection with said controlling means, said electrically operated means and circuit thereby co-operating as an intermediary to operatively connect the said controlling means with the said regulating means.

8. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, means for regulating the flow through one of the conduits, a lever for controlling the regulating means in operable connection with the receptacles whereby said lever is tilted in response to a variation in the ratio of weights of the materials in the receptacles, electrically operated means and an electric circuit for operating said electrically operated means, said electrically operated means being in operative connection with the said regulating means and the said circuit being in operable connection with the said lever whereby the circuit is opened and closed with the tilting of said lever in opposite directions, said electrically operated means and circuit thereby co-operating as an intermediary to operatively connect the said lever with the said regulating means.

9. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, a valve for regulating the flow through one of the conduits, a lever for controlling the valve in operable connection with the receptacles whereby said lever is tilted in response to a variation in the ratio of weights of the materials in the receptacles, an electrical motor, and two electric circuits for operating the motor in opposite directions, said motor being in operative connection with the said valve, and the said circuits being in operable connection with the said lever whereby the circuits are opened and closed with the tilting of said lever in opposite directions, said motor and circuits thereby co-operating as an intermediary to operatively connect the said lever with the said valve.

10. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits leading from said receptacles for supplying the materials therefrom in the desired weight ratio, auxiliary receptacles for receiving the materials from each of said conduits, means for maintaining a uniform level in said auxiliary receptacles while the materials are being fed thereto, conduits leading from said auxiliary receptacles for conveying the material therefrom, means for regulating the flow through one of the conduits leading from said auxiliary receptacles, and means for controlling the regulating means operably responsive to a variation in the ratio of weights of the materials in the said first mentioned receptacles.

11. An apparatus for supplying materials

in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, a conduit leading from one of said receptacles, an auxiliary receptacle for receiving the material from said conduit, means for maintaining a uniform level in said auxiliary receptacle while the material is being fed thereto, a conduit leading from said auxiliary receptacle, a conduit leading from another of said first mentioned receptacles, said last mentioned conduit and the conduit leading from said auxiliary receptacle supplying the materials in the desired weight ratio, means for regulating the flow through one of the said last mentioned conduits, and means for controlling the regulating means operably responsive to a variation in the ratio of the weights of the materials in the said first mentioned receptacles.

12. An apparatus for supplying the materials in a desired ratio of weights comprising, receptacles for containing the material in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, means for regulating the flow through one of the conduits, and a balance supporting the receptacles adapted to operate the regulating means when thrown out of balance by a variation in the ratio of weights of the materials in the receptacles.

13. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, means for regulating the flow through one of the conduits, scales for supporting the receptacles, a lever connected to the scales to be tilted thereby in response to a variation in the ratio of weights of the materials in the receptacles for controlling the regulating means, and intermediate means operatively connecting the lever with the regulating means.

14. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, means for regulating the flow through one of the conduits, scales for supporting the receptacles, a lever connected to the scales to be tilted thereby in response to a variation in the ratio of weights of the materials in the receptacles for controlling the regulating means, a fulcrum relatively movable along the lever for adjustment of the lengths of the lever arm to produce a balance when the desired weight ratio exists, and intermediate means operatively connecting the lever with the regulating means.

15. An apparatus for supplying materials in a desired ratio of weights comprising receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, a valve for regulating the flow through one of the conduits, scales for supporting the receptacles, a lever connected to the scales to be tilted thereby in response to a variation in the ratio of weights of the materials in the receptacles for controlling the valve, an electric motor, and two electric circuits for operating the motor in opposite directions, said motor being in operative connection with the said valve and the said circuits being in operable connection with the said lever whereby the circuits are opened and closed with the tilting of said lever in opposite directions, said motor and circuits thereby cooperating as an intermediary to operatively connect the said lever with the said valve.

16. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the materials in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, means for regulating the flow through one of the conduits, scales for supporting the receptacles whereby a change in weight of the material in said receptacles will operate the scales, one of said receptacles being partially supported by its scale, a lever connected to the scales to be tilted thereby in response to a variation in the ratio of weights of the materials in the receptacles for controlling the said regulating means, and intermediate means operatively connecting the lever with the regulating means.

17. An apparatus for supplying materials in a desired ratio of weights comprising, receptacles for containing the material in the desired weight ratio, conduits communicating with the receptacles for supplying the materials in the desired weight ratio, means for regulating the flow through one of the conduits, a balance supporting the receptacles adapted to operate the regulating means when thrown out of balance by a variation in the ratio of weights of the materials in the receptacles, one of said receptacles being but partially supported by said balance, and means for supporting the remainder of said receptacle positioned on the far side of the center of mass of the receptacle from said balance.

Signed at Leesburg, county of Lake, and State of Florida, this 15th day of April, 1924.

ALEXIS W. KEEN.