

Dec. 7, 1943.

W. E. SAXE

2,336,130

AUTOMATIC PROPORTIONING AND DISPENSING APPARATUS FOR BULK MATERIALS

Filed Dec. 16, 1940

5 Sheets-Sheet 1

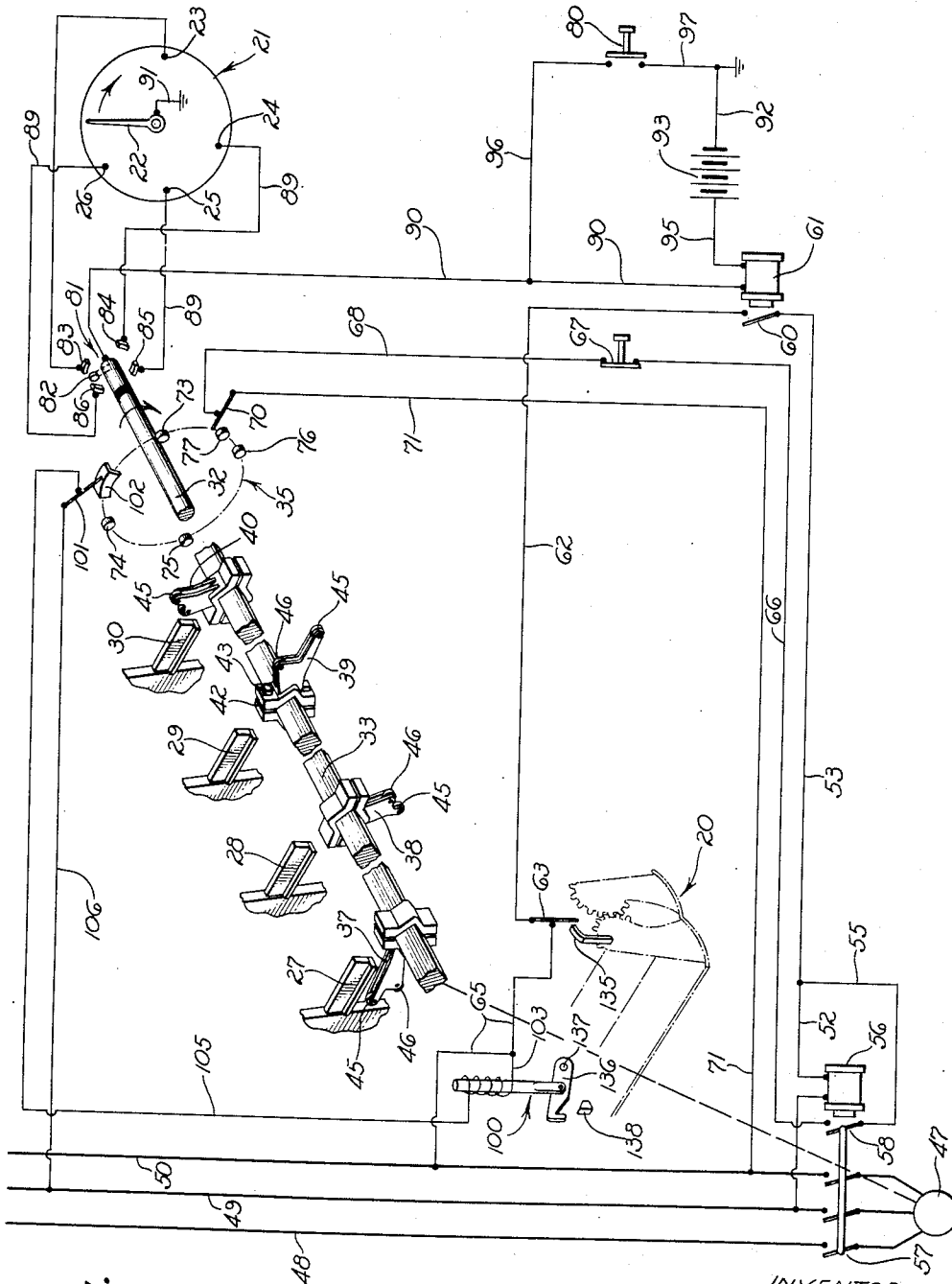


Fig. 1.

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5 Sheets-Sheet 2

Fig. 2.

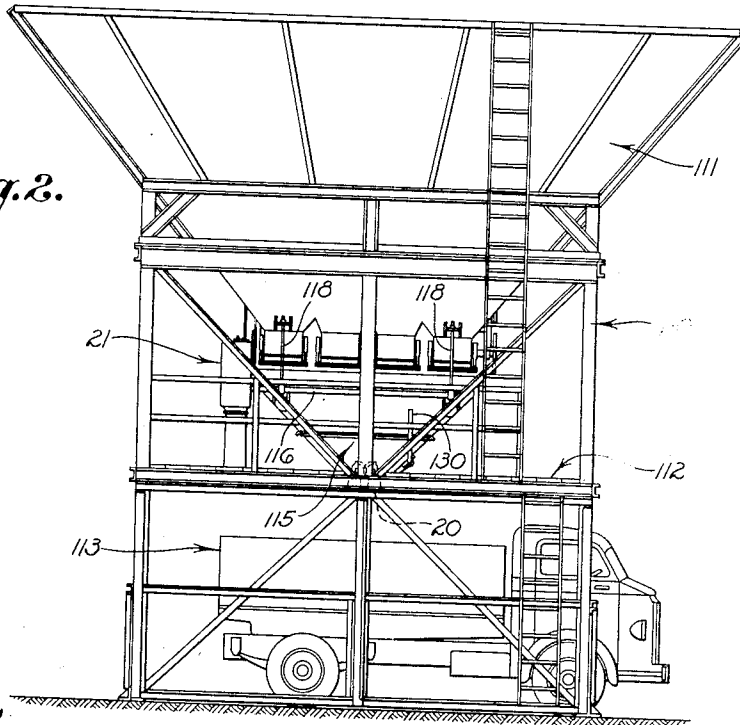


Fig. 3.

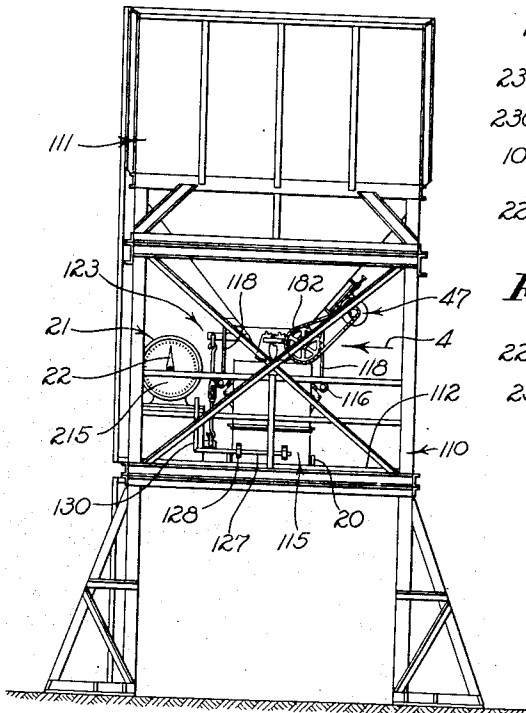
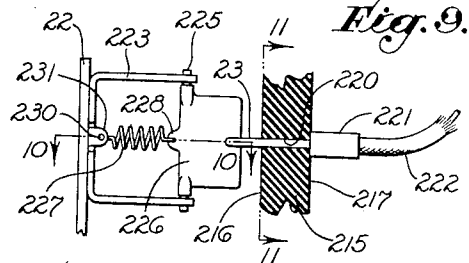


Fig. 10.

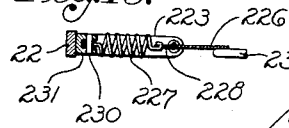
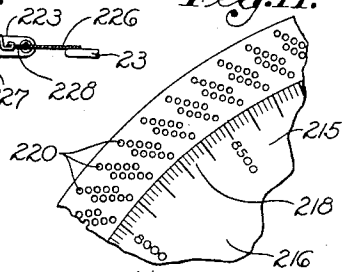


Fig. 11.



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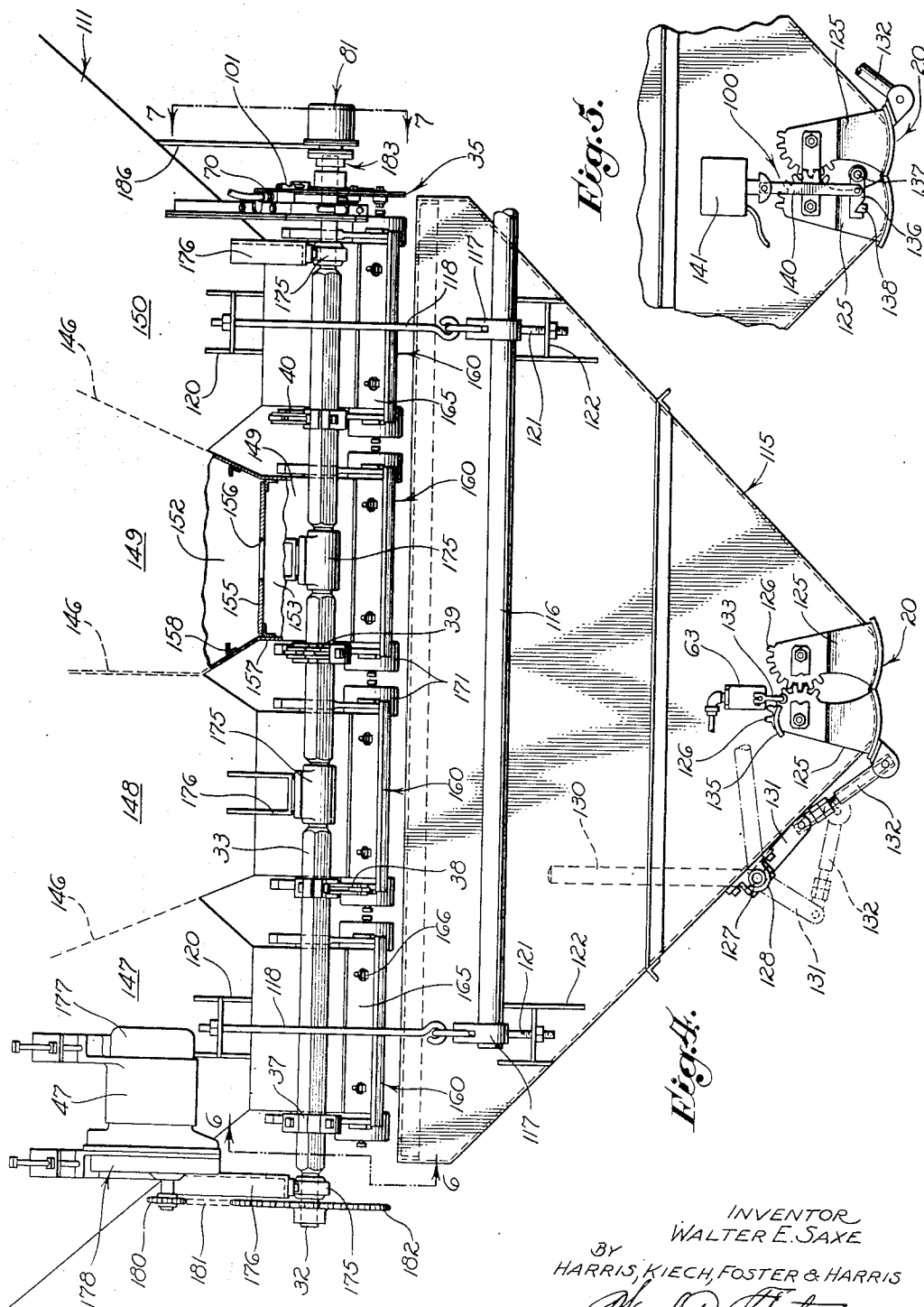


Fig. 5.

Fig. 4.

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Fig. 6.

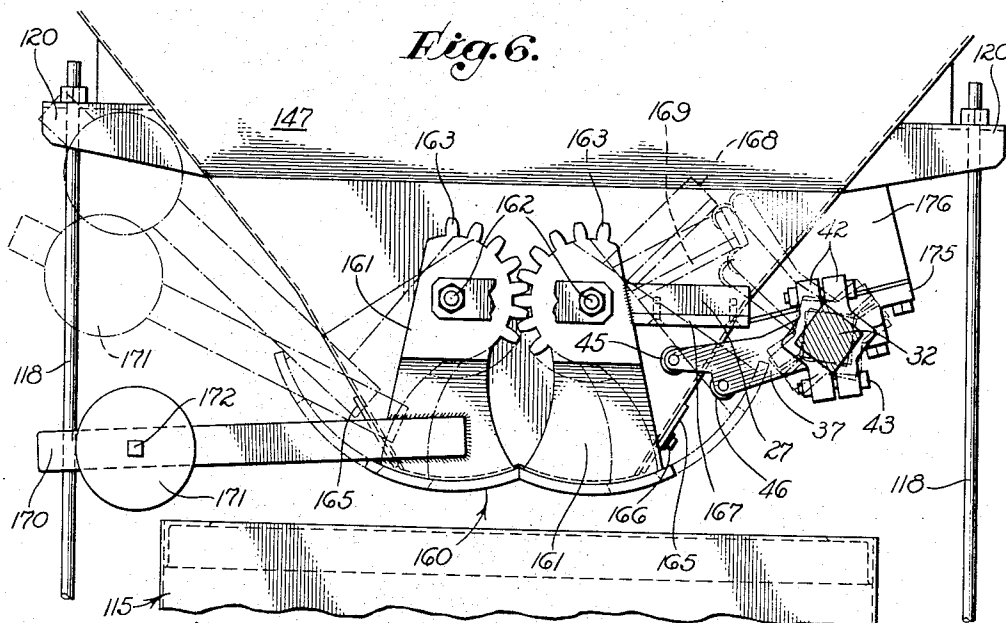


Fig. 7.

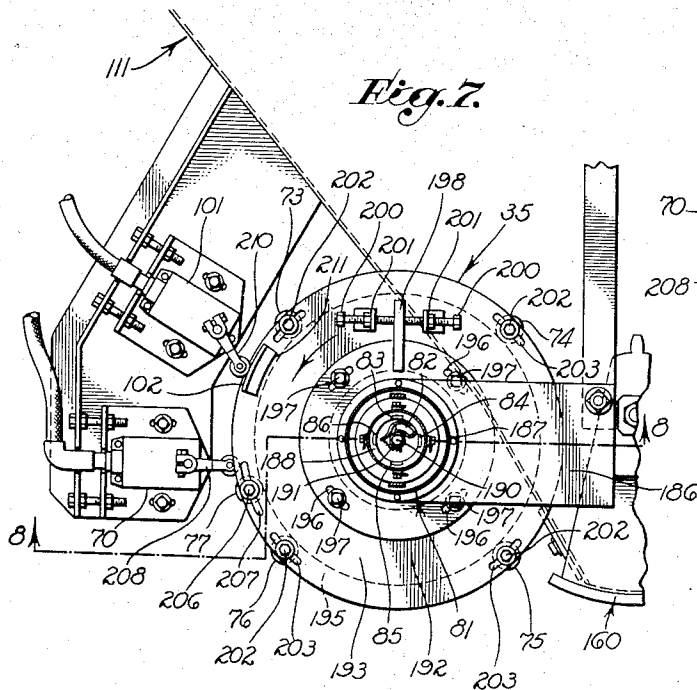
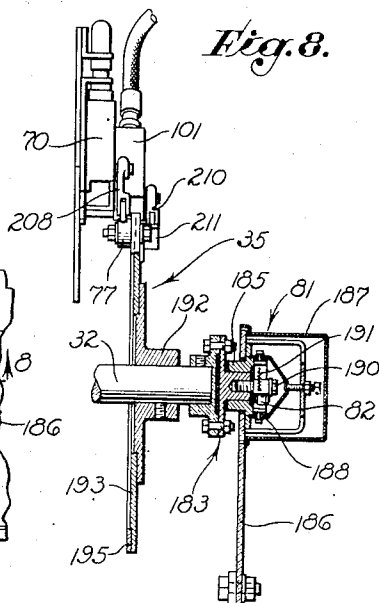


Fig. 8.



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Fig. 12.

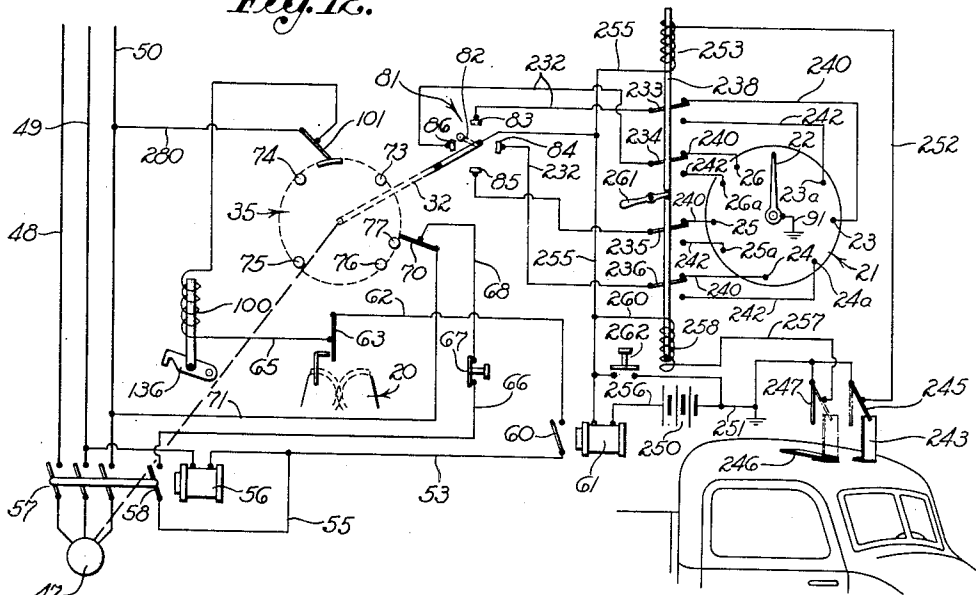
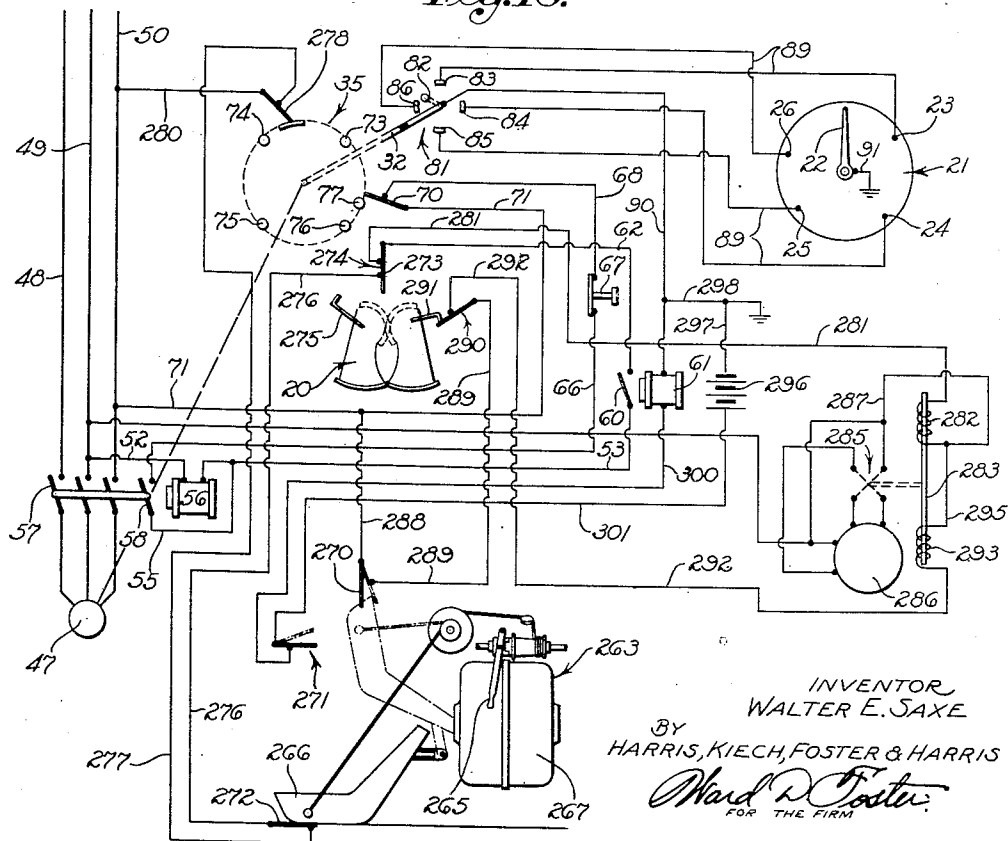


Fig. 13.



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UNITED STATES PATENT OFFICE

2,336,130

AUTOMATIC PROPORTIONING AND DISPENSING APPARATUS FOR BULK MATERIALS

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Application December 16, 1940, Serial No. 370,385

10 Claims. (Cl. 249—14)

My invention relates to apparatus for dispensing bulk materials in measured quantities and more particularly relates to apparatus for measuring out intermixtures of materials in predetermined proportions.

While the invention is applicable to such apparatus broadly and in diverse fields for various purposes, it is being initially embodied in an automatic batching plant designed to handle constituent materials for concrete construction. It will suffice for the purpose of disclosure to limit my description to such an embodiment of the invention since those skilled in the art will find adequate guidance herein for applying the invention wherever it may have utility. An automatic batching plant of the type under consideration has a plurality of material supply means or storage containers that empty in sequence into a common batch-container and has means responsive to the weight of the material in the batch-container to control the sequential quantities that make up the final load of the batch-container.

Batching plants heretofore devised have been characteristically complicated and comprised of delicate mechanism providing multiple points subject to breakdown. Some well known designs have had pneumatic and hydraulic elements with the inevitable problem of fluid leakage and of variation in performance with variation in temperature and other factors. Such apparatus requires continual attention to maintain efficient and accurate operation.

One important object of my invention is to provide an exceptionally rugged, simple, and foolproof batching apparatus for high speed operation in which reliance is placed largely on simple and positive mechanical means as distinguished from pneumatic, hydraulic and photoelectric means. In this regard one purpose in mind is to provide a centralized mechanical means common to the various storage material supply means and adapted to operate in a cycle to discharge material from the supply means in sequence, the movement of the mechanical means from one sequential point to another in the cycle being governed by means responsive to the weight of the material received in the batch-container.

A further object is to provide such an automatic apparatus that may be quickly placed in manual operation on a moment's notice and may be manually operated by one operator at a speed comparable to that of normal automatic operation.

One of the general objects of my invention re-

lates to flexibility, first in the sense of adjustability relative to batching proportions, second, in the sense of adaptability to various material-handling procedures and, third, in the sense of adaptability for cooperation with various material-handling devices. It is contemplated that the batch proportions may be readily and quickly changed whenever required and in one practice of the invention it is proposed to provide a proportion-controlling arrangement that may be pre-set for a plurality of predetermined batch specifications, any one of which may be subsequently elected without loss of time for changing over from one specification to another. It is further proposed to provide a batching apparatus that may be made automatic to various degrees and may be adapted for cooperation in a fully automatic manner with such material-receiving devices as trucks, concrete mixers, conveyors, etc.

One of the more specific objects of my invention relates to means for controlling discharge from a storage container into a batch-container or other receptacle when the discharge is to be cut off at a predetermined quantity in response to the weight of material in the receptacle. To achieve high production the discharge rate must be rapid, yet rapidity of material transfer makes it difficult to stop the material movement at the desired point for accurate weight. A prior solution for the problem is initially to open the discharge gate of the storage container quite wide for a substantial period of rapid discharge and then to partially close the gate to cause the material to dribble into the receptacle as the predetermined weight is approached. Such a solution adds complications to the mechanism for controlling the discharge gate in response to the weight of the transferred material. It is my object to achieve the same end by static structural means apart from the gate so that I may use simple opening and closing movements of the gate.

The above and other objects of my invention will be apparent in the following detailed description, taken with the accompanying drawings.

In the drawings, which are to be considered as illustrative only,

Fig. 1 is a diagrammatic representation of cooperating elements in the preferred form of my invention, a wiring diagram being included;

Fig. 2 is a side elevation of a typical batching plant incorporating the principles of my invention;

Fig. 3 is an end elevation of the batching plant;

Fig. 4 is a fragmentary side elevation on an

enlarged scale, taken as indicated by the arrow 4 in Fig. 3;

Fig. 5 is a smaller fragmentary view from the opposite side of the apparatus;

Fig. 6 is a fragmentary sectional view taken as indicated by the line 6—6 of Fig. 4;

Fig. 7 is a fragmentary section taken as indicated by the line 7—7 of Fig. 4;

Fig. 8 is a fragmentary section taken as indicated by the broken line 8—8 of Fig. 7, the section being rotated 90° in Fig. 8;

Fig. 9 is a fragmentary view partly in section showing cooperating contacts in a weighing scale used in the apparatus;

Fig. 10 is a fragmentary section taken as indicated by the line 10—10 of Fig. 9;

Fig. 11 is a fragmentary section taken along the line 11—11 of Fig. 9;

Fig. 12 is a diagram illustrating how one of my batching plants may be designed for cooperation with a truck; and

Fig. 13 is a diagrammatic view indicating how one of my batching plants may be designed to cooperate with a concrete mixer in a fully automatic manner.

An understanding of the principles underlying the various forms of my invention may be approached by first considering Fig. 1 which exemplifies some of the basic relationships.

A batch-hopper or batch-container in which the various constituents of the batch are weighed and accumulated is not shown in Fig. 1, but is represented by a gate 20 that is opened to release the contents of the batch-hopper after the batch is completed. The weight of the batch-hopper load is transmitted to a scale generally designated 21 having a pointer 22 that serves as a moving contact to cooperate successively with four stationary contacts 23, 24, 25, and 26, the stationary contacts being spaced at selected weight values representing the desired proportioning of the various materials in the batch-hopper. Four material supply means in the general combination are not shown in Fig. 1, but are represented by four discharge-control levers 27, 28, 29, and 30 that are normally in their lowermost positions at which flow of material to the batch-hopper is cut off. The four material supply means may be any material supply devices known to the art, but it is contemplated in the present construction the four material supply means will be in the form of storage containers having normally closed discharge gates that are opened when the corresponding discharge-control levers 27—30 are lifted.

The cyclic means for operating the four discharge-control levers 27—30 in sequence may take various forms. In the construction shown in the drawings the cyclic means includes a shaft 32 having polygonal portions 33 and also includes a control disc 35 rotated by the shaft and four trip arms 37, 38, 39 and 40 on the shaft to cooperate respectively with the discharge-control levers 27—30.

Each of the four trip arms 37—40 has a split base portion 42 that is normally held together by releasable bolts 43 to clamp the polygonal portion 33 of the shaft 32. Since four such trip arms are employed, the polygonal portion of the shaft is square in cross section. The split construction of the base portions 42 of the trip arms 37—40 provides for considerable flexibility since any of the trip arms may be readily removed, or may be slid along the shaft to an inoperative position, or

may be rotatively shifted to be effective simultaneously with a second trip arm on the shaft.

The four trip arms 37—40 are rotated clockwise and preferably each of the trip arms has two end portions with corresponding rollers for successive contact with the corresponding discharge-control levers, the first effective roller 45 on each trip arm being at a relatively long radius from the axis of the shaft 32 and the other roller 46 being at a relatively short radius. The purpose of providing the two end rollers at different radii is to cause each of the gates of the storage containers to be initially opened relatively wide by the outer roller 45 and then to be held at a less wide open position by the inner roller 46. Initially opening each of the four discharge gates relatively wide assures initiation of material flow through the gate and of course the degree to which it is necessary to initially open each gate for such assurance will vary with the material involved. The trip arm 39 is designed to operate a gate to release rock of relatively large size and therefore has its outer roller 45 at a relatively long radius from the shaft 32. Trip arms 37 and 38 are designed to release rocks of smaller size and therefore have their outer rollers 45 at shorter radial distances. The trip arm 40 is designed to control a sand gate and has its outer roller 45 disposed at only a slightly greater radial distance than the inner roller 46.

Each revolution of the shaft 32 may be regarded as an operating cycle with operating points corresponding to the four discharge-control levers 27—30, the discharge-control levers being moved in sequence from their normal ineffective positions to their discharge positions. It is contemplated that the shaft will pause automatically at each of the sequential operating points to cause material from the four material supply means to flow into the batch-hopper and will automatically advance in the operating cycle whenever the scale 21 registers any one of a progressive series of selected weight values, the weight values being in accord with the desired proportions in the final batch. Any suitable means for actuating the shaft 32 may be employed providing it permits the required cyclic control. In the present construction I prefer to actuate the shaft by a motor 47 energized through three motor leads 48, 49, and 50 and to achieve the desired automatic operation by providing suitable control circuits responsive both to the scale 21 and the cyclic means as represented by the shaft 32.

What may be termed a "primary control circuit" for the motor has a trunk portion represented by wires 52 and 53, and has a branch portion represented by a wire 55. It is contemplated that the trunk and branch portions of the primary control circuit will be alternatively effective, the trunk portion being employed to initiate the operating cycle and to resume operation of the cyclic means at each of the sequential operating points of the cycle, the branch portion being employed to stop the motor automatically at each of the operating points of the cycle and at the end of the cycle. Preferably the trunk portion of the control circuit includes means to prevent operation of the cyclic means while the batch gate 20 is open and preferably the branch portion has an emergency switch for stopping operation of the cyclic means.

In the particular wiring layout shown in Fig. 1, the wire 52 energizes an electro-magnet 56 that is effective when energized to close a normally

open motor switch 57 and simultaneously to close an auxiliary switch 58 that is mechanically connected with the motor switch, the purpose of the electromagnet being to make the motor circuit "self-latching." The trunk portion of the primary control circuit includes the previously mentioned wire 53, a contact arm 60 of a relay 61, a wire 62, a normally closed switch 63 that opens in response to the opening of the batch-gate 20, and a wire 65 connected with the motor lead 50. The branch portion of the primary control circuit includes the previously mentioned wire 55, the previously mentioned auxiliary switch 58, a wire 66, a normally closed emergency switch 67, a wire 68, a stop switch 70, and a wire 71 connected with the motor lead 50.

To open the normally closed stop switch 70, the control disc 35 is provided with four projections 73, 74, 75, and 76 that are 90° apart to correspond to the four trip arms 37—40 and the control disc is additionally provided with a fifth projection 77 corresponding to the end of the operating cycle, each of the five projections being adapted to brush against and open the stop switch 70 as the control disc rotates clockwise. It is contemplated that the opening of the stop switch 70 by any of the projections 73—77 will cause the motor 47 to be deenergized, but that the stop switch 70 will be opened only momentarily and then close as the shaft 32 comes to rest. The momentum of the moving parts of the cyclic means will carry the various projections on the control disc sufficiently beyond the stop switch 70. The projections 73 to 77 are therefore slightly advanced relative to the precise sequential points of the operating cycle at which the trip arms 37—40 are to stop, and the projection 77 is advanced relative to the final position of the shaft 32 at the end of the cycle.

The relay 61 is in what may be termed a "secondary control circuit" of low voltage that is associated with a normally open starting switch 80 for initiating the operating cycle and is associated with the weighing scale 21 for resuming the operating cycle at each of the previously mentioned sequential points in the cycle. To avoid accidental closing of the secondary control circuit by movements of the scale pointer 22 as will be explained later, and to keep more than one of the scale contacts 23—26 from being responsive at one time, I find it advantageous to mount a commutator generally designated 81 on the shaft 32. The commutator has a rotary contact arm 82 operated by the shaft 32 and has four stationary contacts 83, 84, 85, and 86 spaced 90° apart to correspond with the four sequential positions in the operating cycle.

The stationary contacts 83—86 of the commutator 81 are connected by four wires 89 with the four scale contacts 23—26 respectively. The secondary control circuit as controlled by the scale 21 is completed as follows: A wire 90 from the relay 61 to the rotary contact 82, a wire 91 from the scale pointer 22 to ground, a wire 92 from ground to one side of a battery 93, and a wire 95 from the battery 93 to the relay 61.

A branch of the secondary control circuit through the starting switch 80 is provided by a wire 96 on one side of the switch to the wire 90 and a wire 97 from the other side of the switch to the wire 92, the starting switch being in effect in parallel with the scale 21.

Fig. 1 shows the various movable parts at their various positions when the cyclic means is stationary and the batch-hopper is empty prepara-

tory for initiation of an operating cycle. Momentary closing of the starting switch 80 causes energization of the relay 61 to momentarily move the contact arm 60 of the relay to closed position. Since the batch-gate 20 is closed, the switch 63 is also closed so that the momentary energization of the relay 61 causes a surge of current through the trunk portion of the primary control circuit. The momentary surge of current through the trunk portion of the primary control circuit energizes the electromagnet 56 to close the auxiliary switch 58 and thereby establishes current flow through the branch portion of the primary control circuit, the branch portion remaining effective by virtue of the electromagnet 56. Since the motor switch 57 closes with the auxiliary switch 58 in response to energization of the electromagnet 56, the motor 47 is thereby energized to rotate the shaft 32 and the shaft rotates until the first projection 73 on the control disc 35 brushes against and momentarily opens the stop switch 70.

The momentary opening of the stop switch 70 by the projection 73 stops flow of current through the electromagnet 56 and thereby permits both the motor switch 57 and the auxiliary switch 58 to open, the shaft 32 coming to stop at the first of the four sequential points in the operating cycle. The tilted position of the discharge-control lever 27 at the first sequential point in the operating cycle results in flow of material from the first of the four storage containers into the batch-hopper, and as the load of the batch-hopper increases, the pointer 22 of the scale 21 responds by clockwise rotation.

Just before the pointer 22 reaches the scale value corresponding to the desired weight for the first material in the batch, the pointer causes the first stationary contact 23 to close the auxiliary control circuit momentarily through the relay 61 and the resulting momentary closing of the relay contact arm 60 causes the primary control circuit to be energized through its trunk position. The trunk portion of the primary control circuit is opened by the immediate return of the contact arm 60 to open position but the momentary flow of current through the trunk portion is sufficient to cause closing of the motor switch 57 and the auxiliary switch 58 by the electromagnet 56, thereby making the primary control circuit effective through its branch portion.

There may be appreciable lag between initial flow of current through the relay 61 and sufficient rotation on the part of the shaft 32 to release the discharge-control lever 27 and as a result an appreciable quantity of material may flow from the first storage container into the hopper after the pointer 22 reaches the contact 23; in practice, however, it is not a difficult matter to compensate for such lag by placing the contact 23 at a sufficiently advanced position to cause the material flow to the batch-hopper to be cut off at close approximation to the desired quantity. Another reason for placing the contact at an advanced position is to compensate for material falling through the air when the pointer reaches the contact.

After the motor is energized as the result of the pointer 22 reaching the contact 23, the motor continues to operate until the projection 74 reaches the stop switch 70 to break the motor circuit, the shaft coming to rest with the projection 74 clear of the stop switch. At this juncture the second trip arm 38 is holding the discharge-control lever 28 in tilted position to

release material from the second storage container to the batch-hopper. Eventually the scale pointer 22 reaches the second stationary contact 24 to cause the cyclic means to cut off the second storage container and advance to the third storage container, the quantity released from the second storage container being determined by the spacing of the scale contacts 23 and 24. In like manner the pause at the third sequential point in the operating cycle represented by the projection 75 on the control disc releases to the batch-hopper a quantity of material from the third storage container in accord with the spacing of the contacts 24 and 25, and the pause at the fourth sequential point corresponding to the projection 76 on the control disc releases a quantity of material from the fourth storage container determined by the spacing of the contacts 25 and 26.

When the scale pointer 22 reaches the final fixed contact 26, the motor is automatically energized to cause the fourth trip arm 40 to release the fourth storage-control lever 30 and then the fifth projection 77 on the control disc reaches the stop switch 70 to bring the shaft 32 to rest at the end of the operating cycle, the various movable parts being returned to the initial positions shown in Fig. 1.

After completion of the cycle, the operator opens the batch-gate 20 to release the batch from the batch-hopper and as the batch-hopper empties, the scale pointer 22 swings back counter-clockwise to its original position. An important feature of the commutator action to be noted here is that the rotary contact arm 82 is at an ineffective position at the end of the operating cycle as indicated in Fig. 1 so that the return movement of the pointer 22 past the various fixed contacts 23—26 on the scale does not cause the secondary control circuit to close. The opening of the switch 63 in response to opening of the batch-gate 20 has the same effect of making the control system non-responsive to the return movement of the scale pointer 22, but I prefer to have the commutator perform the same function because otherwise an operator may manipulate the gate 20 to encourage material flow from the hopper and thereby accidentally permit the switch 63 to close at a moment when the scale pointer 22 is at one of the scale contacts 23—26.

It is quite desirable to provide some automatic means to prevent an operator from opening the batch-gate 20 in the course of the operating cycle while material is being deposited in the batch-hopper. Such a means may take the form of an electrically controlled latch generally designated 100 in Fig. 1 that latches the batch-gate 20 shut when deenergized and releases the batch-gate for opening movement when energized. To cause this latch to be energized automatically at the end of the operating cycle, I place a normally open switch 101 near the control disc 35 to be closed by the cam action of a short flange 102 on the control disc. The latch circuit may be traced as follows: The previously mentioned wire 65 from the motor lead 50, a wire 103 to the latch 100, a wire 105 from the latch to the switch 101, and a wire 106 from the switch 101 to the motor lead 49. Throughout the operating cycle the switch 101 is open and the latch 100 is effective.

Figs. 2 and 3 show a typical batch plant incorporating the present invention. The particular batch plant shown may be called "semi-

portable," since it is designed for convenient separation into units for transportation from one site to another. If the batch plant is employed for road construction, it may readily be advanced from point to point as the road work progresses.

The structure shown in Figs. 2 and 3 includes a frame generally designated 110 that carries an upper storage bin generally designated 111 and an operating platform 112 at an intermediate level spaced sufficiently above the ground to clear a dump truck 113. Underneath the storage bin 111 is a batch-container or hopper 115 having the previously mentioned batch-gate 20 for controlling release of material to the truck 113.

Any of the familiar arrangements may be provided to transmit the weight of the batch-container 115 to the previously mentioned scale 21. In the present construction two torque rods 116 are provided on opposite sides of the batch-hopper and each torque rod has two levers 117 rigidly fixed thereto. The outer end of each lever 117 is suspended by a rod 118 from a fixed bracket 120 and the inner end of each of the levers supports the batch-hopper through a short rod 121 connected to a bracket 122 on the side of the batch-hopper. Rotation of the torque rods 116 responsive to changes in the loading of the batch-hopper is transmitted to the scale 21 through the usual links and levers, generally designated 123 in Fig. 3.

The batch-gate 20 at the bottom of the batch-hopper 115 comprises a pair of jaws 125 of well known construction that are intermeshed by teeth 126 to operate in synchronism. Any suitable means may be employed to operate the batch gate 20. For example, as best shown in Figs. 3 and 4 I mount an operating shaft 127 in suitable bearings 128 on the side of the batch-hopper and provide a manually operable lever 130 on the shaft within convenient reach of the operator. An arm 131 keyed to the shaft 127 is connected to one of the gate jaws 125 through an adjustable link 132 so that clockwise rotation of the gate lever 130, as viewed in Fig. 4, causes the batch-gate 20 to open, the position of the arm 131 and the link 132 at open position of the gate being shown in dotted lines in Fig. 4.

On one side of the batch-hopper 115 is the previously mentioned normally closed switch 63 that opens in response to opening movement of the batch-gate 20. Fig. 4 shows the switch 63 with an operating arm 133 positioned to be swung to a circuit opening position by an arcuate flange 135 on one of the gate jaws 125. The arcuate extent of the flange 135 is such that the switch 63 is opened early in the opening movement of the gate 20 and remains open until near the end of the closing movement of the gate.

On the other side of the batch-hopper 115 is the previously mentioned automatic latch 100 which may be constructed as shown in Fig. 5. A latch arm 136 on a stationary pivot 137 normally engages a latching projection 138 to prevent opening of the batch-gate 20. Extending upward from the latch arm 136 is an operating link 140 that is controlled by a solenoid 141 so that the latch arm 136 is effective to latch the gate when the solenoid is deenergized but is moved upward to release the gate when the circuit through the solenoid is closed.

The storage bin 111 at the upper level of the apparatus is adapted to be filled from above by use of a crane or other elevating means and is divided by three partitions 146 into four storage

containers 147—150 corresponding respectively to the previously mentioned discharge-control levers 27—30. The upper portions of the storage containers 147—150 are consolidated in one continuous structure, but the lower discharge portions of the containers are separate from each other and spaced apart in a row across the top of the batch-hopper 115.

One of the features of the preferred form of my invention is the conception of dividing each of the storage containers 147—150 by adjustable means into an upper storage compartment and a lower dispensing compartment. Thus in Fig. 4 I show the storage container 149 divided into an upper storage compartment 152 and a lower dispensing compartment 153, the division being made by a plate 155 having a central opening 156 for flow of material from the upper storage compartment into the dispensing compartment. The plate 155 is removably supported by a set of clips 157 on the inner wall of the storage container and other sets of clips 158 may be provided for supporting similar plates at other levels to vary the capacity of the dispensing compartment 153. It is contemplated that various plates with various sizes of openings and adapted for use at various levels will be available in setting up the plant for various batching operations. The purpose of employing such plates to divide each of the storage containers into compartments is made clear later.

The bottom of each of the storage containers 147—150 is normally closed by a gate 160, which may be constructed like the batch-gate 20. Fig. 6, for example, shows the gate 160 that controls discharge from the storage compartment 147. The gate 160 includes two gate jaws 161 that are mounted on pivots 162 and are intermeshed by teeth 163 to operate simultaneously. The opposite sloping walls of the storage container 147 adjacent the jaws 161 terminate at plates 165 that are mounted on the walls for adjustment towards the gate jaws. The drawings show each of the plates slotted for engagement by cap screws 166. One of the two jaws 161 of each of the gates 160 is provided with one of the discharge-control levers for opening the gate in response to cyclic rotation of the shaft 32. Thus Fig. 6 shows the right-hand jaw 161 rigidly carrying the discharge control lever 27 that is acted upon by the corresponding trip arm 37. The discharge-control lever 27 is provided with a replaceable hardened strip 167 for contact with the trip arm.

Fig. 6 shows clearly the manner in which the gate is opened by the trip arm 37. As the trip arm 37 swings upward against the discharge-control lever 27, it initially engages the lever by the outer roller 45 and tilts the lever to the extreme position shown in dotted lines at 168. As the shaft 32 comes to rest at the first sequential point in the operating cycle, the outer roller 45 passes beyond the discharge-control lever 27 and the lever then drops to a position of rest against the inner roller 46 at the tilted dotted line position 169 in Fig. 6.

To cause the various gates 160 to close automatically when the various discharge-control levers are released by the corresponding trip arms on the shaft 32, I contemplate employing yielding means to oppose the opening movements of the gates. In my preferred construction I rigidly mount a relatively long lever 170 on the second jaw of each gate to extend outward on the opposite side from the discharge-control lever

of the gate and I mount a weight 171 on the lever 170 to cause the gate to close by gravity. As shown in Fig. 6 the weight 171 is apertured to slide on the lever 170 and is releasably secured by a cap screw 172. The feature of my construction involved here is that each of the four gates 160 may be operated manually independently of the shaft 32 and the various trip arms by simply lifting the corresponding lever 170, and if manual operation is to be carried out for any substantial period of time, the various weights 170 may be shoved inward to make the opening movements easier for the operator.

The shaft 32, as best shown in Fig. 4, may be carried by a number of bearings 175 that are mounted on various supporting brackets 176. The previously mentioned motor 47, which may be adjustably mounted on the side of the storage bin 111 and which may have a built-in magnetic latch 177, is operatively connected to the shaft 32 through a gear reduction mechanism 178, a small sprocket 180, and a sprocket chain 181 to a larger sprocket 182 in the end of the shaft.

The construction of the commutator 81 on the opposite end of the shaft is best shown in Figs. 7 and 8. Since there are four contacts in the present construction, I find it convenient to incorporate in the commutator an ordinary distributor manufactured for use in ignition systems of four-cylinder automobiles. In the construction shown a fitting generally designated 183 fixedly mounted on the end of the shaft 32 rotatably extends into a fixed collar 185 that is carried by a stationary support plate 186, and a cylindrical casing 187 is mounted on the stationary plate to house the commutator. The previously mentioned four commutator contacts 83—86 are mounted at 90° spacing in a fixed insulating ring 188 and the previously mentioned rotary contact arm 82 rotates inside this insulating ring. Figs. 7 and 8 show the rotary contact arm 82 pivotally mounted on a screw 190 in the end of the fitting 183 and show the familiar spring 191 to urge the arm outward against the insulating ring 188.

My preferred construction for the control disc 35, as shown in Figs. 7 and 8, includes a hub member 192 keyed to the shaft 32, an annular plate or primary ring 193 adjustably mounted on the hub member, and a secondary ring 195 adjustably carried by the primary ring. The hub member 192 has spaced arcuate slots 196 concentric to the axis of the shaft 32, through which extend suitable bolts 197 for releasably anchoring the primary ring 193 in a manner to permit limited rotational adjustment of the primary ring relative to the hub. To maintain a given rotary relationship between the hub member 192 and the primary ring 193 and to facilitate adjustment in the relationship the hub member may have an integral radial arm 198 adjustably confined between two set screws 200 mounted in small brackets 201 on the face of the primary ring.

The secondary ring 195 is mounted on the primary ring 193 for rotational adjustment by four bolts 202 extending through arcuate slots 203 in the primary ring. The four previously mentioned projections 73—76 on the control disc 35 that correspond to the four sequential points in the operating cycle may be in the form of rollers rotatably mounted on the adjustment bolts 202, suitable sleeves (not shown) being mounted on the bolt to carry the rollers. It is apparent that adjustment of the primary ring relative to

the hub and/or adjustment of the secondary ring relative to the primary ring may be relied upon to shift the four equidistant projections or rollers 73—76 around the axis of the shaft 32.

The fifth projection 77 mounted on the control disc 35 to close the switch 70 at the end of the operating cycle should be adjustable independently of the four projections 73—76. Therefore this fifth projection 77, which is also in the form of a roller, is carried by a bolt 206 that is adjustably mounted in a relatively long arcuate slot 207, the slot being through both the material of the primary ring 193 and the material of the secondary ring 195. Figs. 7 and 8 show that the previously mentioned stop switch 70 is located adjacent the control disc 35 and has a control arm 208 that extends in the path of the five projections 73—77 in such manner that the switch 70 is momentarily opened five times in each rotation of the control disc.

Figs. 7 and 8 show the previously mentioned switch 101 that is closed at the end of the operating cycle to deenergize the batch-gate latch 100. The switch 101 has an operating arm 210 that is adapted to be deflected to a circuit-closing position by the previously mentioned flange 102. As shown in Fig. 7 the flange 102 may be an arcuate piece of angle-iron 211 mounted on the face of the primary disc 193.

The scale 21 has a dial 215, the construction of which may be understood by referring to Figs. 3, 9, 10, and 11. The dial 215 comprises a plate of non-conducting material having a front face 216 and a rear face 217. The front face 216 is traversed by the pointer 22 and is marked with graduations 218 to indicate the net weights of material in the batch-hopper 115. Numerous holes 220 are provided in the dial 215 to correspond with spaced weight values. For close control of the batch proportions the holes 220 may be relatively close together. In using a 5000 pound scale with a 30 inch dial, I find that by arranging the holes in staggered rows, I may provide a hole for every five pounds marked on the face of the dial.

A number of plug members 221 corresponding to the number of storage containers, in this case four, are mounted on electric cords 222 at the rear of the dial 215, each of the plug members having a pin portion constituting one of the previously mentioned scale contacts 23—26. In Fig. 9 the plug 221 carries the scale contact 23 and the scale contact is mounted in one of the holes 220 to protrude forward from the dial 215 towards the pointer 22. It is apparent that the four contacts 23—26 may be shifted at will to represent any progressive series of selected weight values.

The pointer 22 may carry any suitable type of contact to cooperate with the stationary contacts 23—26 without hindering the movements of the pointer 22 to any significant degree. In my preferred construction I mount a small bracket 223 on the side of the pointer 22 towards the dial 215 to journal the trunnions 225 of a light metal leaf 226, the metal leaf constituting the movable contact for closing circuits through the various stationary contacts 23—26. The metal leaf 226 is very lightly urged towards the dial 215 by a small coil spring 227 that acts between a small ear 228 of the leaf and a pin 230 in a small bracket 231.

To initiate operation of the apparatus an operator on the platform 112 presses a starting but-

ton constituting the switch 80 of Fig. 1 to energize the motor 47. The shaft 32 is thereupon automatically turned to the first sequential point in the operating cycle to hold the discharge-control lever 27 in tilted position. When each of the gates 160 of the storage containers is opened in the course of the operating cycle, initially material passes at a rapid rate into the batch-hopper 115 because a substantial quantity of material is stored in the replenishing compartment 153 immediately above the gate 160. When the stored quantity in the dispensing compartment is exhausted, however, flow into the batch-hopper 115 is thereafter restricted to the flow capacity of the opening 156 in the plate 155 that separates the dispensing compartment 153 from the upper storage compartment 152. The effect is the same as would result from initially opening the discharge-gate 160 relatively wide and then partially closing the gate as the quantity of transferred material reaches the desired predetermined value at which flow is to be cut off. It is to be noted that I attain the desired flow control by static structure without relying upon any functional means responsive to the weight of material in the batch-hopper. Although static structure is relied upon, however, the arrangement is quite flexible since various batching plates 155 may be employed at various levels.

At the end of the operating cycle of the shaft 32 the motor 47 stops and the batch-gate latch 100 is automatically released. The operator may then open the batch-gate 20 by swinging the operating arm 130 to discharge the load of the batch-hopper to the dump truck below. To make the apparatus responsive to the starting button 80 for initiating the next cycle, the operator must close the batch-gate 20 and thereby close the switch 63.

If there is any failure of the automatic system, the operator may resort to manual operation to maintain production. As shown in Figs. 2 and 3, the scale 21 is in full view of the operator for his guidance in manipulation of the various gate levers 170.

Fig. 12 indicates schematically how a batch plant, as described above, may be adapted for two different batch settings on the scale 21 to be used selectively and further indicates how such a modification of the invention may be operated automatically by movement of a truck into receiving position under the batch-hopper.

The primary control circuit in Fig. 12 is identical with the previously described control circuit of Fig. 1 and some of the elements of the secondary control circuits are unchanged, corresponding numbers being used to identify corresponding elements.

In Fig. 12 wires 232 connect the stationary contacts 23—26 of the commutator 81 with the switch arms 233—236 respectively. All of the switch arms 233—236 are controlled by an operating rod 238 that may be moved between an upper position and an alternate lower position, the operating rod being adapted to maintain either position to which it may be moved. At the upper position of the operating rod 238 the switch arms 233—236 are in electrical contact with a corresponding set of wires 240 which lead respectively to the previously mentioned scale contacts 23—27. At the lower position of the operating rod the same switch arms are in electrical contact with a second set of four wires 242 that lead respectively to alternate scale contacts 23a, 24a, 25a, and 26a.

It is contemplated that the batching plant constructed as indicated in Fig. 12, will be used concurrently by fleets of trucks handling two different batch requirements for two different construction jobs. Each of the trucks has two metal "flags" or plates, a left-hand flag 243 positioned on the truck to cooperate with a normally open left-hand switch 245 of the batch plant, and a right-hand flag 246 positioned to cooperate with a normally open right-hand switch 247 of the apparatus. Each of the flags represents one of the two batch settings of the scale and may carry a suitable identifying legend. Each of the flags may be hinged for movement between a lower inoperative position and an upright effective position.

When a truck with the left-hand flag 243 in operative position drives into receiving position under the batch-hopper of the apparatus, the flag brushes against and temporarily closes the switch 245 and thereupon causes current to flow through the following circuit: battery 250, wire 251, switch 245, wire 252, upper solenoid 253, wire 255, relay 61, wire 256 back to the battery 250. The energization of the relay 61 by this circuit closes the switch 60 in the primary control circuit to initiate the operating cycle of the shaft 32. Simultaneously the energization of the solenoid 253 causes the operating rod 238 to be shifted to its upper position if the operating rod is not already in its upper position. At the upper position of the operating rod 238 the scale contacts 23-26 are effective to control the operating cycle and a batch of the corresponding proportions is automatically built up in the batch-hopper. When the moving parts of the apparatus become stationary at the end of the cycle that is automatically initiated by the movement of the truck into receiving disposition, the truck driver or an operator at the apparatus opens the main batch-gate to dump the batch into the truck.

If the truck approaches with the right-hand flag 246 in upright position instead of the left-hand flag 243, the switch 247 is momentarily closed to establish the following circuit: battery 250, wire 251, switch 247, wire 257, lower solenoid 258, wire 260, the previously mentioned wire 255, relay 61 and wire 256 back to the battery 250. This last circuit momentarily energizes the relay 61 to start the operating cycle and the solenoid 258 causes the operating rod 238 to take its lower position whereupon the second set of scale contacts 23a-26a become effective to control the proportioning of materials in the batch-hopper.

The apparatus of Fig. 12 may be operated independently of the two switches 245 and 247 by manipulating a suitable control lever 261 to shift the operating rod 238, if required, and then closing a starting switch 262. As indicated in the drawings one side of the starting switch 262 is connected to the wire 255 and the other side is connected to the wire 251, the switch being in series with the relay 61.

Fig. 13 will indicate to those skilled in the art how my batching plant may be arranged to operate in a fully automatic manner in response to the cyclic movements of a material receiving means such as a cement mixer 263. The cement mixer 263 is of a conventional type in which a clutch lever 265 is manipulated as required to cause a skip 266 to move between a lower receiving position and an upper position at which the skip empties into a revolving drum 267 of the mixer.

The cement mixer may be operatively associ-

ated with the batch plant in various ways. In the present arrangement it is contemplated that the skip 266 at its uppermost position will close a normally open switch 270 to close the batch-gate 20 and on its way downward to its lower position will momentarily close a starting switch 271 for initiating the operating cycle of the apparatus, the skip coming to rest at its lowermost position against a normally open switch 272 and holding the switch 272 closed to cause the batch-gate 20 to open automatically at the end of the operating cycle.

Many of the elements of Fig. 13 are identical with the previously described elements of Figs. 1 and 12, as indicated by the use of like numbers. The changes in the primary control circuit that distinguish Fig. 13 include the following. The wire 62 from one side of the relay contact arm 60 leads to a contact arm 273 of a limit switch generally designated 274 that is adapted to be opened automatically by an arm 275 on the batch-gate 20 to terminate the opening movement of the batch-gate. When the switch 274 is in closed position, the switch arm 273 electrically connects the wire 62 with two contacts. The first of these contacts is connected by a wire 276 with one side of the above-mentioned switch 272, and from the other side of the switch 272 a wire 277 leads to a switch 278 at the control disc 35, the circuit through the switch 278 being completed by a wire 280 to the motor lead 50. The switch 278 is identical in construction and operation with the corresponding switch 101 in Figs. 1 and 12 but serves a different purpose as will be made apparent.

The second fixed contact of the switch 274 is connected by a wire 281 with a solenoid 282 at the upper end of an operating rod 283. The purpose of the operating rod 283 is to control a reversing switch generally designated 285 of a reversing split phase motor 286 that actuates the batch-gate 20. The solenoid 282 is in series with the motor 286 through a wire 287.

One side of the switch 270 that is closed at the upper position of the cement mixer skip is connected by a wire 288 to the wire 71 of the primary control circuit and the other side of the switch 270 is connected by a wire 289 to a second limit switch 290 for the batch-gate 20. The switch 290 is adapted to be opened automatically by an arm 291 on the batch-gate 20 to limit the closing movements of the batch-gate. From the limit switch 290 a wire 292 extends to a second solenoid 293 at the lower end of the operating rod 283 and the circuit through the solenoid 293 in series with the motor 286 is completed by a wire 295 that connects with the previously mentioned wire 287.

The circuit through the starting switch 271 that momentarily closes in response to the downward movement of the skip 266 may be traced as follows: a battery 296, a wire 297, a grounded wire 298 of the scale circuit, wire 90, relay 61, a wire 300, starting switch 271, and a wire 301 back to the battery 296.

For the purpose of describing the operation of this last form of the invention, let it be assumed that the batch-gate 20 is open, switch 274 being open, and that the skip 266 is in the course of its upward movement to dump a batch into the revolving drum 267. When the skip reaches its uppermost position and thereby closes the switch 270, the batch-gate motor 286 is energized to close the batch-gate 20 through a circuit that includes the closed limit switch 290 and the solenoid 293, the function of the solenoid being to cause the

motor to rotate in the gate-closing direction. As the batch-gate 29 reaches its completely closed position, the limit switch 290 opens automatically to break the motor circuit.

When the skip is lowered to its material-receiving position under the batch-gate 20, first it permits the switch 270 to open, then it momentarily closes the switch 271 and finally it closes the switch 272 to initiate the operating cycle of the shaft 32, whereupon a new batch is automatically deposited in the batch-hopper above the batch-gate 20. The switch 278 is opened automatically before the skip reaches the switch 272 and remains open throughout the operating cycle but closes automatically when the load in the batch-hopper is completed. When both the switch 278 and the switch 272 are closed, they complete a circuit through the batch-gate motor 286 through the upper solenoid 282 and the limit switch 274. The energization of the upper solenoid 282 shifts the reversing switch 285 of the motor 286 to cause the motor to rotate in a direction to open the batch-gate 20, operating until the batch-gate opens the limit switch 274. The opening of the batch-gate releases the batch to the skip 266 and the skip may then be again elevated to transfer material to the mixer drum 267.

The preferred form of my invention and the arrangements indicated by Figs. 12 and 13 will suggest to those skilled in the art various changes and substitutions that may be made in various practices and embodiments of my invention. I reserve the right to all such changes and substitutions that come within the scope of my appended claims.

I claim as my invention:

1. An apparatus of the character described having in combination: a plurality of material supply means; discharge-control means for each of said supply means movable from a normal ineffective position to a discharge position; a batch-container adapted to receive material from said supply means; a cyclic means common to all of said discharge-control means and adapted to move said discharge-control means to their discharge positions in sequence at sequential points in an operating cycle; electrically-controlled means to actuate said cyclic means; a control circuit for said actuating means adapted when energized to cause operation of said cyclic means; a first switch in said control circuit having an inherent tendency to open; electro-magnetic means responsive to current in said circuit to hold said switch closed in opposition to said inherent tendency; a second switch in said circuit, said second switch being normally closed and being responsive to said cyclic means to open momentarily when said cyclic means approaches each of said sequential points in the operating cycle, thereby causing said first switch to open; and means responsive to the weight of material in said batch container to cause said first switch to close whenever the weight of the material reaches one of a progressive series of selected magnitudes determined by the relative quantities desired from said supply means whereby said cyclic means advances automatically from one of said sequential points in the operating cycle when the desired quantity from the corresponding supply means is discharged into the batch-container.

2. A combination as set forth in claim 1 in which means is provided to close said first switch to initiate said operating cycle and in which means is provided to automatically open said

second switch at the end of the operating cycle.

3. An apparatus of the character described having in combination: a plurality of material supply means; discharge-control means for each of said supply means movable from a normal ineffective position to a discharge position; a batch-container adapted to receive material from said supply means; a cyclic means common to all of said discharge-control means and adapted to move the discharge-control means to their discharge positions in sequence at sequential positions in an operating cycle; electrically-controlled means to actuate said cyclic means; a control circuit for said actuating means adapted when energized to cause operation of said cyclic means, said control circuit having a trunk portion and a branch portion; a first switch in said branch portion having an inherent tendency to open; electro-magnetic means in said trunk portion adapted when energized to hold said first switch closed in opposition to said inherent tendency; a second switch in said branch portion, said second switch being normally closed and being adapted to automatically open momentarily whenever said cyclic means approaches one of said sequential positions; and a third switch in said trunk portion, said third switch being normally open and being adapted to close in response to the weight of material in said batch-container at each weight value in a progressive series of selected values corresponding to the relative quantities of material desired from said supply means.

4. An apparatus of the character described having in combination: a plurality of material supply means; discharge-control means for each of said supply means movable from a normal ineffective position to a discharge position; a batch-container adapted to receive material from said supply means; a cyclic means common to all of said discharge-control means and adapted to move said discharge-control means to their discharge positions in sequence at sequential points in an operating cycle; electrically-controlled actuating means to drive said cyclic means through said operating cycle; switch means to stop said actuating means automatically at each of said sequential points in the operating cycle; scale means responsive to the load of material in said batch-container; a normally open first control circuit adapted when closed to cause energization of said actuating means; a normally open second control circuit adapted when closed to cause energization of said actuating means; means responsive to said scale means to close said first control circuit at each weight value in a first progressive series of selected weight values and to close said second control circuit at each weight value in a second progressive series of selected weight values; and switch means for making said two control circuits operative selectively whereby either of two sets of proportions may be had in said batch-container by appropriately adjusting said selective switch means in preparation for an operating cycle of said cyclic means.

5. An apparatus of the character described having in combination: a plurality of material supply means; discharge-control means for each of said supply means movable from a normal ineffective position to a discharge position; a batch-container adapted to receive material from said supply means; a cyclic means common to all of said discharge-control means and adapted to move said discharge-control means to their dis-

charge positions in sequence at sequential points in an operating cycle; electrically controlled actuating means to drive said cyclic means through said operating cycle; switch means to stop said actuating means automatically at each of said sequential points in the operating cycle; scale means responsive to the load of material in said batch-container; a normally open first control circuit adapted when closed to cause energization of said actuating means; a normally open second control circuit adapted when closed to cause energization of said actuating means; means responsive to said scale means to close said first control circuit at each weight value in a first progressive series of selected weight values and to close said second control circuit at each weight value in a second progressive series of selected weight values; a second switch means for making said two control circuits operative selectively whereby either of two sets of proportions may be had in said batch-container by appropriately adjusting said selective switch means in preparation for an operating cycle of said cyclic means; and means adapted to be operated by a material receiver to operate said second switch means selectively and automatically when the material receiver is moved into receiving position.

6. An apparatus of the character described having in combination: a plurality of material supply means; discharge-control means for each of said supply means movable from a normal ineffective position to a discharge position; a batch-container adapted to receive material from said supply means; a cyclic means common to all of said discharge-control means and adapted to move said discharge-control means to their discharge positions in sequence at sequential points in an operating cycle; actuating means to drive said cyclic means through said operating cycle; means to stop said actuating means to cause said cyclic means to pause at each of said sequential points in the operating cycle; means responsive to the weight of material in said batch-container to cause said actuating means to advance said cyclic means from said sequential points when the weight of material in the batch-container reaches predetermined values; closure means for controlling discharge from said batch-container to a material receiver, said closure means being adapted to open in response to movement of the material receiver to receiving position and being adapted to close in response to movement of the material receiver out of receiving position; and automatic means effective to start said operating cycle when said closure means closes in response to movement of the material receiver out of receiving position.

7. An apparatus of the character described having in combination: a plurality of material supply means; discharge-control means for each of said supply means movable from a normal ineffective position to a discharge position; a batch container adapted to receive material from said supply means; a cyclic means common to all of said discharge-control means and adapted to move said discharge-control means to their discharge positions in sequence at sequential points in an operating cycle; a motor to drive said cyclic means through said operating cycle; a circuit

arrangement to energize and control said motor; a first switch means in said circuit arrangement responsive to said cyclic means to stop said cyclic means automatically at each of said sequential points in the operating cycle; a second switch means in said circuit arrangement to cause said cyclic means to resume operation whenever the weight of material in said batch-container reaches one of predetermined sequential values; and a commutator in said circuit arrangement responsive to said cyclic means to restrict the instant weight values at which said second switch means is effective.

8. An apparatus as set forth in claim 7 in which said second switch means has a plurality of contacts representing selected weight values and in which said commutator operates to make said contacts effective in said circuit arrangement sequentially.

9. In an apparatus of the character described having in combination: a plurality of material supply means; a mechanically operable means for each of said supply means to control discharge therefrom, each of said discharge means being normally closed; a power driven actuating unit common to all of said discharge means to mechanically open temporarily each of said discharge means in sequence at sequential points in an operating cycle; a circuit arrangement for controlling said actuating unit; a first switch means in said circuit arrangement responsive to said power-driven actuating unit to stop said actuating unit automatically at each of said sequential points in the operating cycle; and a second switch means in said circuit arrangement to cause said power driven actuating unit to resume operation whenever the weight of material in said batch-container reaches predetermined sequential values.

10. An apparatus of the character described having in combination: a plurality of material supply means; discharge-control means for each of said supply means movable from a normal ineffective position to a discharge position; a batch-container adapted to receive material from said supply means; a cyclic means common to all of said discharge-control means and adapted to move said discharge-control means to their discharge positions in sequence at sequential points in an operating cycle; a motor to drive said cyclic means through said operating cycle; a circuit arrangement to energize and control said motor, said circuit arrangement including a plurality of parallel circuits representing selected weight values; a switch means in said circuit arrangement responsive to said cyclic means to stop said cyclic means automatically at each of said sequential points in the operating cycle; a cyclic switch included in said cyclic means to close contacts in said parallel circuits sequentially; and a switch responsive to the weight of material in said batch-container to close contacts in said parallel circuits sequentially as material in the batch-container reaches weights represented by the parallel circuits, thereby cooperating with said cyclic switch to close the parallel circuits.

WALTER E. SAXE.

CERTIFICATE OF CORRECTION.

Patent No. 2,336,130.

December 7, 1943.

WALTER E. SAXE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 13, for "switch 53" read --switch 58--; and second column, line 43, for "position" read --portion--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of February, A. D. 1944.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

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