This invention relates to an apparatus for feeding materials, for example, aggregates and a binding medium such as bitumen, Portland cement or the like, to a mixing machine as in the manufacture of concrete or paving product.

The specifications for concrete or paving mixtures usually require that the various components be mixed in proportion by weight and the mixing operation is usually carried out in batches.

It is, therefore, the principal object of the present invention to provide an apparatus for feeding the various materials by weight for a given specified time so as to deliver to the mixing machine, given quantities of the ingredients in predetermined weight ratios for mixture of a batch having the specified proportions by weight.

Other objects of the invention are to shut down automatically all of the weighing mechanisms when sufficient materials are delivered to a collecting hopper preparatory to discharge of the collected materials into the mixer, and to provide a time control means for shutting down the mixer after the required mixing time has expired.

In accomplishing this and other objects of the invention as hereinafter pointed out, I have provided improved structure, the preferred form of which is shown in the accompanying drawings wherein:

Fig. 1 is a longitudinal section through a mixing machine and feeding apparatus embodying the features of the present invention, the motor circuits being shown diagrammatically.

Fig. 2 is an enlarged side elevation view of the feeding mechanism for one of the ingredients.

Fig. 3 is a cross section on the line 3-3 of Fig. 2.

Fig. 4 is a fragmentary view of a scale beam, axle and recorder for indicating weight of the material being discharged through a given period of time.

Fig. 5 is a detail perspective view of the transmission operating a feed belt and showing the recorder for recording feet of belt delivery during a given period of time.

Referring more in detail to the drawings:

I designates a machine adapted for feeding and mixing aggregates with a bitumen or similar binding material in a batch and in accordance with a specified weight ratio of the respective ingredients. The machine includes a base 2 carrying a frame 3 including longitudinal members 4 and 5. Supported by the frame above the longitudinal members 4 and 5 are hoppers 6, 7 and 8 for containing the dry materials such as the aggregates to be used in making, for example, a paving product. The hoppers have discharge throats 9, 10 and 11 in the bottoms thereof through which the aggregates are discharged into gravimetric feeders 12. The gravimetric feeders are of the same construction, and the description of one suffices for the others. Therefore, only one of the feeders will be described in detail.

Supported below the feed throat of each of the respective hoppers is a downwardly sloping feed tray 13 suspendedly supported by pairs of links 14 and 15 pivoted to the hopper throats as indicated at 16 and to sides of the tray 13 as at 17. The bottom 18 of the tray is spaced from the throats a sufficient distance to allow oscillating movement thereof for promoting discharge of the material as later described.

Formed in each feed throat at the sides thereof at adjacent the discharge end of the feeding tray is an outlet opening 19 which cooperates with a lower or forward edge of a corresponding tray to discharge the material from a hopper. Projecting from the sides of the outlet opening 19 are arms 20 supporting a valve member 21 on a shaft 22 that is carried by the arms 20 and actuated from a remote point through a link 23 having connection with a crank arm 24 on the shaft 22. The valve member 21 has a gate portion 25 movable over the opening 19 to regulate the effective area thereof so that approximately a desired amount of material is delivered from the hopper in a continuous stream.

In order to maintain a positive feed of material from the hoppers, each tray 13 is reciprocated by actuating mechanisms 26. Each actuating mechanism includes a transmission 27 mounted on cross members 28 of the frame to the rear of the respective discharge throats and which is actuated through a belt connection 29 with a motor 30.

Fixed on the driven shaft of the transmission is a pulley 31 (Fig. 5) for driving a pulley 32 on a transverse shaft 33 (Fig. 2). The transverse shaft 33 is located in horizontal alignment with the feed tray on bracket-like supports 34. Slidably mounted in a bearing 35 carried by each bracket-like support 34 is a tappet 36 having a seat 37 engageable with a shaft 38 on the tappet 36 located in coaxial alignment with the tappet in spaced relation therewith is a rod 39 having connection with a tray 13. Each tray 13 together with its rod 39 is normally retained in a forward position by a coil spring 40 sleeved on the rod and having one end bearing against the bracket 34 and its opposite end against a crutch 41 fixed on the rod 39. Fixed to the facing end of the rod and tappet 36 are inclined heads 42 and 43 and projectable between the heads is a control wedge 44 that is supported by a link 45 connected with a scale beam, later to be described.

It is obvious that when the wedge is positioned to fill the space between the heads 42 and 43, full movement of the tappet is imparted to the feeding tray 13 through the rod 39 to effect maximum movement thereof in one direction for return by the spring 40, but as the wedge is withdrawn to leave space between the wedge and respective heads 42 and 43, the stroke of the feeding tray is reduced proportionate to the spacing since part of the movement of the tappet is ineffective until the head and the tappet have moved sufficiently to take up the spaces. Thus by moving the control wedge 44, any predetermined feed of material may be maintained from the throat of the hopper, the primary or rough adjustment being made by the valve member 21 and the fine adjustment through the control wedge 44.

Carried by the longitudinal members 4 and 5 are spaced pairs of scale beam hangers 47 and 48 forming the fulcrum 49 and 50 for pairs of scale beams 51 extending toward each other and having their adjacent ends interconnected by links 53 as shown in Fig. 2. One of the scale beams of the rear pair has an arm 54 that projects rearwardly along the sides of the hopper throat and carries a balancing poise 55 that is slidably mounted thereon to effect balance of the scales. Suspendingly supported from the respective scale beams in spaced relation with the fulcrum points 49 and 50 are hangers 56 and 56' suspending a feed belt frame 57. Journalled in the frame 57 at the ends thereof are shafts 58 and
59 and carried thereon are pairs of sprockets 60 and 61 over which chains 62 and 63 of a feeder belt 64 operates. Fixed to the shaft 60 at one end thereof is a worm-gear 65 meshing with a worm 66 which is connected with a driven shaft 67 of the transmission 27 through a flexible joint 68 so that the feed belt is driven at a predetermined speed. By setting the poise 55 on the scale beam, the scale may be made to balance and by moving the poise from the feed balancing position, the scale will again effect a balance when the weight of the materials thereon corresponds with the position of the poise on the scale beam. Thus as long as the correct amount of material is carried on the belt, the scale will balance and maintain a continuous stream of material at a constant feeding rate in accordance with the weight thereof.

Should the weight of material on any one of the belts change, the scale for that belt is thrown out of balance to cause raising or lowering of the wedge and increase or decrease of the feeding rate of the tray to compensate for the material change. A meter 70 for indicating the rate of feed in accordance with the weight of the material. The weight of material may be recorded and any change may be noted by connecting the poise with a recorder 69 (Fig. 4). The footage rate of movement of the conveyor may also be recorded by means of an instrument 70 having connection with a driven element 71 on the transmission (Fig. 5).

Means is provided for stopping operation of the feeders in case one of the hoppers runs out of material, or in case the rate of feed should change from that set by the scale beams. Fixed to the frame of the machine adjacent to the balance arm 54 of each feeder is a bracket 72 pivotally mounting a mercury switch 73, and fixed to the balance arm 54 is a cooperating bracket 74 having inwardly directed fingers 75 and 76 (Fig. 2) to engage the ends 77 and 78 of a lever 79 carried by the mercury switch 73. The fingers 75 and 76 are located relatively above and below the ends of the lever 79 so that when the beam arm 54 swings downwardly because of lack of material on the belt, the finger 75 engages the lever to close circuit through the conductors 80 and 81 to a solenoid switch 82. The solenoid switch 82 opens circuit through conductors 83 and 84 supplying current to the motors 58. The circuit including the mercury switch 73 is supplied from a transformer 85 that is connected with the main line wires 86 and 87 through branch conductors 88 and 89 (Fig. 1). Thus it is obvious that when any one of the mercury switches 73 is closed because of lack of or a reduced amount of material, the operation of all the feeders is suspended.

Since a reason, one of the feeding mechanisms fail to operate, an excessive amount of material is delivered onto the feeding belt, the scale arm 54 will swing upwardly and the finger 76 on the beam will tilt the mercury switch 73 to effect opening of the motor circuits so that feed of all of the material will be stopped until the correct, desired feeds are again established. A signal 82 may be connected in circuit with the electromagnet 82 to give a visible or audible signal to remote areas that the machine has been shut down.

In operation, the poises 55 of the respective scale mechanisms are set on the scale arms 54 to regulate actuation of the feeding trays 13 in cooperation with the control value 21 for maintaining for a predetermined feed of the aggregates from the respective hoppers according to the weight of the materials being carried in the respective conveyors.

Feed of the materials is effected by gravity through the effective areas of the discharge openings 19 under influence of the vibrating trays 13 to the extent of vibration controlling the amount of feed. Should the pressure of feed onto one of the belts exceed the specified amount by weight, the increased feed on the belt changes the position of the beam arm 54 for that unit, which change in position of the beam arm 54 effects a corresponding change in the control wedge 44 to slow the feed tray 13 for that particular mechanism. When the feed is such as to again maintain the balance as set by the counterpoise 55, the wedge 44 for that unit is automatically readjusted to maintain the feed at the desired amount. Should the poise 55 be moved to change the rate of feed, the action is registered on the recorder 69 (Fig. 4).

The respective aggregates in the proper proportions by weight are discharged off the ends of the feed belts 62 onto a collecting belt 90. The belt 90 has a run 91 extending under the belts 62 and supported by sprockets 92. The belt is driven continuously through a motor 93 and a speed-reducing unit 94 with current through conductors 95 and 96 when a switch 97 is closed. The belt 90 deposits the materials in a hopper 98 which is carried above a mixer or pulpmill 99.

After the amount of materials have been delivered into the collecting hopper 98 for a given batch, means is provided for shutting down the feed by opening circuit to all of the motors 58. This is effected by a time switch 100 that is contained in the circuit conductors or wires 83 and 84. Therefore, when the running time for which the time switch 100 has been set is reached, the motor circuits are automatically opened to stop further feed from all of the hoppers. However, the conveyor 90 operates continuously to clean the mixture of all the feeders.

The hopper 98 has an outlet 101 at the bottom thereof that is normally closed by a gate 102. The gate may be opened and closed by a motor 103 supplied with current through conductors 104 and 105 that are connected with the main line conductors 86 and 87. The hopper 98 is large enough to contain an entire batch of materials wherein a previous batch is being mixed in the mixer 99.

The motor 103 is operated by switch 106.

When the materials are being discharged into the hopper of the pulpmill, a binding material, such as bitumen in the case of asphalt or water in the case of concrete, is discharged onto the material through a nozzle 107 under pressure of a pump 108. The pump 108 is operated through a belt 109 that is driven by a motor 110. The motor 110 is connected in circuit with the current supply through branch conductors 111 and 112. Since the capacity of the pump is a known factor, a quantity may be delivered with the materials into the pulpmill by controlling the timing of operation. This is accomplished by a time switch 113 which is connected in the circuit of the wires 111 and 112 so that it may be set to stop the pump motor when the required amount of fluid has been delivered to the pulpmill. After the materials are delivered to the pulpmill, they are thoroughly mixed therein by means of mixing devices 114 which are operated through a belt 115 driven by a motor 116. The motor 116 is supplied with current through branch conductors 117 and 118. The mixing time for the materials is controlled by a time switch 119.

After the batch has been mixed, it is discharged from the pulpmill through an outlet 120 into trucks or other conveyances used in moving the product to the place of use.

Switches 121, 122 and 123 are provided in conductors 83, 112 and 118 for manual operation in place of the time switches 100, 113 and 119 when weighing, collecting and mixing ingredients used in the apparatus.

From the foregoing, it will be obvious that I have provided a simple apparatus for mixing a product in a batch and which assures that the batch contains the various ingredients in accordance with the weight thereof so as to conform with standard specifications.

What I claim and desire to secure by Letters Patent is:

1. A machine for mixing aggregate materials in batch including means for gravity-controlled feeding and conveying mechanisms for each material and having discharge ends, actuators for each of said feeding mechanisms including a motor, a common current supply circuit
connected with said motors, a time switch in said circuit for stopping operation of the weight-controlled feeding means after a predetermined time interval, a collecting hopper, a conveyor extending under the discharge end of each weight controlled feeding means and having discharge into the collecting hopper for receiving the weighed material discharged from each weight controlled feeding means for conveying the materials to the collecting hopper, a mixer for receiving the materials from the collecting hopper, a nozzle for discharging a liquid on the materials delivered to the mixer, a pump connected with the nozzle for supplying the liquid, a motor connected with the pump, a circuit connected with the motor for supplying an electric current, and a time switch in the last-named circuit for stopping operation of the pump after a predetermined time interval.

2. A machine of the character described including a plurality of hoppers having outlets for separate aggregate materials contained in said hoppers, valves controlling the outlets to maintain a predetermined discharge of materials from the outlets, weighing means below each of said outlets for weighing and discharging the weighed material, a conveyor extending along the discharge of said weighing means for receiving discharge from all of the weighing means and having a discharge end, a collecting hopper at the discharge end of the conveyor for receiving the material from the conveyor, means actuated by said weighing means for regulating discharge of material from said outlets, timing means for suspending feed by said weighing means after a predetermined time interval, and means for continuing operation of the conveyor after the timing means has stopped the weighing means to assure collection of all the materials into the collecting hopper.

3. A machine of the character described including, a plurality of storage hoppers having outlets for materials contained in said hoppers, a separate feeding means below each outlet to maintain a predetermined discharge of materials from the outlets, a collection conveyor common to all the feeding means of the storage hoppers, a collection hopper, conveying means in receiving position relatively to all of said feeding means and having discharge into the collection hopper for discharging the materials into the collection hopper, scale means for weighing the material carried by the conveying means, means actuated by said scale means and connected with said feeding means for regulating discharge of material from said outlets onto the conveying means, means for actuating the conveying means, a circuit supplying current to the actuating means, and a time switch in said circuit for stopping operation of the actuating means after a predetermined time period.

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