Jan. 23, 1945. R. F. HOHMAN 2,367,775

APPARATUS FOR FEEDING MATERIAL

Filed Sept. 28, 1942 7 Sheets-Sheet 1

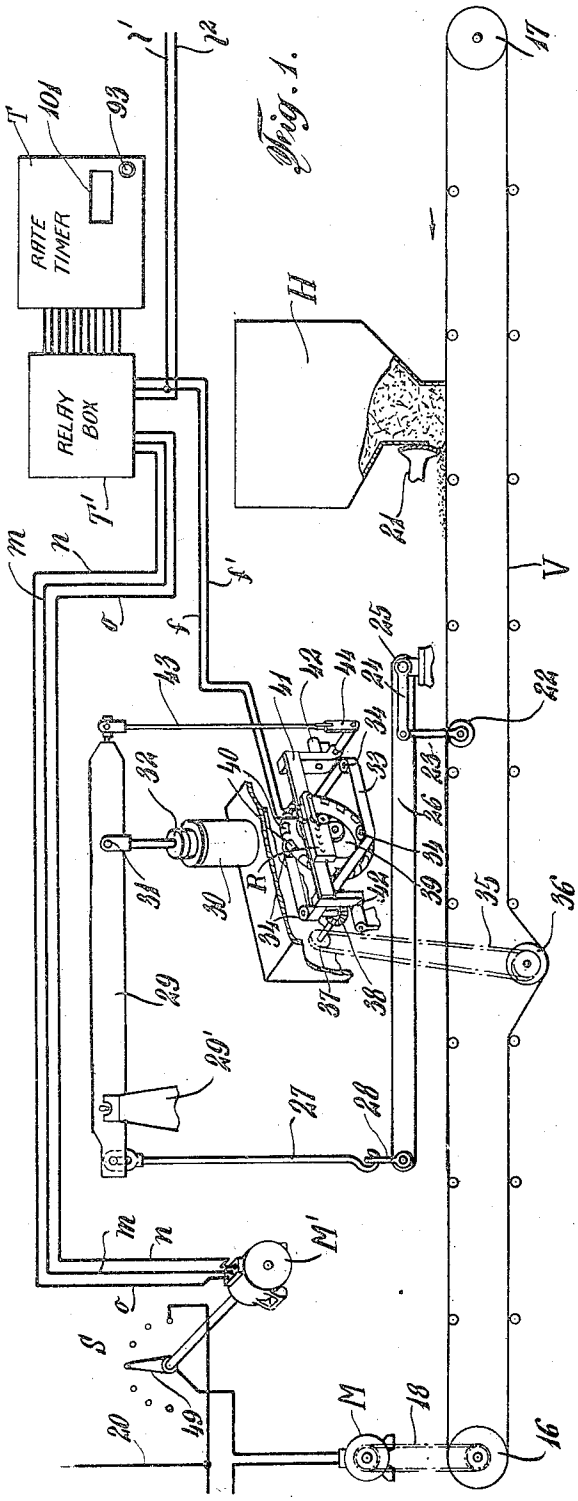

Fig. 1.

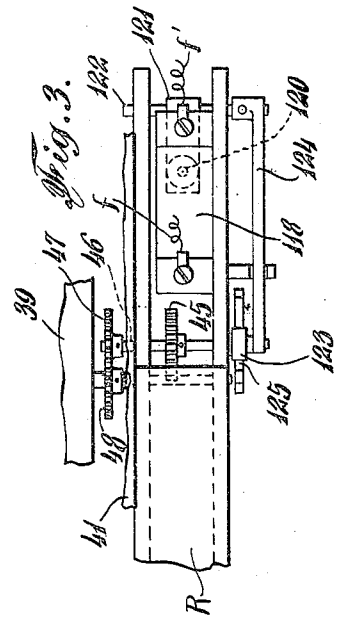

Fig. 3.

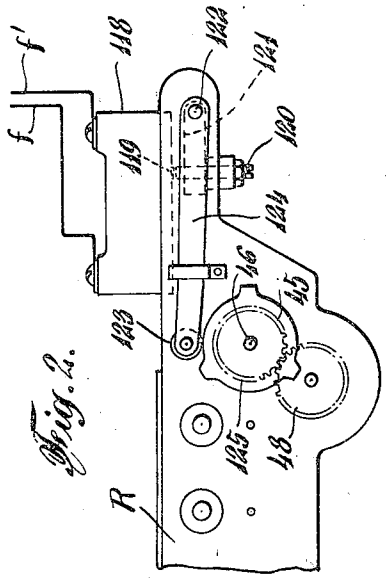

Fig. 2.

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APPARATUS FOR FEEDING MATERIAL

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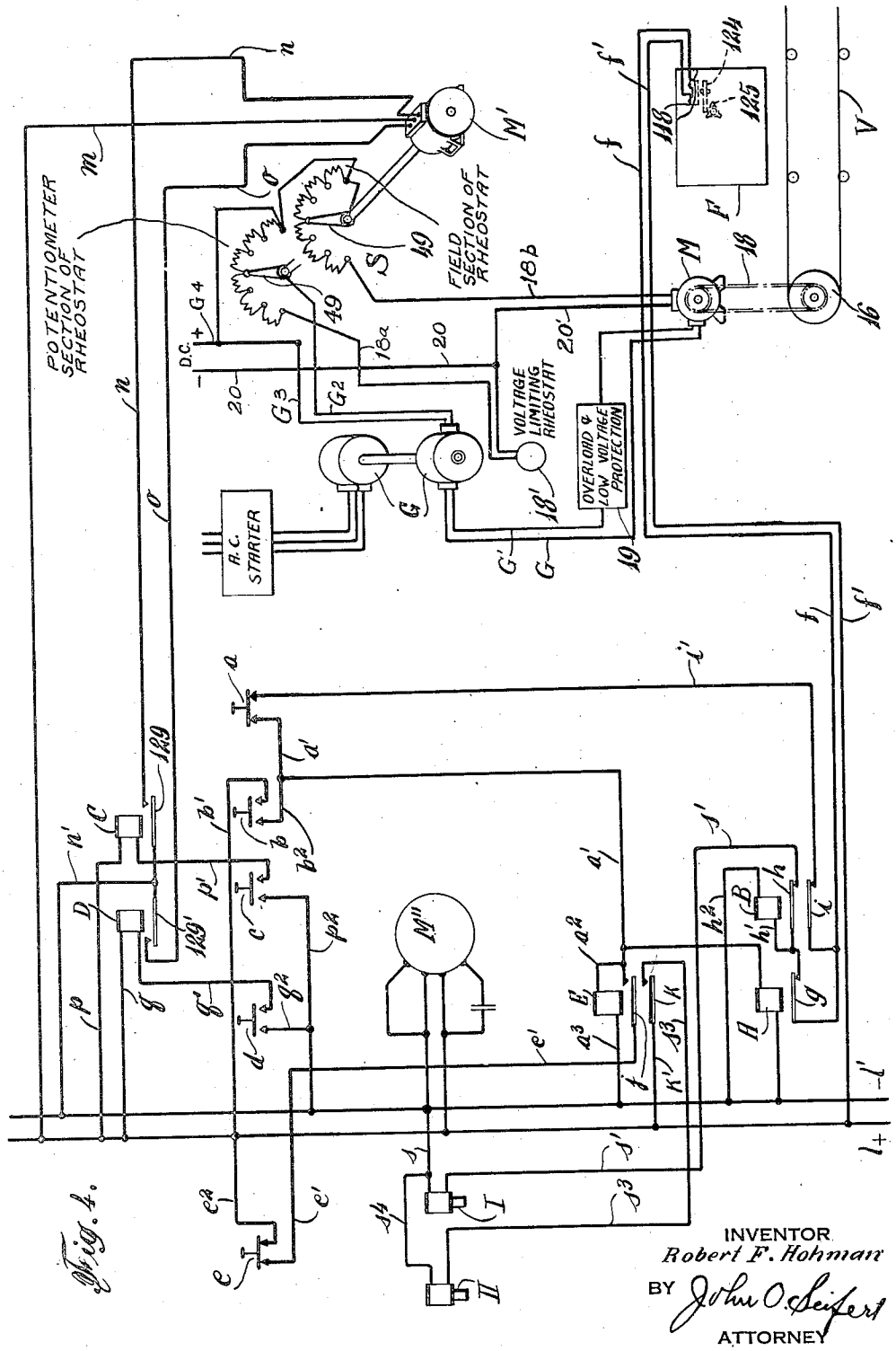

Fig. 4.

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APPARATUS FOR FEEDING MATERIAL

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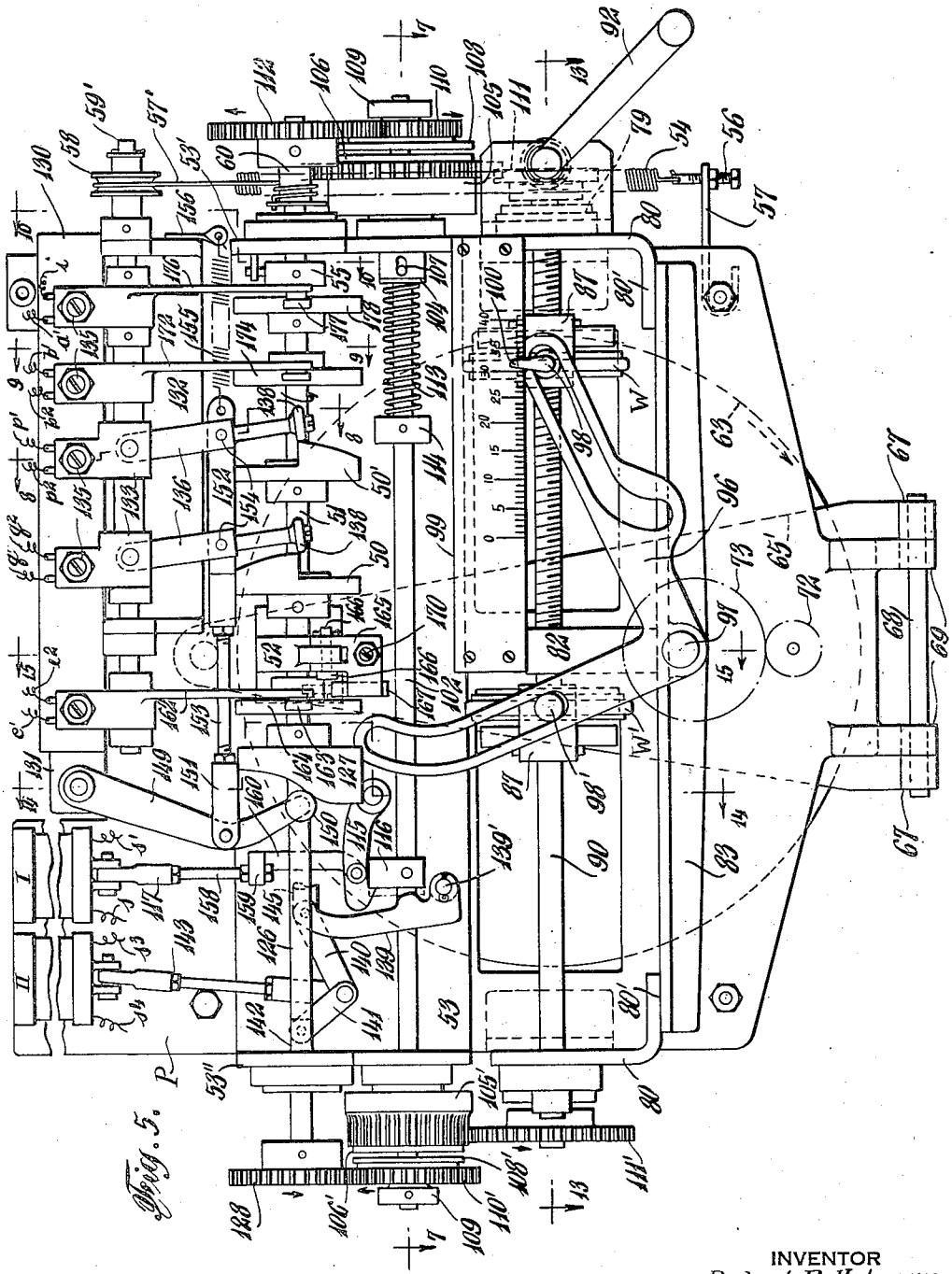

Fig. 5.

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APPARATUS FOR FEEDING MATERIAL

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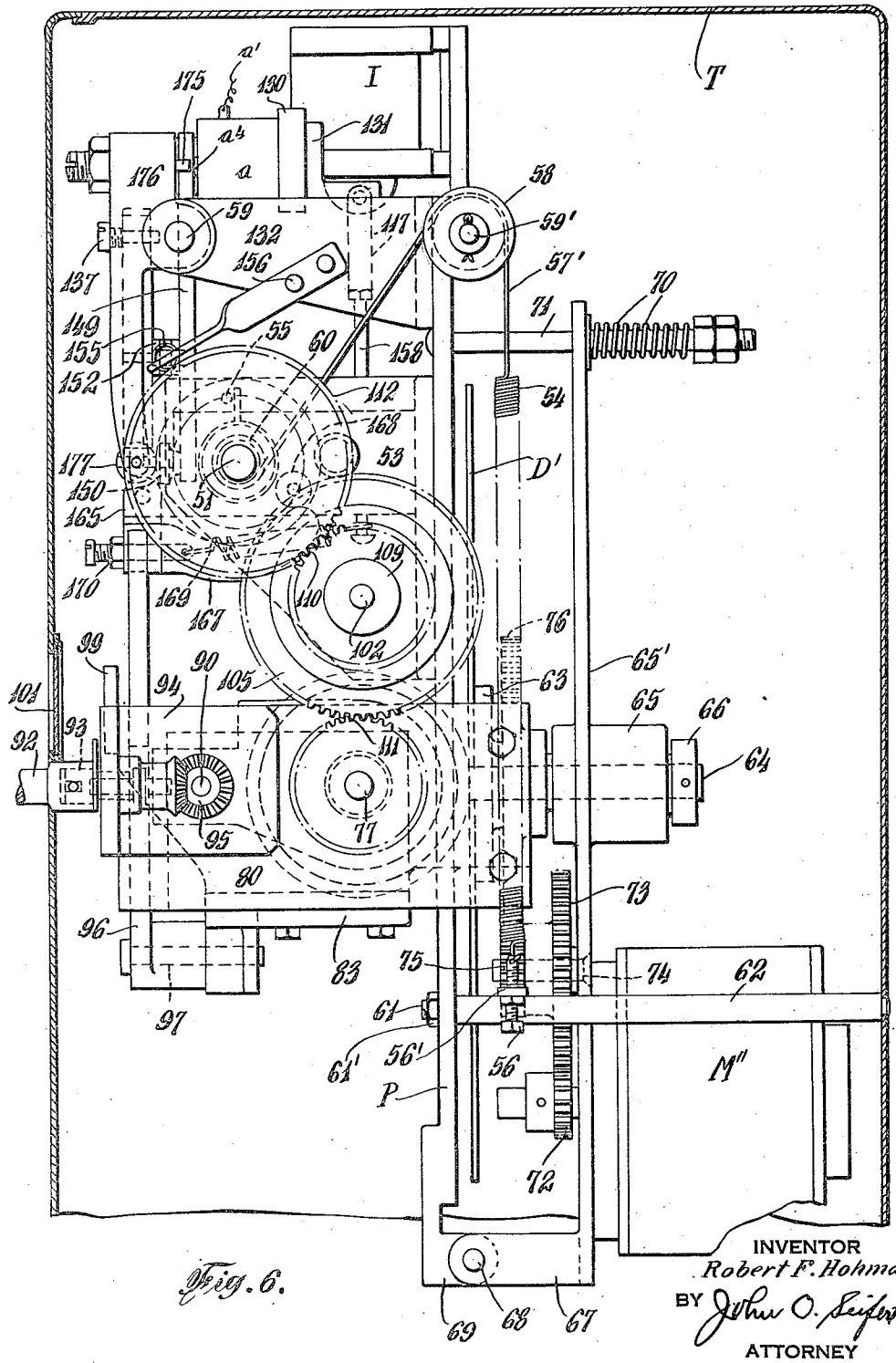

Fig. 6.

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APPARATUS FOR FEEDING MATERIAL

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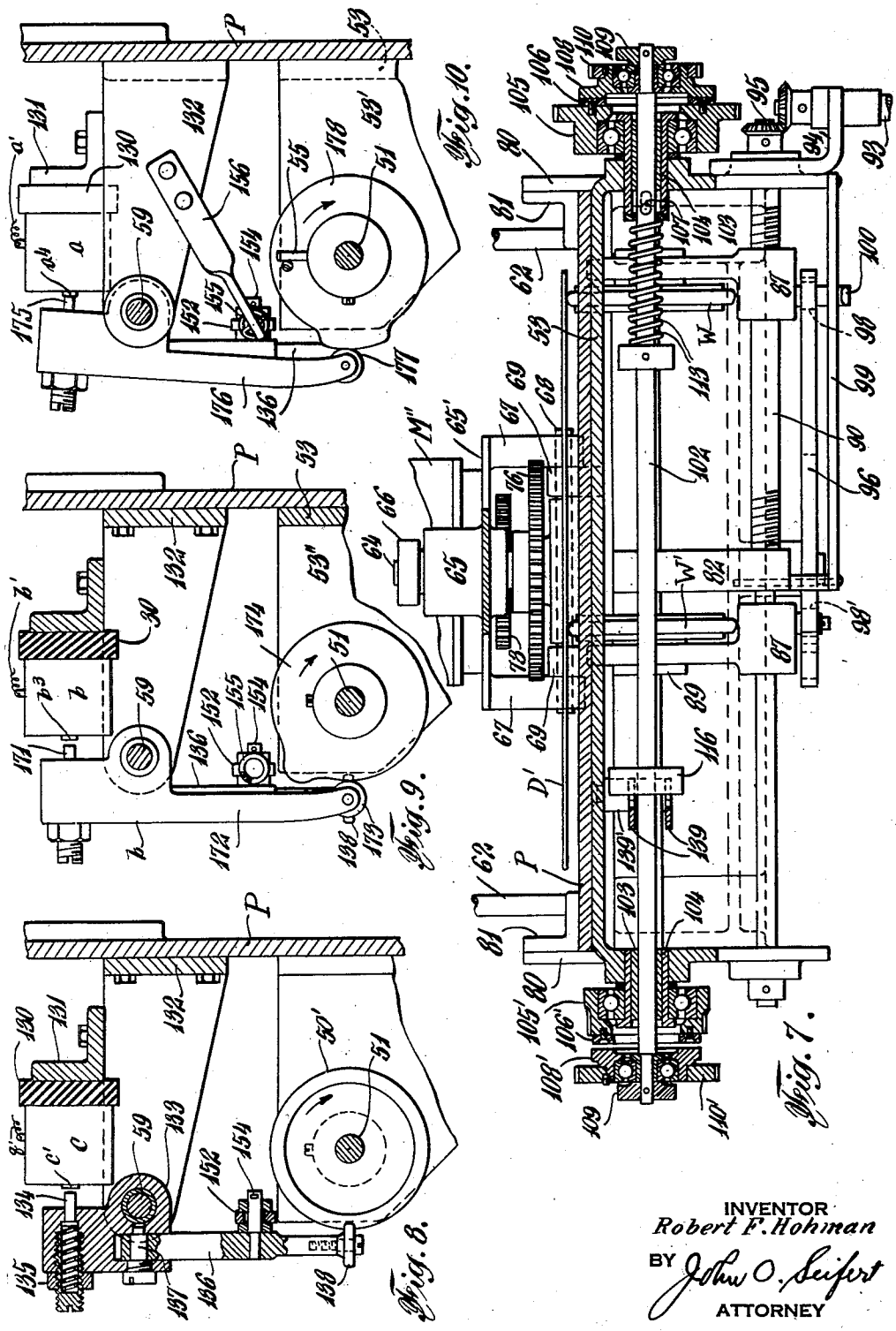

Fig. 10.

Fig. 9.

Fig. 8.

Fig. 7.

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APPARATUS FOR FEEDING MATERIAL

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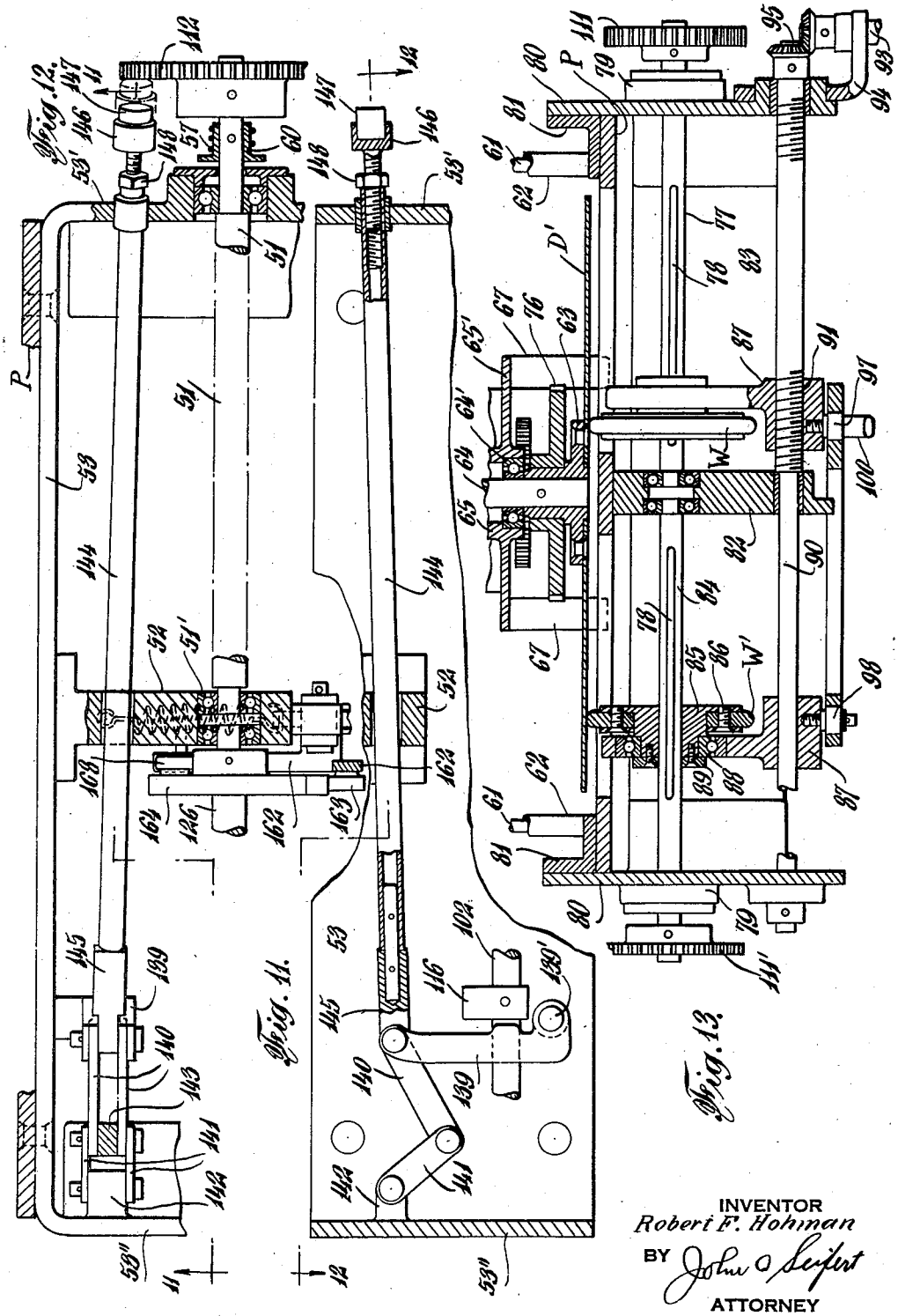

Fig. 12.

Fig. 11.

Fig. 13.

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APPARATUS FOR FEEDING MATERIAL

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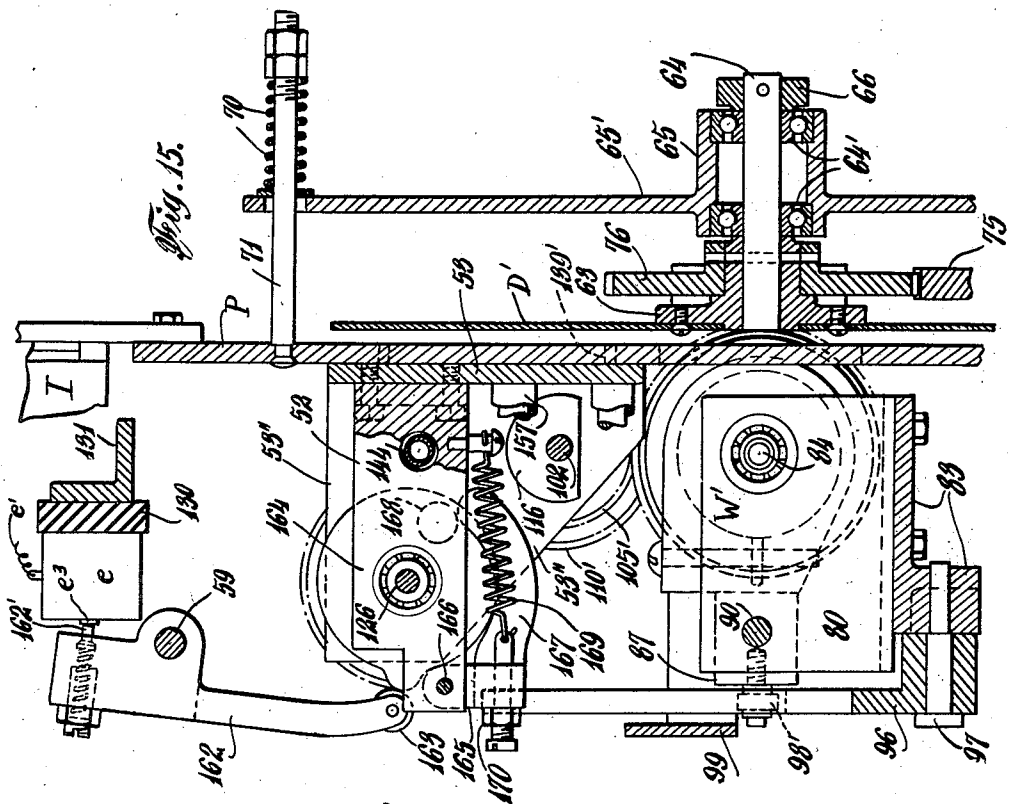

Fig. 15.

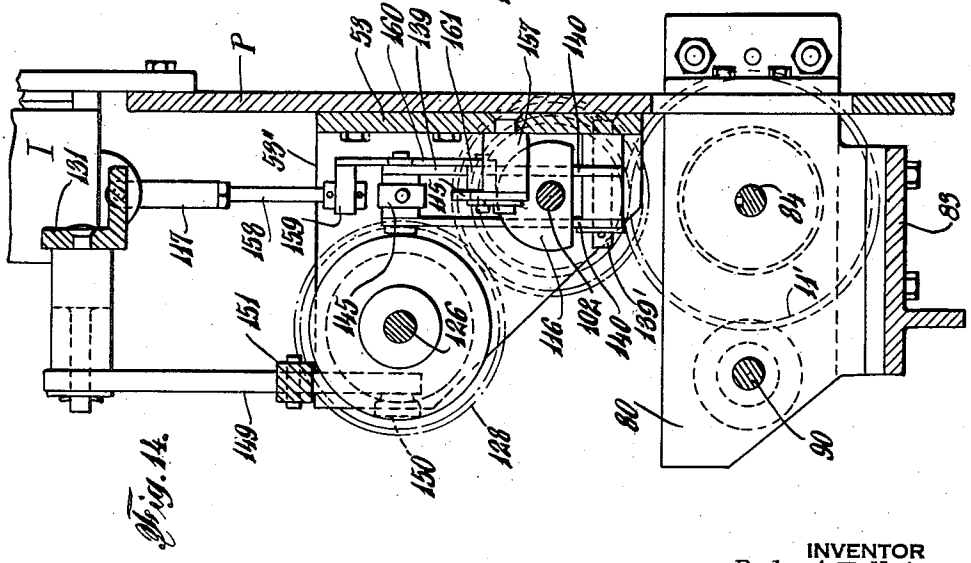

Fig. 14.

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UNITED STATES PATENT OFFICE

2,367,775

APPARATUS FOR FEEDING MATERIAL

Robert F. Hohman, Passaic, N. J., assignor to Merrick Scale Mfg. Company, Passaic, N. J., a corporation of New Jersey

Application September 28, 1942, Serial No. 459,979

32 Claims. (Cl. 198—37)

This invention relates to the feeding of material, and relates particularly to means to automatically regulate the flow of a stream of material to feed material at the rate of a predetermined weight from a source of supply of the material to a place of use or storage of the material.

It is the primary object of the invention to provide in means for continuously feeding material at the rate of a predetermined weight, means operative at successive intervals of time and controlled by the feeding of proportionate portions of the material to regulate the operation of the feeding means to feed material in proportion to any change in the interval of time for feeding a proportionate portion of the material and feed the material at an average of the rate of the predetermined weight.

It is a further object of the invention to provide in material feeding means to continuously feed material at the rate of a predetermined weight, means operative at successive intervals for timing and detecting any change in the operation of the feeding means to feed successive proportionate portions of material, and means rendered operative by a change in the rate of feeding a proportionate portion of the material to vary the operation of the feeding means to effect an increase or decrease in the feeding of the material and feed the material at an average of the predetermined weight.

It is another object of the invention to provide in material feeding means operative to feed material in a continuous stream at the rate of a predetermined weight, means to regulate the flow of the stream of material to feed the material at the rate of the predetermined weight and vary the rate of feed of the material, comprising means operative at successive intervals of time controlled by the feeding of a portion of material of predetermined weight to establish an electric circuit and render means operative to detect any change in the rate of feed of the material and render the regulating means operative to vary the rate of feed of the material in inverse proportion to the magnitude of the detected change in the rate of feed of the material and feed the material at an average of the predetermined weight.

It is another object of the invention to provide in material feeding means including a travelling conveyer adapted to travel at a speed to feed material at the rate of a predetermined weight from a source of supply of the material, means operative at successive intervals to detect any variation in the rate of feed of the material by the conveyer during said intervals, and vary the speed of travel of the conveyer to feed material in inverse proportion to any variation in the rate of feed of the material by the conveyer during said intervals.

It is a further object of the invention to provide in material feeding means including a travelling conveyer, means to counterbalance material of a predetermined weight on the conveyer, means to variably actuate and cause the conveyer to travel at a speed to feed material at the rate of said predetermined weight, and means operative at successive intervals of time for timing the feeding of the material, detect any change in the travel of the conveyer to feed the material at the rate of said predetermined weight during said intervals and render means active to vary the operation of the actuating means for and the speed of travel of the conveyer to feed material in inverse proportion to the magnitude of any change in the rate of feed of the material and feed material off from the conveyer at an average of said predetermined weight.

Another object of the invention is to provide in material feeding means including a travelling conveyer and means to counterbalance material of predetermined weight on the conveyer, variable speed operating means to actuate the conveyer to travel at a speed to feed material from a source of supply at the rate of the weight counterbalanced on the conveyer and integrate and register the cumulative weight of the material fed by the conveyer, and means rendered operative from the operation of the integrating means and feeding of material of predetermined weight by the conveyer to detect any change in the travel of the conveyer to feed material of said predetermined weight and render means operative to vary the operation of the actuating means for and vary the speed of travel of the conveyer to feed material in inverse proportion to the magnitude of any change in the travel of the conveyer to feed material of said predetermined weight and average the feeding of the material off from the conveyer at the rate of said predetermined weight.

Other objects and advantages of the invention will hereinafter appear.

In the drawings accompanying and forming a part of this application,

Figure 1 is a diagrammatic representation of an embodiment of the invention showing in side elevation a material conveyer and means to counterbalance material of predetermined weight thereon, and showing in perspective means to integrate and register the cumulative weight of

the material fed by the conveyer and circuit making means actuated thereby connected in circuit with and controlling the operation of means for timing the feeding of the material and the operation of circuit closing means for controlling the operation of means to regulate the operation and feeding of material by the conveyer.

Figure 2 is a front elevation of a portion of the register and circuit making means actuated by the integrating means to control the operation of the timing means.

Figure 3 is a view looking at the top of Figure 2.

Figure 4 is a wiring diagram showing the electrical hook-up of the conveyer actuating motor with its source of power and the electrical connections between the circuit making means actuated by the integrating means and the means for controlling the operation of the timing means and circuit closing means for controlling the operation of a reversible motor for actuating a rheostat device for regulating the operation of the conveyer actuating motor.

Figure 5 is a front elevation of the means for timing the feeding of material by the conveyer and means to cooperate therewith to detect any change in the rate of feeding the material and actuating the circuit closing means for and controlling the operation of the rheostat actuating motor.

Figure 6 is an elevational view, partly in section and partly broken away, looking at the right of Figure 5.

Figure 7 is a sectional view taken on the line 7—7 of Figure 5 looking in the direction of the arrows.

Figures 8, 9 and 10 are sectional views taken on the lines 8—8, 9—9 and 10—10 of Figure 5 looking in the direction of the arrows.

Figure 11 is a sectional view taken on the line 11—11 of Figure 12 looking in the direction of the arrows, and showing means to lock the timing means in actuated position during the actuation of the detecting and circuit closing means for the reversible motor.

Figure 12 is a sectional view taken on the line 12—12 of Figure 11.

Figure 13 is a sectional view taken on the line 13—13 of Figure 5 looking in the direction of the arrows.

Figures 14 and 15 are sectional views taken on the lines 14—14 and 15—15 of Figure 5 looking in the direction of the arrows.

In carrying out the embodiment of the invention illustrated in the drawings, as shown in Figure 1, the material is fed in a continuous stream by a conveyer V of the endless belt type passing around and supported by pulleys or drums 16 and 17 and the conveyer actuated or driven to travel in the direction indicated by the arrow by a motor M operatively connected to the drum 16 by a sprocket chain passing around a sprocket wheel rotatable with the drum 16 and a sprocket wheel fixed on the shaft of motor M, or of a speed reducing mechanism associated therewith, as shown at 18. In the present instance the motor M is a direct current motor connected by conductor G', G'' in circuit with a motor-generator G (Figure 4) connected to a source of alternating electric current, the conductor G'' having an overload and low voltage protective device interposed therein, as shown at 18' in Figure 4, the motor M also being connected to a separate source of direct electric current excitation, hereinafter described.

Material to be fed by the conveyer is supplied to the conveyer from a suitable source of supply, and shown as discharged onto the conveyer from the outlet of a hopper or bin H, the area of the bin outlet being adapted to be varied, and thereby the discharge of the material from the hopper or bin H, by an adjustable gate 21. The material is fed by the conveyer at the rate of a predetermined weight, and for this purpose means are provided for counterbalancing material of a predetermined weight on the conveyer. As shown this means comprises a roller 22 rotatably supported at the ends by a pair of links 23 pivotally suspended from one end of a pair of arms 24 fixed at the opposite ends to and extending horizontally from a shaft 25 rotatably supported in bearings mounted on a fixed support, the roller extending transversely below and supporting a portion of the lower stretch of the conveyer intermediate the conveyer supporting drum 16 and the bin H. A weighing lever 26 of greater length than the lever arms 24 is fixed at one end to the shaft 25 to extend parallel to the lever arms 24 and at the opposite end pivotally supported by a rod 27 having a hook at one end engaging a clevis 28 pivotally connected to said weighing lever and the opposite end of the rod pivotally connected to the short end of a beam 29 fulcrumed upon a fixed support 29'. The material on the conveyer is automatically counterbalanced and the beam 29 is caused to be deflected from the horizontal or balanced position in proportion to the load on the conveyer by a plunger operating in a dash pot 30 mounted on a fixed part, the plunger being carried by a rod pivotally connected to and suspended from the long end of the beam, as at 31. To counterbalance the dead weight of the parts suspended from the short end of the beam 29 counterpoise weights 32 are applied to the plunger rod of the dash pot.

Means are provided for integrating the weight of the material fed by the conveyer and to register the cumulative weight of the material fed by the conveyor. While this integrating means may be of different construction and arrangement, as shown it is of the type disclosed in Letters Patent No. 954,870 issued April 12, 1910, only so much of said mechanism, as well as of the weighing mechanism, being shown as is essential to an understanding of the invention. The integrating means comprises a belt 33 supported by and passing around a series of four pulleys 34 mounted in a casing, only a portion of which casing is shown, to rotate on vertical axes and whereby the belt is adapted to travel in a rectangular path in a horizontal plane, the belt being driven at a speed in correspondence with one of the quantities, the speed of travel of the conveyer, to be integrated, and is driven from the conveyer by a sprocket chain 35 passing around a sprocket wheel fixed on the shaft of a roller 36 frictionally engaging and driven from the lower stretch of the conveyer, and around a sprocket wheel 37 fixed on a shaft having a bevel pinion connection with a shaft of one of the pulleys 34, as shown at 38. A carrier in the form of a disk 39 carries a series of integrating rollers or wheels 40 mounted on the disk to independently rotate about axes tangential to the periphery of the disk, and the carrier is supported in a frame 41 to rotate within the belt 33 about an axis transverse to the travel of said belt and diametrically opposite integrator wheels 40 frictionally engaging opposite stretches of the belt, the rotation of the disk or

carrier being representative of the other quantity to be integrated, the weight of the material fed by the conveyer and transported over the roller 22 of the weighing mechanism. The frame 41 is pivotally supported, as at 42, to have adjustment on an axis transversely of the axis of rotation of the carrier 39 and the travel of the belt 33, whereby the carrier is adapted to be positioned to extend at a right angle, and different angles less than a right angle, relative to the plane of travel of said belt. When the carrier is positioned at a right angle to the travel of the belt 33 with diametrically opposite integrating wheels 40 contacting opposite stretches of the belt said wheels are rotated about their axes and no rotation is imparted to the carrier or disk. Should the carrier supporting frame 41 be adjusted so the carrier is disposed at an angle less than a right angle relative to the travel of said belt, the belt exerts a force on the integrating wheels contacting the belt perpendicular to the plane of rotation thereof and thereby produces rotation of the carrier or disk 39 across the face of the belt, the following rollers coming into action with the belt in orderly procession and imparting continuous rotation to the carrier. The carrier is adapted to be adjusted to take different positions in angular relation to the travel of the belt 33 by the load or weight of the material on the conveyer. For this purpose the disk carrying frame 41 is connected to the beam to participate in the deflection thereof out of the horizontal or no load position in direct proportion to the weight of the material on the conveyer by a rod 43 pivotally connected at one end to the end of the beam and connected at the opposite end, as at 44, to the frame 41. By this arrangement the frame 41 and thereby the carrier 39 will instantly take different angular positions relative to the plane of travel of the belt 33 corresponding to fluctuations in the value of the weight of the material on the conveyer. A complete revolution is imparted to the carrier or disk 39 by the feeding of a quantity of material of predetermined weight over the roller 22 or weighing point, and each revolution of the carrier 39 is, therefore, representative of a quantity, or the weight, pounds or tons, of material fed by the conveyer. To register the successive revolutions of the carrier 39 and thereby the cumulative weight of the material fed by the conveyer a register or counter R of conventional form is mounted on the frame 41, the primary mover of which register is actuated from the carrier 39 by a pinion 45 (Figure 3) fixed on a shaft 46 and the shaft rotated by a pinion 47 fixed thereon meshing with a pinion 48 fixed on the supporting trunnion or shaft of the carrier 39.

The conveyer is adapted to feed material from the bin H and off from the end of the conveyer at the rate of the predetermined weight determined by the quantity of material discharged onto the conveyer from the bin controlled by the adjustable gate 21 and the speed of travel of the conveyer. To vary the speed of travel of the conveyer, means are provided to vary the excitation of the field of and actuation of the motor M for driving the conveyer, and as shown comprises a rheostat device, shown in a conventional manner at S in Figures 1 and 4, and including potentiometer and field sections.

The motor M is connected by a conductor 18b to a terminal contact of the field section of the rheostat and by conductors 18a and 20' to the terminal contact of the potentiometer section of the rheostat, said conductors 18a and 20' having a voltage limiting rheostat 18' interposed therein. The motor G is connected by conductor G^3 to the terminal contacts at the ends of the potentiometer and field sections of the rheostat opposite the ends to which the conductors 18a, 18b are connected, and said generator G connected by conductor G^2 in circuit with circuit maker 49 of the rheostat device adapted to make contact with one of a series of contacts electrically connected to different portions of the potentiometer and field sections of the rheostat device S and thereby connect into and cut out of the circuit of motor M different amounts of the resistance of the rheostat device and correspondingly vary the actuation of motor M. The circuit maker 49 is set whereby during the normal operation of the motor M a portion of the resistance device will be connected in the circuit of said motor and the actuation of the motor controlled by cutting out a part of the resistance and connecting an additional amount of the resistance of the rheostat device into the motor circuit. The motor M is connected to the separate source of direct electric current excitation by a conductor 20 connected to the conductor 20' and a conductor G^4 connected to the conductor G^3.

To effect feeding of material by the conveyer in a continuous stream at a predetermined rate, or at an average of a predetermined rate, means are provided for timing the feeding of proportionate portions, or portions of predetermined weight, of the material by successive lengths of conveyer travel, to detect any change in the rate of feeding the material by the conveyer and effect actuation of the rheostat device S to regulate the operation of the conveyer actuating motor M and thereby the speed of travel of the conveyer in inverse proportion to the magnitude of the change in the rate of feeding the material and feed the material at an average of the predetermined rate. This means, herein termed a "rate timer," shown in front elevation in Figure 5, is mounted and enclosed in a housing T, and relays connected in circuit with and for controlling operating circuits of the rate timer are carried in a box or casing T', and the operation of said relays is controlled from the integrating means by the feeding of proportionate portions of material and actuation of circuit closing means thereby at successive intervals rendering active the timing means and the detecting means and circuit closing means to connect a reversible pilot motor M' in one of two operating circuits for actuating the circuit maker 49 of the rheostat device S connected to the shaft of said motor M', or a speed reducing means combined therewith, as shown in Figures 1 and 4.

The timing means (Figure 5) comprises a pair of cam wheels 50, 50' fixed to and spaced axially of a shaft 51, the shaft being journaled at one end by an anti-friction bearing in a bearing member 52 fixed to and extending forwardly of an intermediate portion of a bracket 53 (Figures 14 and 15) mounted on the face of a mounting plate P supported in vertical position in the housing T, the bracket 53 being of a length equal to the width and extending transversely of the mounting plate P and having the opposite ends flanged laterally to extend at a right angle and in the same direction from the body of the bracket, as at 53' and 53'', and the timing cam shaft 51 journaled at the opposite end in the bracket flange 53'. The mounting plate P is supported from and in spaced

relation to the rear wall of the housing T by studs 61 fixed at one end in the rear housing wall and extended through sleeves 62 interposed between the housing wall and the mounting plate P and extended through openings in the mounting plate with nuts threaded onto the studs at the face of the mounting plate, as shown at 61'. The shaft 51 with the cam wheels is rotated by a spring 54 in the direction indicated by the arrow in Figure 5, and said rotation of the shaft is limited by a pin fixed in and extending laterally from a collar fixed on the shaft 51 yieldingly engaging a stop pin fixed in and extending laterally from the bracket flange 53', as shown at 55. The spring 54 is attached at one end to a stud 56 having an adjustable threaded connection with a bracket 57 fixed to and extending laterally from the mounting plate P and the stud secured in adjusted position by a nut threaded onto the stud abutting the bracket. The opposite end of the spring is attached to a cable 57' passing over a flanged wheel 58 rotatable on a shaft 59' and the opposite end portion of the cable having two or more turns around a flanged sleeve 60 fixed on the timing cam shaft 51 and the free end of the cable attached to the flange of the sleeve. In this position of the timing cam shaft 51 the cam wheels 50, 50' are in predetermined position of rest.

The timing cam shaft 51 is rotated in a direction opposite to that indicated by the arrow by suitable driving means, and shown as comprising a friction disk D' fixed to head 63 (Figure 15) on the end of a shaft 64 journaled by antifriction bearing 64' in a hub 65 of a plate 65', and the shaft with the disk held against axial movement by the disk carrying head 63 abutting one bearing and a collar 66 fixed on the outer end of the shaft abutting the other bearing. The plate 65' has a pair of perforated arms 67 extending downwardly from the lower end thereof adjacent the opposite side edges and laterally at a right angle relative to the face of the plate, and is pivotally supported by said arms from the mounting plate P by a pin 68 engaging the perforations in the plate arms 67 and in openings in ears extending laterally from lugs projecting downwardly from the lower end of the mounting plate P intermediate the side edges thereof, and said ears engaging within the plate arms 67, as shown at 69 in Figures 5 and 6, whereby the plate 65' is adapted to have pivotal movement toward and away from the mounting plate. The plate 65' is yieldingly urged in a direction toward the mounting plate P by a spring 70 coiled about a stud 71 fixed at one end in and extending rearwardly from the mounting plate, said stud extending through an opening in the plate 65' of larger diameter than the stud and the spring confined between the plate 65' and nuts threaded onto the end of the stud, as shown in Figures 6 and 15. The friction disk is rotated by a synchronous motor M'' through a pinion 72 fixed on the motor shaft meshing with a gear 73 rotatable on a stud 74 fixed at one end in and extending laterally from the plate 65', and a pinion 75 rotating with the gear 73 meshing with a gear 76 mounted on and rotatable with the disk carrying head 63.

The rotation of the friction disk is transmitted to a friction wheel W mounted on a shaft 77 to rotate with and have axial adjustment on said shaft, as by a key 78 fixed in the shaft slidably engaging a keyway in the hub of the friction wheel. The shaft 77 is journaled at one end, as by an anti-friction bearing, in a bearing 79 fixed on one of a pair of brackets 80 fixed by angle brackets 81 to the mounting plate P to extend forwardly thereof, and the opposite end of said shaft journaled by an anti-friction bearing in a bearing member 82 extending forwardly from and transversely of a member 83 fixed to and supported at the ends from angle portions of the brackets 80, as at 80'. A second friction wheel W' is driven from the friction disk for a purpose to be hereinafter described, said wheel being mounted on a shaft 84 to rotate with and have axial adjustment on said shaft, as by a key fixed in the shaft slidably engaging a keyway in the hub of the friction wheel the same as the mounting of the wheel W on the shaft 77. The friction wheels may be of suitable construction, and as shown, each wheel comprises an annular member of friction material mounted on a hub member 85 in juxtaposed relation to a flange at an end of the hub member and releasably secured thereto by an annular member and screws, as shown at 86. The shaft 84 is journaled at one end by an anti-friction bearing in the bearing member 82 coaxially of the shaft 77 and at the opposite end in a bearing member similar to the bearing member 79 on the other bracket 80. By this arrangement the friction wheels contact the friction disk at opposite sides of the axis of the disk and are rotated in opposite directions, and the friction disk yieldingly urged into engagement with the friction wheels by the spring 70 urging the plate 65' by which the friction disk is carried toward the friction wheels.

By the adjustment of the friction wheels on the shafts 77 and 84 the wheels are adjusted radially of the friction disk and by the adjustment of the friction wheel W radially inwardly on the friction disk the other friction wheel W' is adjusted radially outwardly on the disk, and by adjustment of the wheel W radially outwardly on the disk the wheel W' is adjusted radially inwardly on the disk. To effect this adjustment of the friction wheels W, W' a shifter 87 is provided for each friction wheel in which the friction wheels are rotatably mounted by anti-friction bearings engaging a portion of reduced diameter of the wheel hub, as at 88, and the friction wheels retained in operative connection with the shifters by washers 89 secured by screws to the end of the hub members at the outer side of the anti-friction bearings, as shown at the left in Figure 13. To simultaneously adjust the friction wheels a shaft 90 having two diameters is rotatably mounted in the bearing member 82 and the brackets 80, the portion of larger diameter being screw threaded and the shifter for the friction wheel W having a hub with a screw threaded bore for threaded engagement with the threaded portion of the shaft, as at 91, the portion of smaller diameter of the shaft being smooth and the hub of the shifter for the wheel W' slidably engaged thereon. The shaft 90 is rotated to adjust the shifter for the wheel W on the shaft by a crank 92 (Figure 5) adapted to be removably connected to a shaft 93 (Figures 7 and 13) rotatably mounted in an angle portion of an angle bracket 94 mounted on a laterally extending boss on the one bracket 80 concentric of the shaft 90 and the shafts 90, 93 operatively connected by a bevel pinion on the shaft 93 meshing with a bevel pinion on the end of shaft 90, as at 95. To effect simultaneous adjustment of the wheel W' inwardly or outwardly on the friction disk and reverse to the direction of adjustment of the friction wheel W a bell crank lever 96 is pivotally supported at the angle portion on a headed stud fixed in a rib extending downwardly and

longitudinally of the member 63, as shown at 97 in Figure 15. One arm of said lever has a slot therein having the inner end curved laterally and the slot engaged by a roller on a stud fixed in the shifter 87 for the friction wheel W, as at 98 in Figure 5, and the other lever arm has a slot therein curved slightly inward at the outer end and engaged by a roller on a stud fixed in the shifter for the friction wheel W', as at 98'. The slots in the lever arms are arranged so that when wheel W is adjusted radially outward on the friction disk, wheel W' will be adjusted radially inward on the friction disk, and whereby wheel W' will be rotated in a direction reverse to and at a reduced speed proportional to the speed of rotation of the friction wheel W.

The rotation of the friction wheel W and timing cam shaft 51 is proportional to the speed of travel of the conveyer to feed material at the rate of a predetermined weight. To effect feeding of the material by the conveyer at the rate of a predetermined weight, such as tons per hour, and regulate the speed of travel of the conveyer to feed material at an average of said predetermined rate, the rate timer is preset to adjust the friction wheel W on the friction disk to be rotated at a speed proportional to the speed of travel of the conveyer, and to indicate the setting of the rate timer and the rate of feed of material by the conveyer a scale 99, graduated in tons per hour, is provided, said scale being mounted on the bearing member 82 and the bracket 80 in which the one end of the shaft 77 is journaled, as shown in Figure 5. To indicate on the scale the weight at the rate of which the material is fed by the conveyer a pointer 100 is adjustable relative to the scale effected by the adjustment of the friction wheels, and as shown in Figure 5 said pointer is arranged on the stud carrying roller 98 engaging the slot in and connecting the one arm of lever 96 to the shifter 87 for the friction wheel W. The crank 92 for adjusting the shifter adjusting shaft 90 is disposed exterior of the housing T and is adapted to be extended through an opening in said housing to removably connect it to the shaft 93, and to observe the adjustment of the pointer 100 relative to the scale 99 and thereby the setting of the rate timer the housing is provided with a window 101.

The rotation of the friction wheel W is transmitted through the shaft 77 to the timing cam shaft. For this purpose clutch mechanism is provided comprising a shaft 102 mounted to have axial adjustment in a pair of bearings 103 which in turn are mounted in bushings 104 having an annular flange at one end mounted in openings in bosses on the brackets 80 with the flanged end extending laterally from said brackets. A combined clutch member and gear 105, 105' is mounted by an anti-friction bearing on each bushing 104 between the bushing flange and the bracket bosses with an interposed washer, as clearly shown in Figure 7. The outer end or face of said clutch and gear members has an annular member 106 of friction material secured thereto, as by countersunk screws. By this arrangement the shaft 102 is mounted axially in said clutch and gear members to have axial adjustment which is limited by a pin and slot connection between the shaft and one of the bushings 104, as at 107. Clutch members 108, 108' are rotatably mounted by anti-friction bearings on the reduced ends of said shaft between the members of friction material 106 and collars 109 fixed on the outer ends of the shaft. Each of said clutch members 108, 108' has a pinion 110, 110' fixed on the outer end thereof. The gear teeth of clutch member 105 mesh with a gear 111 fixed on the outer end of shaft 77 whereby the clutch member 105 is driven from the shaft 77. The timing cam shaft is driven through the pinion 110 meshing with a gear 112 fixed on said shaft. The clutch shaft 102 is yieldingly urged in a direction to engage clutch member 108 with clutch member 105 by a spring 113 coiled about the shaft and confined between the bushing 104 on which the clutch member 105 is mounted and a collar 114 fixed on said shaft. However, the clutch shaft is normally positioned with the clutch members 108, 108' out of engagement with the clutch members 105, 105' by a pivoted latch 115 engaging a collar 116 fixed on the clutch shaft. The latch is released from said collar 116 to permit actuation of the clutch shaft to engage clutch member 108 with clutch member 105 to couple the timing cam shaft to the shaft of friction wheel W by the energizing of a solenoid magnet I to the core of which magnet the latch is connected by adjustable connecting means 117 pivotally connected to the latch and the magnet core, as shown in Figures 5 and 14. The solenoid I is connected in circuit with a source of electric energy having normally open circuit closing means interposed in the circuit thereof adapted to be actuated to close the circuit and energize the solenoid by the feeding of a proportional portion of material of predetermined weight by the conveyer. As shown in the wiring diagram in Figure 4 one terminal of the solenoid I is connected by a conductor s to a lead-in wire l' connected to a source of electric energy, and the other terminal of said solenoid I connected by a conductor s' through contact makers g and h of relays A and B, for a purpose to be hereinafter described, with a conductor f connected to one terminal of a normally circuit opening switch 118, the other terminal of which switch is connected by conductor f' to the lead-in wire l. The friction disk rotating motor M'' is also connected in circuit with the conductors l, l'. The switch 118 is actuated to circuit closing position at successive intervals from the rotation of the integrating disk 39 by the feeding of proportionate portions of material of predetermined weight. As shown in Figures 2 and 3 this switch 118 is mounted on extensions of the front and rear walls of the register or counter and the switch actuator 119 is actuated by a pin 120 adjustably carried by an arm 121 fixed on a rock shaft 122 rotatable in the front and rear wall extensions of the register casing, and said shaft rocked by a roller 123 rotatably carried at one end of a lever 124 fixed at the opposite end on the rock shaft following a three hump cam 125 fixed on the shaft 46 on which the register actuating pinion 48 is mounted. Relay B is connected in circuit with lead in conductors l, l' through circuit making contact g associated with relay A by conductor h' connected to one terminal of the coil of relay B and the other terminal of said relay coil connected by conductor h^2 to the conductor l'. As the circuit of solenoid I is closed through the switch 118 and the first electrical impulse is sent out initiating the operation of the rate timer, the circuit of relay B is also closed, but as said relay is of the inertia type the actuation of the contact maker h to circuit opening position is delayed for a sufficient interval of time to effect energization of the solenoid I.

As stated, the friction wheel W and the timing cam shaft 51 are rotated at a speed proportional to the speed of travel of the conveyer to feed material at the rate of the predetermined weight indicated by the pointer 100 on the scale 99, and whereby a proportionate portion of material is fed by a predetermined length of conveyer travel during a predetermined interval of time. The cam wheels 50, 50' are rotated with the timing cam shaft 51 until the successive actuation of the switch 118 to circuit closing position by the cam 125 actuated from the integrator disk 39 and the feeding of a proportionate portion of material by the conveyer during said interval. Should the time interval to feed said proportionate portion of material be less than the predetermined interval the timing cam shaft will be rotated through an arc of something less than 180 degrees due to the rate of feed of the conveyer being too high to feed material at the predetermined rate, and should the time for feeding a proportionate portion of the material be greater than the predetermined time interval the timing cam shaft will be rotated through an arc of more than 180 degrees due to the rate of feed of the conveyer being too slow to feed material at the predetermined rate.

To effect actuation of the conveyer to feed material at the predetermined rate, or an average of the predetermined rate, means are provided to detect any change in the rate of feed of the conveyer to feed a proportionate portion of the material of predetermined weight and vary the rate of feed of the conveyer in inverse proportion to the magnitude of the change in the rate of feed of the conveyer to feed said proportionate portion of material of predetermined weight. This means comprises a shaft 126 having a cam wheel 127 fixed thereon, herein termed the "regulating cam shaft," driven from the friction wheel W' by a gear 128 fixed on shaft 126 meshing with the gear 110' associated with the clutch member 108', the cam wheel 127 operating actuators for circuit makers to connect the reversible motor M' in one of two operating circuits and rendered active by the establishing of a successive circuit and sending out of a successive electrical impulse by the switch 118 actuated from the integrator by the feeding of a proportionate portion of material of predetermined weight. For this purpose one terminal of the fields of the rheostat adjusting motor M' is connected by a conductor *m* (Figures 1 and 4) to lead-in conductor *l*. The other terminal of one field of said motor is connected by a conductor *n* through the contact member 129 of a relay C to a conductor *n'* connected to lead-in conductor *l'*, and the other terminal of the other field of said motor is connected by a conductor *o* to the contact member 129' of a relay D connected to conductor *n'* connected to conductor *l'*. One terminal of the relays C and D is connected by conductors *p*, *q*, to conductor *l* while the other terminals of said relays are connected by conductors *p'*, *q'* to one terminal of normally open circuit makers or switches *c* and *d*, the other terminals of which switches are connected by conductors p^2, q^2 to conductor *l'*. The relays C, D are mounted in the box or casing T', and the switches *e*, *d*, which are "Heineken" switches, are mounted on an insulator member 130 (Figures 5, 8, 9 and 15) fixed to an angle bar 131 mounted upon right angle end portions of a bracket 132 in which the shaft 59 is mounted and which bracket is mounted on the face of mounting plate P.

The switches *c*, *d* are actuated to connect the reversible motor M' in one of its two operating circuits by actuator means for each of said switches, shown in connection with switch *c* in Figure 8, mounted on the shaft 59, which is mounted in the right angle end portions of bracket 132, as shown in Figure 5. Each of said actuator means comprises an arm 133 of lever means pivotally mounted with an interposed bushing on shaft 59 to project upwardly in space relation to the switches and slidably carries a headed pin 134 in a portion of reduced diameter of a bore in said arm in line with a circuit maker for the switches, as shown at *c'*, the pin being yieldingly urged outwardly from the bore by a spring engaging in a hollow screw threaded into the portion of larger diameter of the arm bore, as shown at 135. The other lever arm 136 is pivotally supported in a bifurcation of the lever arm 133 by a headed stud threaded into one of the bifurcation legs, as at 137, whereby the lever arms 136 are adapted to have pivotal movement relative to the lever arms 133 on an axis transverse to the axis of the shaft 59 and movement in a direction transverse to said pivotal movement to transmit rotation to the arms 133 on the shaft 59 toward the switch and thereby engage the pin 134 with and actuate the circuit maker *c'* to circuit closing position. A roller 138 is carried at the opposite ends of the lever arms 136 to rotate on an axis extending longitudinally of the lever arms, and said lever means are simultaneously actuated to the left, as viewed in Figure 5, and thereby cause the rollers 138 to move past or engage and follow the cam edge of a cam wheel 50 or 50' depending on the position of said cam wheels. Should the timing cam shaft 51 be rotated through an arc of 180 degrees by the feeding of a proportionate portion of material of predetermined weight the lever rollers 138 as the lever arms 136 are moved to the left will not engage the cam edge of a cam wheel 50 or 50' since there is no correction required to be made in the travel of the conveyer to feed such proportionate portion of material. However, should the timing cam shaft 51 be rotated through an arc of less than 180 degrees due to the rate of feed of the conveyer being too high to feed such proportionate portion of material the cam wheels will be positioned so that when the lever arms 136 are moved to the left the roller 138 carried by the lever arm at the right, as viewed in Figure 5, will engage with and ride on the cam edge of cam 50' causing the lever not only to move about the pivot stud 137 but also imparting rotative movement to its associated lever arm 133 on the shaft 59 and thereby actuating circuit maker *c'* of switch *c* to close the circuit of and effect actuation of the relay C to close the circuit of the reversible motor M' through conductors *m*, *n* and effecting adjustment of the rheostat device S to reduce the speed of the conveyer actuating motor M and the speed of travel of the conveyer. Should the timing cam shaft be rotated through an arc greater than 180 degrees the cam wheels 50, 50' will be positioned so that when the lever arms 136 are moved to the left the roller carried by the lever arm at the left will engage with and ride up the cam edge of the cam wheel 50 thereby actuating switch *d* to close the circuit of and effect actuation of relay D to connect the rheostat adjusting motor M' in its other operating circuit through conductors *m*, *o* and thereby effect adjustment of the rheostat device to increase the

speed of the conveyer actuating motor and speed of travel of the conveyer.

The timing cam shaft 51 is maintained coupled to and rotated from the friction wheel W during the interval of feeding a proportionate portion of material of the predetermined weight. The successive hump on the cam 125 actuated by the integrator disk then actuates the switch 118 closing a circuit through conductors *f*, *f'* and sending out a successive electrical impulse, the second impulse during the rate timer operating cycle. This second electric impulse renders means active to actuate the clutch shaft 102 to uncouple the timing cam shaft 51 from friction wheel W, actuate means to lock the timing cam shaft in actuated position, couple the regulating cam shaft 126 to and rotate the same from the friction wheel W' in a direction reverse to the direction of rotation of the timing cam shaft and actuate the switch actuating levers 136 to cause them to cooperate with the cam wheels 50, 50' to actuate one of the switches *c*, *d* to connect the reversible rheostat adjusting motor M' in one of its operating circuits. The regulating cam shaft 126 is rotated through a complete revolution and the speed of rotation of the regulating cam shaft 126 is inversely proportional to the speed of rotation of the timing cam shaft 51 due to the setting of the friction wheels W, W' on the friction disk D', since correcting a variation in the feeding of the material at a high setting of the rate timer to feed a large quantity of material, say 25 or 30 tons per hour, requires a proportional longer time interval to regulate the speed of travel of the conveyer than when feeding material at a lower setting of the rate timer to feed a smaller quantity of material, say 5 or 10 tons per hour. To effect this result the regulating cam shaft 126 is rotated at a low speed proportional to the speed of rotation of the timing cam shaft 51 for a high setting of the rate timer and feeding of a large quantity of material thus requiring a longer interval of time to rotate the regulating cam shaft one revolution, and the regulating cam shaft 126 is rotated at a higher speed proportional to the speed of rotation of the timing cam shaft for a low setting of the rate timer and feeding a smaller quantity of material. This means comprises a pair of levers 139 pivotally supported at one end on a stud 139' fixed in the bracket 53 to engage at opposite sides of the clutch shaft 102, as shown in Figures 7, 10, 11, 12 and 14, with sleeves interposed between the levers and the one lever and bracket 53 (Figure 14), the levers being pivotally connected at the opposite ends to one end of a pair of links 140 of a double toggle the other links 141 of which toggle are pivotally connected to a fixed support 142 on the bracket 53. The core of a solenoid II is pivotally connected to one end of an adjustable connecting means 143 and at the opposite end pivotally connected to the connecting pivot pin of the toggle links, as shown in Figures 5, 11 and 12, the parts normally assuming the positions shown in Figure 5. Upon the successive or second closing of a circuit by the integrator disk through switch 118 a circuit is established through conductors *l*, *f'*, *f*, contact *i* of relay B, conductor *i'*, normally closed switch *a*, conductors *a'*, a^2 connected to one terminal of relay E the other terminal of which relay is connected by conductor a^3 to conductor *l'* (Figure 4), the relay E actuating a contact *k* associated therewith to connect solenoid II in an energizing circuit with conductors *l*, *l'* by a conductor *k'* connected to said contact *k* and conductor *l* and a conductor s^3 connected to one terminal of the coil of the solenoid, and a conductor s^4 connected to the other terminal of said solenoid coil and conductor *s* to conductor *l*. Simultaneously with the closing of the circuit of solenoid II through contact *k* and conductors *k'*, *l* and conductors s^3, s^4, *s* and *l'*, a second contact *j* associated with relay E is actuated to connect a normally circuit closing switch *e* in a holding circuit for solenoid II through conductor *e'* connected to one terminal of switch *e*, contact *j*, conductor a^2, relay E and conductors a^3 and *l'*. The other terminal of switch *e* is connected by conductor e^2 to leadin conductor *l*. When the holding latch 115 is released from the collar 116 on the clutch shaft as described, and the clutch shaft is actuated to engage clutch members 106, 108, said collar will engage with a nose intermediate the ends of levers 139, as shown in dotted lines in Figure 5.

A rod in the form of a tube 144 is connected at one end by a coupling pin to a member 145 pivotally connected to the pivot pin connecting the toggle links 140 to the levers 139, as shown in Figures 11 and 12, the tube extending through an opening in the bearing member 52 and is slidable in a bushing in the angle portion 53' of bracket 53. A cup member 146 carrying a shoe of friction material 147 has a screw threaded stem having threaded connection with the end of the tube whereby the shoe carrying cup member is adjustable outwardly from and inwardly toward the end of the tube and locked in adjusted position by a nut threaded onto the stem abutting the end of the tube, as shown at 148. As the solenoid is energized the core thereof is drawn into the coil of the solenoid thereby actuating the toggle links 140, 141 to straighten the toggle and imparting longitudinal movement to the tube 144 and impinging the shoe 147 against the side of the gear 112 on the timing cam shaft holding said gear and timing cam shaft with the cam wheels in actuated position. Simultaneously with the actuation of the brake shoe carrying rod the nose on levers 139 engaging the collar 116 at opposite sides of the clutch shaft 102 moves the clutch shaft axially disengaging the clutch member 108 from the clutch member 105 uncoupling the timing cam shaft from the friction wheel W and engaging clutch member 105' with clutch member 108' coupling the regulating cam shaft 126 to the friction wheel W'. A lever 149 of obtuse angle form in longitudinal section (Figure 5) is pivotally connected at one end to a stud carried by and extending forwardly of the angle member 131, the lever carrying a roller 150 to follow the cam edge of the cam wheel 127. The lever 149 is connected to the actuating levers 136 for the switches *c* and *d* by a bifurcated member 151 pivotally connected to the lever 149 and a bar 152 is connected to the bifurcated member by a rod 153 having adjustable screw threaded connection at the ends with said members 151, 152 (Figure 5), the rod 153 being connected to the lever arms 136 by pins 154 fixed at one end in said lever arms intermediate the ends and the pins extending through openings in the bar 152 having a width substantially equal to the diameter of the pins and elongated transversely of the bar with washers on the pins disposed at opposite sides of the bar whereby longitudinal movement of the bar transmits pivotal movement to the lever arms 136 on the pivot supports 137 thereof in the lever arms 133 and also moved laterally of the bar to transmit rotary

movement to the lever arms 133 to actuate the circuit makers of the switches *c*, *d*. The lever arms 136 and lever 149 are yieldingly urged to position, as viewed in Figure 5, to cause the roller 150 to engage and follow the cam wheel 127 by a spring 155 attached at one end to the bar 152 and at the opposite end attached to an arm 156 fixed to the bracket 132, as shown in Figures 5, 6 and 10.

The holding latch 115 for the clutch shaft 102 is pivotally mounted on a stud fixed on and projecting forwardly of the bracket 53 with a sleeve on the stud interposed between the bracket and the latch, as shown at 157 in Figure 14 so that the latch is disposed above and in line with the axis of the clutch shaft 102. The means to connect the core of solenoid I to the latch is also disposed in line with the axis of the clutch shaft 102. For this purpose a rod 158 has an adjustable screw thread connection with one end of a member pivotally connected at the opposite end to the solenoid core, the opposite end extending through an opening in a lateral extension 159 of a member 160 with collars fixed on the rod 158 at the top and bottom of said extension. The latch 115 is pivotally connected to a member 160 by a stud fixed in and extending laterally from said member parallelly of the extension 159 with a sleeve interposed between the latch and said stud, as shown at 161. By this arrangement the latch 115 and the connection of the latch with the solenoid I is disposed in vertical alinement with the axis of the clutch shaft 102 and adapting the connecting member 160 for the passage of the brake shoe carrying rod 144 and its connections with the levers 139. After the regulating cam shaft 126 has made a complete revolution the circuit of solenoid II is opened by actuating the switch *e* to circuit opening position to deenergize the solenoid II and permit actuation of the locking means for the timing cam shaft to releasing position, the actuation of the timing cam shaft by the spring 54 to position the cam wheels 50, 50' in normal position of rest, and impart axial movement to the clutch shaft 102 to permit of engagement of the collar 116 on the cam shaft with the holding latch 115 and hold said shaft in neutral position by the clutch shaft actuating spring 113. This is effected by actuating the normally circuit closing switch *e* to circuit opening position, said switch consisting of a Heineken switch having a circuit opening member e^3 projecting from the carrying casing for the switch (Figure 15) which is engaged by a pin 162' to actuate said switch to circuit opening position. The switch actuating pin 162' is slidably mounted in a bore in an arm of a lever 162 pivotally mounted on the shaft 59 and yieldingly projected from the bore by a spring seated at one end in a tubular screw threaded into the lever bore and a head on the pin the same as the mounting of the actuating pin 134 for switch *c* shown in Figure 8. The lever 162 is actuated to actuate the switch *e* to open the circuit of solenoid II as the regulating cam shaft 126 completes one revolution by a roller 163 rotatably carried at the end of the other arm of the lever 162 following a cam 164 in the form of a disk having a peripheral cam projection mounted on the cam shaft 126, and as said cam roller rides up said cam projection, as shown in Figure 15. When the regulating cam 127 completes one revolution and the switch actuating lever 162 for switch *e* is actuated to open the circuit of solenoid II said cam following roller will be in engagement with the projection on cam 164 and maintain the circuit of solenoid II open and acting to prevent energization of the solenoid II. To cause the lever roller 163 to ride off from the cam projection and the lever 162 actuated to permit the switch *e* to assume circuit closing position, means are provided to impart a slight rotative movement to the regulating cam shaft 126. This means, as shown in Figures 5, 6, 12 and 15, comprises a bracket having a bifurcated portion 165 engaged by a portion of reduced width projecting forwardly from the bearing member 52 and the bracket suspended from said bracket portion to have rocking movement by a pin 166, as shown in Figure 5. The bracket is provided with an arcuate lever arm 167 extending from the bracket at a right angle to the bifurcated portion to extend below the regulating cam shaft 126 and juxtaposed to the side of the regulating cam 164 to be engaged by a roller 168 rotatably carried on the side of said cam, as shown in Figures 6 and 15. A spring 169 attached at one end to a stud fixed in the bearing member 52 and the opposite end attached to a headed pin extended through and having screw threaded connection with the wall of an opening in the bracket 165 below the bifurcated portion and secured therein by a lock nut, as shown at 170, urges the bracket in a direction toward the roller carried on the side of the cam. When the regulating cam shaft 126 comes to rest by opening the circuit of and de-energizing the solenoid II through switch *e* the roller 163 will be in engagement with the projection of cam 164 and the roller 168 will engage with a portion of a concave edge of the bracket 167, as shown in Figure 15, and move the bracket arm against the tension of spring 168, the tension of the spring reacting to move the bracket arm over the roller and thereby imparting sufficient rotation to the regulating cam shaft 126 to cause the lever roller 163 to ride off from the projection of cam 164. The movement of the bracket 165 is limited by the bifurcated portion of the bracket engaging the bearing member 52.

After the timing cam shaft 51 has been coupled to and is actuated by the driving means said shaft, due to the stopping of the conveyer or the stopping of the flow of material from the bin, may be coupled to driving means for an indeterminate interval of time and have indeterminate rotation imparted thereto before a successive closing of a circuit through the circuit making means 118 and sending out of the successive or second electric impulse to energize the solenoid II to effect operation of the means to uncouple the timing cam shaft 51 from, and couple the regulating cam shaft 126 to, the driving means. Means are, therefore, provided to close the energizing circuit of the solenoid II after the timing cam shaft 51 has been rotated through an arc greater than 180 degrees or one-half revolution, and comprising, as shown in Figures 4, 5 and 10, a normally open circuit closing means in the form of a "Heineken" switch *b*, similar to the switch *e*, having one terminal connected by conductor *b'* to the conductor *l* and the other terminal connected by conductors b^2, *a'*, a^2, relay E and conductor a^3 to lead in conductor *l'*, the switch having a circuit maker b^3 normally projecting from the switch casing, as shown in Figure 9. The switch *b* is actuated by a pin 171 engaging the circuit maker b^3, the pin 171 being of a construction similar to the pin 134 and the mounting thereof

in the lever arm 135 (Figure 8), in an arm of a lever 172, similar to the lever 162 (Figure 15) pivotally mounted on the shaft 59 and rotatably carrying a roller 173 at the end of the opposite lever arm to follow a cam 174 fixed on the timing cam shaft 51, the cam 174 being in the form of a disk having a peripheral cam projection or nose. The actuation of the switch *b* to circuit closing position closes an energizing circuit for solenoid II and said solenoid effecting operation of the means to actuate the clutch shaft 102 to uncouple the timing cam shaft 51 from the driving means and couple the regulating cam shaft 126 to the driving means to effect completion of the operating cycle as hereinbefore described and return the rate timer to initial position ready for a new cycle of operations as soon as the conveyer is started again or the flow of material from the bin onto the conveyer is resumed.

The solenoid II is connected in circuit with the lead in wires *l*, *l'* upon the closing of a circuit and sending out of an electrical impulse by the actuation of the switch 118 from the integrator disk or carrier 39 and through a normally closed circuit making means in the form of a "Heineken" switch *a*, said switch being connected by a circuit making contact *i* associated with relay B to conductor *f* connected to one side of the switch 118 and normally closing a circuit through conductor *i'* connected to one terminal of switch *a*, the other terminal of which switch is connected by conductors *a'*, a^2 to one terminal of the coil of relay E, the other terminal of which relay coil is connected by conductor a^3 to the conductor *l'*. A circuit making contact *k* of the relay E is connected by conductor *k'* to the lead in conductor *l* and adapted to close a circuit through conductor s^3 connected to one terminal of the coil of solenoid II, the other terminal of which solenoid coil is connected by conductors s^4, *s* to conductor *l'*. The switch *a* is mounted on the insulator bar 131 (Figure 10) and has circuit maker a^4 projecting from the switch casing. The switch actuator a^4 is actuated to circuit opening position by a pin 175 slidably mounted, similarly to the mounting of the pin 134 in lever arm 133 in Figure 8, in an arm of a lever 176, similar to the levers 162, 172, pivotally mounted on the shaft 59, the other arm of the lever 176 carrying a roller 177 adapted to follow a cam 178, in the form of a disk fixed on the timing cam shaft 51 and having a cam projection on the periphery, engaged by the lever roller 177 in the neutral position of the parts of the rate timer.

The operation is substantially as follows: The gate 21 for regulating the outlet of the hopper H is set to permit the discharge of a volume of material from the hopper onto the conveyer to obtain the desired load per foot of travel of the conveyer. As the conveyer travels over the conveyer supporting roller 22 or weighing point the beam 29 is deflected in exact proportion to the load on the conveyer and causes the integrator mechanism, driven at a speed proportional to the speed of travel of the conveyer, to actuate the switch 118 and send out impulses timed in exact proportion to the rate of feed of the conveyer. The friction wheels W, W' of the rate timer are then set through the rotation of the shaft 90 by the crank 92 to register the pointer 100 with the graduation on the scale 99 corresponding to the desired weight at the rate of which the material is to be fed by the conveyer, the parts of the rate timer being in the position indicated in Figure 5. After feeding a predetermined portion of the material by the conveyer at the rate at which the material is to be fed, normally open circuit making switch 118 is actuated from the integrator disk or carrier 39 to send out an electrical impulse and close the energizing circuit for the solenoid I through conductor *f'* connected to the lead in conductor *l*, conductor *f* being connected through circuit making contacts *g*, *h* associated with relays A, B through conductor *s'*, solenoid I and conductor *s* to lead in conductor *l'*. Simultaneously with the closing of said solenoid energizing circuit the circuit of relay B is closed through contact *g* associated with relay A connected by conductor *h'* to one terminal of coil of relay B and conductor h^2 connected to the other terminal of the relay coil and conductor *l'*, the closing of the circuit of relay B actuating its associated contact *h* to position to open the energizing circuit of solenoid I. However, the relay B is of the inertia type having a delay action and thus maintaining the circuit of solenoid I closed for a sufficient length of time to energize said solenoid and actuate the holding latch 115 out of engagement with the collar 116 on and release the clutch shaft 102 to permit actuation of the clutch shaft to engage clutch members 106, 108 and couple the timing cam shaft 51 to the friction wheel W. Also simultaneously with the closing of the energizing circuit for solenoid I the circuit to one side of switch *a* is closed through circuit making contact *i* associated with relay B connected to the conductor *f* and conductor *i'*, but as said switch *a* is actuated to circuit opening position by the switch actuating pin 175 carried by lever 176 which is actuated by the cam 178 no circuit will be established through said switch *a* and the energizing circuit of solenoid II will remain open.

The timing cam shaft 51 is rotated at a speed in proportion to the rate of feed set by crank 92 and indicated on the scale 99 by the pointer 100 whereby said cam shaft and the timing cam wheels 50, 50' are rotated through 180 degrees or one-half revolution by the feeding of a proportionate portion of material by the conveyer of the predetermined weight indicated by the pointer on the scale, and the timing cam shaft is rotated until a second circuit is closed by the switch 118 and a second electrical impulse is sent out, the deflection of the timing cam shaft being directly proportional to the time interval between the first and second electrical impulses sent out through the operation of the switch 118.

The timing cam shaft 51 is rotated until the successive closing of a circuit through switch 118 closing the circuit of solenoid II through conductors *l*, *f'*, *f*, contact *i* associated with relay B, conductor *i'*, switch *a*, which has been actuated to circuit closing position by the lever roller 177 riding off from the cam projection of cam 178, conductors *a'*, a^2, relay E and conductor a^3 and *l'*. The closing of the circuit through relay E closes a circuit through its associated contact maker *k* connected to conductors *k'*, *l*, s^3, solenoid II and conductors s^4, *s* and *l'* energizing the solenoid II. Simultaneously therewith the circuit of relay A is closed actuating the circuit making contact *g* associated with relay A and opening the circuit of solenoid I, the circuit of switch *e* being closed through circuit making contact *j* associated with relay E connected by conductor *e'* to switch *e* and conductor e^2 connected to lead in conductor *l*, this circuit being in effect a holding circuit for the solenoid II.

Energization of the solenoid II actuates the clutch shaft 102 against the action of spring 113 through levers 139 co-operating with collar 116 on said clutch shaft and toggle links 140, 141 disengaging the clutch members 106, 108 and uncoupling the friction wheel W from the timing cam shaft 51 and engaging clutch members 106', 108' to couple the regulating cam shaft 126 to the friction wheel W' and simultaneously therewith the cam shoe is engaged with the gear 112 to hold the timing cam shaft 51 in actuated position. The regulating cam shaft 126 and therewith the cam 127 is rotated through a complete revolution in a direction reverse to the rotation of the timing cam shaft 51 and at a speed inversely proportional to the speed of rotation of the timing cam shaft, as hereinbefore set forth, the lever 149 and through the connection thereof with the levers 136 causing the lever rollers 138 to co-operate with the cam edges of the cam wheels 50, 50', one of said levers 136 actuating one of the switches c or d to close and connect the reversible motor M' in one of its operating circuits. Should the timing cam wheels be rotated one-half revolution a proportionate portion of the material of predetermined weight has been fed by a predetermined length of conveyer travel and requiring no correction in the speed of travel of the conveyer, and the lever rollers 138 will not engage the timing cam wheels 50, 50'. Should the timing cam shaft 51 be rotated less than one-half revolution during the interval of sending out two impulses by the closing of circuits through the switch 118 the speed of travel of the conveyer is too fast and as the switch actuating lever arms 136 are actuated through the regulating cam 127 actuating the lever 149 the roller carried by the lever arm 136 at the right, as viewed in Figure 5, will engage and ride along the cam edge of the cam wheel 50' swinging said lever arm 136 on its pivot connection 137 with the lever arm 133 and rocking said lever arm 133 on the shaft 59 (Figure 8) and engaging pin 134 carried by lever arm 133 with and actuating the circuit maker c' of switch c to close the circuit of the coil of relay C through conductor p' connected to one terminal of the coil of relay C. conductor p^2 connected to lead in conductor l' and conductor p connected to the other terminal of said relay coil and conductor l energizing relay C and thereby closing one operating circuit of the reversible motor M' through circuit making contact 129 associated with relay C connected by conductor n' to conductor l' and by conductor n to one terminal of one field of said motor, the other terminal of which field is connected by conductor m to conductor l rendering the motor M' active to actuate the circuit maker 49 to connect part of the resistance of the rheostat S into the conveyer actuating motor M and thereby reducing the speed of said motor and speed of travel of the conveyer in proportion to the magnitude of the change in the travel of the conveyer to feed said proportionate portion of the material. Should the timing cam shaft be rotated through an arc of more than 180 degrees or one-half revolution during the travel of the conveyer to feed the proportionate portion of the material of predetermined weight the speed of travel of the conveyer is too slow and requiring that the speed of travel of the conveyer be increased. In such case as the lever arms 136 are actuated by cam 127 the roller 138 carried by the lever arm 136 at the left as viewed in Figure 5 will engage with and ride along the cam edge of the cam wheel 50 actuating its associated lever arm 133 to close a circuit through switch d and closing the circuit of relay D through conductors q^2 and p^2 connected to lead in conductor l' and conductor q' connected to one terminal of the coil of relay D, the other terminal of said relay coil being connected by conductor q to conductor l, thereby energizing relay D and closing the circuit through the other field of the motor M' through circuit making contact 129' associated with relay D connected by conductor n' to conductor l' and through conductor o connected to one terminal of said motor field, the other terminal of said field being connected by conductor m to conductor l and rendering the motor M' active to actuate the circuit marker 49 of the rheostat S to cut out resistance of the rheostat from the conveyer actuating motor M and thereby increasing the speed of said motor and the speed of travel of the conveyer in proportion of the magnitude of the change in the speed of travel of the conveyer to feed said proportionate portion of the material. As stated, when the clutch shaft 102 is actuated to couple the regulating cam shaft 126 to the friction wheel W' the rod 144 is moved longitudinally to impinge the friction shoe 147 against the side of the gear 112 to lock the timing cam shaft 51 in actuated position during the rotation of the regulating cam shaft 126. Should there be a delay in sending out the second electrical impulse by actuation of the switch 118 to close the energizing circuit of solenoid II, which may be due to a reduction in the quantity and weight of the material fed by the conveyer and a consequent increase in the length of conveyer travel to feed a proportionate portion of the material there would be an indeterminate rotation of the timing cam shaft 51. To energize the solenoid in such case its energizing circuit is closed by the cam 174 operating lever 172 to actuate switch b connecting the solenoid II in an energizing circuit with conductors l, l' by conductor b' connected to conductor l, and conductors b^2, a' and a^2 connected to one terminal of relay E, and conductor a^3 connected to the other terminal of said relay coil and conductor l', actuating and closing a circuit through circuit making contact k associated with relay E connected by conductor k' to conductor l and conductor s^3 connected to the other terminal of the coil of solenoid II, and conductors s^4 connected to the other terminal of said solenoid coil and conductor s connected to conductor l'. Upon a complete revolution of the regulating cam shaft 126 the circuit of solenoid II is opened and said solenoid de-energized by cam 164 actuating lever 162 and said lever actuating the circuit maker of normally circuit closing switch e to circuit opening position. Upon the de-energization of solenoid II the clutch shaft 102 is moved longitudinally by the spring 113 the collar 116 on the clutch shaft engaging with and actuating the levers 139 to move the rod 144 longitudinally and the brake shoe carried thereby out of engagement with the gear 112 releasing the timing cam shaft 51, which is returned to normal position with the pin fixed in said shaft engaging the stop pin 155 and moving the clutch member 108' out of engagement with the clutch member 106' uncoupling the regulating cam shaft 126 from the friction wheel W', moving the collar 116 on the clutch shaft 102 into engagement with the latch 115, which has dropped by gravity to position to be engaged by said collar upon the de-energization of the solenoid I, and moving the clutch member 106 out of engagement with the clutch member 108 and uncoupling the timing cam shaft 51 from

the friction wheel W, the parts of the rate timer being in the position for the next cycle of operations. The closing of the circuit and sending out of a successive electrical impulse through the actuation of the switch 118 to circuit closing position by the third hump on the cam 125 actuated from the integrator disk 39 will not initiate a new operating cycle for the rate timer unless the previous cycle is completed. As long as the cycle is not completed the relay E is energized and holds the contacts *k* and *j* associated therewith in position to close the energizing circuit for the relay A and actuating the contact *g* associated therewith to and retaining it in position to open the energizing circuit of solenoid I and preventing energization of said solenoid by a new electric impulse. After the completion of the cycle of operations of the rate timer, switch *e* in the holding circuit of relay E is opened by the cam 164 actuating the switch actuator 162 de-energizing relay E and causing the contacts *k*, *j* to open the energizing circuits of solenoid II and coil of relay A. Relay A is of the time delay action type and when energized instantly actuates the contact *g* associated therewith to circuit opening position, but permits said contact to move to circuit closing position with sufficient delay to permit the parts of the rate timer to return to their normal or starting position.

Variations may be made in the construction and arrangement of the parts without departing from the scope of the invention. and portions of the invention may be used without others and come within the scope of the invention.

Having described my invention, I claim:

1. In material feeding apparatus, means to cause a stream of material to flow at a predetermined rate, means operative at successive intervals by the flow of a predetermined quantity of material during each interval for timing flow of said quantity of material during said intervals, and means operative to detect any change in the time of flow of each predetermined quantity of material and means controlled by and rendered active by the timing means to vary the flow of the material in inverse proportion to the magnitude of any change in the rate of flow of the material and cause the material to flow at an average of said predetermined quantity of predetermined rate.

2. In material feeding apparatus, means to feed material of predetermined weight in a continuous stream, means successively operative by the feeding of successive quantities of material of predetermined weight for timing the interval of feeding each of said quantities of material, and means to detect any change in the time of feeding said quantity of material and means controlled by and rendered active at the termination of the timing period to vary the operation of the feeding means and feeding of material in inverse proportion to the magnitude of any change in the rate of feeding said predetermined quantity of material and feed the material at an average of the predetermined weight.

3. In material feeding apparatus, means to feed material at a predetermined rate, means to vary the operation of the feeding means and feeding of the material, means successively operative for timing the intervals of feeding and detecting any change in the rate of feeding proportionate portions of the material, and means controlled by the timing means rendered operative by a change in the rate of feeding said predetermined portions of material to automatically vary the operation of the feeding means to feed material in inverse proportion to the change in the rate of feed thereof.

4. In material feeding means, means for feeding material, driving means for said feeding means, means operative to regulate the operation of said driving and feeding means to feed material at the rate of a predetermined weight from a source of supply of the material and vary the feeding of the material, means for timing the intervals of feeding successive proportionate portions of the material of predetermined weight, and means controlled by the timing means operative to detect any change in the time intervals of feeding said portions of material of predetermined weight and rendered active to regulate and vary the operation of the driving and feeding means to vary the feeding of material in proportion to the magnitude of the change in the time interval of feeding said preportional portion of the material.

5. In material feeding means, a travelling material conveyer, means supplying material to the conveyer, weighing mechanism for supporting a portion of the conveyer and counterbalance material of predetermined weight thereon, means to actuate the conveyer, means for regulating the operation of the conveyer actuating means and conveyer to feed material of said predetermined weight means successively operative from the conveyer by the feeding of successive portions of material of predetermined weight for timing the travel of the conveyer for feeding said portions of the material and render means operative by a change in the conveyer travel to feed material of said predetermined weight to regulate and vary the operation of the conveyer actuating means and travel of the conveyer in inverse proportion to the magnitude of the change in the travel of the conveyer to feed said portions of material of predetermined weight and average the speed of travel of the conveyer to feed material at the rate of said predetermined weight.

6. In material feeding means, a travelling material conveyer, means for supplying material to the conveyer, weighing mechanism for supporting a portion of the conveyer and counterbalance material of predetermined weight thereon, means to drive the conveyer at a speed to feed material of predetermined weight and feeding material off the conveyer at a predetermined rate, means for regulating the operation of the conveyer driving means to vary the speed of travel and feeding of material by the conveyer, means to integrate and register the cumulative weight of the material fed by the conveyer, means controlled by the integrating means and feeding of successive portions of the material of predetermined weight for timing the travel of the conveyer for feeding said portions of material of the predetermined weight, means rendered operative by the integrating means to render the timing means inactive and cooperating with the timing means to detect any change in the travel of the conveyer for feeding said portions of material of predetermined weight and by any change in the time of travel of the conveyer to feed said portions of material render operative the regulating means for the conveyer driving means to vary the speed of travel of the conveyer in inverse proportion to any change in the travel of the conveyer for feeding material of said predetermined weight and feed material at an average the rate of said predetermined weight.

7. In material feeding means, a travelling material conveyer, means to supply material to the

conveyer, weighing mechanism to support a portion of the conveyer and counterbalance material of predetermined weight thereon, means to drive the conveyer to travel at a speed to feed material of said predetermined weight by successive lengths of conveyer travel, means for regulating the operation of the conveyer driving means to vary the speed of travel and feeding of material by the conveyer, means operative at successive intervals by the feeding of material of said predetermined weight for timing the travel of the conveyer for feeding portions of material of said predetermined weight, and means operative for detecting any change in the travel of the conveyer for feeding said portions of material of predetermined weight and by a change in the travel of the conveyer to feed material of said predetermined weight rendering operative the regulating means for the conveyer driving means and vary the travel of the conveyer in inverse proportion to the change in the conveyer travel for feeding said portions of material of predetermined weight and average the feeding of the material by the conveyer at the rate of said predetermined weight.

8. In material feeding apparatus, means to feed material in a continuous stream at the rate of a predetermined weight from a source of supply of the material, means to vary the operation of the feeding means and rate of feed of the material, means rendered operative from the feeding means and feeding of successive portions of material of said predetermined weight for timing the feeding means for feeding said portions of material, and means rendered operative from the feeding means alternately with the operation of said timing means and cooperating with the timing means to detect any change in the rate of feed of said portions of the material during said intervals and to render operative the means to vary the operation of the feeding means and feeding of the material in proportion to any change in the rate of feed and average the feeding of the material at the rate of said predetermined weight.

9. In material feeding apparatus, a travelling conveyer, means supplying material to the conveyer, weighing mechanism to counterbalance material of predetermined weight on the conveyor, means to actuate the conveyer to feed material of predetermined weight by successive lengths of conveyer travel, means to vary the operation of the conveyer actuating means and thereby the speed of travel of the conveyer and feeding of the material, means operative at successive intervals for timing the successive lengths of conveyer travel for feeding portions of material of said predetermined weight, means operative alternately with said timing means to detect any change in the travel of the conveyer for feeding material of said predetermined weight and render operative the means to vary the travel of the conveyer and actuate the conveyer at a speed in inverse proportion to said change in the speed of travel of the conveyer to feed material of said predetermined weight and average the feeding of the material at the rate of said predetermined weight.

10. In material feeding apparatus, means for continuously feeding material, electrically operated means for regulating the actuation of the feeding means to feed material at the rate of a predetermined weight and vary the actuation of the feeding means, circuit closing means in and normally opening the circuit of said electrically operated means and operative to connect the same in one of two operating circuits, means connected in open circuit with a source of electricity operative by the feeding means upon feeding successive portions of material of predetermined weight to close said circuit and produce electric impulses, and means rendered operative by said electric impulses for timing the feeding means to feed a portion of material of said predetermined weight between successive impulses and actuate the circuit closing means in the circuit of the electrically operated regulating means by a change in the actuation of the feeding means to feed a portion of material of said predetermined weight to connect said electrically operated regulating means in one of its operating circuits and vary the actuation of the feeding means to feed the material in inverse proportion to the change in the actuation of the feeding means to feed said portion of material of predetermined weight and average the feeding of the material at the rate of the predetermined weight.

11. In material feeding apparatus, means for continuously feeding material at the rate of a predetermined weight, means for regulating said feeding means to vary the feeding of the material, means operative for timing the feeding of successive proportionate portions of the material, and means operative by the feeding of a proportionate portion of material to lock the timing means in actuated position and actuate means to cooperate with the timing means by a change in the rate of feeding said proportionate portion of material to render operative the regulating means to vary the operation of the feeding means to feed the material in inverse proportion to the magnitude of any change in the rate of feeding said proportionate portion of material and average the feeding of the material at the rate of the predetermined weight.

12. In material feeding apparatus, a travelling material conveyer, means to supply material to the conveyer, means to support a portion of the conveyer and counterbalance material of predetermining weight thereon, means to actuate the conveyer at a speed to feed material at the rate of said predetermined weight, means for regulating the actuating means for the conveyer to vary the speed of travel and feeding of material by the conveyer, a reversible electric motor for actuating said regulating means, means to integrate and register the cumulative weight of the material feed by the conveyer, and means rendered successively operative by the integrating means for timing the feeding of proportionate portions of material of predetermined weight by the conveyer, detect any change in the rate of feeding said proportionate portions of material and render the reversible motor operative by a change in the rate of feeding a proportionate portion of material to actuate the regulating means to regulate the operation of the conveyer actuating means to vary the speed of travel of the conveyer and feeding of the material in inverse proportion to the magnitude of the change in the rate of feeding said proportionate portions of material and average the feeding of the material by the conveyer at the rate of the predetermined weight.

13. In material feeding apparatus, a travelling material conveyer, weighing mechanism for counterbalancing material of predetermined weight on the conveyer, means to actuate the conveyer, means to regulate the operation of the

conveyer actuating means to feed material at the rate of said predetermined weight and vary the speed of travel of the conveyer and feeding of the material, means for timing the travel of the conveyer to feed successive proportionate portions of material of said predetermined weight, detect any change in the travel of the conveyer for feeding each of said portions of the material and by a change in the travel of the conveyer for feeding said proportionate portions of material render the regulating means operative to vary the operation of the conveyer actuating means and speed of travel of the conveyer to feed material in inverse proportion to the change in the rate of feeding said proportionate portion of material, means to actuate the timing means to normal position of rest, driving means, means to operatively connect said driving means to and disconnect the same from said timing and detecting means, means normally actuating the connecting means to connect the driving means to the timing means, means releasably holding said connecting means in position to disconnect the driving means from the timing and detecting means, means controlled by the conveyer operative to actuate said holding means to release and permit the connecting means to be actuated to connect the driving means to and actuate the timing means, means operative by the feeding of a proportionate portion of material of predetermined weight to actuate the connecting means to disconnect the driving means from the timing means and connect the driving means to and actuate the detecting means, and means operative upon the actuation of the detecting means in predetermined proportion to the actuation of the timing means to render inoperative said actuating means to connect the detecting means to the driving means and permit said connecting means to be actuated into engagement with the holding means and disconnect the timing and detecting means from the driving means.

14. In material feeding apparatus as claimed in claim 13, means to releasably lock the timing means in actuated position adapted to be actuated to locking position by the means to actuate the connecting means to connect the driving means to the detecting means and be released from and permit the timing means to be actuated to normal position of rest when the driving means is disconnected from the detecting means.

15. In material feeding apparatus, a travelling material conveyer, means to support and counterbalance material of predetermined weight on the conveyer, regulatable means to actuate the conveyer to feed material at the rate of the counterbalanced weight and vary the speed of travel and feeding of material by the conveyer, means to integrate the weight of material fed by the conveyer, means operative for timing the travel of the conveyer for feeding successive proportionate portions of material of the predetermined weight, means operative to detect any change in the travel of the conveyer for feeding said portions of material of predetermined weight and effect regulation of the conveyer actuating means to vary the travel of the conveyer in inverse proportion to any change in travel of the conveyer to feed said portions of the material, driving means, means for coupling said driving means to the timing and detecting means, means to releasably hold said coupling means in position with the driving means uncoupled from the timing and detecting means, means rendered operative by the integrating means to actuate said holding means to release and permit actuation of the coupling means to couple the driving means to and actuate the timing means, and means rendered operative by the integrating means by the feeding of a proportionate portion of material of the predetermined weight to actuate the coupling means to uncouple the driving means from the timing means and couple the driving means to and actuate the detecting means in predetermined proportion to the actuation of the timing means and at the termination of the actuation of said detecting means render said actuating means inactive and permit actuation of the coupling means into engagement with the holding means and the driving means uncoupled from the timing and detecting means.

16. Material feeding apparatus as claimed in claim 15, wherein the driving means comprises a rotatable friction disk, a pair of independently rotatable and axially adjustable friction wheels engaging the disk at opposite sides of the axis thereof and frictionally driven in opposite directions from the disk, means to adjust one wheel radially outward and the other wheel simultaneously radially inward on the disk to be rotated at a speed in predetermined proportion to the rotation of the outwardly adjusted wheel and set the driving means to actuate the timing and detecting means at a speed proportional to the speed of travel of the conveyer for feeding material at the rate of the predetermined weight.

17. Material feeding means as claimed in claim 15, wherein the driving means comprises a rotatable disk, a pair of coaxially disposed rotatable shafts extending radially of the disk, a friction wheel mounted on each of said shafts to rotate with and have adjustment on said shafts radially of the disk, a rotatable shaft extending parallelly of said pair of shafts and having a portion substantially equal in length to one of the pair of shafts externally screw threaded, a pair of shifters each rotatably carrying a friction wheel, one of said shifters being slidable on the unthreaded portion of said shaft and the other shifter having threaded connection with the threaded portion of the shaft and adapted to be adjusted on the shaft by the rotation of the shaft and adjust the wheel carried thereby radially of the disk, and means connected to and operative to transmit the adjustment of said adjustable shifter to the other shifter and adjust the wheel carried thereby radially on the disk opposite the radial adjustment of the other wheel with the shifter and rotate said wheel in a direction reverse to and at a speed in predetermined proportion to the rotation of the wheel carried by the adjustable shifter and set said wheels radially on the disk to be rotated at speeds in proportion to the speed of travel of the conveyer for feeding material at the rate of the predetermined weight, a graduated scale, and an indicator mounted on the adjustable shifter and adjustable therewith relative to the scale to indicate the adjustment of the wheels and the weight at which rate the material is fed by the conveyer.

18. Material feeding means as claimed in claim 15, wherein the timing means comprises a rotatable shaft, a pair of cam wheels rotatable with and spaced axially on the shaft, and means to rotate the shaft in one direction and normally position the cam wheels in a predetermined position of rest, and said cam shaft during the interval of feeding material of the predetermined weight being coupled to the driving means and rotating the cam wheels from their position of

rest through a predetermined arc at a speed proportional to the conveyer travel for feeding said portion of material of predetermined weight.

19. Material feeding means as claimed in claim 15, wherein the timing means and the means for coupling the timing means to the driving means during the interval of feeding a portion of the material of predetermined weight comprises a rotatable shaft, a pair of cam wheels rotatable with and spaced axially on said shaft, means to rotate the shaft with the cam wheels in one direction to position the cam wheels in predetermined position of rest, a clutch member rotatable from the driving means, an axially adjustable shaft slidably mounted axially of said clutch member, a second clutch member rotatable on and participating in the axial adjustment of said shaft to engage said second clutch member with and rotate it from the first clutch member, and gearing operatively connecting said second clutch member to the cam shaft.

20. In material feeding apparatus, a travelling material conveyer, means to support and counterbalance material of predetermined weight on the conveyer, regulatable means to actuate the conveyer to feed material at the rate of the counterbalanced weight, means to integrate the weight of the material fed by the conveyer, means for timing the travel of the conveyer to feed material of predetermined weight, means actuating said timing means to normal position of rest, driving means, means to couple said driving means to and actuate the timing means, means yieldingly urging the coupling means in a direction to couple the driving means to the timing means, means to releasably hold said coupling means in position with the driving means uncoupled from the timing means, electromagnetically operated means connected to said holding means having normally open circuit closing means in the circuit thereof, means operative by the integrating means to actuate said circuit closing means to close the circuit of and energize said electromagnetically operated means to actuate said holding means to release and permit actuation of the coupling means to couple the driving means to and actuate the timing means, means operative to detect any change in the travel of the conveyer to feed material of said predetermined weight and regulate the actuating means for and vary the travel of the conveyer in proportion to any change in the conveyer travel to feed material at the rate of said predetermined weight, a second electromagnetically operated means connected in normally open circuit with the circuit closing means in the circuit of the first electromagnetically operated means, and said circuit closing means operative by the integrating means upon feeding a proportionate portion of material of said predetermined weight to close the circuit of and energize said second electromagnetically operated means and actuate the coupling means to uncouple the driving means from the timing means and couple the driving means to and actuate the detecting means, a circuit maker in the circuit of said second electromagnetically operated means normally assuming circuit closing position, and means operative by the actuation of the detecting means in predetermined proportion to the timing means to actuate said circuit maker to open the circuit of and deenergize said second electromagnetically operated means and permit actuation of the coupling means to uncouple the driving means from the timing and detecting means and actuation of the coupling means into engagement with the holding means therefor and permit actuation of the timing means to position of rest.

21. In apparatus for feeding material, a continuously travelling conveyer to feed material at the rate of a predetermined weight, weighing mechanism to counterbalance material of predetermined weight on the conveyer, conveyer actuating means, electrically operated regulating means to vary the operation of the conveyer actuating means and travel of the conveyer having normally open circuit closing means in the circuit thereof operative to connect said regulating means in one of two operating circuits, means for timing the travel of the conveyer to feed successive proportionate portions of material of said predetermined weight normally urged to a position of rest, driving means, means to couple the timing means to the driving means, means to actuate said coupling means to couple the timing means to the driving means, means to hold the coupling means in position to uncouple the timing means from the driving means, electrically operated means having normally open circuit closing means in the circuit thereof operative at successive intervals from the travel and feeding of a proportionate portion of material of predetermined weight by the conveyer to close the circuit of and actuate said holding means to release and permit actuation of the coupling means to couple the driving means to and actuate the timing means, means to lock the timing means in actuated position, means to actuate and cause the circuit closing means in the circuit of the electrically operated regulating means to cooperate with the timing means to connect said regulating means in one of its operating circuits by an increase and connect said regulating means in the other of its operating circuits by a decrease in the travel of the conveyer to feed a proportionate portion of material of said predetermined weight and vary the travel of the conveyer in proportion to any change in the travel of the conveyer to feed said proportionate portion of material, a second electrically operated means connected in circuit with the circuit closing means of the first electrically operated means and operative from the conveyer feeding a proportionate portion of material of said predetermined weight to close the circuit of said second electrically operated means and actuate the locking means to lock the timing means in actuated position, actuate the coupling means to uncouple the timing means from and couple said circuit closing means of the regulating means to the driving means, and a circuit closer normally closing the circuit of said second electrically operated means operative upon a predetermined operation of the circuit closing means for the regulating means to open the circuit of said second electrically operated means and permit actuation of the coupling means to uncouple the driving means from said circuit closing means, release the locking means from the timing means and actuate the timing means to position of rest and engage the coupling means with the holding means.

22. Apparatus for feeding material as claimed in claim 21, wherein the timing means and the means to actuate the circuit closing means to connect the electrically operated regulating means for varying the travel of the conveyer in one of two electric operating circuits, comprise a pair of coaxially disposed cam wheels, a cam

wheel independently rotatable on an axis coaxially of the pair of cam wheels, a pivoted lever carrying a roller to follow said latter cam wheel, a pair of actuators for the circuit closing means in circuit with the electrically operated regulating means connected to and operative by the lever from the rotation of the cam wheel to cause one of said actuators by a decrease in the travel of the conveyer to feed a proportionate portion of material of said predetermined weight to follow one of the pair of cam wheels and connect said electrically operated means in one of its operating circuits and increase the speed of travel of the conveyer in inverse proportion to the decrease in the travel of the conveyer to feed said proportionate portion of the material and cause the other of said actuators by an increase in the travel of the conveyer to feed a proportionate portion of material to follow the other of said pair of cam wheels and connect the electrically operated means in the other of its operating circuits and decrease the travel of the conveyer in inverse proportion to the increase in the travel of the conveyer to feed said proportionate portion of the material.

23. In material feeding means, a travelling material conveyer, means to counterbalance material of predetermined weight on the conveyer, means to actuate the conveyer, electrically operated means having circuit closing means in circuit therewith to regulate the operation of the conveyer actuating means and conveyer to feed material at the rate of said predetermined weight and vary the travel and feeding of waterial by the conveyer, means operative at successive intervals for timing the travel of the conveyer for feeding proportionate portions of material of said predetermined weight, means operative alternately with the timing means and cooperating therewith to detect any change in feeding of proportionate portions of material of said predetermined weight and actuate the circuit closing means to connect said electrically operated means in one of two electric operating circuits to actuate the regulating means to vary the travel of the conveyer to feed material in inverse proportion to any change in the rate of feeding material of said predetermined weight, means actuating the timing means to normal position of rest, driving means, means to connect and disconnect the driving means from said timing means and said detecting and circuit closing means, means normally releasably holding said connecting means in position to disconnect the driving means from the timing means and the detecting and circuit closing means, means actuating the connecting means to connect the driving means to the timing means, electromagnetically operated means having circuit closing means in the circuit thereof operative at successive intervals to close the circuit of and energize said electromagnetically operated means to release the holding means from and permit actuation of the connecting means to connect the driving means to and actuate the timing means in proportion to the travel of the conveyer to feed a proportionate portion of material of said predetermined weight, means to releasably lock the timing means in actuated position, and a second electromagnetically operated means connected in circuit with the circuit closing means in the circuit of the first electromagnetically operated means operative by the travel of the conveyer to feed material of said predetermined weight to close the circuit of and energize said second electromagnetically operated means and actuate the connecting means to disconnect the driving means from the timing means, actuate the locking means to lock the timing means in actuated position, connect the driving means to and actuate the detecting and circuit closing means for the electrically operated means for regulating the conveyer actuating means by a change in the travel of the conveyer to feed said material of predetermined weight.

24. In material feeding means as claimed in claim 23, means actuated by said detecting and circuit closing means operative upon a predetermined actuation thereof to open the circuit of and de-energize said second electromagnetically operated means and permit actuation of the connecting means into engagement with the holding means therefor, release the locking means from the timing means and actuation of the timing means to normal position of rest.

25. In material feeding apparatus, electric motor driven conveyer for continuously feeding material, means to counterbalance material of predetermined weight on the conveyer, a rheostat for regulating the operation of said motor and feeding means to feed material at the rate of said predetermined weight, a reversible motor for actuating said rheostat having normally opened circuit closing means in circuit therewith operative to connect said reversible motor in one of two operating circuits, means to integrate and register the cumulative weight of the material fed by the feeding means, means for timing the feeding means to feed successive proportionate portions of material of predetermined weight, means to actuate and cause the circuit closing means in the circuit of the reversible motor to cooperate with the timing means to connect the reversible motor in one of its operating circuits by a change in the actuation of the conveyer to feed a proportionate portion of material and actuate the rheostat to vary the actuation of the conveyer operating motor in inverse proportion to the magnitude of the change in the feeding of said proportionate portion of material, driving means, means to couple the driving means to said timing means and said circuit closing means, means to actuate the coupling means to couple the driving means to the timing means, means to releasably hold the coupling means in position with the driving means uncoupled from the timing and circuit closing means, electromagnetically operated means to actuate said holding means to release and permit actuation of the coupling means to couple the driving means to the timing means, a second electromagnetically operated means to actuate the coupling means to uncouple the timing means from and couple the circuit closing means to the driving means, and normally open circuit closing means in circuit with both of said electromagnetically operated means actuated to circuit closing position by the integrating means to send out an electric impulse to energize the first electromagnetically operated means to actuate the holding means to release and permit actuation of the coupling means to couple the driving means to the timing means and after an interval of operation of the conveyer to feed a proportionate portion of the material of predetermined weight send out a second impulse and energize the second electromagnetically operated means to actuate the coupling means to uncouple the timing means from and couple the circuit closing means to said driving means.

26. In material feeding means as claimed in claim 25, means to actuate the timing means to normal position of rest and from which position it is actuated by the driving means, means to releasably lock the timing means in actuated position, a circuit closer in and normally closing the circuit of said second electromagnetically operated means, and means participating in the actuation of the circuit closing means operative upon a predetermined operation of the circuit closing means relative to the operation of the timing means to open the circuit of said second electromagnetically operated means and permit actuation of the coupling means into engagement with the holding means, release the locking means from the timing means and actuation of the means to return the timing means to normal position of rest.

27. In material feeding apparatus, a traveling conveyer, means to counterbalance material of predetermined weight on the conveyer, regulatable means for actuating said conveyer to feed material at the rate of said predetermined weight and vary the travel thereof including a reversible motor having circuit closing means in open circuit therewith and operative to connect said reversible motor in one of two operating circuits, means to integrate and register the cumulative weight of the material fed by the conveyer, means for timing the conveyer for feeding proportionate portions of material of said predetermined weight, means to actuate the timing means to a normal position of rest, means to actuate and cause said motor circuit closing means to ccoperate with the timing means to connect said reversible motor in one of its operating circuits by a change in the travel of the conveyer to feed a proportionate portion of material and vary the conveyer travel in inverse proportion to the change in the travel thereof to feed said proportionate portion of the material, driving means, means to couple the driving means to the timing means and the circuit closing means, means to releasably hold the coupling means in position to normally uncouple the driving means from the timing means and the circuit closing means, means to actuate the coupling means to couple the driving means to and actuate the timing means, means to lock the timing means in actuated position, electromagnetically operated means to actuate the holding means to release the coupling means, a second electromagnetically operated means to actuate the coupling means to uncouple the driving means from the timing means, actuate the locking means to lock the timing means in actuated position and couple the driving means to and actuate the circuit closing means, normally open circuit closing means in circuit with both of said electromagnetically operated means operative by the integrating means to close said circuits in a sequence by the feeding of a proportionate portion of material of predetermined weight, and means operative by the actuation of the circuit closing means in predetermined proportion to the actuation of the timing means to open the circuit of the second electromagnetically operated means to permit operation of the coupling means to uncouple the driving means from the circuit closing means, release the locking means from the timing means and actuate the coupling means into engagement with the holding means.

28. In material feeding means, continuously operating means for feeding material, means to counterbalance material of predetermined weight on the feeding means, means for actuating the feeding means, electrically operated means to regulate the operation of the actuating means for the feeding means to feed material at the rate of said predetermined weight and having circuit making means in the circuit thereof operative to connect the regulating means in one of two operating circuits, and means operative for timing the feeding means to feed proportionate portions of material of said predetermined weight and actuate the circuit making means to connect the regulating means in one of its operating circuits to vary the operation and feeding of material by the feeding means in inverse proportion to any change in the operation thereof to feed a proportionate portion of material of said predetermined weight, comprising a rotatable shaft having a pair of cam wheels spaced axially on and rotatable with said shaft, a second shaft coaxial of the first shaft having a cam wheel fixed thereon, driving means to rotate said shafts at speeds proportional to the operation of the feeding means and normally uncoupled therefrom, a pair of actuators for the circuit making means in the circuit of the regulating means, means connected to said actuators operative by the cam wheel on the second shaft to cause one of said actuators to cooperate with one of said pair of cam wheels by a change in the operation of the feeding means to feed a proportionate portion of material of said predetermined weight, and means operative to couple and uncouple said cam wheel carrying shafts from the driving means controlled from the feeding means and feeding of a proportionate portion of the material of said predetermined weight.

29. Means for continuously feeding material as claimed in claim 28, wherein the means to couple and uncouple the cam wheel carrying shafts from the driving means, comprises an axially adjustable shaft, a clutch member fixed on each end of said adjustable shaft, means to operatively connect and rotate said shaft with the clutch members from the driving means, a pair of clutch members loose on said shaft, one juxtaposed to each of the fixed clutch members, and gears connecting said loose clutch members to the cam wheel carrying shafts, one of said loose clutch members being adapted to be engaged with a clutch member fixed on the adjustable shaft by adjustment of said shaft in one direction to couple the shaft with the pair of cam wheels to the driving means and disengage the same therefrom by axial adjustment of said shaft in the opposite direction, and said latter adjustment of the clutch carrying shaft adapted to engage the other clutch member loose on said shaft with the other clutch member fixed on the shaft and thereby couple the shaft with the cam wheel operative to actuate the actuators for the circuit maker in the circuit of the regulating means to the driving means.

30. Means for feeding material as claimed in claim 28, wherein the driving means for the cam wheel carrying shafts comprises a rotatable friction disk, a pair of coaxial rotatable shafts extending radially of the disk, a friction wheel mounted on each of said shafts to rotate with and have axial adjustment on said shafts, gearing operatively connecting said frictionwheel carrying shafts to the axially adjustable clutch member carrying shaft, and means to adjust one of said friction wheels on its shaft inwardly or outwardly radially of the disk and simultaneously correspondingly adjust the other friction wheel on its shaft outwardly or inwardly radially of the disk to rotate said friction wheels and the cam wheel

carrying shafts in opposite directions and proportional to the actuation of the material feeding means.

31. Means for feeding material as claimed in claim 28, wherein the driving means for the cam wheel carrying shafts comprises a rotatable friction disk, a pair of coaxial rotatable shafts extending radially of the disk, a friction wheel mounted on each of said shafts to rotate therewith and have axial adjustment thereon, gearing connecting said friction wheel carrying shafts with the axially adjustable clutch member carrying shaft, means to simultaneously adjust said friction wheels on the shafts, one radially inward or outward and the other radially outward or inward of the friction disk to rotate said friction wheels at speeds proportional to each other and the actuation of the material feeding means, a scale graduated in predetermined units of weight, and an indicator adjustable relative to said scale by the friction wheel adjusting means to indicate the predetermined weight of the material at the rate of which the material is fed by the material feeding means.

32. In means for feeding material as claimed in claim 28, means to rotate the shaft carrying the pair of cam wheels in one direction to engage a stop with the cam wheels in predetermined position of rest, means normally holding said coupling means in position with the cam wheel carrying shafts uncoupled from the driving means, means rendered operative by the material feeding means to actuate the holding means to release and permit actuation of the coupling means to couple the shaft carrying the pair of cam wheels with the driving means, means rendered operative by the feeding a proportionate portion of means feeding material of said predetermined weight to actuate the coupling means to uncouple the shaft carrying the pair of cam wheels from the driving means, actuate the means to lock said cam wheel carrying shaft in actuated position and couple the other cam wheel carrying shaft with the driving means, and means operative by a predetermined rotation of the latter cam wheel carrying shaft to render the means to actuate the coupling means to couple said cam wheel carrying shaft with the driving means inactive and permit actuation of the coupling means to engage its holding means, release the locking means from and permit actuation of the shaft carrying the pair of cam wheels to position with the cam wheels in normal position of rest.

ROBERT F. HOHMAN.

CERTIFICATE OF CORRECTION.

Patent No. 2,367,775. January 23, 1945.

ROBERT F. HOHMAN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 11, first column, line 47, claim 1, strike out "the" second occurrence, and insert instead --said predetermined quantity of--; line 49, same claim, strike out "said predetermined quantity of" and insert instead --the--; and second column, line 73, claim 6, for the words "the rate" read --of the rate--; page 12, first column, line 40, claim 8, before "render" strike out "to"; page 15, first column, line 34, claim 23, for "waterial" read --material--; and second column, line 41, claim 25, after "material" insert --of predetermined weight--; page 17, second column, line 10, claim 32, strike out "a proportionate portion of" and insert the same after "feeding" in line 11, same claim; 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 10th day of April, A. D. 1945.

Leslie Frazer

(Seal) Acting Commissioner of Patents.