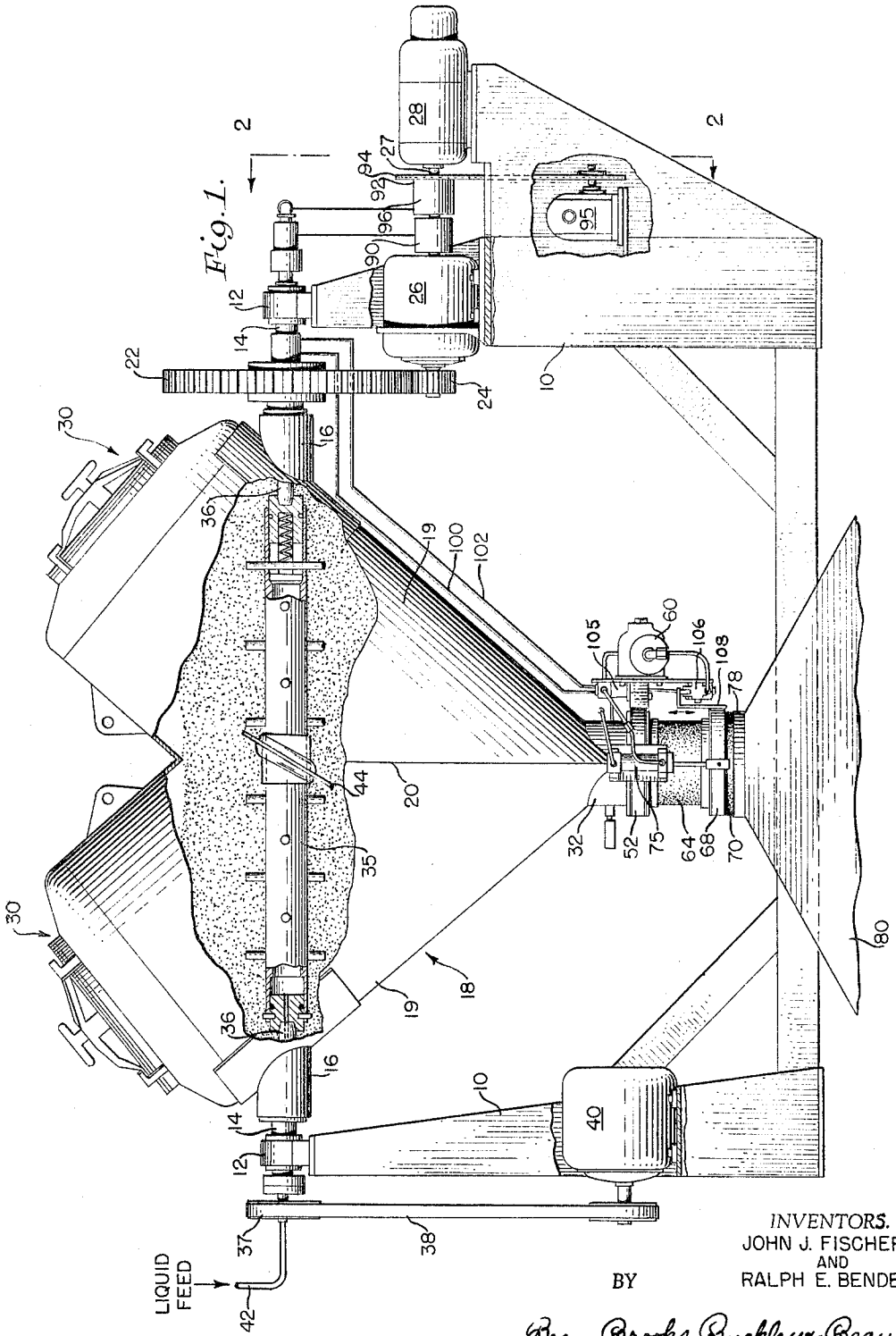
Aug. 16, 1966 J. J. FISCHER ETAL 3,266,779

MATERIALS MIXING AND BLENDING MACHINE

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Fig. 1.



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MATERIALS MIXING AND BLENDING MACHINE

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Fig. 2.

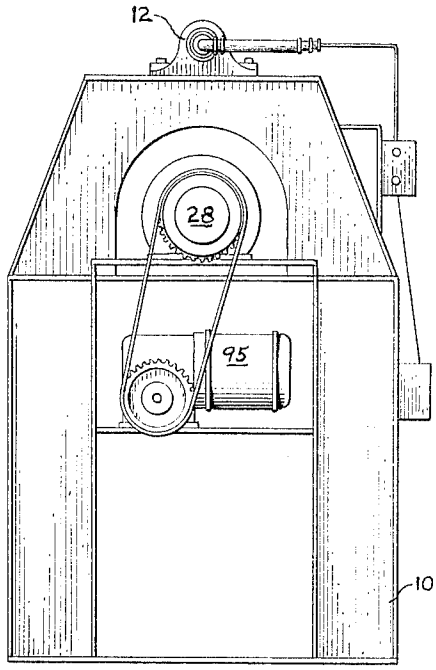
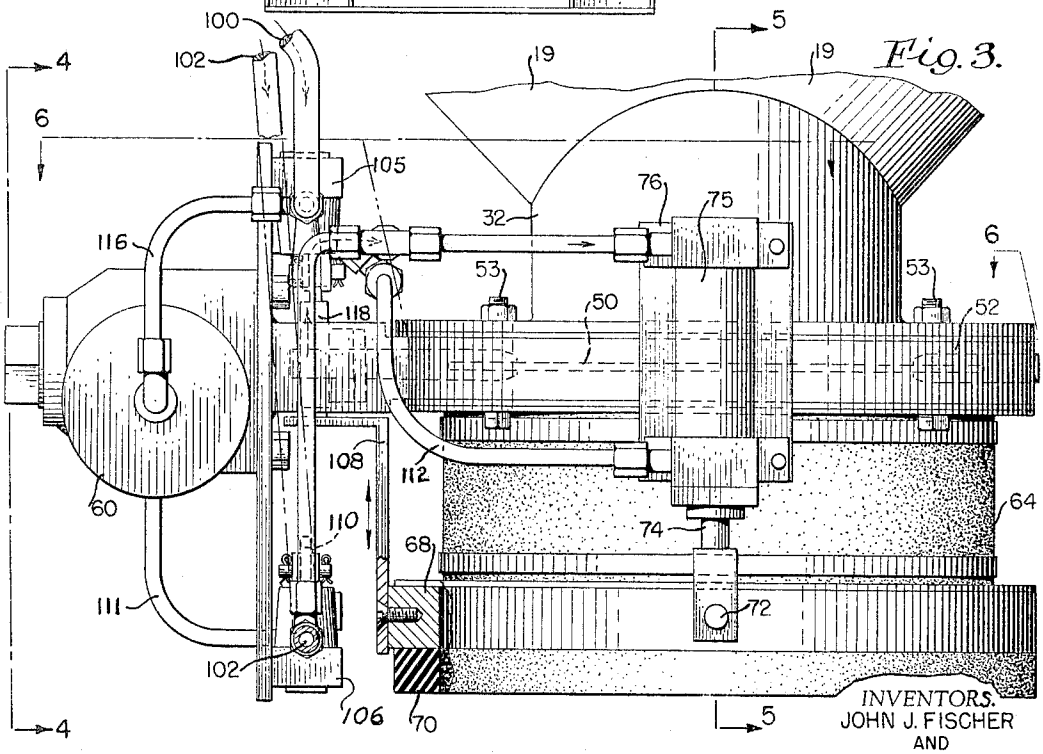


Fig. 3.



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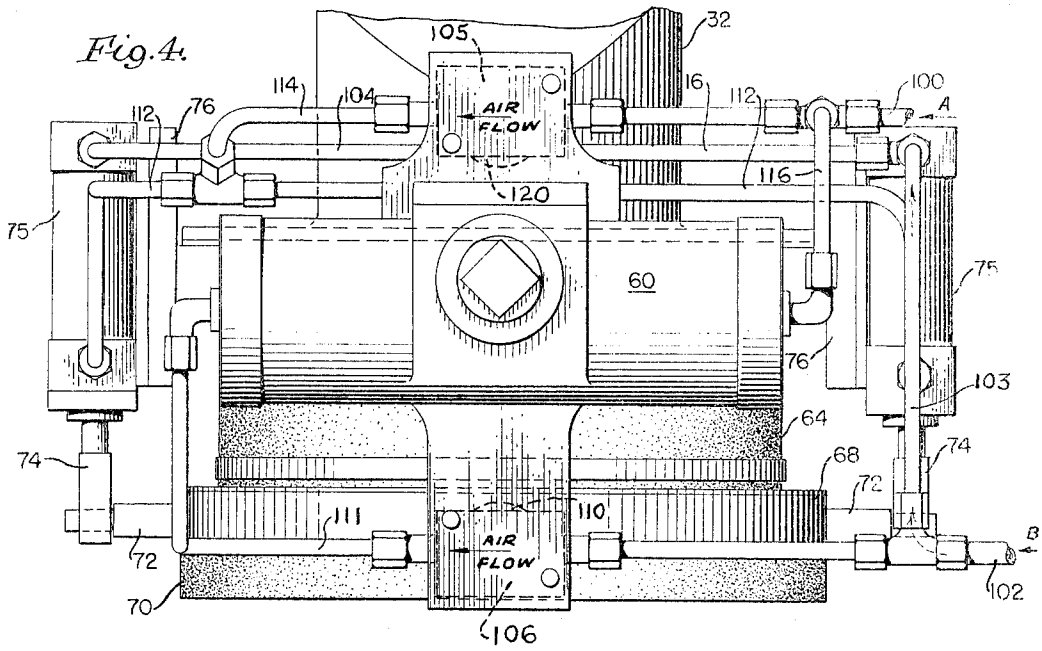
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MATERIALS MIXING AND BLENDING MACHINE

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Fig. 4.



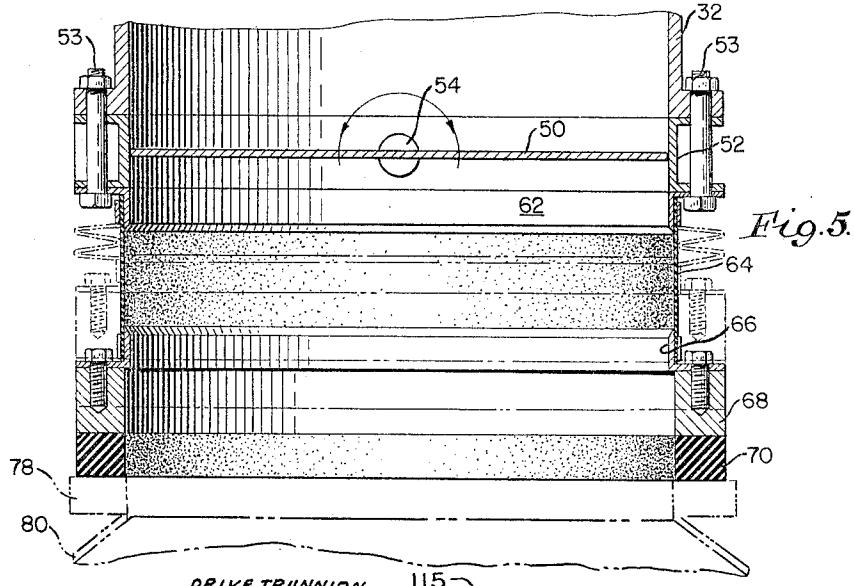
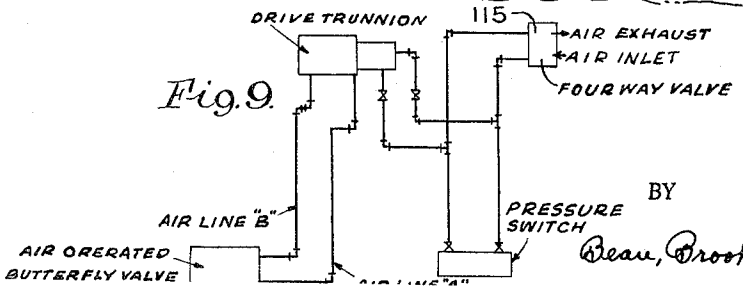


Fig. 5.

Fig. 9.



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MATERIALS MIXING AND BLENDING MACHINE

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Fig. 6.

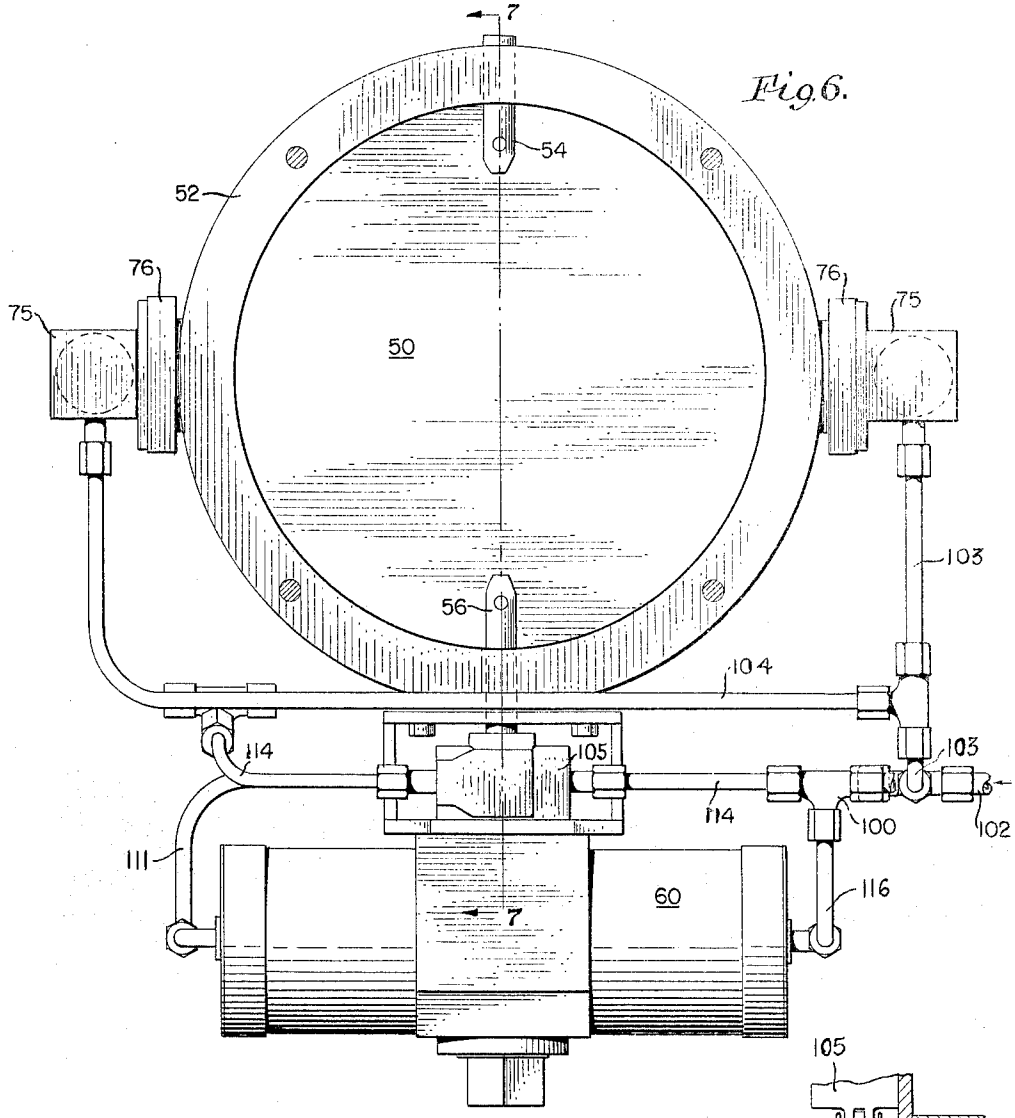
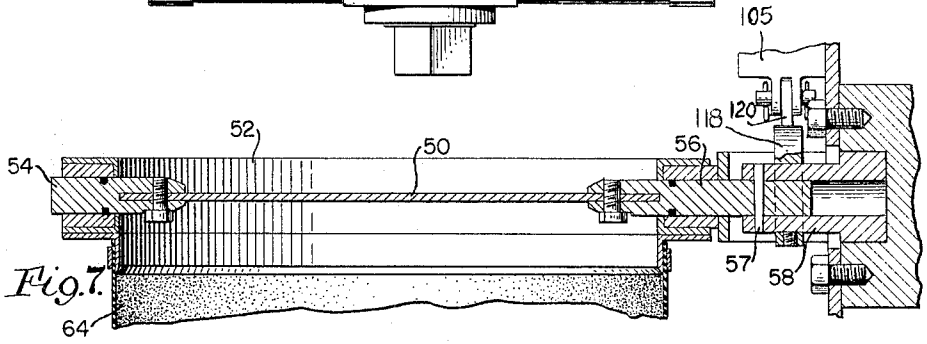


Fig. 7.



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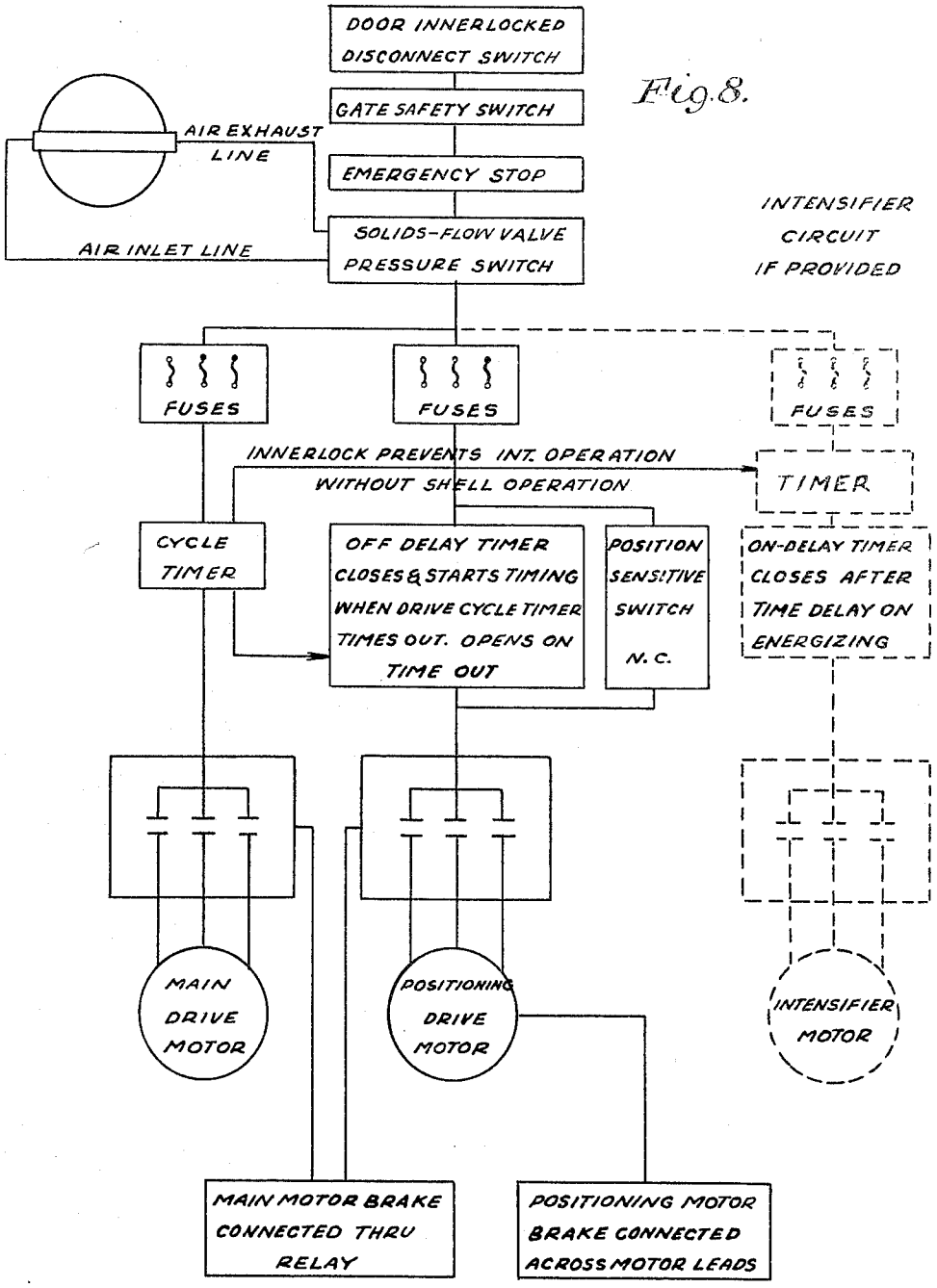
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MATERIALS MIXING AND BLENDING MACHINE

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Fig. 8.



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United States Patent Office 3,266,779 Patented August 16, 1966

3,266,779

MATERIALS MIXING AND BLENDING MACHINE

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Filed Feb. 5, 1964, Ser. No. 342,666
8 Claims. (Cl. 259—3)

This invention relates to tumbling mill type blenders, for use in mixing and/or blending dry materials and/or dry and wet materials in connection with various industries. More specifically, the invention relates to improvements in the type machines disclosed for example in U.S. Patents 2,514,126; 2,915,300; and the like.

It is an object of the present invention to provide in conjunction with a mixer or blender of the type referred to, an improved operational control system, and an improved dust control system.

Another object is to provide an improved operational control system as aforesaid which may be wholly or partially automated or automatically controlled, as may be preferred.

Another object is to provide in a tumbling mill type machine improved means for automatically controlling the driving and braking and positioning the mill sequentially relative to the mill loading and unloading facilities.

Other objects and advantages of the invention will be apparent from the specification herewith and the accompanying drawings wherein:

FIG. 1 is a fragmentary front side elevational view of a blending mill embodying one form of the invention, with portions broken away to show the interior;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a fragmentary rear side elevational view, on enlarged scale, of a portion of the mechanism of FIG. 1;

FIG. 4 is a view taken along line 4—4 of FIG. 3;

FIG. 5 is a fragmentary section taken along line 5—5 of FIG. 3;

FIG. 6 is a section taken along line 6—6 of FIG. 3;

FIG. 7 is a fragmentary sectional view taken along line 7—7 of FIG. 6;

FIG. 8 is a diagram of a typical control system for the mechanism; and

FIG. 9 is a diagrammatic view illustrating the system for controlling the shroud actuating mechanism.

As shown by way of example in the drawing herewith, the invention may be embodied in a blending mill of the tumbling type, comprising pedestals 10, 10 (FIG. 1) supporting bearing blocks 12, 12 in which are journaled mutually aligned stub shafts 14, 14. The stub shafts extend to axial alignment from trunnions 16, 16 welded or otherwise fixed to the shell of the mill which is indicated generally at 18. In the example shown, the shell 18 comprises a pair of cylindrical leg portions 19, 19 each of which are slant-cut at one end and then welded together as at 20 to provide a generally V-shaped casing as viewed in FIG. 1. One of the stub shaft members is provided with a driving gear 22 engaging a pinion 24 keyed to the output shaft of a speed reducer as indicated at 26. The speed reducer connects through a drive shaft 27 to the output shaft of the main drive motor 28. Thus it will be appreciated that upon operation of the motor 28 the gear train will be driven to cause the mill to rotate in tumbling fashion upon the bearings 12, 12.

Loading and/or access doors may be provided as illustrated at 30, 30 to comprise end cover plates and screw clamping devices for holding the plates in closed positions over openings formed in the ends of the shell portions 19, 19. A spout is provided as indicated at 32 at the apex portion of the shell 18 for loading and/or discharge

of blended materials under control of a valve which normally closes the spout 32, as will be explained in detail hereinafter. Thus, it will be appreciated that when standing in the attitude illustrated in FIG. 1, the cover plates 30, 30 may be lifted and the material to be blended dumped into the mill. Or, alternatively, the mill may be turned until the spout end portion of the mill is on top, whereupon the mill may be loaded therethrough. In any case, upon operation of the drive motor 28 the contents of the mill will be mixed or blended, as explained in the prior patents referenced hereinabove.

Further, as shown in FIG. 1, a material agitating device is preferably employed interiorly of the mill; and as shown in FIG. 1 this device may comprise a tube 35 having paddle devices extending radially therefrom and supported at its opposite ends by means of stub shafts 36, 36 resting in the trunnions 16, 16. One of the stub shafts 36, as shown for example at the left hand portion of FIG. 1, is keyed to the agitator bar 35, and is formed with an integral extension reaching through the interior of the concentrically disposed main shaft 14 and outwardly beyond its bearing 12 to carry a pulley 37 arranged to be driven by a belt 38 which in turn is powered by motor 40. The motor 40 is operated so as to drive the agitator device 35 in rapidly rotating manner, so as to locally intensify the blending action on the materials within the mill as the latter rotates to tumble the material back and forth across the agitating device. Provision may also be made to feed liquids into the interior of the mill while in operation, such as through a liquid supply conduit as indicated at 42, conveying liquid from any suitable supply source through the hollow interior of the stub shaft 36 into the tube 35. Thus the liquid feeds therefrom through apertures formed in the tube wall leading into an extenuated expression gap between plates as indicated at 44 encircling the agitation shaft 35; such an arrangement being disclosed in detail for example in U.S. Patent 2,915,300.

The invention contemplates improved means for controlling the operation of the mill in connection with the steps of loading the mill, running the mill, and discharging the product of the blending operation. As shown herein (FIG. 3) the control valve for the spout 32 may conveniently comprise a disc-shaped plate 50 pivotally carried within a collar 52 bolted to the bottom of the spout 32 as indicated at 53. For this purpose the valve plate 50 is mounted on pins 54, 56 disposed in axial alignment at diametrically opposite positions of the ring 52 as shown in FIGS. 6, 7. The pin 56 is keyed as indicated at 57 to a drive shaft 58 which is driven to oscillate by means of a rack and pinion device (not shown) connected to the piston of a pneumatic cylinder 60. The parts are so arranged that reciprocation of the piston within the cylinder 60 will cause the shaft 56 to oscillate so as to rotate the valve plate 50 between a transverse horizontal "closed" position as shown in FIGS. 5–7, and an upright position thereby opening the conduit 32 for free passage of materials through the spout.

Because such mills are customarily used to process powdery and dry materials tending to form clouds of dust when falling through open spaces, the spout device 32 is provided within an extensible shroud. As shown herein this extensible shroud is fabricated to include an upper collar 62 around which is fastened the upper end of a flexible skirt 64; the lower end of which encircles a collar 66 which is bolted to a bumper ring 68 preferably carrying a resilient sealing ring 70 at its lower end. The ring 68 is suspended at diametrically opposite positions by means of pivot arms 72 (FIGS. 3, 4) from connecting rods 74 leading upwardly into connections with corresponding pistons carried within pneumatic cylinders 75, 75 disposed at opposite sides of the device and supported by the dis-

charge spout 32 as by means of brackets 76. Thus, reciprocation of the pistons within the cylinders 75, 75 will provide corresponding up and down movements of the sealing ring-gasket devices 68, 70.

The parts are so dimensioned and arranged that when the mill is stopped for example in the position shown in FIG. 1 with the spout device in vertical alignment with the load receiving port 78 of a receiving bin 80, or the like, the piston cylinder units 75, 75 may be actuated to ram the sealing ring unit 68, 70 downwardly against the lip of the receiving bin in dust-sealing relation therewith, while the flexible skirt portion 64 of the device extends to accommodate the change-of-length motion. Thus, prior to unloading the mill after each cycle of blending operation, the mill will be stopped in the position shown in FIG. 1 and the cylinders 75, 75 operated to extend the shroud of the spout device downwardly so that the sealing member 70 thereof mates with the mouth of the bin 80. The valve 50 may now be displaced to its "open" position so that the mill contents will fall by gravity into the bin 80 without loss of material and/or dusting of the surrounding atmospheres. Prior to any rotation of the mill the spout-shroud device will be retracted upwardly away from the lip of the bin 80, so that when the mill starts to swing upon its trunnion mounting there will be no interference between the shroud device and the bin 80. The mill may be loaded either through one or both of the access doors 30–30, or through the spout 32, as preferred.

The invention contemplates a mill tumbling and loading and unloading control system which will operate automatically, if desired, to cause the loading and blending and unloading operations to occur automatically in proper sequence without attention by an operator. Or, each loading operation may be manually controlled, and blending and unloading operations may then be initiated by actuation of a single manual control, whereupon the blending and unloading operations will be automatically sequenced without further attention by the attendant, as may be preferred.

For example, with the mill disposed in an attitude representing 180° rotation from the position shown in FIG. 1, with the spout portion 32 pointed upwardly and in registry with a feed spout, the mill may be loaded with the dry materials to be blended. Actuation of a "start" switch will then energize the main motor 28 to drive the mill through the speed reducer 26 and the gear train 22, 24; causing the V-shaped casing to tumble about the axis of the bearings 12—12 for the required number of times as may have been previously determined according to the character of the materials to be blended. Thus, the motor control circuit may include either a time-controlled delay device for opening the power circuit to the motor 28 after a prescribed time lapse. Or, in the alternative, a revolution counter may be operatively associated with any suitable moving part of the mill to open the motor power supply circuit whenever the mill has made a prescribed number of revolutions; and in any case, with a view to stopping the mill with the spout 32 thereof directed downwardly into alignment with a discharge receiver. Due, however, to the weight of the mill and its contents it tends to "coast" for a substantial length of time following deenergization of the motor 28, and the control system of the present invention includes an improved braking system in conjunction with the speed reducer drive shaft, which is operable to brake the rotation of the mill and stop it in the desired position.

In the past, various attempts have been made to provide devices operable automatically to assist a braking system in bringing a heavy moving object to rest in a precisely preindexed position, such as is required in this case to bring the discharge spout of the mill in registry with the inlet opening at the top of the receiver tank 80. However, such prior devices have been unduly complicated and unreliable and otherwise inadequate and unsatisfactory. In the case of the present invention the primary braking action is arranged to operate only until such time as the mill is slowed down to a "crawl," whereupon the main brake is released and a second "Sunday" motor (with its own brake system) comes into operation to pick up and further drive the mill slowly until such time as the delivery spout 32 comes into registry with the inlet opening of the receiver bin. The brake in association with the "Sunday" motor output is then actuated to stop the power transmission system and to hold the mill precisely in proper unloading position. The cylinders 75—75 controlling the extensible spout shroud are then actuated to extend the shroud into dust-sealing relation with the receiver bin inlet port, whereupon the discharge control valve 50 is actuated to "open" and dump the mill contents into the bin 80. Upon discharge of the mill load the valve 50 may be arranged to automatically close and the cylinders 75—75 to then operate to retract the spout shroud, for return of the mill to loading position in preparation for a new blending cycle. Or, the mill may, if preferred, be loaded through one of the covers 30 when in the position shown in FIG. 1.

When the machine is arranged to be both loaded and discharged through the spout 32 the mill drive motor is controlled to stop with the spout 32 at either top or bottom "dead center" positions for alternate filling from an overhead hopper and emptying into a hopper underneath. The main drive motor shaft carries a sprag type over-running clutch 92 with a sprocket 94 on its outer race. During the "positioning" phase of operation, the clutch mounted sprocket 94 is driven (at approximately 1/10 the main motor speed) by a slow-speed positioning drive motor 95. A brake 96 on the "Sunday" drive system prevents chain rotation (such as might be caused by friction in the clutch) when the main motor is operating.

When the positioning motor takes over, the main drive motor is deenergized (but its separately connected brake is kept energized and "Off"), and the "Sunday" motor is started. The main motor now slows down but overruns the sprocket driven by the "Sunday" motor until the main motor speed is less than that of the sprocket. The reducer input shaft will then be driven slowly by the "Sunday" drive system. An adjustable time delay in the system is used to insure that control of the mill has been established by the "Sunday" drive. Then after the mill is under control of the "Sunday" drive, limit switches located at top "dead center" or bottom "dead center" positions shut off the "Sunday" drive system and set both brakes when the mill spout 32 reaches the required position.

To operate the valve and shroud actuating cylinders 60, 75—75, a compressed air supply system is employed, such as includes a pair of conduits 100–102 leading from a directional reversing four way valve 115 (FIG. 9) which in turn communicates with a compressed air supply tank and a vent to the atmosphere. Thus, upon controlled reversals of the valve 115 compressed air will be supplied alternatively to the conduits 100–102. Starting with the machine in the position shown in FIG. 4 (the valve 50 closed, and the shroud retracted) when it is desired to discharge a blended batch of material the control valve 115 will be adjusted so that the air supply will enter conduit 102 and conduit 100 will be opened to atmosphere. The air entering 102 thus has access through conduits 103–104 to the top ends of cylinders 75—75 and drives their pistons down, thereby extending the shroud 64 as to the position shown in FIG. 5. The air from the cylinders 75—75 exits through lines 112, 114 and poppet valve 105 which is in "open" position. Another poppet valve 106 (which is normally closed) withholds transmission of air to the valve control cylinder 60 until a bracket 108 which is carried by the lower end of the shroud depresses the actuator 110 of the poppet valve 106 causing it to open and permit air pressure to travel through conduit 111 to apply pressure to the piston in cylinder 60. This shifts the piston rack of the cylinder and drives through the gear to rotate the value shaft 56, to open the valve 50 for discharging

the blender contents. The residual air in cylinder **60** is exhausted to atmoisphere through conduit **116** into conduit **100**. When the shaft **56** turns it carries with it a cam **118** (FIG. 3) which previously held down the actuator **120** of poppet valve **105** to hold it in "open" condition. This motion of the cam now releases the actuator **120** thereby causing the valve **105** to close, thus preparing the system for the next valve opening cycle.

After the blender is emptied the control valve **115** is readjusted to reverse the direction of air flow so that conduit **100** is pressurized and **102** is open to atmosphere. The air now entering **100** passes through conduit **116** to the opposite end of cylinder **60**, causing it to close valve **50**, while being blocked by poppet **105** to prevent premature raising of the shroud. However, when the piston in cylinder **60** reaches the end of its travel thereby closing valve **50**, it also causes cam **118** to move to again depress actuator **120** of poppet valve **105**, thus allowing air to flow through conduits **114** and **112** into the bottom ends of cylinders **75—75**, causing them to raise the shroud as to the position shown in FIG. 4. Air exhausts from cylinder **60** through line **111** to line **102** and from cylinders **75—75** through line **104** and **103** to **102**.

Thus the main valve is closed and the shroud retracted and the mill is ready to be rotated to loading position, where the same cycle of shroud-extension and main valve opening (to receive the new load) and valve closing and shroud-retraction is repeated.

Typical sequence control operations

Assuming the blender to be filled with material, manual pressure on the "Cycle Start" control button energizes the main motor and causes its brake to be released; the "Sunday" drive motor and its brake remaining deenergized and therefore "free." After a time delay of say 10 seconds, the intensifier motor **40** starts; its cycle being controlled by a separate synchronous timer. The machine attendant can thus use the Intensifier for any desired length of time but, through the interlock system the Intensifier will not run if the blender is not operating. When the mill cycle timer times out, the main motor is deenergized but its brake remains energized and "Off," and the "Sunday" drive motor and its brake are now energized. The Intensifier motor will be deenergized when the shell cycle timer times out even if the setting of the Intensifier timer is such that it has not yet timed out. After a prescribed time delay the main motor has slowed to less than say 175 r.p.m. and the limit switches come into control of the circuit and stop the blender in its downward or discharge position as shown in FIG. 1.

The operator then causes the air-operated valve **50** to open by energizing the four-way control valve **115** through manipulation of a panel mounted selector switch (marked "Valve Open-Close"). When the blender is emptied, reverse movement of the switch causes the valve to reclose. A dual pressure switch mounted in the air lines controlling the discharge valve **50** prevents mill rotation if there is pressure in the line tending to open the discharge valve and *unless* the line closing the valve is pressurized. The valve selector switch is disconnected from the circuit when the mill is rotating. A "reset" switch is provided to release the main motor brake and start the "Sunday" drive. When the discharge spout **32** reaches top "dead center" (indicated to the panel by a limit switch), the "Sunday" drive and its brake is deenergized and the main motor brake set. Thus, the main motor is not used to position the spout **32** upward. The cycle timers are now reset, and after reloading of the mill, the operator depresses the "Cycle Start" switch button to repeat the cycle.

A "Cycle Interrupt" pushbutton is provided to suspend the cycle and position the blender in downwardly pointed position as at the end of the cycle. The cycle can be subsequently continued by again depressing the "Cycle Start" button. Similarly, a power failure will suspend the cycle following which can be resumed by depressing the "Cycle Start" control button. The Intensifier can be manually stopped during the automated cycle by depressing an "Intensifier Stop" control button. To restart the Intensifier the "Cycle Interrupt" button is depressed, and after the blender has then positioned itself with the spout **32** downward, the "Cycle Start" button is depressed.

Also, an "Auto-Manual" selector switch is provided. In the "Manual" position the blender can be started with the same "Cycle Start" pushbutton as in the automatic mode. A "Jog" pushbutton is provided to "jog" the blender through means of the "Sunday" drive. The "Jog" pushbutton has another function; that is, to stop the mill rotation when in the "Manual" mode of operation. The cycle timer is inoperative in "Manual." To stop mill rotation when in the "Manual" cycle, the "Jog" pushbutton is depressed. This starts the "Sunday" drive, and when it is released it sets the brake.

The Intensifier can be operated in the "Manual" mode without simultaneously operating the mill; and for this purpose, "Intensifier Start" and "Intensifier Stop" pushbuttons are provided. The valve **50** can be operated in any position of the mill when the selector switch is on "Manual." However, even in the "Manual" mode, the valve **50** is inoperable if the mill is rotating, and the mill will not rotate if the pressure switches indicate to the panel that the valve is open.

Whereas only one form of the invention has been illustrated and described in detail hereinabove, it will be understood that various changes may be made therein without departing from the spirit of the invention or the scope of the following claims.

We claim:

1. A batch-type materials mixing machine comprising,
a trunnion-mounted container of V-shaped form terminating at its apex end in a loading-unloading portal,
a valve for controlling flow of material through said portal,
separately operative primary and secondary drive means for causing said container to rotate at relatively high speed and at relatively low speed respectively whereby said container is rotatable to mix materials therein,
said drive means including start-stop control means therefor whereby said container may be stopped to dispose said portal alternatively in up-pointed position to receive gravity fed material from a feed spout and in down-pointed position to discharge mixed materials therefrom into a gravity receiver.

2. A batch-type materials mixing machine comprising,
a trunnion-mounted container having at a peripheral portion thereof a loading-unloading portal for receiving feed materials from a feed spout and for discharging mixed materials to a receiver,
a valve for controlling flow of material through said portal,
separately operative primary and secondary drive means for causing said container to rotate at relatively high speed and at relatively low speed whereby said container is rotatable at high speed to mix materials therein and at low speed to facilitate stopping the machine with said portal in registry with either a materials dispenser or receiver,
said drive means including start-stop control means therefor whereby said container may be stopped to dispose said portal alternatively in up-pointed position to receive gravity fed material from a feed spout and in down-pointed position to discharge mixed materials therefrom into a receiver.

3. A batch-type materials mixing machine comprising,
a trunnion-mounted container of V-shaped form terminating at its apex end in a loading-unloading portal,
a valve for controlling flow of material through said portal,

separately operative primary and secondary drive means for causing said container to rotate at relatively high speed and at relatively low speed respectively whereby said container is rotatable to mix materials therein,

said drive means including start-stop control means therefor whereby said container may be stopped to dispose said portal alternatively in up-pointed position to receive gravity fed material from a feed spout and in down-pointed position to discharge mixed materials therefrom into a gravity receiver,

and an extensible-contractible conduit in communication with said portal adapted for closed communications with a feed spout and a receiver, respectively, when the machine is stopped with said conduit in extensible alignment therewith.

4. The batch-type materials mixing machine according to claim 3 including means for automatically controlling operation of said conduit.

5. The batch-type materials mixing machine according to claim 3 including means for automatically controlling operation of both said valve and said conduit.

6. A batch-type materials mixing machine comprising,

a trunnion-mounted container having at a peripheral portion thereof a loading-unloading portal for receiving feed materials from a feed spout and for discharging mixed materials to a receiver,

a valve for controlling flow of material through said portal,

separately operative primary and secondary drive means for causing said container to rotate at relatively high speed and at relatively low speed whereby said container is rotatable at high speed to mix materials therein and at low speed to facilitate stopping the machine with said portal in registry with either a materials dispenser or receiver,

said drive means including start-stop control means therefor whereby said container may be stopped to dispose said portal alternatively in up-pointed position to receive gravity fed material from a feed spout and in down-pointed position to discharge mixed materials therefrom into a receiver,

and an extensible-contractible conduit in communication with said portal adapted for closed communications with a feed spout and a receiver, respectively, when the machine is stopped with said conduit in extensible alignment therewith.

7. A batch-type materials mixing machine comprising,

a trunnion-mounted container of V-shaped form terminating at its apex end in a loading-unloading portal,

a valve for controlling flow of material through said portal,

separately operative primary and secondary drive means for causing said container to rotate at relatively high speed and at relatively low speed respectively whereby said container is rotatable to mix materials therein,

said drive means including start-stop control means therefor whereby said container may be stopped to dispose said portal alternatively in up-pointed position to receive gravity fed material from a feed spout and in down-pointed position to discharge mixed materials therefrom into a gravity receiver,

a materials agitating device comprising a paddle shaft rotatably mounted to extend into said container,

a feed liquid inlet device comprising a conduit for delivering liquid feed material into the interior of said paddle shaft for egress through a perforated wall portion thereof,

motor means for driving said agitator device to rotate,

and valve actuation means carried by said container for alternate opening and closing of said valve.

8. A batch-type materials mixing machine comprising,

a trunnion-mounted container of V-shaped form terminating at its apex end in a loading-unloading portal,

a valve for controlling flow of material through said portal,

separately operative primary and secondary drive means for causing said container to rotate at relatively high speed and at relatively low speed respectively whereby said container is rotatable to mix materials therein,

said drive means including start-stop control means therefor whereby said container may be stopped to dispose said portal alternatively in up-pointed position to receive gravity fed material from a feed spout and in down-pointed position to discharge mixed materials therefrom into a gravity receiver,

an extensible-contractible conduit extending in connection with said portal for communication with said feed spout and said receiver spout when in alignment therewith,

a materials agitating device comprising a paddle shaft rotatably mounted to extend into said container,

a feed liquid inlet device comprising a conduit for delivering liquid feed material into the interior of said paddle shaft for egress through a perforated wall portion thereof,

motor means for driving said agitator device to rotate,

valve actuation means carried by said container for alternate opening and closing thereof,

and conduit actuation means carried by said container for causing alternate extension and contraction thereof.

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