Aug. 8, 1967 TOSHIHIKO SATAKE 3,334,675
APPARATUS OF CONTROLLING THE YIELD OF A
POLISHING MACHINE FOR GRAINS
Filed Dec. 16, 1963 6 Sheets-Sheet 1

FIG. 1

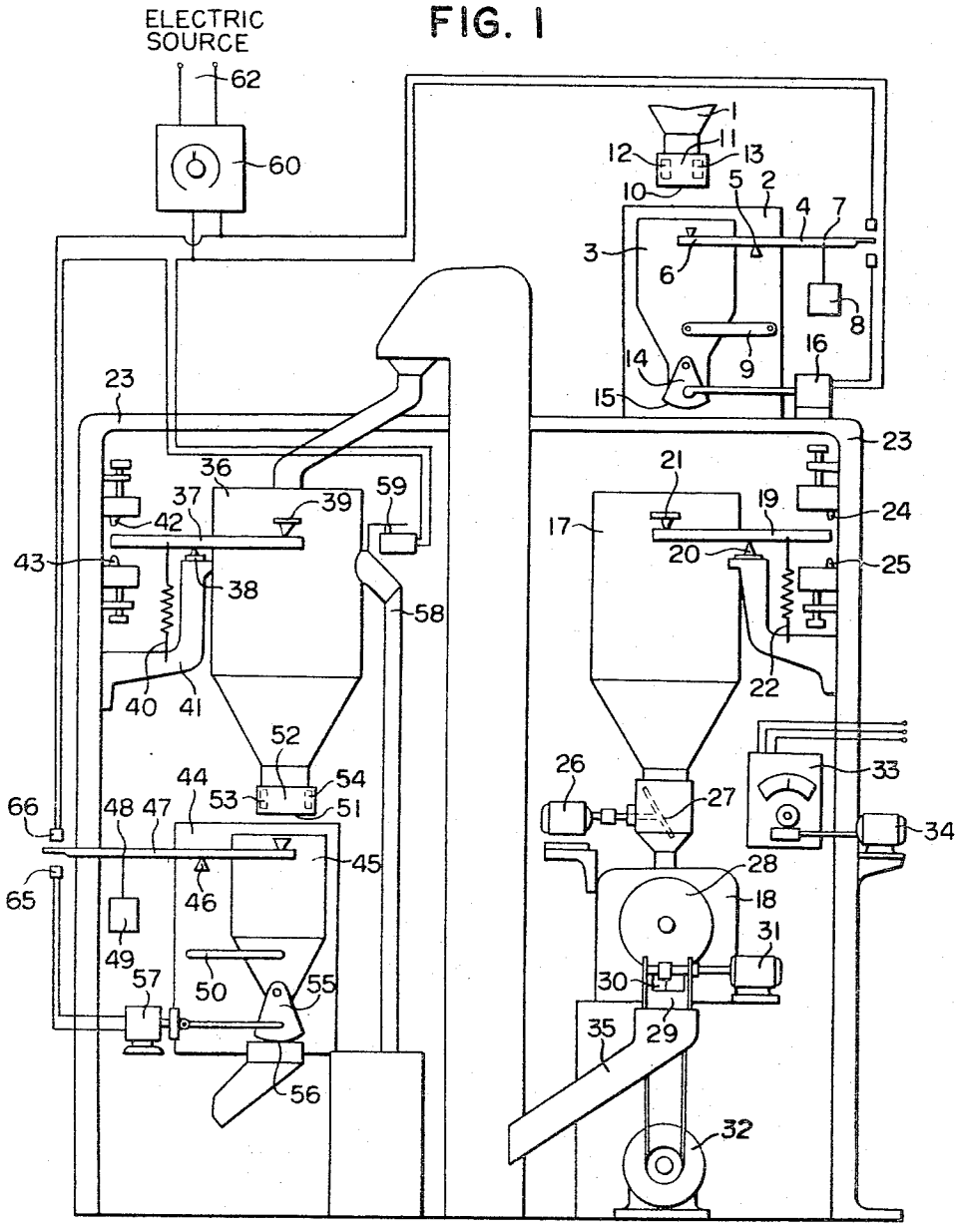


FIG. 2

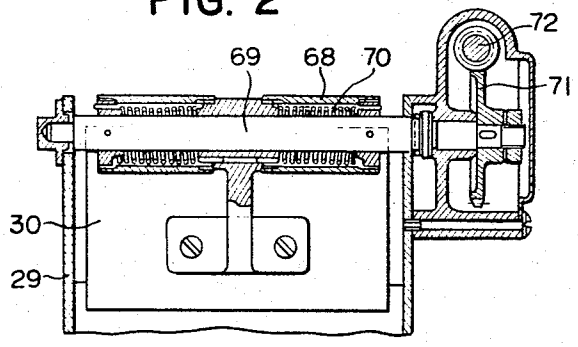


FIG. 3

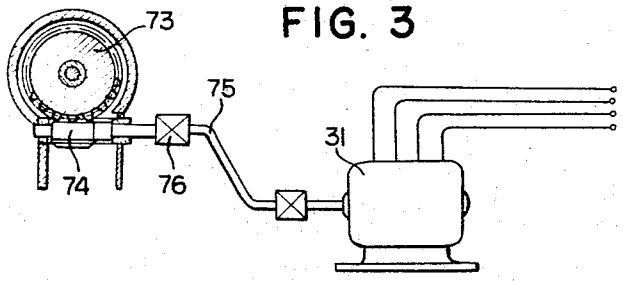


FIG. 4

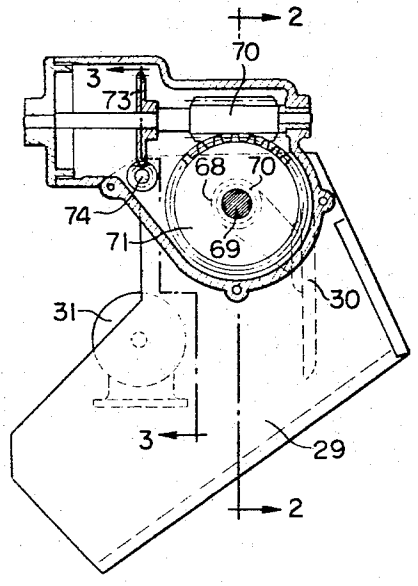


FIG. 5

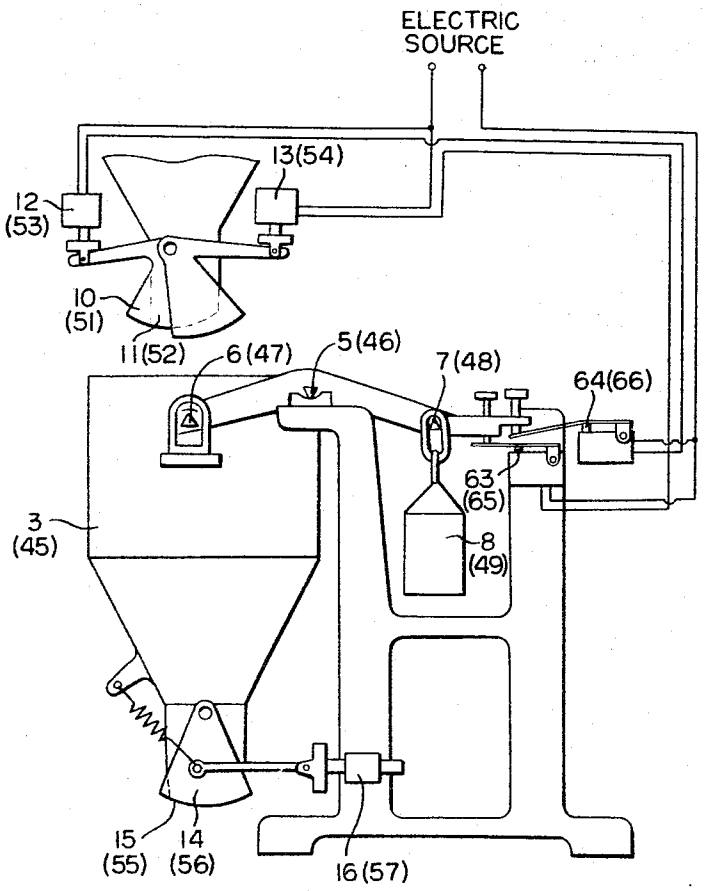

ELECTRIC SOURCE
13(54)
12 (53)
10 (51)
11(52)
6(47)
5(46)
7(48)
64(66)
63 (65)
8 (49)
3 (45)
15 (55)
14 (56)
16(57)

FIG. 6

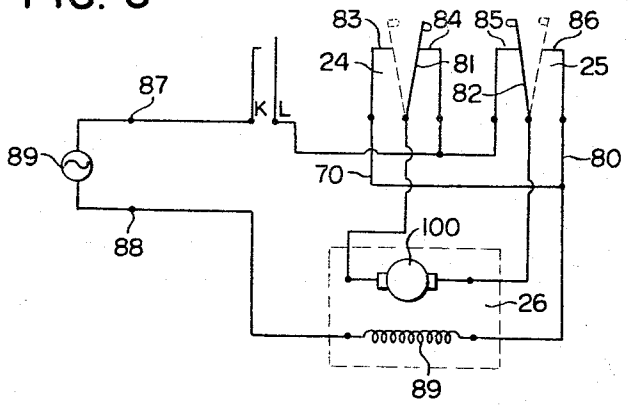


FIG. 8

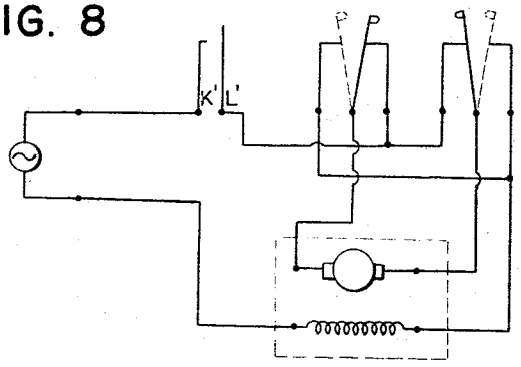


FIG. 9

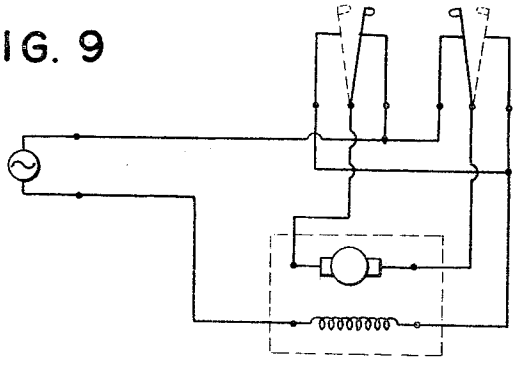


FIG. 7

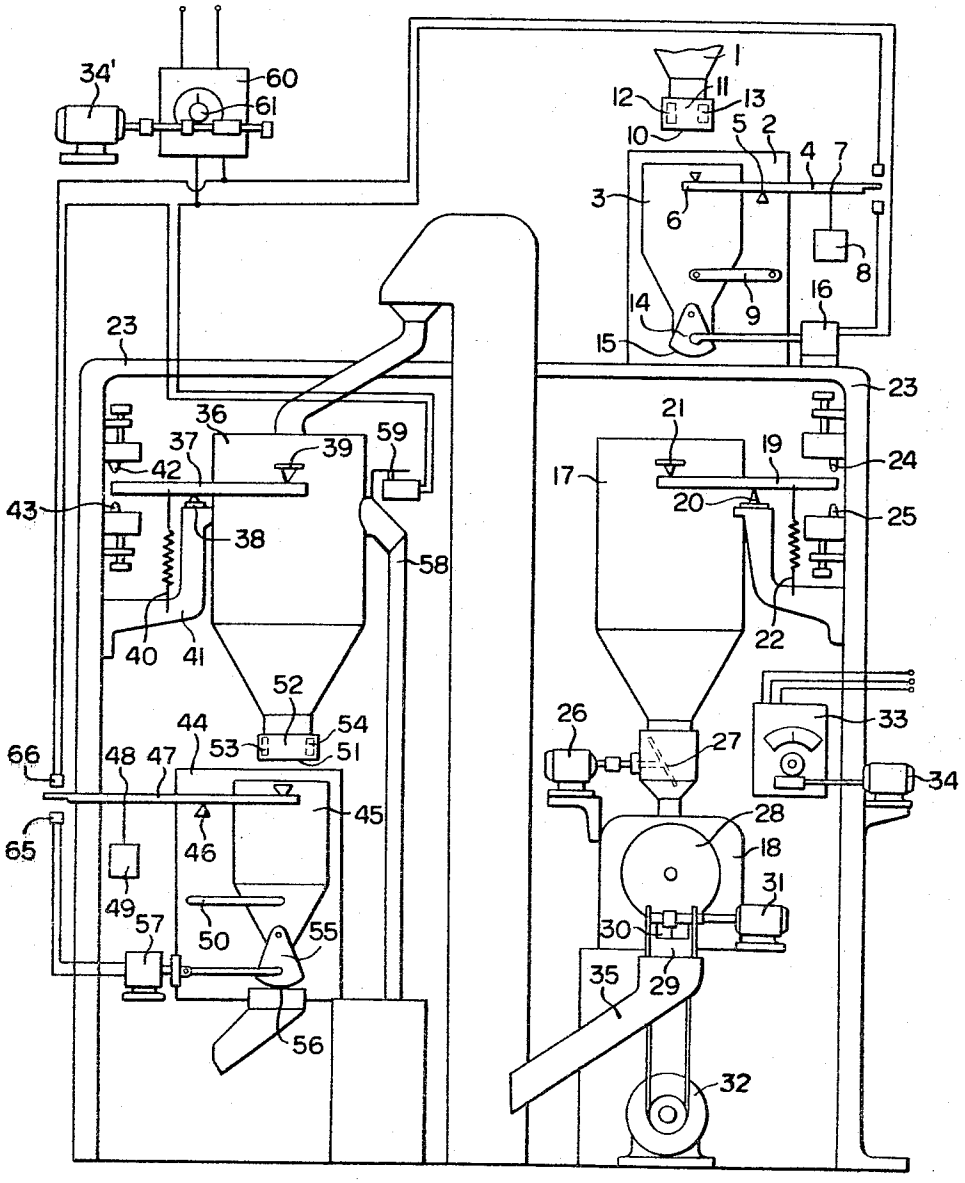
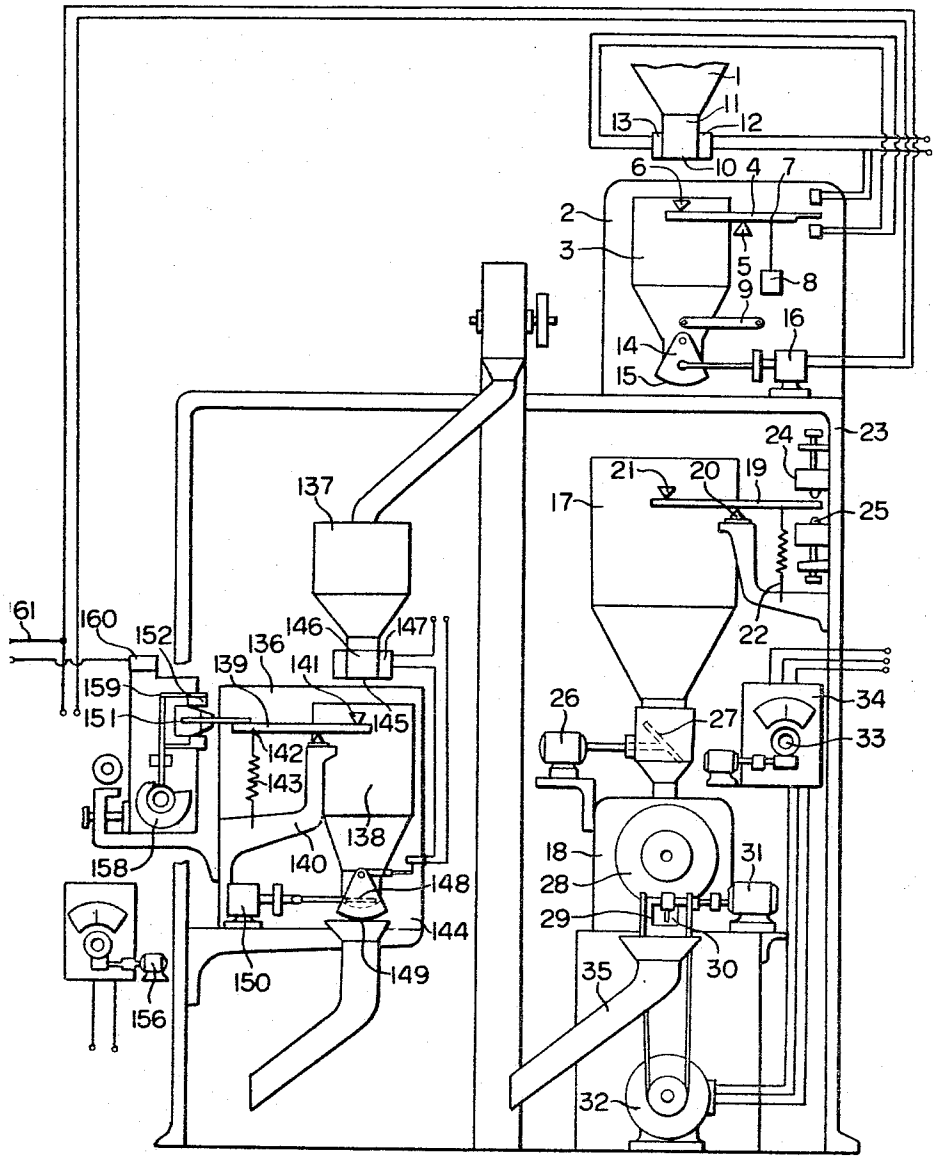

34'
60
61
1
11
12
13
10
5
2
4
7
3
6
8
14
9
16
15
23
23
36
37
39
59
42
43
38
58
40
41
52
44
54
53
51
66
48
47
45
65
46
49
57
50
55
56
21
19
24
17
20
25
22
26
27
33
34
28
18
31
30
35
29
32

FIG. 10


1
11
12
13
6
10
4
7
2
3
5
9
8
16
14
15
24
23
21
20
19
17
25
22
137
61
160
152
146
147
136
139
141
159
151
145
142
143
138
140
158
148
144
150
149
156
26
27
34
33
18
31
28
29
30
35
32

United States Patent Office 3,334,675 Patented Aug. 8, 1967

3,334,675

APPARATUS OF CONTROLLING THE YIELD OF A POLISHING MACHINE FOR GRAINS

Toshihiko Satake, 687–2 Oaza Saijo-Higashi, Saijomachi Kamo-gun, Hiroshima-ken, Japan

Filed Dec. 16, 1963, Ser. No. 331,005
Claims priority, application Japan, Dec. 15, 1962, 37/57,187; Dec. 22, 1962, 37/58,487; Dec. 24, 1962, 37/58,685; Jan. 9, 1963, 38/878; Apr. 1, 1963, 38/16,670
1 Claim. (Cl. 146—251)

The present invention relates to apparatus for automatically controlling the yield of a grain polishing machine.

In the present invention, a grain polishing machine is arranged between a measuring machine for unhulled grains to be supplied to said polishing machine and a measuring machine for polished (hulled) grains. These machines are arranged in series to form a single path for the grain flow.

In the present invention, the ratio between the unit measuring valves of both measuring machines is related with the predetermined yield. In this condition, the grain to be supplied and the polished grain are measured. The difference between the desired yield and the actual working yield is evaluated by detecting an increase or a decrease in the level of the grain-mass in a tank disposed between the polishing machine and the polished grain-volume measuring machine. In one embodiment of the present invention, the flowing volume of the grain of the load of polishing is so adjusted that an amount of the grain retained within the tank remains within predetermined upper and lower limits. In another embodiment of the present invention, the measuring machine of the unpolished grain and the measuring machine of the polished grain are operated together synchronously, so that the flowing quantity of the grain or the load of polishing may be adjusted in accordance with the ratio of the weight of the grain in the both measuring machines. Further, the flowing quantity of the grain and the load of polishing are simultaneously adjusted, so that the polishing operation is effected with the yield desired.

The synchronizing operation is obtained by connecting electrically the valve means of the both measuring machines either to each other or by using a timer. To adjust the flowing quantity of the grain or the load of polishing in accordance with the yield of the polished grain, manual means or automatic means may be employed. Further, the adjusting of the flowing quantity may be obtained by increasing or decreasing the measuring cycle or the measured volume in the measuring machine. In the case of increasing or decreasing the measuring cycle, this cycle should have a time clearance larger than the time of the measuring. In such case of adjusting the yield by the increase or the decrease of the flowing quantity of the grains, for keeping the load of the polishing machine constant, it is preferable to dispose an automatic control apparatus for the polishing load.

Further, in the case of adjusting the flowing quantity by increasing or decreasing the polishing load, the resistant means of the discharge outlet port or the resistant means of a polishing chamber may be adjusted.

To automatically adjust the yield of the polished grains, a limit switch means disposed in the retaining tank or, other limit switches disposed in an automatic indicating meter are connected to a cycle timer of the measuring machine, a measured volume adjusting means or the load adjusting means of the polishing machine.

In the present invention, the yield is adjusted by a synchronizing control of the measuring machines of the unpolished grains to be supplied and the polished grains in the polishing machine.

The present invention enables the polishing machine to polish the grains with exact yield by regulating the polished grain yield by the synchronizing control of both machines relatively.

An object of the present invention is to provide apparatus for controlling the yield of a polishing machine for grains, comprising a polishing machine disposed between a measuring machine for unpolished grains to be supplied thereto and a measuring machine for polished grains treated by said polishing machine, these machines being connected in series to form a single flow path for the grains.

Another object of the present invention is to provide an apparatus for controlling the yield of a polishing machine comprising a measuring machine for unpolished grains to be supplied thereto, a polishing machine disposed following to said measuring machine, a measuring machine for polished grains disposed after said polishing machine, said machines being connected in series, means operating synchronously valves in said both measuring machines and electric means connecting limit switches provided in said measuring machines to operating means of a load adjusting means in said polishing machine.

A further object of the present invention is to provide an apparatus for controlling the yield of a polishing machine for grains, comprising a polishing machine, an unpolished grain measuring machine, a polishd grain measuring machine, said machines being connected in series to form a single path for grain flow, indicating means provided in each said measuring machine, and limit switches defining an upper limit and a lower limit in either of said measuring machines, said limit switches being connected to circuit means in a load adjusting means of said polishing machine or an adjusting means of the grain flow.

Other objects and the advantages of this invention will be understood from the following description relating to the embodiments of this invention referring to the accompanying drawings, in which:

FIGURE 1 is a diagrammatic view showing one embodiment according to the present invention;

FIGURE 2 is an enlarged sectional view along lines 2—2 in FIG. 4 of a discharge valve;

FIGURE 3 is a view in section along lines 3—3 in FIG. 4 of gear means for said discharge;

FIGURE 4 is a view partially in section of the valve means in the polishing machine of FIG. 1;

FIGURE 5 is a circuitry diagram showing the measuring machine;

FIGURES 6, 8 and 9 are circuit diagrams of the limit switches and their driving motor used for the apparatus according to the present invention;

FIGURE 7 is a diagrammatic view showing another embodiment according to the present invention;

FIGURE 10 is a diagrammatic view showing a further embodiment according to the present invention.

In the embodiment illustrated in the FIGURES 1 to 5, the regulation of the yield is performed by the controlling of the load of the polishing machine. The apparatus of this embodiment comprises a tank **1** for unhulled grains as raw material. A grain volume measuring machine **2** is disposed below the tank **1**. The machine **2** is provided with a measuring means **3** and a balance beam **4** supported on a support **5**. One end **6** of the balance beam **4** supports the measuring means **3** and the opposite end **7** supports a dead weight **8** which is hung from said beam **4**. The measuring means **3** is supported for upward and downward movement by a supporting rod **9** carried on the body

of the measuring machine 2. A release valve 10 is disposed in a supply opening 11 of the tank 1 and is operated by solenoids 12 and 13. The solenoid 12 operates said valve 10 to open said supply opening 11 and the solenoid 13 operates said valve 10 to close said supply opening 11. A shutter valve 14 is disposed in a discharge outlet port 15 of the measuring means 3 and is operated in connection with said valve 10. The shutter valve is disposed so as to rotate about a pivot point adjacent the upper edge thereof. The pivot point is formed with a pivot pin which is secured to the measuring means 3. A solenoid 16 is mounted on a machine frame 23 and actuates the shutter valve 14 to open the same. In this embodiment there is provided means 17 for converting intermittent flow of the grain supplied from the measuring machine 2 into a steady delivery. The means 17 serves as well as a tank supplying the grain to the polishing machine 18.

The tank 17 is supported at one end 21 of a balancing lever 19, mounted on a fulcrum 20. The opposite end of the lever 9 is connected to one end of a pull spring 22 fitted to the frame 23.

An upper limit switch 24 and a lower limit switch 25 are disposed on the frame 23. The end of the balancing lever 19 is positioned between said switches 24 and 25. These switches 24 and 25 are electrically connected to an electric motor 26 and when the end of the balancing lever 19 contacts the switch 24, the motor 26 is energized through the circuit including the switch 24, when said end contacts the switch 25, the motor 26 is energized through the circuit including the switch 25. The motor 26 rotates reversely and alternatively by contacting of the lever 19 with either of said switches. The motor 26 is connected mechanically with a valve 27, so that said valve may be opened or closed. The grain supplied from the measuring machine 2 intermittently is delivered at steady flow to a polishing chamber 28, and then discharged from an outlet port 29. A shutter 30 is disposed swingably at the outlet port 29. The shutter 30 is operated by an electric motor 31 which can be energized to rotate alternatively in reverse directions. The polishing machine 18 is driven by an electric motor 32. The motor 32 is controlled by a limit switch 33 which restricts the limit of the loads of said motor 32. The limit switch 33 is operated by an adjustable speed electric motor 34 so that the reference load value of said switch may be changed.

The grain discharged from the polishing machine 18 is transferred to a tank 36 through a bran removing trough 35. The tank 36 acts as a standard retaining grain volume measuring means for regulating the yield. The tank 36 is supported by a balancing lever 37 mounted rotatably on a fulcrum 38 provided on the frame 23. The tank 36 is supported at one end of the lever 37 and the other end thereof is subjected to the action of a spring 40 secured to a supporting frame 41. A lower limit switch 42 and an upper limit switch 43 are connected to the motor 34. The end of the lever 37 is positioned between these switches 42 and 43. When said end contacts with the switch 43, the motor 34 is energized to rotate in the normal direction so that the limit switch 33 may be operated to control the standard load value. When said end of the lever 37 contacts the switch 42, the motor 34 is energized to rotate reversely. Therefore, the limit switch 33 is operated to control the standard load value in opposite directions. Accordingly, the load of the polishing machine is controlled by the increasing or the decreasing of the limitation of the grain retaining volume within the tank 36. The tank 36 is followed by a hulled grain measuring machine 44 provided with a measuring means 45. In this measuring machine, a balancing lever 47 supports the measuring means 45 at one end thereof, while the other end 48 carries a dead weight 49. This lever is supported on a fulcrum 46 disposed on the stationary part of the measuring machine 44. The measuring means 45 is carried movably supported for upward and downward movement by a supporting rod 50 mounted on the body of the measuring machine 44. A release valve 51 is disposed in a discharge opening 52 of the tank 36 and is operated by solenoids 53 and 54. The solenoid 53 operates said valve 51 to open said supply opening 52 and the solenoid 54 operates said valve 10 to close said supply opening 52. A shutter valve 55 is disposed in a discharge outlet port 56 of the measuring means 45 and is operated in connection with said valve 51. The shutter valve is disposed so as to rotate about a pivot point adjacent the upper edge thereof. The pivot point is formed with a pivot pin which is secured to the measuring means 45. A solenoid 57 is mounted on the machine frame and operates the shutter.

An overflow passage 58 is connected to the tank 36 in the side wall thereof and its lower end discharges into a container. The overflow passage 58 is provided for retaining the grains within the tank 36 in the beginning of the operation. In the inlet of the passage 58 opening on the side wall of the tank 36, a valve 59 is disposed so as to close when the grain volume in the tank reaches a predetermined level. At the same time the valve 59 is closed, a circuit K and L are closed, so that a circuit comprising the solenoid 16 and 57 and a timer 60 is closed. The timer 60 is controlled by a dial 61 in relation to the timers and the intervals of said timer. The timer is supplied with electric power from a source 62.

In FIGURE 5 rotary switches 63, 64 and 65, 66 are provided for electric magnets 12, 13 and 53, 54 of the valves in the measuring machines 2 and 44. These switches are operated by the upward and the downward movements of the measuring machines.

FIGURE 6 shows one embodiment of the operating circuit for the retaining tank 17. In FIG. 6, grain of a constant amount is fed from a hopper 1 to the retaining tank 17 intermittently. As the volume of the grains in the tank 17 increases rapidly as a result of the receiving of the grains, the grains are discharged slowly and continuously from the outlet port 15 to the polishing machine 18. When the volume of the grains in the tank 17 become lowered the grain is again fed from the measuring means 3.

In the present invention, the fluctuation of the volume of the grains in the tank 17 due to excessive differences between the upper level and the lower level of the grain-volume in the tank 3 can be decreased. In this respect relay switches 24 and 25 are disposed in the tank 17, as aforesaid, in the positions corresponding to the upper level and the lower level, respectively. These relay switches are connected to circuits 70 and 80 of a drive motor 26, as shown in FIGURE 6.

The relay switches comprise movable contacts 81 and 82 and stationary contacts 83, 84, 85 and 86. The contacts 81, 83 and 84 are disposed in the relay switch 24 and the contacts 82, 85 and 86 are disposed in the relay switch 64. The contacts 85 and 84 are connected to one supply terminal 87 in series together. The contacts 83 and 86 are connected to the other supply terminal 88 together in series through a field coil 89 of the motor 26. The supply terminals 87 and 88 are connected to an electric source 89. The movable contact 81 is connected to one terminal of an armature 100 in the motor 26 and the other movable contact 82 is connected to the other terminal of said armature 100.

When the upper level of the mass of the grain in the tank 17 reaches the movable contact 81 of the relay switch 24, the movable contact 81 contacts the contact 83 as shown by the dotted line in the FIGURE 6. Thus, the motor 26 is energized so that it thus rotates in one direction to decrease the opening degree of the valve 27. When the level of the mass of the grain in the tank 3 reaches the relay switch 25, the motor 26 is so energized as to rotate in the opposite direction to increase the opening degree of valve 27.

In the FIGURE 8, the same circuit as that illustrated in the FIGURE 6 is shown and said circuit is provided for the means **17** as illustrated in FIGURE 2. As the principal operations of this circuit also is same as the operations of the circuit illustrated in FIGURE 6, a detail explanation may be omitted.

FIGURE 5 illustrates partially the electric circuit means of the measuring means **3** or **45**.

FIGURE 7 illustrates another embodiment in which the yield of the polished grains is regulated by controlling the amount of the grain flow in the polishing process. In this embodiment, the reversible motor **34'** is used as a driving means for adjusting the time and the period of a timer **60**. In this case, when the amount of grain flow is to be changed, the resistance in the polishing machine **18** is maintained at a desired value by the limit switch **33** and the reversible motor **31**. Thus, the load of the polishing machine is stabilized, and therefore the measuring machines **2** and **44** of the unpolished grain and the polished grain are able to act synchronously. In the above regulation, the yield of the polished grains is controlled.

In the present apparatus, the electric connection can be performed by lines or by a wireless system.

In FIGURES 2, 3 and 4, the resistance shutter **30** and an operating mechanism therefor are illustrated. The shutter **30** is carried by a supporting sleeve **68** mounted on a shaft **69**. The sleeve and the shaft are mechanically connected by springs **70**. The shaft is driven by the motor **31** through a gear train comprising gears **71**, **72**, **73** and **74**. The gear **74** is connected to the motor **31** through a flexible rotary shaft **75** having joints **76**.

FIGURE 9 illustrates a circuit means for operating the valve **27** in the regulating tank **17**. The effects and the operations of this circuit is the same as those of the circuits shown in the FIGURES 6 and 8. Accordingly, detailed explanations relating to this circuit means are omitted.

In FIG. 10, a tank **1** a measuring machine **2**, a tank **7** and a polishing machine **18** are quite same as the apparatus corresponding, shown in the FIGURES 1 and 7, to these machines.

The polished grains discharged from the polishing machine are transfered to a tank **137** of a polished grain measuring machine **136** having a measuring tank **138**. The tank **138** is supported on a balancing lever **139** at end **141** of said lever. The other end of said balancing lever **139** is urged downwardly by a spring **143** at point **142**. The tank **138** is supported for movement upwardly and downwardly by supporting rods **144**. A discharge valve **145** is disposed in the outlet port **146** of the tank **137** and is operated by a solenoid **147**. A discharge valve **148** is disposed in the outlet port **149** of the measuring means **138**. The valves **145** and **148** are cooperatively operated with each other. The valve **148** is operated by a solenoid **150**. An indicator **151** is attached to the balancing lever **139**. Switches **152** and **153** are provided for the measuring means **138**, and they define an upper limit and a lower limit, respectively. These switches are connected with a reversible motor **154** adjusting the limit of limit switch **33** for an automatic controlling means or a reversible motor **156** adjusting the period of a timer **155** controlling operation of the valves **15** or **148**.

The limit switches **152** and **153** are mounted on a frame **157** movable upwardly and downwardly and adapted to act in correspondence with the indicator **151** which moves upwardly and downwardly by the supplying of the grain to the tank **138**. When the upper end **159** of the frame **157** contacts a relay means **160** a circuit **161** is closed, so that the solenoids **16** and **150** act simultaneously. At the same time the solenoid **150** operates to open the valve, a lever **162** rotates, so that the relay **160** is closed and the switch **147** is operated to open the valve **145**.

In case the circuit of the limit switches **152** or **153** is closed, the motor **154** or **156** rotates in either normal or reverse direction, so that the yield of the polished grains may be controlled automatically.

What is claimed is:

Apparatus for controlling yield in a polishing machine for grain, comprising a measuring machine for unpolished grain, a polishing machine following said measuring machine for receiving grain therefrom, a measuring machine for polished grain disposed after said polishing machine, said machines being connected in series, each of said machines including discharge valves, means synchronously operating the discharge valves of both said measuring machines, limit switch means in said measuring machines, load adjusting means in said polishing machine, and electric means connecting said limit switches in said measuring machines to said load adjusting means to control the latter to provide a determined quantity of grain, each said measuring machine comprising a tank to be supplied with grain, the limit switches being an upper limit switch and a lower limit switch mounted adjacent the tank, a balancing lever having one end positioned between said switches, said discharge valve being disposed in the outlet port of said tank, and a driving motor for said discharge valve, each said switch being provided with a movable contact operated by said lever and two stationary contacts opposite said movable contact, said movable contacts being connected in series with the rotor of said motor, one stationary contact in said upper limit switch and one stationary contact in said lower limit switch being connected to a power source through the field coil of said motor in series, said coil being placed between said source and said one stationary contact of said lower limit switch.

References Cited

UNITED STATES PATENTS

674,101	5/1901	Stone	146—251
1,157,979	10/1915	Fasting	241—34
2,408,221	9/1946	Michel	222—56
2,652,984	9/1953	Dodds	146—282 X
3,117,734	1/1964	McCarthy et al.	241—34 X

FOREIGN PATENTS

252,613	6/1926	Great Britain.

WILLIAM W. DYER, JR., *Primary Examiner.*

W. GRAYDON ABERCROMBIE, *Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,334,675 August 8, 1967

Toshihiko Satake

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the heading to the printed specification, line 8, after "37/57,187;" insert -- Dec. 20, 1962, 37/58,227; --.

Signed and sealed this 29th day of October 1968.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents