

March 29, 1938.

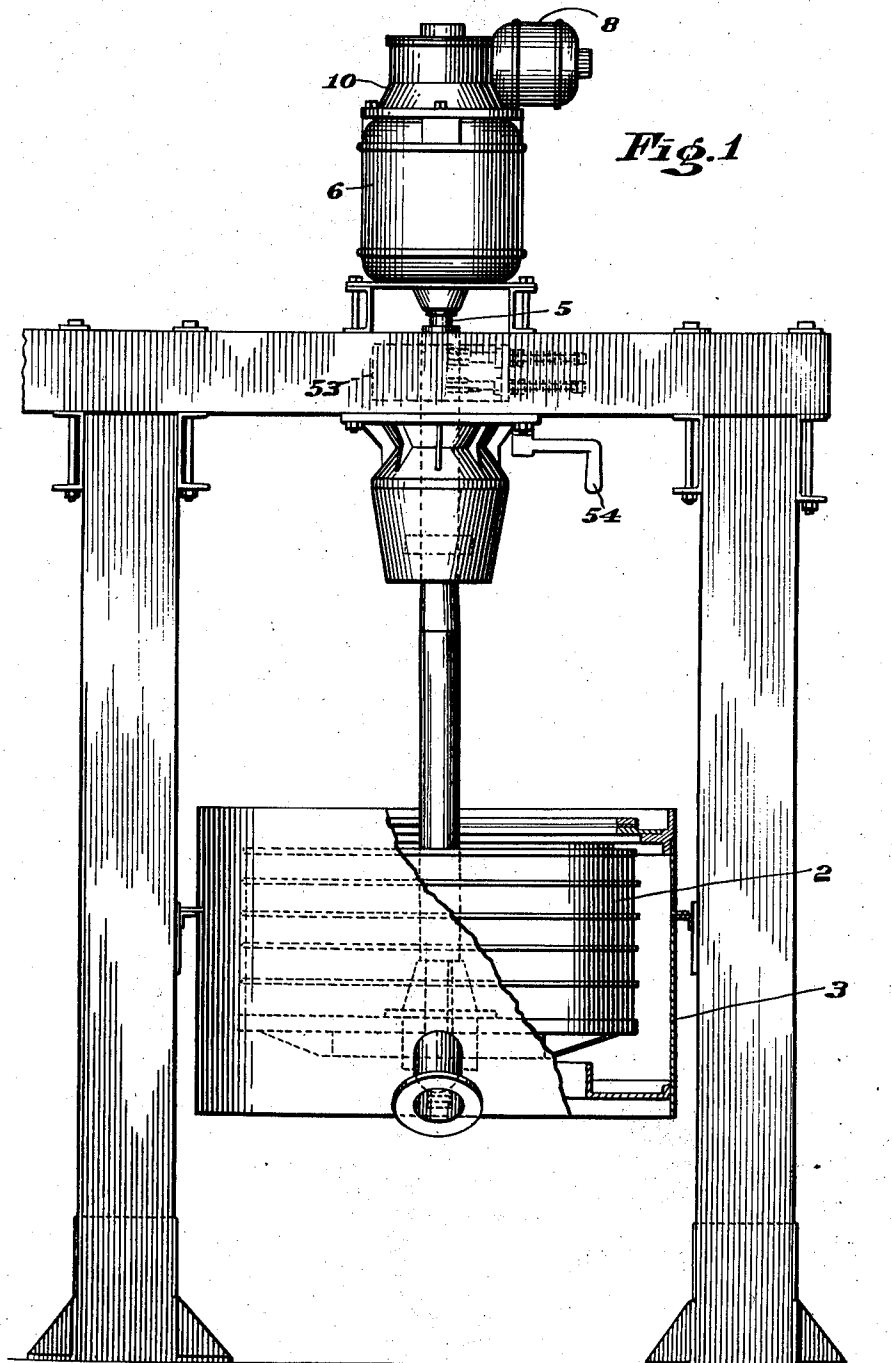
J. E. THOLL

2,112,430

DOUBLE DRIVE FOR CENTRIFUGAL SEPARATORS

Filed April 13, 1936

5 Sheets-Sheet 1



INVENTOR
John E. Tholl,
BY *J. H. McCready,*
ATTORNEY.

March 29, 1938.

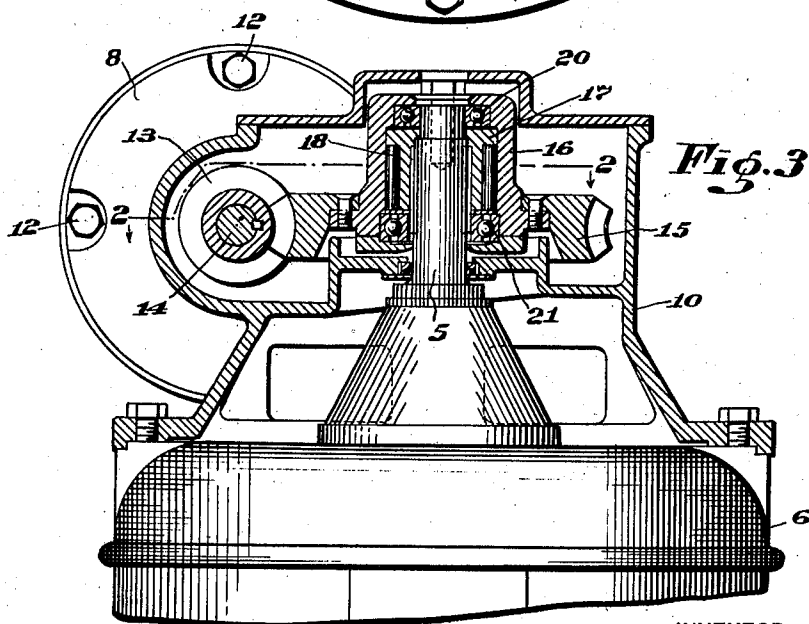
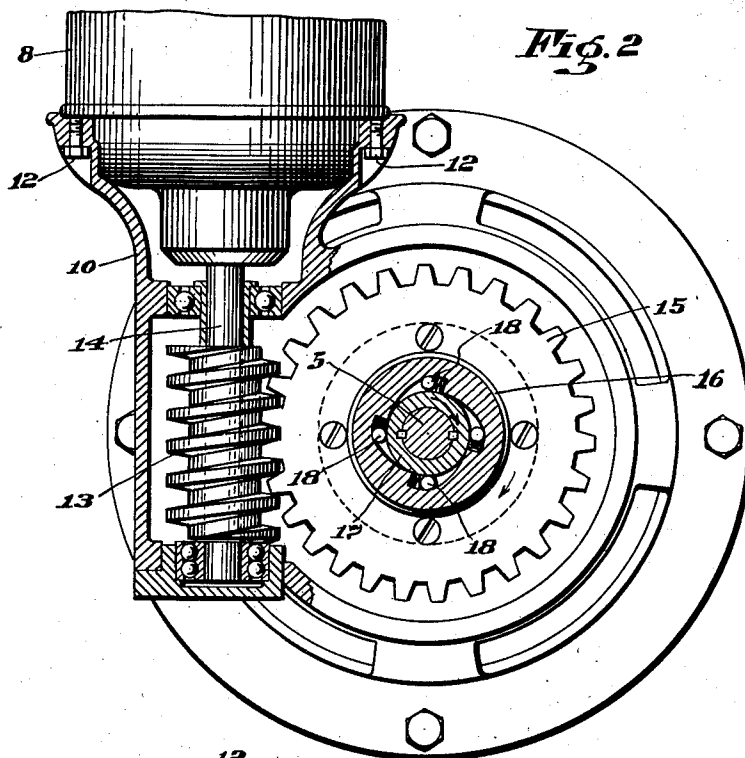
J. E. THOLL

2,112,430

DOUBLE DRIVE FOR CENTRIFUGAL SEPARATORS

Filed April 13, 1936

5 Sheets-Sheet 2



INVENTOR
John E. Tholl,
BY *John M. O'Connell,*
ATTORNEY

March 29, 1938.

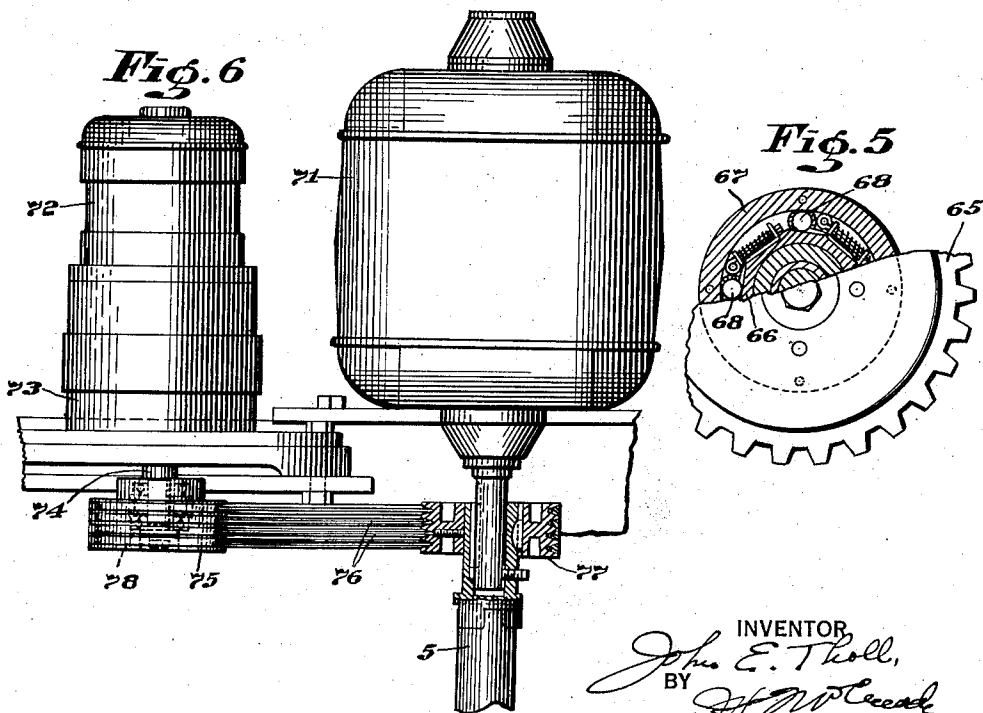
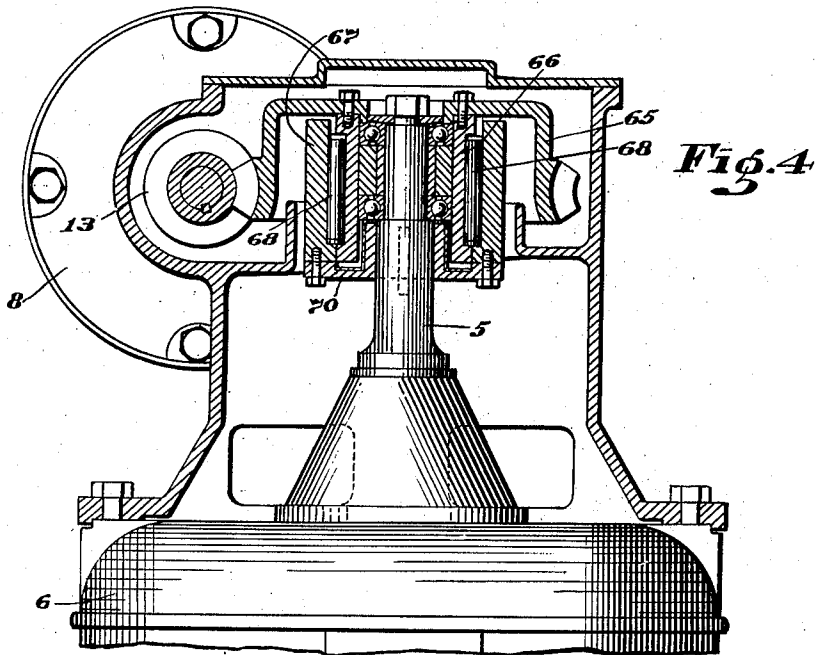
J. E. THOLL

2,112,430

DOUBLE DRIVE FOR CENTRIFUGAL SEPARATORS

Filed April 13, 1936

5 Sheets-Sheet 3



INVENTOR
John E. Tholl,
BY
H. W. McCarty,
ATTORNEY

March 29, 1938.

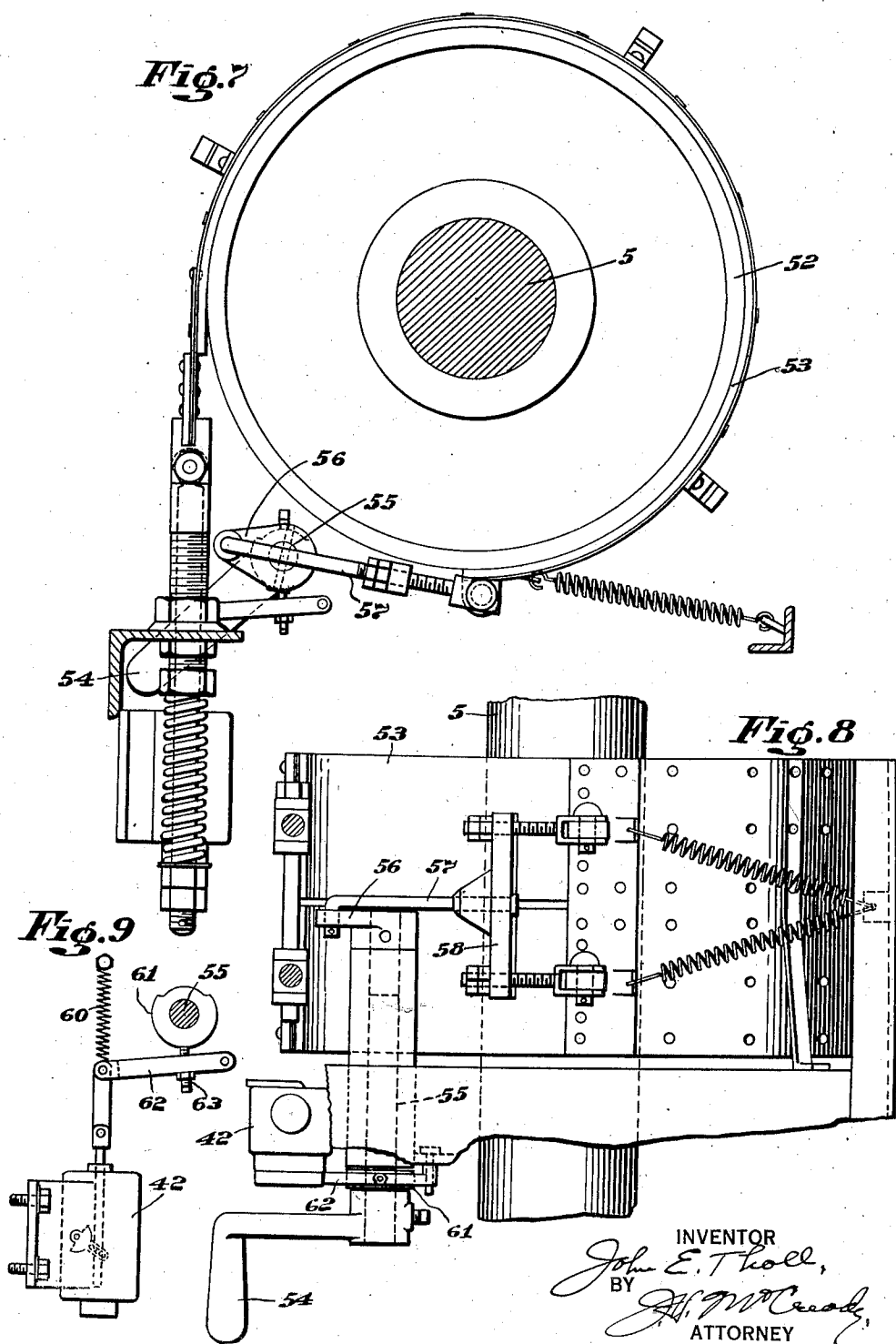
J. E. THOLL

2,112,430

DOUBLE DRIVE FOR CENTRIFUGAL SEPARATORS

Filed April 13, 1936

5 Sheets-Sheet 4



March 29, 1938.

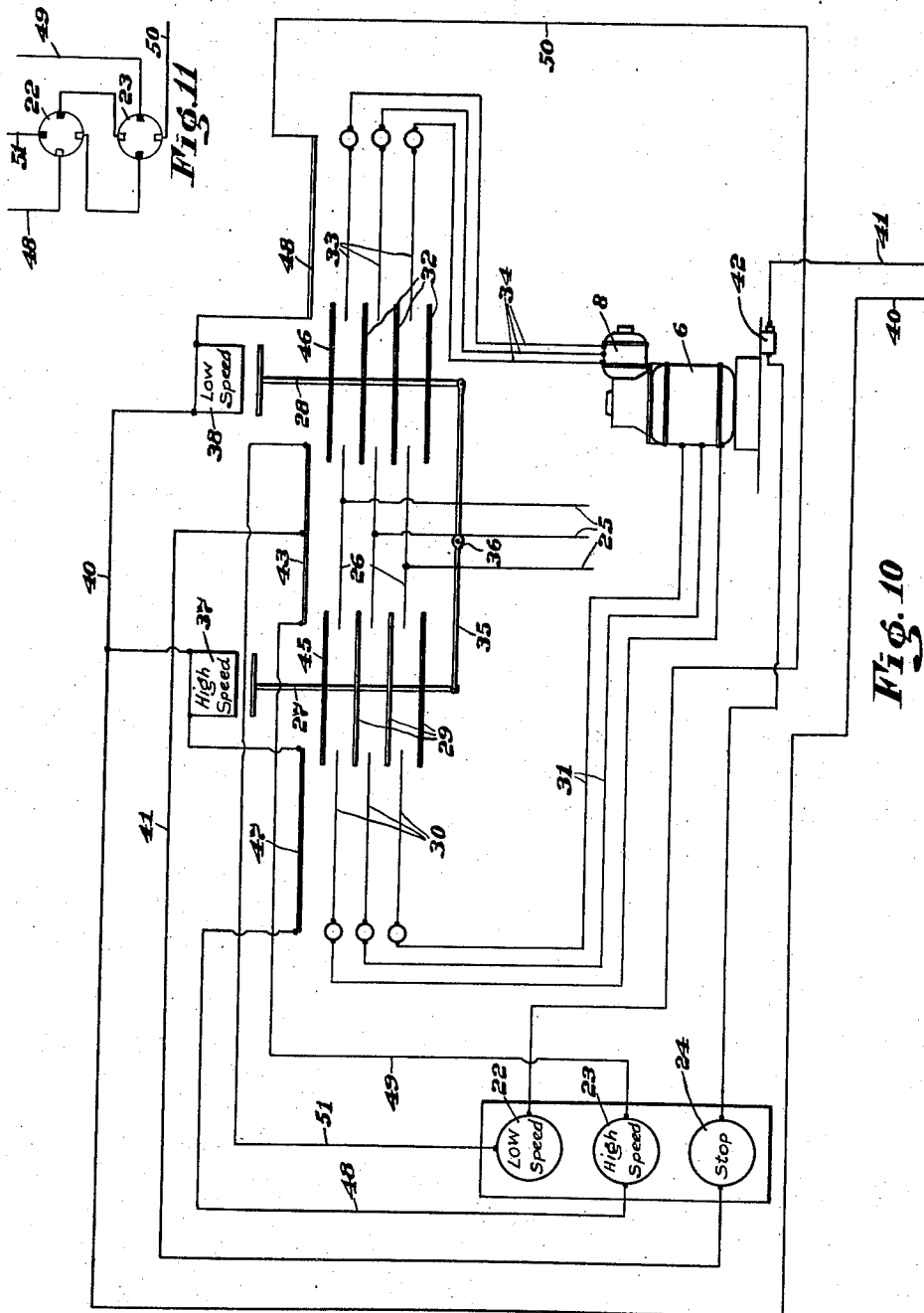
J. E. THOLL

2,112,430

DOUBLE DRIVE FOR CENTRIFUGAL SEPARATORS

Filed April 13, 1936

5 Sheets-Sheet 5



INVENTOR
John E. Tholl
BY
J. H. McCarty
ATTORNEY

UNITED STATES PATENT OFFICE

2,112,430

DOUBLE DRIVE FOR CENTRIFUGAL SEPARATORS

John Edward Tholl, Needham, Mass., assignor to American Tool & Machine Co., Hyde Park (Boston District), Mass., a corporation of Massachusetts

Application April 13, 1936, Serial No. 74,024

3 Claims. (Cl. 210—72)

This invention relates to centrifugal separators, and will be herein disclosed as embodied in a machine of the type used in sugar refineries, it being understood, however, that the invention is equally as applicable to other types of centrifugals where similar problems are involved.

A typical procedure in unloading a centrifugal used in treating sugar, chemicals, sludges, and the like, is to slow down the rotation of the basket, to force the discharger or "plow" into the accumulation of solids on the inner wall of the basket, and then, by hand control of the driving mechanism, to "nudge" or "inch" the basket along a little at a time. Assuming that the basket is driven by an electric motor individual to the machine, as is the common practice, the operator accomplishes this relatively slow movement of the basket by throwing the switch on, thus causing the motor to start up, and immediately opening it again. In some cases an automatic switch mechanism is provided to operate the motor in essentially this manner. Both of these methods produce excessive heating of the motor because of the heavy current which flows through it upon starting up and the fact that these starting operations are repeated at very frequent intervals and over a period of time lasting for, perhaps, three or four minutes during each discharge. Consequently, it is necessary to use motors that are oversize for a given operating horse power in order to stand this excessive heating.

Another variation of the method above described consists in equipping the machine with an oversized motor, and reducing the speed for unloading by introducing outside resistance into the motor circuit. A special winding usually is required in motors used for this purpose.

These, and other methods which have been employed to some extent, are all open to the objection that they require special or oversized motors, and therefore substantially increase the first cost of the entire machine unit. A further difficulty is that in none of them is a basket speed maintained which is best suited to the requirements of the unloading operation.

In any of the arrangements above described, after the plow has been forced into the sugar and the basket has made one or more revolutions, the plow will come into some space from which all of the sugar has been knocked off during a preceding revolution. When this occurs, the load on the motor is almost completely removed, the basket jumps ahead, and is then stopped suddenly again, or its speed is greatly reduced, when the plow next strikes the accumulation of sugar. These operations are repeated at frequent, but irregular, intervals as the unloading process continues. The basket begins to sway, and thereafter a large part of the operator's time and en-

ergy are consumed in "chasing" the basket with the plow.

The present invention deals with the considerations above described and the problems presented by them. It aims to improve the driving mechanism for centrifugals with a view to producing both the high operating speeds and the low discharging speeds best suited to the requirements of the material being processed while at the same time eliminating the necessity for using expensive special motors, and facilitating the unloading or discharging operation.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a side elevation illustrating a centrifugal installation embodying the present invention, certain parts being broken away in order better to illustrate the underlying construction;

Fig. 2 is a horizontal, sectional view through the upper part of the drive, the plane of section being indicated approximately by the line 2—2, Fig. 3;

Fig. 3 is a vertical, sectional view of the parts shown in Fig. 2;

Fig. 4 is a view similar to Fig. 3 illustrating a slightly different arrangement;

Fig. 5 is a plan view, partly in section, of the overrunning clutch included in the connections between the small motor and the basket spindle;

Fig. 6 is a side elevation, with parts in section, illustrating another embodiment of the invention;

Fig. 7 is a plan view, with parts in section, of a brake mechanism included in the installation;

Fig. 8 is a side elevation of the parts shown in Fig. 7;

Fig. 9 is a plan view of a switch and an operating means therefor, portions of which are shown in Fig. 8;

Fig. 10 is a wiring diagram of the control for the two motors shown in Fig. 1; and

Fig. 11 shows a modification of said wiring diagram.

Referring first to Fig. 1, the arrangement there shown comprises a centrifugal basket 2 mounted inside a casing 3. This centrifugal is of the suspended type and includes an overhead bracket 4 in which the basket spindle or shaft 5 is mounted, this spindle or a shaft section coupled to it, extending up through the mounting to a point above the supporting frame. So far as the foregoing features are concerned, the construction may be of any suitable character.

The embodiment of the invention illustrated in Figs. 1, 2 and 3 includes an electric motor 6 mounted vertically on the frame and having its

shaft coupled to the basket spindle 5 so that the two are compelled to revolve in unison. This motor may be, and preferably is, of a standard construction and of suitable horse power to drive the basket normally at its operating speed which usually, in sugar centrifugals, is between one thousand and twelve hundred R. P. M. It is controlled by suitable switching mechanism, the nature of which necessarily will depend upon the electrical characteristics of the motor, the type of current supply, and conditions peculiar to the individual installation.

A satisfactory unloading speed for a centrifugal of this type is in the neighborhood of thirty to forty R. P. M. and for the purpose of driving the basket at such speeds, a small motor 8 is provided. In a typical installation the large motor 6 may have a rating of, say, twenty-five horse power, while the small motor 8 may be of only two horse power. These two motors may conveniently be secured together by means of a casing 10 bolted to the top of the large motor 6 and having a cavity or recess in one side thereof to receive the end of the small motor, as best shown in Fig. 2, the latter being secured to the casing by several bolts, such as those shown at 12.

Housed in the casing 10 are a reduction gearing and an overrunning clutch through which the small motor drives the basket spindle 5 for the unloading operation. The reduction gearing preferably is of the worm type and includes a worm 13 fast on the shaft 14 of the small motor and a worm wheel 15 secured to the driving member 16 of the clutch. The driven member of this clutch consists of a bushing 17 keyed to the basket spindle 5 or the shaft of the large motor, this spindle and shaft forming, functionally, a single driving member. Between the clutch members 16 and 17 are several rolls 18 located in circumferentially tapering pockets formed in the inner wall of the driving member 16. Each roll is backed up by a spring tending to force it into the smaller part of the space in which it is located so that it will bind between the wall of its pocket or recess and the outer surface of the bushing 17 whenever the driving member revolves at a higher speed than the bushing. When the rolls are so pinched or bound they compel the inner clutch member 17 to revolve with the outer or driving clutch member 16. At this time the small motor 8 will drive the basket 2, due to the fact that the inner clutch member 17 is keyed to the basket spindle 5. So long as the large motor drives the basket, the speed of the spindle 5 is higher than that of the worm wheel 15 so that the clutch rolls 18 are held in their inoperative positions, and the spindle 5 revolves as freely as though the motor 8 were not connected with it. In order to provide free running conditions at this time, upper and lower ball bearings 20 and 21, respectively, are interposed between the clutch member 16 and the spindle 5.

A suitable controlling system for the two motors is illustrated diagrammatically in Fig. 10. It is of the push button type, including a high speed button 22, a low speed button 23, and a stop button 24. Power supply lines are shown at 25 leading to double contact terminals 26 designed to cooperate with other contacts carried by the plungers 27 and 28, respectively. Three of these contacts 29 for the high speed motor are arranged to engage with the terminals 30 of conductors 31 leading to the high speed motor 6, and a similar arrangement, including cooperating sets

of contacts 32 and 33 and conductors 34, control the flow of current to the small motor 8. Connecting the two plungers 27 and 28 is a lever 35 fulcrumed at 36 and pivoted to both the plungers so that both plungers cannot be up and in their circuit closing position at the same time. In other words, these two electro-magnetic switches are arranged to be operated selectively by the push buttons 22 and 23. For this purpose two solenoids 37 and 38, respectively, are mounted in cooperative relationship to the respective plungers 27 and 28, and are included in a control circuit, the supply conductors for which are shown at 40 and 41. The former is connected to one terminal of each of the solenoids 37 and 38, while the latter is connected through the normally closed brake switch 42 with the stop button 24, and runs from the latter to a stationary contact 43 designed to be engaged by either of the uppermost contacts 45 or 46 carried by the plungers 27 and 28.

The arrangement is such that when the high speed button 23 is pushed in, it will close a circuit from the conductor 40 through the solenoid 37, stationary contact 47, conductors 48 and 49, and contact 43 to the other supply conductor 41. The resultant energizing of the solenoid 37 will lift the plunger 27, thus closing the three-phase circuit leading to the high speed motor 6. Simultaneously with this operation, the upper contact 45 closes the circuit through the solenoid 37 by its engagement with the contacts 43 and 47, and thus maintains the solenoid energized even after the button 23 has been released.

Similarly, when the button 22 is depressed, it closes the circuit from the supply conductor 40 through the low speed solenoid 38, contact 48, and conductors 50 and 51 to the other supply conductor 41. This results in switching current on to the slow speed motor 8. At the same time the contact 46 engages the stationary contacts 47 and 48, thus holding current on the solenoid 38 after the low speed button 22 has been released. By pushing the stop button 24 the supply circuit 40-41 is opened, thus de-energizing either solenoid which is in operation at that moment, and causing the electro-magnetic switches to return to their neutral positions, as shown in Fig. 10.

While, due to the nature of the connections between the two motors, no damage would result if they were both brought into action at the same time, nevertheless it is uneconomical to run both motors together, and there is no reason for doing it. Accordingly, an electrical interlock preferably is provided between the low speed and high speed push buttons, as shown in Fig. 11. Here the two black contacts of each switch are open, so long as the button is up, but are closed when it is pushed down. The white contacts are closed, so long as the button is up, and are open when it is pushed down. It will be seen that the conductors 48 and 49 for the high speed solenoid are led through the normally open contacts of the high speed switch 23 and the normally closed contacts of the low speed switch 22. The same arrangement is provided for the circuit connections for the low speed solenoid through the conductors 50 and 51. In other words, with both buttons up, both solenoids are de-energized. If either solenoid is energized its control circuit will be opened by pressing the button for the other solenoid.

In order to stop the machine quickly for the discharging operation, the machine preferably is

equipped with brake mechanism comprising a brake drum 52, Fig. 7, secured fast on the basket spindle 5 and a brake band 53 encircling it. The operating means for this brake comprises a hand lever 54, Figs. 1, 7 and 8, secured on a rock shaft 55, on which an arm 56 also is secured, and is connected by a link 57 with a brake yoke 58, the general construction and arrangement of this brake being like that commonly used in brakes of this type. An interlocking connection, however, is provided between this brake mechanism and the motor control circuits to ensure the automatic release of the solenoids 37 and 38 prior to setting the brake to stop the basket. This connection comprises the normally closed switch 42, previously referred to, a spring 60, Fig. 9, for moving the switch rod in one direction, a cam 61 fast on the rock shaft 55, and a lever 62 connected with the switch rod. The cam is so designed that so long as the brake is off it will hold the switch 42 closed, but when the lever 54 is operated to apply the brake, the consequent rotation of the cam will bring a low spot opposite the screw 63 carried by the lever and engaging the cam, thus permitting the spring 60 to move the switch into its open position and hence to open the circuit through the supply conductor 41, Fig. 10.

At any time after the high speed motor 6 has been cut out and the speed of the basket has been sufficiently slowed down by the application of the brake, and the brake released, the small motor 8 may be brought into action, at which time it will revolve the basket slowly, but positively, in the same direction in which it has been rotating. The discharging operation may then be performed in the usual manner by moving the plow into engagement with the accumulation of solids on the inner wall of the basket and feeding it down slowly while the basket continues to revolve. With this arrangement the ideal speed for discharging may be produced, and that speed will be maintained evenly and positively, without jumping, even though the load on the plow may vary for the reasons above described. This result has never been obtainable heretofore, so far as I have been able to learn.

In addition to the foregoing, the invention provides a construction in which speeds perfectly suited to both the normal running and unloading conditions may be obtained with standard motors, as distinguished from special motor constructions. Thus the high cost of special motors is avoided, and any necessity for motor overloading is eliminated. While the parts are not subject to excessive wear, the nature of the design is such that any part can be quickly replaced.

In some cases it is desirable to drive the spindle 5 from the inside clutch member instead of from the outside member 16, as in the construction shown in Figs. 1 and 2. Such an arrangement is illustrated in Fig. 4 where the worm 55, driven by the small motor 8, drives a worm wheel 65 which is bolted to the inside clutch member 66. The cooperating outside clutch member 67, inside of which the clutch rolls 68 are mounted, is bolted to a collar 70 keyed to the spindle or shaft 5. These clutch parts 66, 67 and 68 may consist of a common commercial form of over-running clutch, parts of which are better shown in Fig. 5.

Another arrangement embodying the invention in a different form is shown in Fig. 6. Here the motors 71 and 72 correspond, respectively, to the motors 6 and 8 of the arrangement above

described, the former being connected directly to the basket spindle 5, or the short shaft often used in these installations immediately above said shaft, and which forms, in effect, a continuation of it. Both motors are of standard constructions, but the small motor 72 has a built-in reduction gearing enclosed in the casing 73. The slow speed shaft 74 of this motor drives a grooved pulley 75 connected by belts 76 with a similar pulley 77 on the shaft of the motor 71. This drive is effected through an overrunning clutch included in either of the pulleys 75 or 77, as may be desired. In the arrangement shown, this clutch is in the former pulley and is of the type illustrated in Fig. 5, parts of the clutch being indicated at 78.

These motors may be controlled by a switching arrangement similar to that illustrated in Figs. 10 and 11. In fact, this drive may simply replace that shown in Fig. 1, the other parts remaining as there illustrated and as above described.

While I have herein shown and described typical embodiments of my invention, it will be understood that the invention may be embodied in other forms without departing from the spirit or scope thereof. Also, while I prefer to use standard motors for the reasons above explained, it is obvious that if the circumstances make it desirable to use multi-speed motors, either for driving the basket at high speeds or at low discharging speeds, such motors can be used with any of the arrangements above described, and certain of the advantages of the invention still will be obtained.

Having thus described my invention, what I desire to claim as new is:

1. The combination with a centrifugal separator including a basket, of an electric motor directly connected with the spindle of said basket to drive the basket at normal operating speeds, a small motor mounted on the frame of said first motor, an overrunning clutch mounted on the shaft of said first motor and driven by the small motor, and a reduction gearing also mounted on said frame and through which said small motor drives said overrunning clutch.

2. The combination with a centrifugal separator including a basket, of an electric motor directly connected with the spindle of said basket to drive the basket at normal operating speeds, a casing at one end of said motor housing a portion of the motor shaft, a small motor secured to and supported by said casing, an overrunning clutch mounted on said shaft and housed in said casing, and a reduction gearing in said casing driven by said small motor and driving one member of said clutch.

3. The combination with a centrifugal separator including a basket, of an electric motor directly connected with the spindle of said basket to drive the basket at normal operating speeds, means supporting said motor in a vertical position, a casing at one end of said motor housing a portion of the motor shaft, a smaller motor mounted horizontally on said casing, a worm on the shaft of said small motor, a worm gear mounted to revolve around the axis of said first mentioned shaft and meshing with said worm, an over-running clutch through which said worm gear is operative to drive the shaft of said larger motor when the speed of said last mentioned shaft drops below that of said gear, said clutch, worm and worm gear being housed in said casing.

JOHN E. THOLL.