May 5, 1925.

C. A. OLCOTT

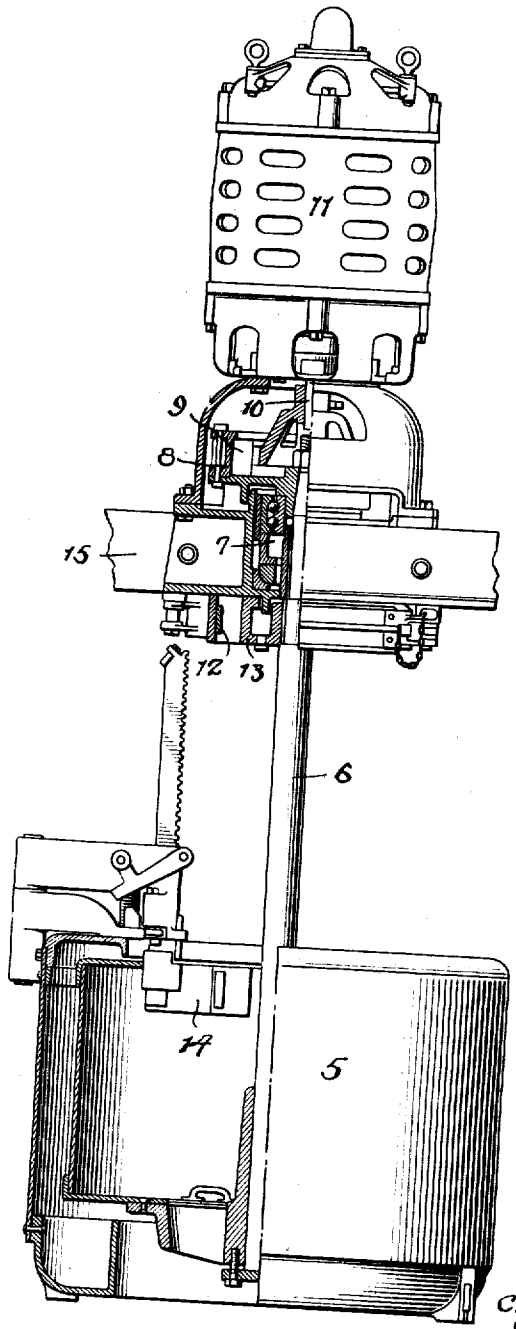
1,536,915

CENTRIFUGAL MACHINE

Filed June 3, 1921

2 Sheets-Sheet 1

Fig. 1.



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2 Sheets-Sheet 2

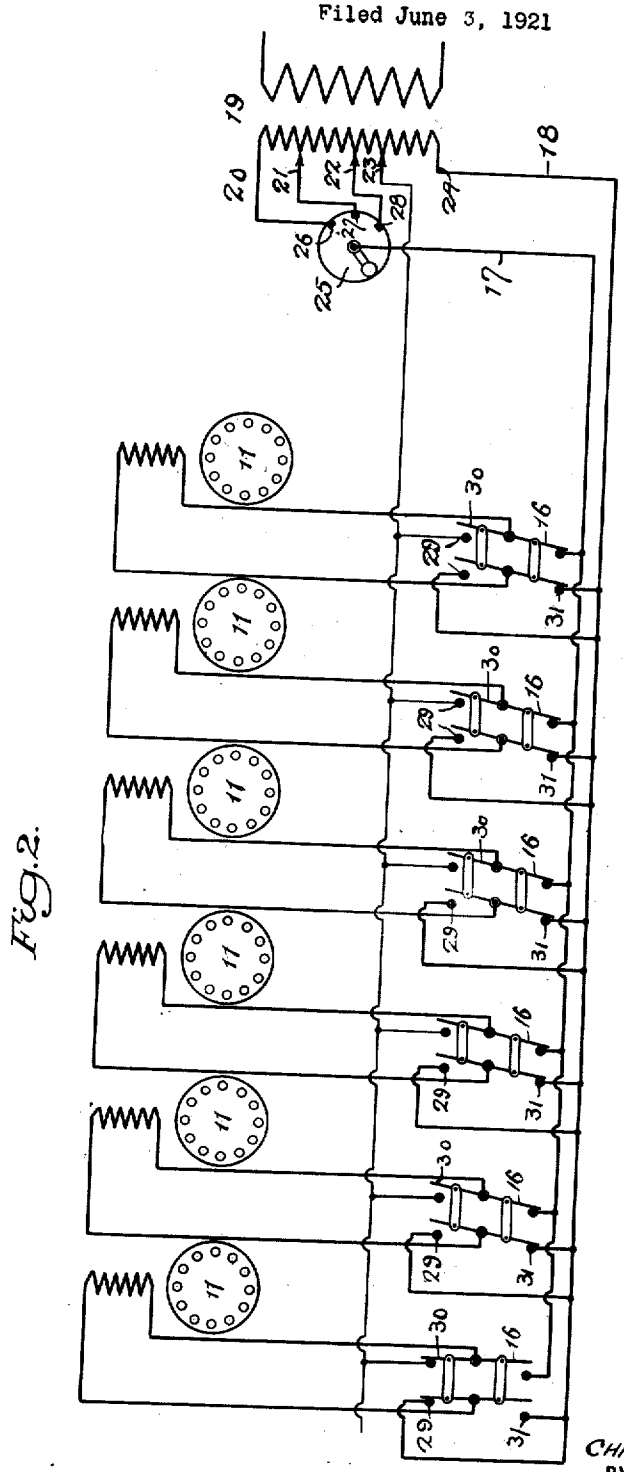


Fig. 2.

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Patented May 5, 1925. 1,536,915

UNITED STATES PATENT OFFICE.

CHARLES A. OLCOTT, OF NEW YORK, N. Y., ASSIGNOR TO S. S. HEPWORTH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

CENTRIFUGAL MACHINE.

Application filed June 3, 1921. Serial No. 474,842

To all whom it may concern:

Be it known that I, CHARLES A. OLCOTT, a citizen of the United States of America, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Centrifugal Machines, of which the following is a specification.

My invention relates to centrifugal machines, and particularly to a centrifugal driven by an associated electric motor through a slip clutch—preferably by an induction motor through a slip clutch of the centrifugal type. Among the objects of my invention are (1st) to provide a centrifugal machine layout such that while the motor employed is of the single speed type (viz., a motor which under no load has a substantially constant speed at various voltages) different rates of acceleration of the centrifugal basket are obtained by selectively predetermining the voltage impressed upon the motor, and thus changing the torque exerted by the motor through the slip clutch upon the centrifugal basket or the like; (2nd) to provide means for impressing upon the motor a voltage different from any of the selected acceleration voltages, but such as to exert upon the basket, through the centrifugal clutch, a torque sufficient to rotate the basket at a speed appropriate for the discharge of material therefrom by a mechanical unloader, the drag of which causes the clutch to slip and the basket to lag behind the motor; (3rd) to provide means by which the shop foreman, or other appropriate official, may predetermine and set the voltage to be impressed upon the motor to obtain appropriate acceleration of the basket for the particular material under treatment, while the machine attendant has no control over the voltage of the motor current, his control being limited merely to switching the foreman-regulated current on and off the motor.

In the accompanying drawings—

Fig. 1 is a side elevation partially in section of a centrifugal unit from a battery to which my invention may be advantageously applied; and

Fig. 2 is a diagram of a battery of centrifugals illustrating the motor control for the group.

The present invention is particularly applicable to centrifugals for drying sugar and the like, which are generally run at a speed of about one thousand revolutions per minute. When drying "first" sugars and other materials of similar properties, it is desirable to reach this speed as soon as possible after starting, in order that the drying operation may be completed as quickly as possible and thus to secure as great an output as possible. With some materials, such as low grade sugars and the like, a slower acceleration of the basket is preferable. While for first sugars the practice is to bring the basket to ultimate speed in about one minute, on the contrary, with low grade sugars and the like, it is desirable to have the speed of acceleration extend over a period of from three to ten minutes.

The advantages which result from different rates of acceleration upon various grades of material will be apparent from the following considerations. Take, for example, a solid material suspended in a very viscous mother liquor, such as low grade sugar suspended in molasses. When such a mixture is brought rapidly to speed in a centrifugal basket, the solid material packs against the side of the basket, forming a mass that is relatively impervious to the thick molasses. On account of the fact that the crystals are heavier than the molasses, they move toward the screen at the side of the basket very rapidly. Therefore, when the machine reaches full speed rapidly, the crystals not only form an impervious wall between the molasses and the screen, but also are still further compressed by the weight of the relatively large mass of molasses, which has not yet found its way through the screen and out of the basket. As a result of this additional pressure, the solid mass is even more impervious than it would have been had it not been subjected to the pressure resulting from the centrifugal force on the molasses. If the basket is brought to speed slowly, the crystals do not pass rapidly through the molasses vehicle and pack so rapidly against the basket wall. A larger amount of molasses therefore escapes before the crystals form a wall between the molasses and screen. Furthermore, the crystals being subjected to less centrifugal force, do not form an impervious mass. By the time the machine reaches full speed, most of the molasses has escaped through the screen. There is therefore no great

amount of molasses endeavoring to find its way through the solid material. When the material being treated is in this condition, with a relatively small amount of molasses, it can be run at the high speed in the centrifugal machine without any great degree of packing of the solid mass, and the residual molasses can therefore escape much more easily than if the acceleration had been rapid.

Let us now consider a free draining material such as a high grade sugar suspended in a molasses much less viscous than that to be separated from low grade sugar. It is desirable to accelerate the basket containing such material rapidly, for the following reasons:

1. Because the accelerating period comprises a large percentage of the total time required to dry the charge, and therefore a reduction of this period reduces the time required to dry the charge and consequently increases the output of the machine;

2. It is desirable to have the material "wall up" in the basket before all of the mother liquor is thrown off. If the basket is accelerated slowly, most of the mother liquor will leave the basket before the solid material is "walled up", with the result that the solid material being deprived of the moisture in which it has been suspended will no longer flow upward by centrifugal force, and the wall of material will be relatively thick at the bottom and thin at the top; thus causing uneven drying, and if the material is to be washed in the basket, great difficulty in washing it effectively.

It has heretofore been proposed by Mackintosh (United States Patent No. 1,342,405) to provide an alternating current induction motor having different windings to secure two motor speeds—one a working speed and the other an unloading speed. He has also suggested a centrifugal clutch connection between the motor and the basket to permit the lag of the basket, through slip at the clutch, during the unloading operation. This layout has several disadvantages, however. In the first place the double wound motor is initially expensive, and the windings are too complicated to permit rewinding or repair of the motor in the ordinary shop of a centrifugal operating plant. Secondly, the working torque of the motor is definitely fixed and inflexible, and since this fact results in a uniform rate of acceleration regardless of the character of the material treated in the basket, the utility of the Mackintosh arrangement is practically restricted to the treatment of that material for which the one rate of acceleration provided is appropriate.

It has also been proposed by Mackintosh to substitute a D. C. motor for the A. C. motor mentioned, and to employ resistance in the motor circuit to obtain the two speeds. This type of motor is unsatisfactory for many reasons, and the resistance adds to the expense and difficulties of maintenance.

My invention is based primarily upon two considerations. 1st, that the torque of a single speed motor of the alternating current induction type may be controlled by varying the voltage impressed on the motor, and 2nd, that a motor-load connection of the centrifugal clutch type, permits the motor to come rapidly to speed which applies the clutch to the load but thereafter accelerates both motor and the load only in proportion to the torque exerted by the motor, the latter being itself braked by the load imposed through the centrifugal clutch. Therefore, if the voltage impressed on the motor be lower, the torque of the motor at the clutch is reduced and both motor and basket come more slowly to full speed than when the motor torque is high, incident to a higher voltage impressed on the motor.

It should be borne in mind that during the first portion of the accelerating period, the rotor of the motor revolves at a substantially constant speed while the basket is revolving at a lower, but increasing speed, the clutch slipping meanwhile. The speed of the rotor is that at which the torque of the motor equals the torque of the slip clutch. This torque is the torque which is effective in accelerating the basket. The torque transmitted by a centrifugal slip clutch increases when the speed of the driving member of the clutch is increased and likewise decreases when the speed of the driving member is decreased. The torque of the alternating current induction motor, at any given speed, increases when the voltage impressed upon the motor is increased, and decreases when the voltage is decreased. Therefore the speed at which the rotor of the motor revolves while the clutch is slipping, is relatively high, and the torque transmitted by the clutch is relatively great when higher voltage is impressed on the motor. Likewise the rate of rotation of the rotor is relatively low, and the torque transmitted by the clutch is relatively less when lower voltage is impressed on the motor. Since the acceleration of the basket is rapid when the torque of the clutch is great, and the acceleration is slower when the torque of the clutch is less, the basket accelerates rapidly or slowly according to whether high or low voltage is impressed upon the motor.

The torque required for discharging, that is, the torque necessary to drive the basket against the drag of a mechanical unloader is usually different from the torque required for accelerating the basket to a drying speed, and is always less than that required for the rapid acceleration of the basket desired for free draining materials such as high

grade sugar. Impressing on the motor a voltage lower than that used for rapidly accelerating the basket causes a reduced torque of the clutch, and a proper lower voltage will therefore cause the clutch to transmit the proper torque to drive the basket against the drag of the unloader.

It is thus possible by the use of a single speed motor and a motor-load connection of the centrifugal clutch type, to obtain an installation having many advantages. A single speed motor of this type is not initially expensive. Its winding is so simple that it may be readily repaired or rewound in the ordinary shop of the centrifugal plant. The appliances for varying the voltage to be impressed upon the motor are of simple and durable character. A flexibility of rate of acceleration of the basket is obtained which makes it possible to handle in the basket materials having markedly different characteristics, and requiring markedly different rates of acceleration. It prevents the relatively unskilled machine attendant from exercising any discretionary control over the rate of acceleration of the basket, and leaves this to the judgment of the foreman or other official of experience. It simplifies the work of the attendant at the basket, who has merely to close the motor switch to impress upon the motor the voltage predetermined by the foreman. The invention also makes it possible for the foreman to regulate the acceleration voltage of the centrifugal independent of the unloading voltage; while for a battery of centrifugals the connections are so arranged that the motor of each machine may be independently accelerated and discharged by the manipulation of switches under the control of the machine attendant.

A centrifugal machine of the present type is indicated in Fig. 1. The centrifugal basket 5 is suspended by shaft 6 from bearing 7, and has a clutch cup 8 with which cooperates the centrifugal clutch blocks 9 at the lower end of the shaft 10 of the single speed induction motor 11. The usual band brake 12 and drum 13 on the shaft 6, and the mechanical unloader 14 for the basket are employed. Preferably a battery of centrifugals is mounted on the frame 15 and is controlled as indicated in Fig. 2. Each motor 11 is connected by means of a switch 16 to the line wires 17 and 18 leading to the source of power. Suitable means is provided for selecting the voltage to be impressed on the motor circuit. As indicated, this means consists of a transformer 19 having various taps 20, 21, 22, 23 and 24. A selector switch 25 serves to connect the motor circuit to the transformer through one or other of the several contacts 26, 27 and 28 which lead respectively to the several taps 20, 21 and 22 of the transformer 19. Obviously, if the switch contact be made with the tap 20, a high voltage will be impressed upon the motor and the latter will bring the centrifugal to speed very rapidly. Whereas, if the switch be connected to the tap 22 for a lower voltage, the basket will be brought to speed much slower.

If the units of the battery be connected in multiple as indicated, each basket 5 is accelerated at the same rate upon the closing of its switch 16, since the same voltage is impressed upon each motor from the motor circuit controlled by the selector switch 25. It is thus possible for the foreman, or other official in authority, to set the selector switch 25 in such position that it will connect to the current source at that voltage which, when impressed upon the several motors of the battery, by the manipulation of the several independent motor switches 16, will cause the baskets to accelerate similarly at that predetermined rate which is chosen by the foreman as suitable for the treatment of the particular material in hand. The operators at the centrifugals thus have no control over the rate of acceleration of the baskets, and this set rate will be maintained until the foreman shifts the selector switch 25 to another voltage connection to obtain a different rate of acceleration appropriate for a new batch of material of different character.

When the material in a basket is sufficiently dried, the motor switch 16 is opened at the contacts 31, thus deenergizing the motor and permitting the operator through the brake 12—13 to bring the basket to a halt, or to such speed as will enable him to remove the cover from the discharge port at the bottom of the basket. In order to drive the basket for unloading by means of the mechanical unloader 14, the motor circuit is then closed at the contacts 29 and 30, thus impressing upon the motor a voltage derived from the transformer at tap 23. The blades 30 which cooperate with the contacts 29 may be those of an independent motor switch, or the switch 16 may be a two-position switch, swinging to the line terminals 31 during the acceleration and drying operation, and to the terminals 29 for unloading. As will be noted, the tap 23 is connected to the transformer at a point which impresses upon the motor circuit a lower voltage than that afforded by any of the acceleration taps 20, 21 and 22. The torque exerted by the motor is less therefore during unloading than even at the lowest speed of acceleration during the working period. The motor switch controls the unloading connection independently for each unit of the battery, so that any basket of the group may be unloaded while the others are completing the drying operation. This is indicated in Fig. 2, where the five right-hand units are con-

nected by switch 16 to the "drying" line 17 leading to the selector switch 25, whereas the unit at the left hand of the group is connected to the "discharging" line which leads to the tap 23. It will of course be understood that when a very slow acceleration of the basket is desired there may be selector switch taps which afford a voltage lower even than that used for unloading.

Various other ways of accomplishing the same result will occur to those dealing with the problem, without departing from the underlying thoughts which I claim as my invention.

I claim—

1. A centrifugal machine installation, comprising a centrifugal basket or the like for the reception of material to be treated, an electric motor which under no load has a substantially constant speed at various voltages, a slip clutch connection between the motor and the basket, and master controlled means for selecting and impressing different desired voltages upon the motor to cause it to exert a predetermined torque upon the basket through the slip clutch, depending upon the character of the material fed to the basket and the desired rate of acceleration of the basket for the treatment of said material.

2. A centrifugal machine installation, comprising a centrifugal basket or the like for the reception of material to be treated, an electric motor which under no load has a substantially constant speed at various voltages, a centrifugal slip clutch connection between the motor and the basket, and master controlled means for impressing different selected voltages upon the motor to cause it to exert a predetermined torque upon the basket through the slip clutch, depending upon the character of the material fed to the basket and the desired rate of acceleration of the basket for the treatment of said material.

3. A centrifugal machine installation, comprising a centrifugal basket or the like for the reception of material to be treated, an electric motor which under load has a substantially constant speed at various voltages, a slip clutch connection between the motor and the basket, selector means for connecting the motor circuit at different voltages to a source of power, and independent means for making and breaking connection between the motor and the motor circuit at the selected voltage to cause the motor to exert a predetermined torque upon the basket through the slip clutch, depending upon the character of the material fed to the basket and the desired rate of acceleration of the basket for the treatment of said material.

4. A centrifugal machine installation, comprising a centrifugal basket or the like for the reception of material to be treated, an electric motor which under no load has a substantially constant speed at various voltages, a slip clutch connection between the motor and the basket, said clutch affording a variable grip which increases with the speed of the motor, and master controlled means for impressing different selected voltages upon the motor to cause it to exert a predetermined torque upon the basket through the slip clutch, depending upon the character of the material fed to the basket and the desired rate of acceleration of the basket for the treatment of said material.

5. A centrifugal machine installation, comprising a centrifugal basket or the like for the reception of material to be treated, an electric motor which under no load has a substantially constant speed at various voltages, a slip clutch connection between the motor and the basket, and master controlled means for impressing different selected voltages upon the motor to cause it to exert a predetermined torque upon the basket through the slip clutch, depending upon the character of the material fed to the basket and the desired rate of acceleration of the basket for the treatment of said material, in combination with independent means for impressing a different selected voltage upon the motor to cause it to exert such torque upon the centrifugal basket through the slip clutch that the braking action of a mechanical unloading may be utilized to cause the basket to lag behind the motor, through the slip clutch connection to the motor.

6. A centrifugal machine installation, comprising a centrifugal basket or the like for the reception of material to be treated, an electric motor which under no load has a substantially constant speed at various voltages, a slip clutch, the grip of which increases as the speed of the motor increases, selector means for connecting a motor lead at different voltages to a source of power, a fixed connection to the source of power at a different voltage suitable for unloading, and means for energizing the motor at the selected voltage during the working period of the centrifugal and at the fixed voltage for unloading.

7. A battery of centrifugal machines comprising a group of motors which under no load have a substantially constant speed at various voltages, a centrifugal basket or the like for each motor, a slip clutch connection between each motor and its corresponding basket, means common to the motor group for supplying the same with current at selected voltage, and means associated with each motor for impressing a different voltage thereon.

8. A battery of centrifugal machines comprising a group of electric motors which under no load have a substantially constant speed at various voltages, a centrifugal

basket or the like for each motor, a slip clutch connection between each motor and its corresponding basket, and means common to the motor group for varying in unison the voltage of the current supplied thereto, together with independent means associated with each motor for connecting the same to the source of power at a lowered voltage appropriate for driving the motor at a torque suitably reduced for an unloading operation, substantially as described.

9. A centrifugal machine comprising an electric motor, which at no load has a substantially constant speed at various voltages, a centrifugal basket or the like, a friction clutch drive connection between the motor and the basket, means for selecting the voltage impressed upon the motor during the working period of the centrifugal, and independent means for connecting the motor to a source of current at a voltage so reduced as to materially reduce its torque, together with a mechanical unloader serving by its drag to cause the friction clutch to slip at the thus materially reduced torque of the motor, and thus to reduce the speed of the basket to a speed less than that of the motor and to one suitable for unloading.

10. A battery of centrifugal machines, comprising a group of electric motors which under no load have a substantially constant speed at various voltages, a centrifugal basket or the like for each motor, a slip clutch connection between each motor and its corresponding basket, a transformer having a plurality of tap connections, a selector switch associated with the transformer for energizing the motor circuits in unison at different voltages, in combination with an independent switch in each motor circuit for changing the voltage impressed upon its associated motor.

11. The method of operating a centrifugal driven by a motor which at no load has a substantially constant speed at various voltages, and having a slip clutch connection between the motor and the centrifugal, which comprises predetermining the character of the charge to be placed in the centrifugal basket, selecting the voltage to be impressed upon the motor with reference to the predetermined character of the charge in order to obtain a rate of acceleration of the basket appropriate to efficient operation upon the charge, impressing the thus predetermined voltage upon the motor during the acceleration period of the centrifugal, decreasing the voltage after the charge has been sufficiently subjected to centrifugal action and discharging the centrifugal during the period of reduced torque incident to the decreased voltage.

12. The method of operating a centrifugal driven by a motor which at no load has a substantially constant speed at various voltages, and having a slip clutch connection between the motor and the centrifugal element, which comprises predetermining the character of the charge to be placed in the centrifugal basket, selecting the voltage to be impressed upon the motor with reference to the predetermined character of the charge in order to obtain a rate of acceleration of the basket appropriate to efficient operation upon the charge, impressing the thus predetermined voltage upon the motor during the acceleration period of the centrifugal, decreasing the voltage after the charge has been sufficiently subjected to centrifugal action and causing the clutch to slip to reduce the speed of the centrifugal below that incident to the reduced torque exerted thereon by the motor at the lower voltage, for the discharge of the centrifugal.

13. The method of operating a centrifugal driven by a motor which at no load has a substantially constant speed at various voltages, and having a slip clutch connection between the motor and the centrifugal, which comprises predetermining the character of the charge to be placed in the centrifugal basket, selecting the voltage to be impressed upon the motor with reference to the predetermined character of the charge in order to obtain a rate of acceleration of the basket appropriate to efficient operation upon the charge, and impressing the thus predetermined voltage upon the motor to bring the basket to speed at the predetermined desired rate of acceleration.

In testimony whereof I have signed my name to this specification.

CHARLES A. OLCOTT.

basket or the like for each motor, a slip clutch connection between each motor and its corresponding basket, and means common to the motor group for varying in unison the voltage of the current supplied thereto, together with independent means associated with each motor for connecting the same to the source of power at a lowered voltage appropriate for driving the motor at a torque suitably reduced for an unloading operation, substantially as described.

9. A centrifugal machine comprising an electric motor, which at no load has a substantially constant speed at various voltages, a centrifugal basket or the like, a friction clutch drive connection between the motor and the basket, means for selecting the voltage impressed upon the motor during the working period of the centrifugal, and independent means for connecting the motor to a source of current at a voltage so reduced as to materially reduce its torque, together with a mechanical unloader serving by its drag to cause the friction clutch to slip at the thus materially reduced torque of the motor, and thus to reduce the speed of the basket to a speed less than that of the motor and to one suitable for unloading.

10. A battery of centrifugal machines, comprising a group of electric motors which under no load have a substantially constant speed at various voltages, a centrifugal basket or the like for each motor, a slip clutch connection between each motor and its corresponding basket, a transformer having a plurality of tap connections, a selector switch associated with the transformer for energizing the motor circuits in unison at different voltages, in combination with an independent switch in each motor circuit for changing the voltage impressed upon its associated motor.

11. The method of operating a centrifugal driven by a motor which at no load has a substantially constant speed at various voltages, and having a slip clutch connection between the motor and the centrifugal, which comprises predetermining the character of the charge to be placed in the centrifugal basket, selecting the voltage to be impressed upon the motor with reference to the predetermined character of the charge in order to obtain a rate of acceleration of the basket appropriate to efficient operation upon the charge, impressing the thus predetermined voltage upon the motor during the acceleration period of the centrifugal, decreasing the voltage after the charge has been sufficiently subjected to centrifugal action and discharging the centrifugal during the period of reduced torque incident to the decreased voltage.

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13. The method of operating a centrifugal driven by a motor which at no load has a substantially constant speed at various voltages, and having a slip clutch connection between the motor and the centrifugal, which comprises predetermining the character of the charge to be placed in the centrifugal basket, selecting the voltage to be impressed upon the motor with reference to the predetermined character of the charge in order to obtain a rate of acceleration of the basket appropriate to efficient operation upon the charge, and impressing the thus predetermined voltage upon the motor to bring the basket to speed at the predetermined desired rate of acceleration.

In testimony whereof I have signed my name to this specification.

CHARLES A. OLCOTT.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,536,915, granted May 5, 1925, upon the application of Charles A. Olcott, of New York, N. Y., for an improvement in "Centrifugal Machines," an error appears in the printed specification requiring correction as follows: Page 4, line 49, claim 3, after the word "under" insert the word *no;* 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 2d day of June, A. D. 1925.

[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.

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[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.