No. 861,561. PATENTED JULY 30, 1907.

D. E. VIRTUE.

COMBINED CHURN AND BUTTER WORKER.

APPLICATION FILED MAY 27, 1907.

3 SHEETS—SHEET 1.

Fig. 1.

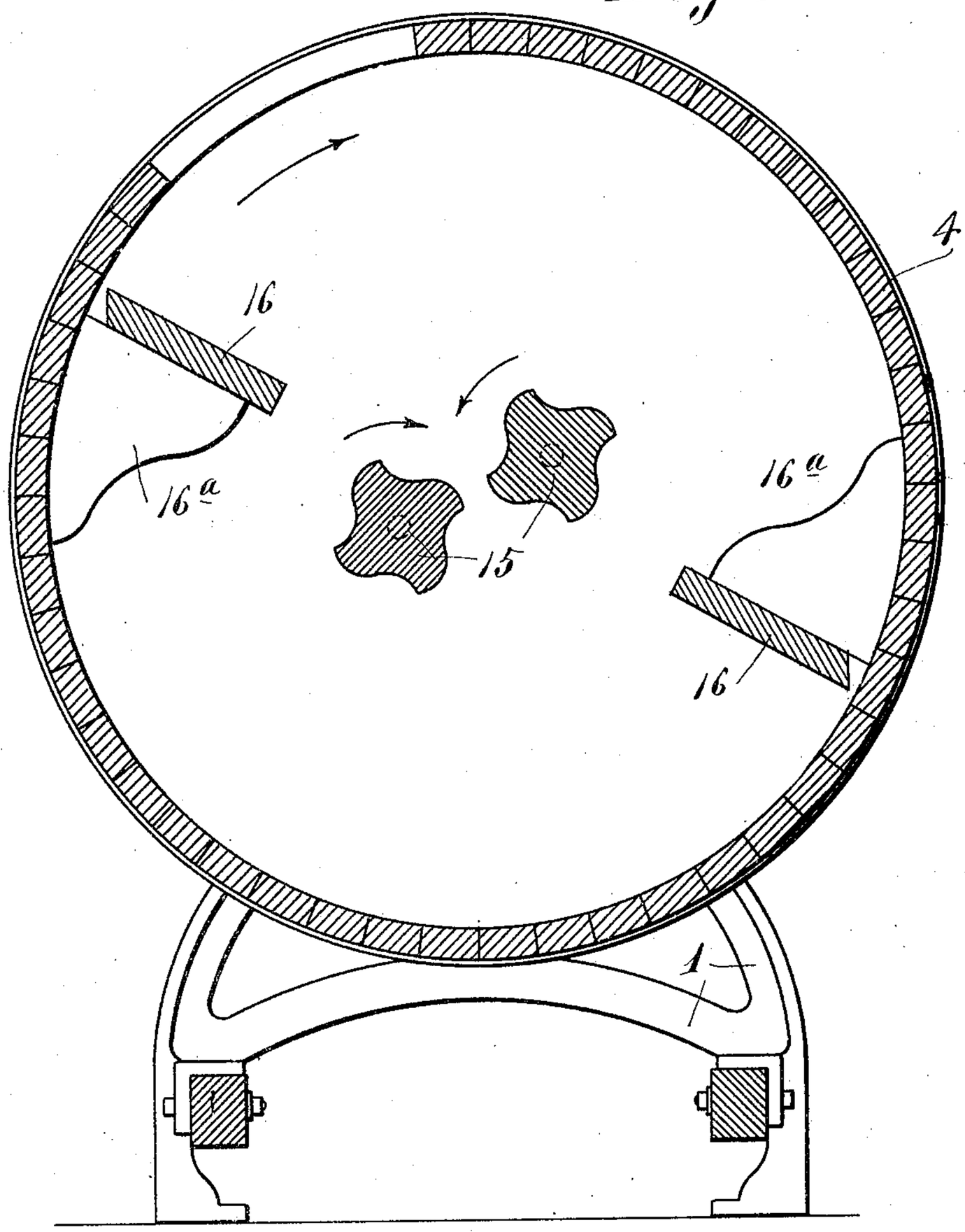


Fig. 3.

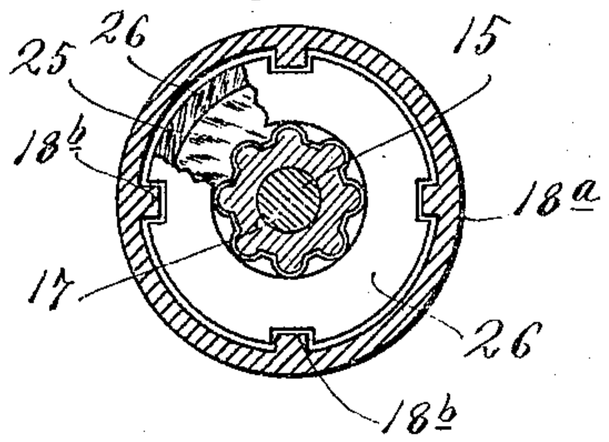
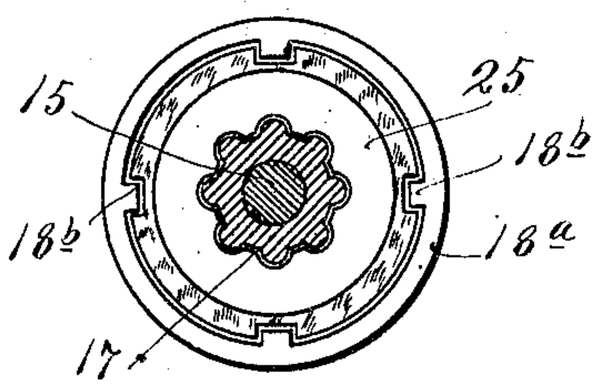


Fig. 2.



Witnesses.
E. W. Jeppesen.
R. H. Ofsahl.

Inventor.
D. E. Virtue.
By his Attorneys.
Williamson & Merchant

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3 SHEETS—SHEET 2.

Fig. 5.

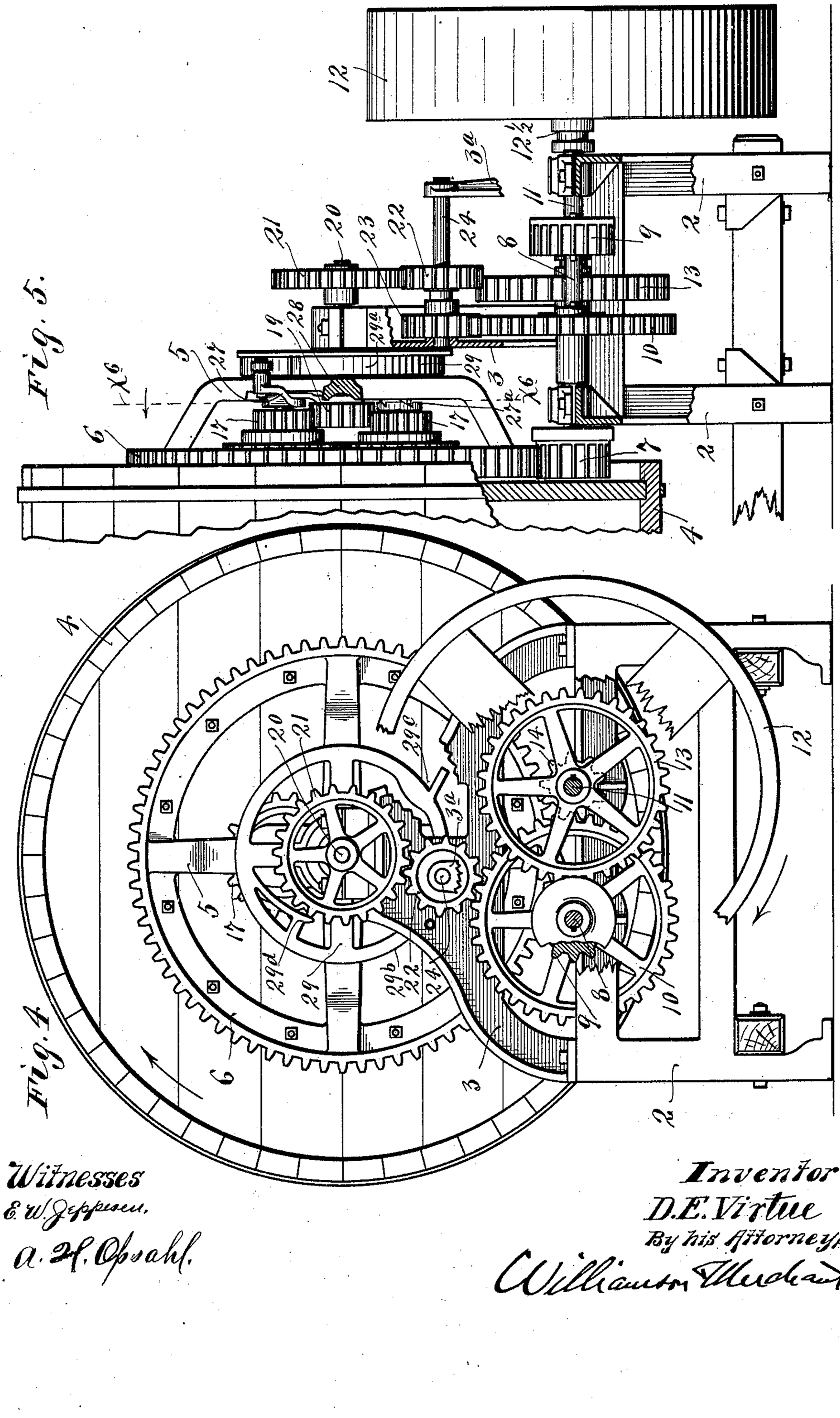

Fig. 4.

Witnesses
E. W. Jeppesen.
A. H. Ossahl.

Inventor
D. E. Virtue
By his Attorneys.
Williamson Merchant

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3 SHEETS—SHEET 3.

Fig. 6.

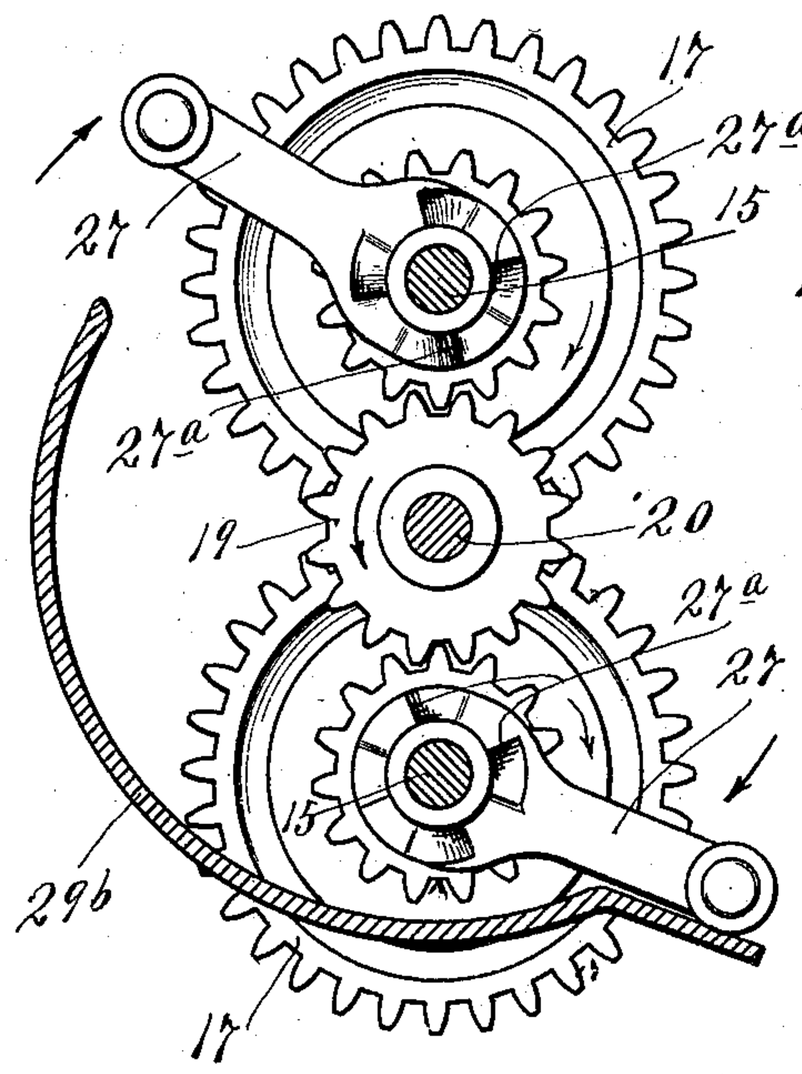


Fig. 7.

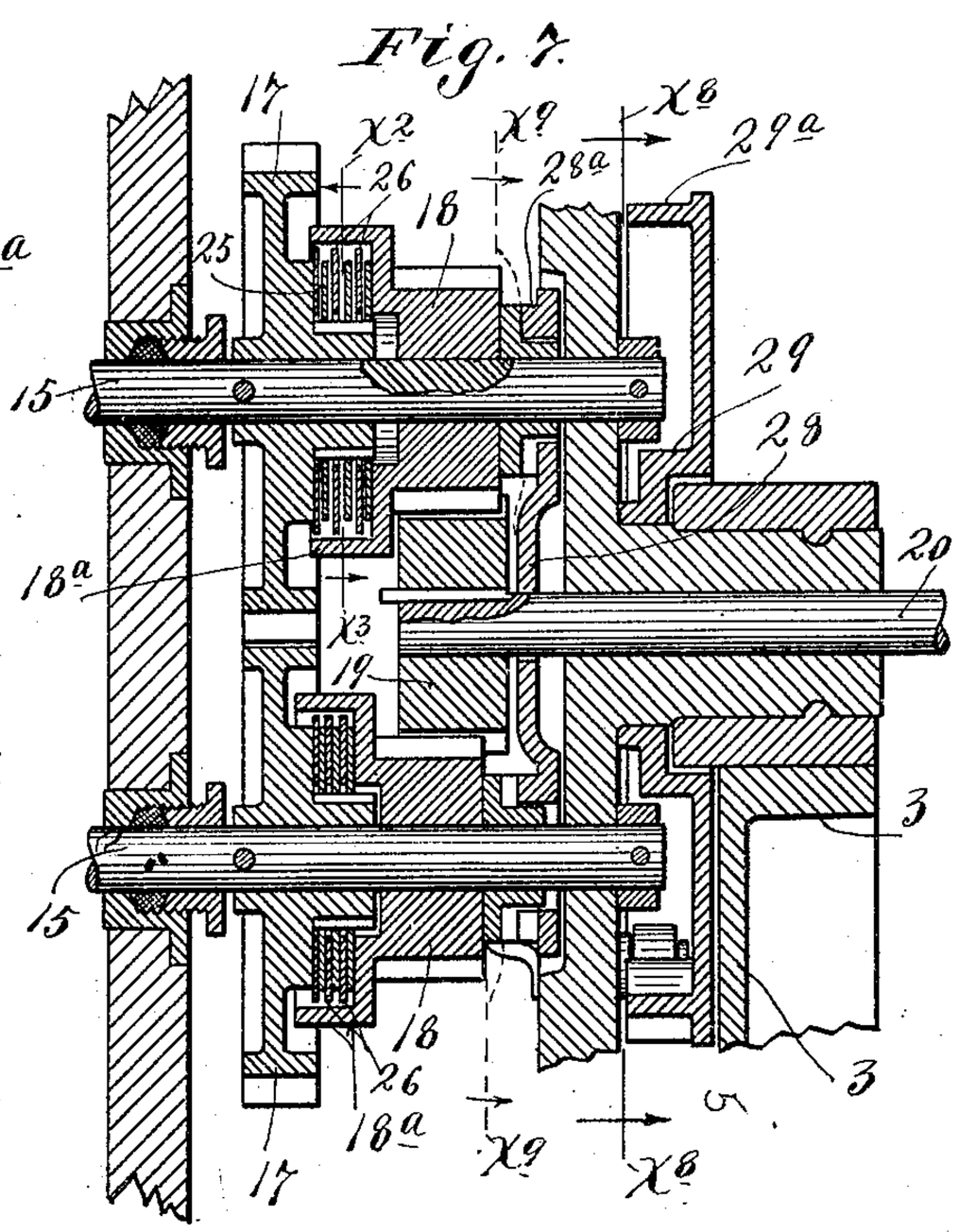


Fig. 8.

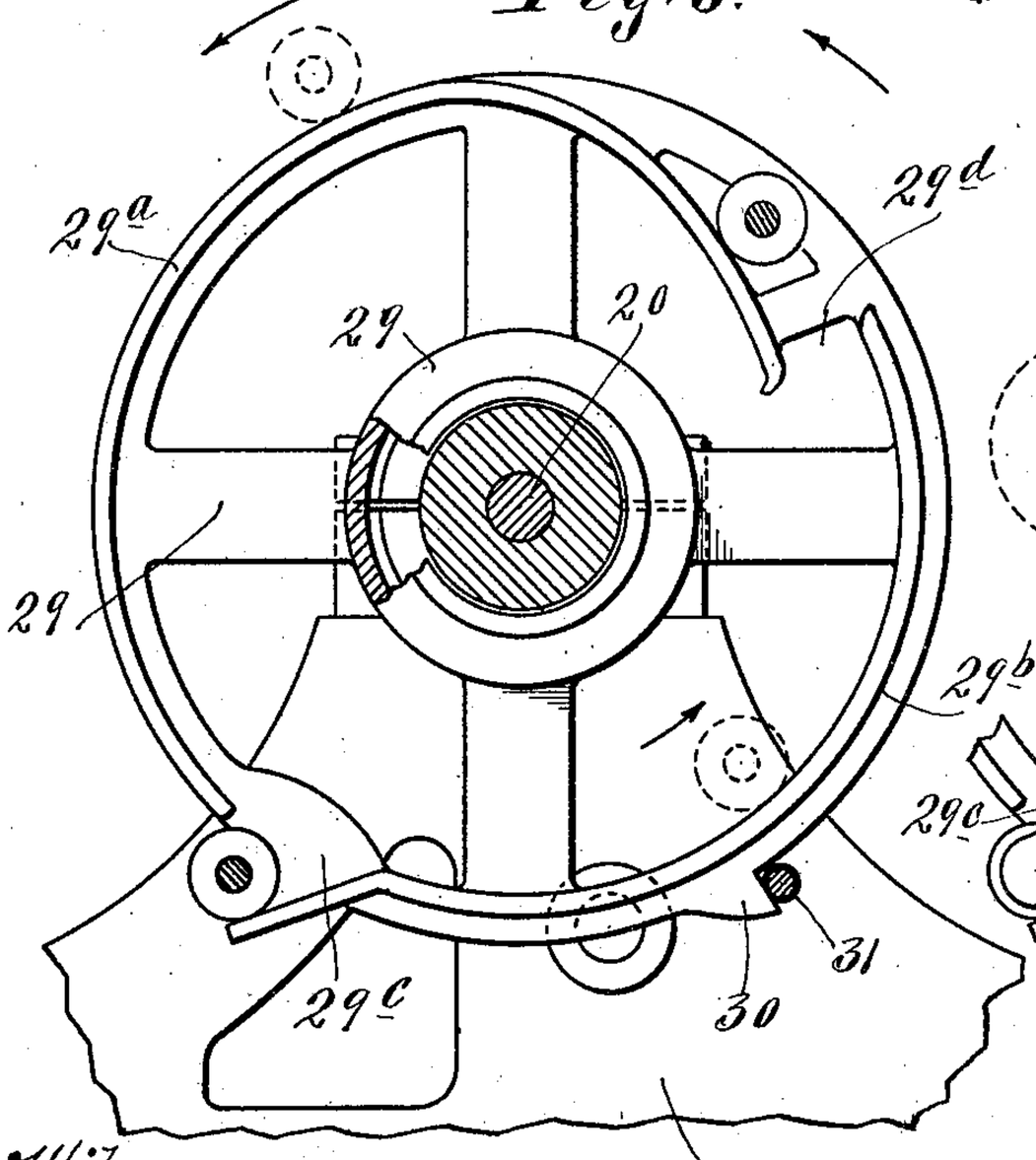
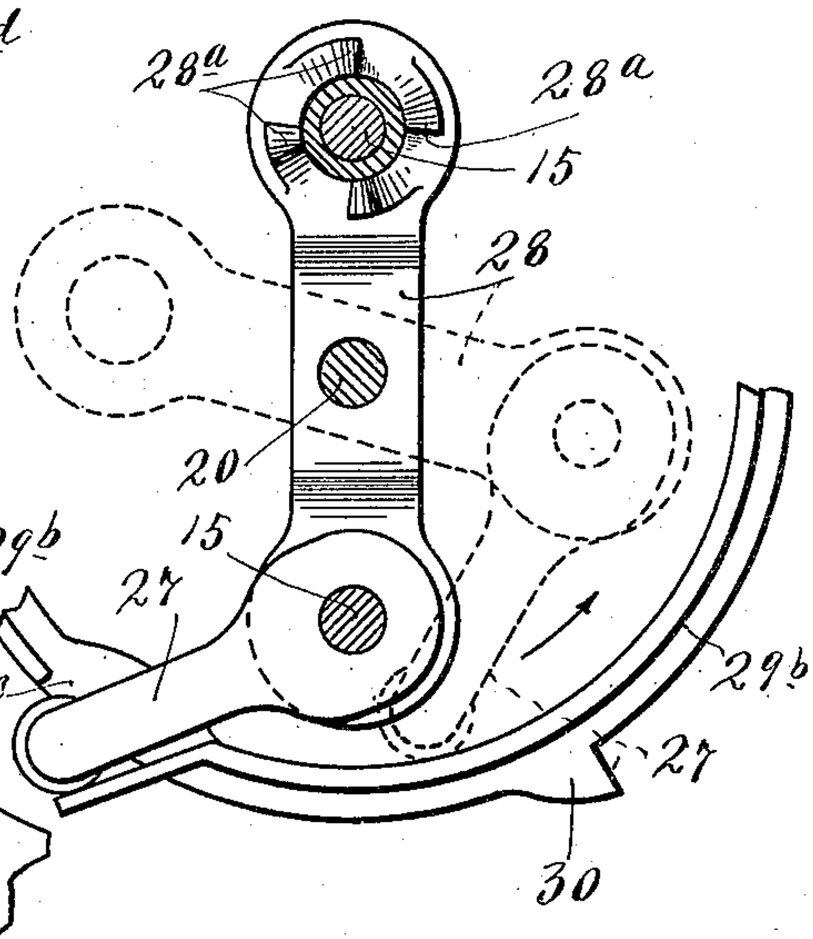


Fig. 9.



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E. W. Jeppesen.

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Inventor.

D. E. Virtue.

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Williamson & Merchant

UNITED STATES PATENT OFFICE.

DENNIS E. VIRTUE, OF OWATONNA, MINNESOTA.

COMBINED CHURN AND BUTTER-WORKER.

No. 861,561. Specification of Letters Patent. Patented July 30, 1907.

Application filed May 27, 1907. Serial No. 375,894.

To all whom it may concern:

Be it known that I, DENNIS E. VIRTUE, a citizen of the United States, residing at Owatonna, in the county of Steele and State of Minnesota, have invented certain new and useful Improvements in a Combined Churn and Butter-Worker; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to combined churns and butterworkers, and has for its object to provide an efficient machine of this class.

To this end, it consists of the novel devices and combinations of devices hereinafter described and pointed out in the claims.

In some of its general features, my machine herein disclosed is similar to the machine disclosed and claimed in the prior U. S. patent issued to myself and M. Deeg, of date October 3rd, 1899, No. 634,074, but my present machine differs from said prior machine in respect to many important features herein disclosed and claimed.

My improved machine is illustrated in the accompanying drawings, wherein like notations indicate like parts throughout the several views.

Referring to the drawings, Figure 1 is a vertical cross section through the entire machine, with some parts removed. Figs. 2 and 3 are details in section on the line x^2 x^3 of Fig. 7, illustrating parts of the friction clutches used as elements in the roller drive. Fig. 4 is a view chiefly in elevation, but with some parts in section, others broken away, and some parts removed, showing the geared or front end of the machine. Fig. 5 is a view chiefly in side elevation, with some parts broken away and others removed, showing the same or geared end of the machine. Fig. 6 is a detail, in vertical section, on the line x^6 x^6 of Fig. 5. Fig. 7 is a view in section, in a plane through the axis of the drum and axes of the two rollers, with some parts broken away, with the roller shafts standing in a vertical line. Fig. 8 is a view in section on the line x^8 x^8 of Fig. 7; and Fig. 9 is a detail, partly in section and partly in elevation, on the line x^9 x^9 of Fig. 7, with some parts broken away and others removed.

In a suitable supporting frame is mounted a rotary drum 4. Of the parts of said frame it is sufficient, for the purposes of this case, to note the rear end leg or pedestal 1, the front end extension or rectangular portion 2, and the front end pedestal 3 and bearing bracket 3^a both bolted fast to said extension 2. The drum 4, at its rear end, has a suitable trunnion, not shown, fixed to the head of the drum, and suitably journaled in the rear end frame leg or pedestal 1. At its front end, the drum 4 is provided with a trunnion spider 5, the trunnion of which is hollow and is journaled in the front end pedestal 3. The spider 5 has cast integral therewith an external ring gear 6, and this combined gear and spider casting is bolted fast to the front head of the drum. With the external gear 6 engages a pinion 7 fixed to the inner end of counter-shaft 8 which is mounted in the framework 2. It is obvious, that when the counter-shaft 8 is turned, rotary motion will be imparted to the drum 4 by means of the pinion 7 and the external ring gear 6.

A two speed drive is provided for the shaft 8 so as to turn the drum at a higher speed for churning and a lower speed for working the butter. For this purpose, said counter-shaft 8 has fixed thereto an outer or small gear wheel 9 and an inner or large gear wheel 10. A main driving shaft 11 is journaled in the framework 2, parallel with the counter-shaft 8, and is provided at its outer end with a driving pulley or band wheel 12 which, in practice, is equipped with a radially expansible friction clutch $12^1/_2$, the hub of which only is shown, for gripping the wheel to the shaft 11. On said shaft 11 is mounted a double gear casting, the outer or larger member of which is marked 13 and the inner or smaller member of which is marked 14. This casting, with the gears 13 and 14, is splined to the shaft 11, so as to be capable of a sliding movement lengthwise thereof to change from the high to the low speed, for the drum, whenever so desired. The double gear casting is shifted by a suitable shipper fork, not shown. When said double gear casting is shifted to its outermost position, its large gear wheel 13 will engage with the small gear 9 on the counter-shaft 8, and thus afford the high speed, the parts being shown in this position in Fig. 4, and when said double gear casting is shifted to its innermost position, its small member 14 will engage with the large gear wheel 10 on the counter-shaft 8 and afford the low speed, the parts being shown in this position in Fig. 5.

In the drum 4 are mounted a pair of fluted rollers 15, the axes of the respective rollers being parallel with the axis of the drum, on opposite sides thereof and substantially equi-distant therefrom. The shafts of the rollers 15, at the rear end of the drum, are journaled in the head of the drum, but, at the front or geared end of the drum, the roller shafts extend outward through suitably packed joints and are journaled in one of the cross arms of the trunnion spider 5. A pair of shelves 16 are fixed to the drum, parallel with the rollers, opposite to each other and in such position as to have their working faces substantially in a plane intersecting the axis of the drum at an angle to a plane through the axes of the two rollers, as clearly shown in Fig. 1 of the drawings. The shelves 16 are fixed to the drum in any suitable way, such as being made fast at their ends to the head of the drum and supported at or near their centers by brackets 16^a fixed to the walls of

the drum. The shelves 16 are preferably so set as to leave a little space between the same and the wall of the drum.

The drum 4 is driven continuously, in a constant direction. The rollers are so driven that they always turn toward each other at their upper or butter receiving surfaces. In this machine, and most others of this class, the butter is always worked only on the rising side of he drum. Hence, it follows that, in order to have the rollers turning toward each other at their upper or butter receiving surfaces, for coöperation with two opposite shelves 16 in succession, so as to work the butter through twice in each revolution of the drum, the rollers 15 must be reversed twice in each revolution of the drum. An important feature of my invention herein disclosed and claimed, relates to this reversing roller drive, or means for positively reversing the rotation of the rollers twice in each revolution of the drum, while the drum turns continuously in a constant direction. The means for this purpose will now be noted.

The rollers 15 are geared to be driven one from the other, and this driving relation shifts from one to the other twice in each revolution of the drum. As shown, the shafts of the rollers 15 have fixed thereto a pair of intermeshing gears 17; and on the said pair of shafts, outward of the gears 17, are loosely mounted, with freedom for sliding motion thereon, a corresponding pair of pinions 18. These pinions 18 are engaged by opposite sides of a small gear fixed to the inner end of a central driving shaft 20. The driving shaft 20 passes out through the hollow gudgeon of the drum supporting spider 5, and has its bearing therein. At its outer end, the shaft 20 has fixed thereto a relatively large gear wheel 21. On a stationary shaft 24 fixed to the parts 3 and 3^a of the framework, at the geared end of the machine, is loosely mounted a double gear casting, the outer member of which is marked 22 and the inner member 23, and which casting, in practice, is subject to a shipper fork for sliding the same lengthwise of the supporting shaft 24. When said double gear casting is in its innermost position, its inner gear 23 will be in engagement with the large wheel 10 on the countershaft 8 and its outer member 22 will be in engagement with the gear 21 on the roller driving shaft 20; or, as the parts are shown in Fig. 5; or otherwise stated, this relationship is made to exist at the time when the drum is being driven at its slow speed. By shifting the double casting, on the shaft 24 to its outermost position, its gear 23 will be thrown out of mesh in respect to the gear 10, and its gear 22 will be thrown out of mesh with the roller driving gear 21; and this relationship is made to exist at the time when the drum is being driven at its fast speed, as desired in the churning action.

From the foregoing, it is obvious that the roller driving shaft 20, when in motion, is driven in a constant direction opposite to the motion of the drum, and that its inner end gear 19 will turn the loose pinions 18 of the roller shafts, in common directions but opposite to the direction of said shaft 20, as can readily be understood from an inspection of Fig. 7. It is obvious also, that if the pinions 18 can be alternately clutched to the respective gear wheels 17 fixed to the roller shafts, the driving relation between the two rollers will be alternately shifted from one to the other, and the rotation of the rollers on their own axes will be reversed, while the drum continues to revolve in a constant direction. The means for this purpose will now be noted.

The hubs of the roller gear wheels 17 are corrugated to receive the smaller or corrugated disks 25 of a corresponding pair of multiple disk friction clutches, best shown in Figs. 2, 3 and 7. The inner hubs of the pinions 18 are provided with housing flanges 18^a having, on their interior, radially projecting ribs or lugs 18^b adapted to engage with the peripheral notches of the larger disks 26 of the friction clutches. The disks 25 and 26 are intercalated with respect to each other, and as the smaller disks 25 engage with the hubs of the gear wheels 17, and the larger members 26 engage with the ribs 18^b of the housing flanges 18^a on the hubs of the pinions 18, it, of course, follows that, when one of the clutches is in its closed position and the other is in its open position, motion will be imparted to both rollers 15 from the one thereof having thereon the clutch which is in its closed position at the time.

On the roller shafts, directly outward of the pinions 18, are mounted a pair of roller-equipped cam levers 27 with raised cam lugs 27^a on their outer hub faces, as most clearly shown in Figs. 6 and 9. Directly outward of the hubs of the cam levers 27, is located a reaction bar 28 with raised cam surfaces 28^a on the inner faces of its opposite ends for coöperation with the raised cam surfaces 27^a on the hubs of the cam levers 27. The outer ends of the reaction bar 28 are provided with openings to fit over and ride upon the hubs of the cam levers 27, and the bar 28 is also provided with a central passage enabling it to be slipped over the central shaft 20, as best shown in Fig. 7. With this stated relation of the parts 27 and 28, it is obvious that angular motion of the cam levers 27 will slide the pinions 18 lengthwise of the roller shafts so as to close the clutches by clamping together the friction disks 25 and 26. To control these angular movements of the cam levers 27, a cam casting 29 is provided which, as shown, is mounted on the trunnion of the drum supporting spider 5, directly inward of the frame pedestal 3, at the geared end of the machine, as best shown in Figs. 4, 5, 7 and 8. This cam casting 29 is provided with a peripheral cam flange or track made in two sections, marked 29^a and 29^b, staggered in respect to each other and so related as to have their main portions in arcs of different circles, and also so as to afford an inlet gap 29^c and an outlet gap 29^d for the rollers of the cam levers 27. The cam flange 29^a is so shaped as to have a considerable section thereof extending in the arc of a true circle but to have one portion thereof, to-wit, that portion adjacent to the outlet gap 29^d bent inward or formed eccentric to the arc of its main portion. The cam flange 29^b has its main portion formed in the arc of a true circle which is concentric to the main portion of the cam flange 29^a but struck on a smaller radius, so that the inner face or surface is staggered inward toward the axis of the drum, as compared with the outer face of the cam flange 29^a; and the roller entrance end of the flange 29^b turns outward tangential to the arc of its main or body portion—all as most clearly shown in Figs. 8 and 9.

The levers 27 are so shaped that their roller-equipped ends will reach outward beyond the cross bars of the

trunnion spider 5 and engage with the cam flanges 29^a and 29^b of the cam casting 29, as can be best seen in Figs. 5, 8 and 9. The cam casting 29 is provided with a peripheral shoulder or lug 30 adapted to engage with the pin 31 removably seated in the pedestal 3, as shown in Fig. 8, for holding the cam casting 29 in a stationary position, at the time when so desired, to-wit, when said cam is to be called into action for coöperation with the cam levers 27 to reverse the rollers twice, in each revolution of the drum. The time, of course, during which this continues is while the machine is being used for working the butter. The pin 31 is withdrawn from its seat before the churning action begins; and, in the churning action, the cam casting 29 travels with the drum, being carried around therewith by the cam levers 27. With the structure of the cam casting 29 and the relationship thereof to the cam levers 27 distinctly in mind, the operation of these parts can readily be understood.

Assume that all the parts are in position for working the butter. The cam casting 29 will then be held in a stationary position by the pin 31, or as shown in Fig. 8. Then, under the rotation of the drum, the rollers of the cam levers will travel around the cam casting 29, bearing against the outer face of the cam flange 29^a until the gap 29^c is reached, whereupon, the roller will be intercepted by the tangential projection of the cam flange 29^b and be shifted inward so as to come into engagement with the inner face of the cam flange 29^b, thus producing an angular movement of that particular cam lever and thereby forcing the coöperating clutch into its closed position; and this relationship will be maintained until that particular roller reaches the gap 29^d, whereupon, the inturned or eccentric portion of the cam flange 29^a will engage with the inner surface of said roller and thereby impart angular motion to the cam lever 27, in an outward or reverse direction, thus throwing that particular clutch into its open position. At the same time that one cam lever is thus thrown outward by the eccentric portion of the cam 29^a, the roller of the other cam lever 27 will be entering the gap 29^c, and be forced inward, thereby throwing its coöperating clutch into its closed position. The cam flange 29^b is of such length as to hold the cam lever 27 passing over the inner face thereof, in its innermost or clutch closing position for nearly but not quite a half revolution of the drum; the other cam flange 29^a is of such length as to hold the cam lever passing over the outer face thereof, in its outermost or clutch opening position for a little more than a half revolution of the drum. The cam flange 29^b occupies such a position, when the cam casting 29 is held stationary by the pin 31, that the lowest member of the two cam levers 27 engages with the said cam flange 29^b. It follows, that the lowest roller, on the rising side of the drum, is always the driving member; and, hence, it further follows that the upper or butter receiving faces of the two rollers 15 will always turn toward each other, on the rising side of the drum, as is required to receive the butter from the shelf 16, on the rising side of the drum, and work the same therethrough.

The devices, hereinbefore described, for securing the reversing drive for the rollers, it will be seen, from the above statements, are of such a character as to make the action positive where required and yielding where required, and so that the reverse will take place, at the proper times, in a reliable manner, without any shock or jar to the coöperating parts. Otherwise and briefly stated, the smooth running of the moving parts of the machine are not in anywise interfered with, by the reversing action of the rollers. The multiple disk friction clutches, shown and described for coöperation with the gears 17 and the pinions 18, are of a standard type and are desirable for such a purpose, but it must be understood that any other suitable form of clutch members might be employed.

Having regard to the effect on the cream and the butter, it will, of course, be obvious that the requisite concussion of the cream for the churning action is secured by the shelves 16. The presence of the rollers 15 is of no assistance in the churning action. The churn would probably work faster in the churning action, if the rollers were not present. After the cream has been churned, the buttermilk drawn off, and the butter washed and the water drawn off, the butter will be in the bottom of the drum in a granular form. The salt is then applied and the drum is started up under its slow motion. The shelf 16, on the rising side of the drum, will then engage with the butter and coöperate with the belly of the drum, in advance of the shelf, to carry up the butter to such a height that the upper portion of the mass of butter will be overcome by gravity and will drop off the mass and roll down along the side of the same until caught by the rollers 15, whereupon it will be worked therethrough and dropped into the bottom of the drum. All the butter carried up by a given shelf will be worked through the rollers and dropped into the bottom of the drum before the rollers are reversed. At this time, the shelf which had been carrying up the butter will be slightly beyond its vertical position. Under the continued movement of the drum, the rollers are reversed under the coöperative action of the cam casting 29 and the cam levers 27, as hitherto noted, and will thereafter turn in the right direction for coöperation with the other shelf which will now be on the rising side of the drum. This second shelf then engages with the butter and in coöperation with the belly of the drum carries same up until, under the action of gravity, the butter is again delivered to the rollers and worked therethrough and again dropped into the bottom of the drum. In this way, the actions are repeated, working the butter through twice, in each revolution of the drum, and in substantially the reverse order in point of time, thus completely turning over the mass of butter and thoroughly incorporating the salt therewith and removing the moisture therefrom, in a minimum of time.

The efficiency of this machine herein disclosed and described has been fully demonstrated by actual usage thereof.

What I claim is:—

1. The combination with a rotary drum and a pair of rollers thereon geared to be driven one from the other, of a reversing drive for said rollers which drive includes a pair of constantly driven clutch members, and means for automatically forcing said two clutch members alternately into clutch closing and clutch opening positions in each half revolution of the drum, substantially as described.

2. The combination with a rotary drum and a pair of

rollers therein geared to be driven one from the other, and a reversing drive for said rollers which drive includes a pair of constantly driven clutch members loose on their supports and traveling with the drum, and means for automatically forcing said two clutch members alternately into clutch closing and clutch opening positions with each half revolution of the drum, substantially as described.

3. The combination with a rotary drum and means for driving the same in a constant direction under a continuous motion, a pair of rollers in said drum geared to be driven one from the other; and a reversing drive for said rollers including a pair of constantly driven clutch members loose on their supports and traveling with the drum, and means for automatically forcing said two clutches into driving and idle positions alternately in reverse order, in each half revolution of the drum, substantially as described.

4. The combination with a rotary drum and a pair of rollers therein having intermeshing gears fixed to their respective shafts, and a reversing drive for said rollers including a pair of constantly driven clutch members loose one on each of said roller shafts, a pair of cam levers angularly movable one on each of said shafts to force said clutch members into clutch closing positions, and a cam coöperating with said levers to hold one thereof in clutch closing and the other in clutch opening positions for substantially a half revolution of the drum, substantially as described.

5. The combination with a rotary drum, of a pair of rollers therein having gears fixed to their respective shafts and engaging with each other, and a reversing drive for said rollers which drive includes a pair of pinions loose on the roller shafts and movable lengthwise thereof, clutch surfaces between said roller gears and said loose pinions, a central driving shaft with pinions fixed thereto and engaging opposite sides of said loose pinions, a pair of cam levers angularly movable on said shafts to slide said loose pinions into clutch closing positions, and a cam adapted to be held in a stationary position and provided with cam surfaces so shaped and disposed as to hold one of said levers in clutch closing position and the other in clutch opening position for substantially a half revolution of the drum, substantially as described.

6. In a machine for churning or working butter, the combination with a rotary drum, of a pair of rollers therein having their axes respectively on opposite sides of the axis of the drum and substantially equi-distant therefrom, means for the continuous rotation of the drum in a common direction, means for reversing the rotation of the rollers twice in each revolution of the drum and at times when the axes of said rollers are substantially in a vertical line, and a pair of shelves fixed to the drum opposite to each other and having their faces substantially in a plane intersecting the axis of the drum at an angle to a plane through the axes of the rollers, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

DENNIS E. VIRTUE.

Witnesses:
H. D. KILGORE,
F. D. MERCHANT.