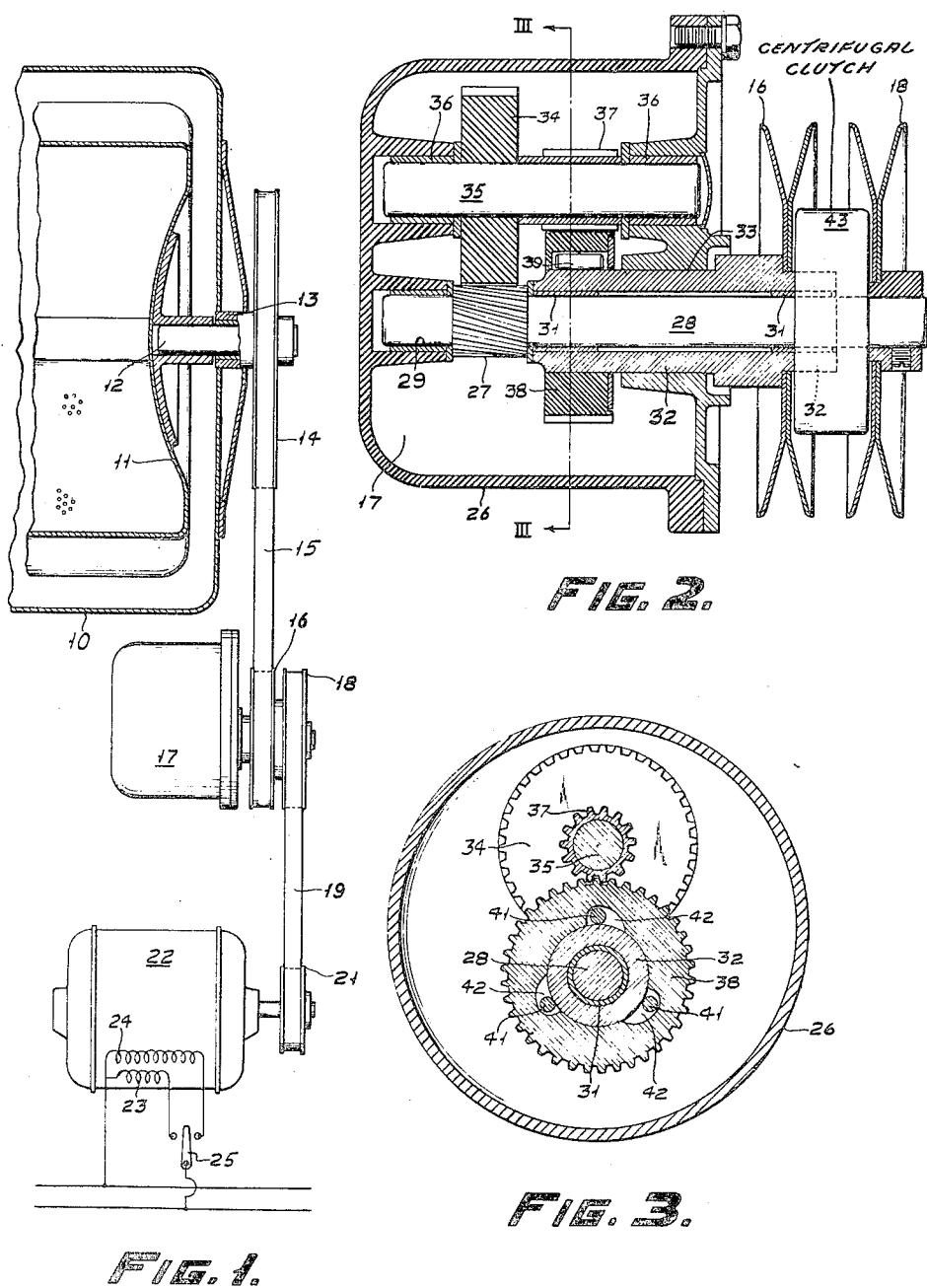


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SPEED CHANGING APPARATUS

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SPEED CHANGING APPARATUS

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1

My invention relates to speed-changing apparatus and has for an object to provide improved apparatus of this kind.

A further object of the invention is to provide improved speed-changing apparatus having a variable speed-driving shaft and a driven shaft, wherein the ratio of low and high-speed operation of the driven shaft exceeds the ratio of low and high-speed operation of the driving shaft.

A still further object of the invention is to provide an improved speed-changing mechanism for a washing and centrifuging machine, which mechanism is simple in construction and readily adjusted to provide high and low-speed operation of the washing and centrifuging machine.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a diagrammatic view of a washing and centrifuging machine having my improved speed-changing apparatus applied for the driving thereof;

Fig. 2 is a sectional view showing, enlarged, the geared transmission mechanism employed in Fig. 1; and

Fig. 3 is a section taken along the line III—III of Fig. 2.

Reference will now be had to Fig. 1 of the drawings wherein I have elected to show my improved speed-changing apparatus applied to a washing and centrifuging machine of the so-called horizontal axis type. This machine includes a tub 10 for containing a body of washing fluid and having a rotatable perforate basket 11 disposed therein for containing the fabrics to be treated. The basket 11 is carried by a shaft 12 suitably journaled, as shown at 13 in a wall of the tub 10 and provided with a sheave 14 for the rotation of the basket. During washing periods, the basket 11 is rotated at a relatively low speed of approximately $49\frac{1}{2}$ R. P. M. in the presence of a body of washing water within the tub 10 so that the fabrics are tumbled in the water whereby they are cleansed. At the conclusion of the washing period, the body of water is removed from the tub and the basket is then rotated at a much higher speed for centrifugally extracting water from the fabrics.

The sheave 14 is belted as shown at 15 to the driven pulley 16 of a gear transmission, generally indicated at 17, further reference to which is made hereinafter. The transmission 17 is provided with a driving pulley 18 belted, as shown

2

at 19 to the pulley 21, forming a part of a two-speed electric motor of any well-understood construction and indicated at 22. The motor 22 may be of the split-phase type and provided with windings 23 and 24 which respectively provide for two-pole and four-pole operation of the motor 22. Accordingly, when the motor winding 23 is energized by 60-cycle alternating current, the motor pulley will be rotated at a speed of 3500 R. P. M. and when the four-pole winding 24 is energized, the pulley 21 will be rotated at approximately 1750 R. P. M. A suitable switch 25 is provided for selectively energizing the two-pole winding 23 or the four-pole winding 24.

Reference will now be had to Figs. 2 and 3, for a description of the speed-change transmission 17. This member includes a casing structure 26 which houses a chain of gears, the driving pinion 27 of which is fixed to and rotatable with a shaft 28, the latter extending from the casing and being driven by the driving pulley 18. The shaft 28 is suitably journaled, as shown at 29, in the casing 26 and is also supported by bearings 31 disposed within a sleeve 32 which is fixed to and rotates with the driven pulley 16. The sleeve 32 is journaled, as shown at 33, in an end wall of the casing 26.

The pinion 27 meshes with a gear 34 which is carried upon and drives a shaft 35 suitably journaled in the casing 26, as shown at 36. The shaft 35 drives a pinion 37 which meshes with the final gear 38, the latter being carried by the inwardly-extending sleeve 32 of the pulley 16. An overrunning clutch 39 of any well-understood construction is interposed between the gear 38 and the sleeve 32 to provide a driving connection between the gear 38 and the sleeve 32. As described hereinafter, during high-speed operation the sleeve 32 will rotate at a higher speed than the gear 38 and at this time the clutch 39 provides for overrunning of the sleeve 32 relative to the gear 38. The overrunning clutch 39 may include a plurality of rollers 41 which are disposed within recesses 42 formed in the gear 38. In this type of clutch, as is well understood, one end of the recesses has a depth greater than the diameter of the rollers 41; the depth of the recesses progressively diminishing towards the other end thereof. As viewed in Fig. 3, the gear 38 and the sleeve 32 rotate at all times counterclockwise. During periods when the sleeve 32 is rotated at a higher speed than the gear 38, the rollers are disposed in the deep portions of the recesses in order to permit such operation. However, when the sleeve 32 is driven by the gear 38,

3

the rollers 41 are wedged between these members in a portion of the recess of reduced depth.

A centrifugal clutch mechanism, generally indicated at 43 and of any well-understood construction, is driven by the shaft 28 and effects the clutching of the shaft 28 and the sleeve 32 when the shaft 28 is rotated at or above a predetermined high speed. At this time, of course, the shaft 28 and the sleeve 32 being engaged, rotate in unison. At lower speeds the clutch 43 is disengaged so that the shaft 28 may rotate relative to the sleeve 32. Since the clutch 43 may be of any well-understood type or construction, I have not disclosed it in detail for the sake of clearness and brevity. In the embodiment of the invention disclosed herein, the clutch will be centrifugally engaged at speeds above 1800 R. P. M. to provide a direct driving connection between the shaft 28 and the sleeve 32 and at speeds below 1800 R. P. M. the clutch 43 will be disengaged.

The ratio of the diameter of the pulleys 21 and 18 is such that the pulley 18 is rotated at speeds of 1055 R. P. M. and 2110 R. P. M. during four-pole and two-pole operation of the motor 22, respectively. The ratio of the gear transmission 17 during periods when the pulley 18 is rotated at 1055 R. P. M. rotates the pulley 16 at 105 R. P. M. The ratio of the pulleys 16 and 14 provides a basket speed of $49\frac{1}{2}$ R. P. M.

During washing periods, the four-pole winding of the motor 24 is energized by the selector switch 25 so that the pulley 21 rotates at a speed of 1750 R. P. M. and the pulley 18 at a speed of 1055 R. P. M. At this pulley speed, the centrifugal clutch 43 is disengaged so that the pulley 16 is driven by the shaft 28, the gears 27, 34, 37 and 38, the overrunning clutch 39 and the sleeves 32. As set forth heretofore, the basket 11 and the sheave 14 are rotated at approximately $49\frac{1}{2}$ R. P. M.

High-speed operation of the basket 11 and centrifuging of the fabrics are effected by energizing the two-pole winding 23 of the motor 22. Accordingly, the speed of the pulley 21 accelerates from 1750 R. P. M. to 3500 R. P. M. and the speed of the pulley 18 is increased from 1055 R. P. M. to 2110 R. P. M. During the early stages of this accelerating period, the speed of the pulley 16 and the sheave 14 increases proportionately. When the speed of the pulley 18 has been increased to approximately 1800 R. P. M., the centrifugal clutch 43 is engaged so that the pulleys 16 and 18 rotate in unison. Of course, at this time the overrunning clutch 39 permits rotation of the sleeve 32 relative to the gear 38. During the latter stages of the accelerating period, the speed of the pulleys 16 and 18 increases from 1800 R. P. M. to 2110 R. P. M. and the speed of the basket 11 and the sheave 14 are increased to 975 R. P. M.

Slow-speed operation of the basket may be initiated by deenergizing the two-pole winding of the motor 22 and energizing the four-pole winding thereof. As the motor decelerates from 3500 to 1750 R. P. M., the speed of the pulley 18 is reduced proportionately and at 1800 R. P. M. the centrifugal clutch 43 becomes disengaged so that the driving of the pulley 16 is then through the speed-reducing gear mechanism, as described.

The various speeds set forth heretofore for the different pulleys are given by way of example and it will be apparent that the pulley sizes and gear ratio provided by the transmission 17 may

4

be varied to provide the desired washing and centrifuging speeds of the basket 11. Furthermore, other types of variable speed A. C. or D. C. motors, employing speed ratios other than two to one may be used.

From the foregoing description, it will be apparent that I have provided an improved variable speed mechanism for driving washing and centrifuging or other machines requiring two-speed operation, wherein a relative large ratio of speeds of the driven member is effected with a relative small ratio of speeds of the driving motor. The only adjustment necessary to provide the various speeds of the driven element is the adjustment by a switching means of the speed of the driving motor. Solenoid-operated clutches usually employed for the variation of speeds in apparatus of this general type are obviated with the noise and frequent servicing which accompanies the use of such devices. This feature is particularly desirable in domestic type machines. Furthermore, the apparatus disclosed herein may be economically produced, as such elements as variable speed motors and compact centrifugal clutches of the type and sizes shown at 43 are readily available on the market at relatively low cost. The gear transmission which I employ is of simple construction and readily constructed.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof.

What I claim is:

1. In speed-changing apparatus, the combination of a gear mechanism including a driving gear and a driven gear, a shaft for the driving gear, a sleeve carrying the driven gear and concentrically arranged with respect to said shaft, means for rotating the shaft at low and high speeds, a centrifugal clutch associated with said shaft and sleeve and operative at a speed intermediate said low and high speeds for clutching the shaft and sleeve, and an overrunning clutch associated with the sleeve and driven gear and defining a driving connection therebetween during periods when the centrifugal clutch is released and providing for overrunning of the sleeve relative to driven gear during periods when the centrifugal clutch is engaged.

2. In speed-changing apparatus, the combination of a casing, a gear mechanism in the casing including a driving pinion and a driven gear, a shaft fixed to the pinion and extending exteriorly of the casing, a sleeve supporting the driven gear and extending exteriorly of the casing, said sleeve and shaft being concentrically arranged, means for rotating the shaft at low and high speeds, a centrifugal clutch exterior of the casing and associated with the shaft and sleeve, said centrifugal clutch being driven by the shaft and engaged when the speed of the shaft exceeds a predetermined value intermediate said low and high speeds, said centrifugal clutch being disengaged when the speed of the shaft is below said predetermined value, and an overrunning clutch associated with the driven gear and the sleeve and providing a driving connection therebetween when said centrifugal clutch is disengaged, said overrunning clutch permitting overrunning of the sleeve relative to the driven gear when the centrifugal clutch is engaged.

3. In speed-changing apparatus, the combination of a casing, gearing arranged in the casing

5

and including a driving gear and a driven gear, a sleeve carrying the driven gear and journaled in the casing, a shaft journaled within the sleeve and fixed to the driving gear, means for rotating the shaft at low and high speeds, a centrifugal clutch disposed exteriorly of the casing and associated with the shaft and sleeve, said clutch being driven by the shaft and engaged for clutching the shaft and sleeve when the speed of the shaft exceeds a predetermined value intermediate said low and high speeds, said clutch being disengaged when the speed of the shaft is less than said predetermined value for relasing the shaft and sleeve, and an overrunning clutch disposed within the casing and associated with the sleeve and driven gear, said overrunning clutch providing a driving connection between the driven gear and sleeve during periods when the centrifugal clutch is disengaged and permitting rotation of the sleeve relative the driven gear during periods when the centrifugal clutch is engaged.

4. In speed-changing apparatus, the combination of a gear mechanism including a driving gear and a driven gear, a shaft for the driving gear, a sleeve carrying the driven gear and concentrically arranged with respect to said shaft, a

6

variable speed motor driving said shaft and having first and second electric circuits selectively energized for rotating the shaft at low and high speeds, means for selectively energizing the circuits, a centrifugal clutch associated with said shaft and sleeve and operative at a speed intermediate said low and high speeds for clutching the shaft and sleeve, and an overrunning clutch associated with the sleeve and driven gear and defining a driving connection therebetween during periods when the centrifugal clutch is released and providing for overrunning of the sleeve relative the driven gear during periods when the centrifugal clutch is engaged.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
784,285	Sturtevant	Mar. 7, 1905
834,592	Sturtevant	Oct. 30, 1906
2,187,835	Martin	Jan. 23, 1940
2,387,216	Hood	Oct. 16, 1945