

July 14, 1970

KOJIRO TAKEYAMA

3,520,158

WASHING MACHINE

Filed Sept. 11, 1968

2 Sheets-Sheet 1

FIG. 1

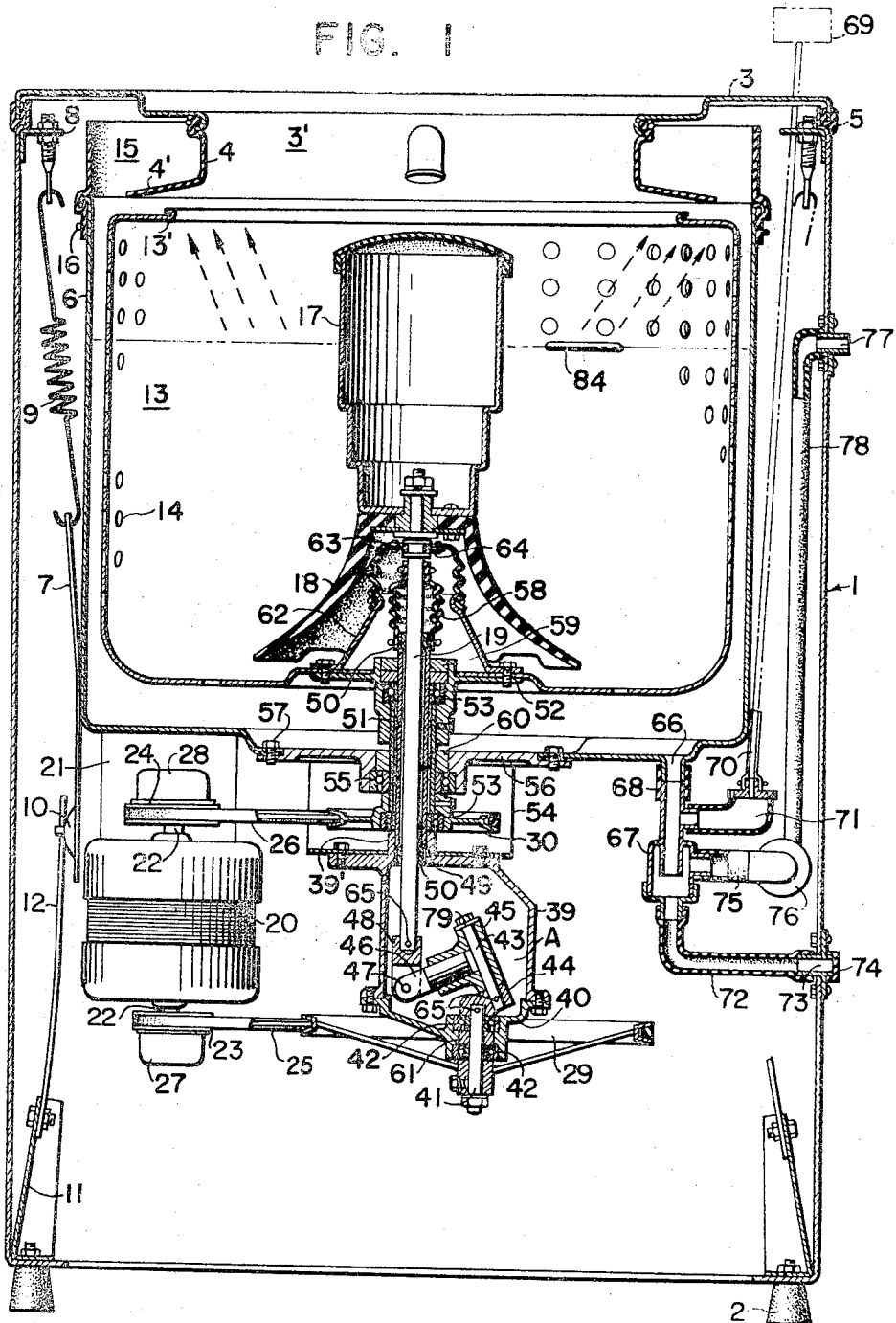
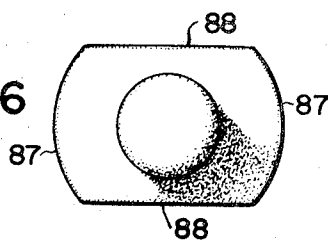


FIG. 6



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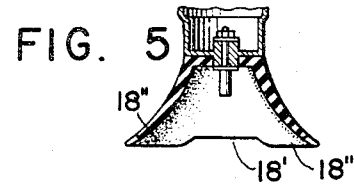
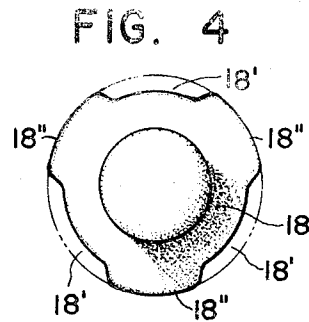
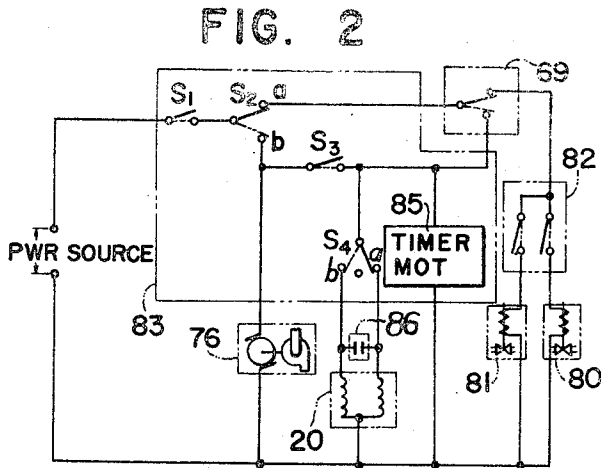
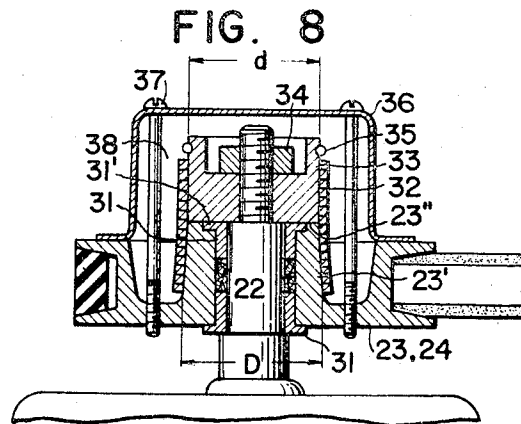
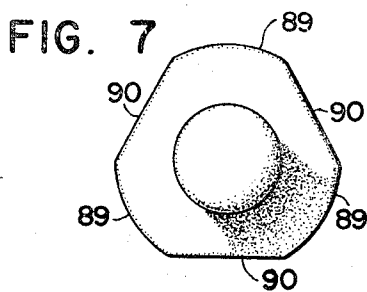


FIG. 3

	WASH- ING	DR	RINSING- OUT 1	DR	RINSING- OUT 2	DR	RINSING- OUT 3	DR	DEHYDR- ATION	OFF
S ₁										
S ₂ ^a										
S ₂ ^b										
S ₃										
S ₄ ^a										
S ₄ ^b										
	12MIN	2MIN	2MIN	2MIN	2MIN	2MIN	3MIN	2MIN	5MIN	



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3,520,158

WASHING MACHINE

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Filed Sept. 11, 1968, Ser. No. 758,971

Claims priority, application Japan, June 18, 1968, 43/42,671

Int. Cl. D06f 23/04, 37/40

U.S. Cl. 68—23.6

4 Claims

ABSTRACT OF THE DISCLOSURE

A washing machine of the so-called one-drum type having a single drum which serves both as a washing drum and as a dehydration drum, said washing machine being so designed that a washing operation and a dehydrating operation are carried out selectively in said drum upon switching the rotating direction of a driving motor from one way to the other, said washing operation being performed by an agitator disposed in said drum and moved up and down during the operation to cause streams of washing water.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention generally relates to a washing machine of the so-called one-drum type provided with a single drum which serves both as a washing drum and as a dehydration drum, and more in detail relates to a novel washing machine of the type specified above, which is so designed that a washing operation and a dehydrating operation are carried out selectively in said drum upon switching the rotating direction of a driving motor from one way to the other, said washing operation being performed by an agitator disposed in said drum and moved up and down during the operation to cause streams of washing water.

Description of the prior art

A conventional washing machine of the type wherein an agitator is moved up and down to perform a washing operation, has the drawbacks that the washing is twisted in the shape of a doughnut during the washing operation, whereby the washing effect is decreased, and further that the washing is wound around the agitator during a dehydrating operation, impeding the dehydrating operation.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to obtain an efficient washing operation without causing damage to the washing and to avoid uneven washing, by producing non-uniform water streams around an agitator by said agitator.

Another object of the present invention is to provide an improved driving mechanism which enables the operator to select a washing operation or a dehydrating operation accurately by switching the rotating direction of a driving motor from one way to the other.

Still another object of the present invention is to provide novel means for preventing splashing of water during the washing operation and thereby preventing the intrusion of water into the washing machine operating mechanism.

Still another object of the present invention is to provide for the use of an aluminum alloy of relatively low hardness or a similar material (which can be shaped by die casting) for a motor pulley, by interposing a flange of metal between the contacting surfaces of a clutch

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boss and the motor pulley, and thereby to simplify the fabrication and reduce the costs.

Other objects and advantages of the invention will be evident from the following detailed description of preferred embodiments thereof with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical cross-sectional view of an embodiment of the present invention.

FIG. 2 is an electrical connection diagram of the washing machine shown in FIG. 1.

FIG. 3 is a timer program showing the positions of the contacts of time switches.

FIG. 4 is a plan view of an agitator.

FIG. 5 is a fragmentary cross-sectional view of a principal portion of the agitator.

FIG. 6 is a plan view of another form of the agitator.

FIG. 7 is a plan view of still another form of the agitator.

FIG. 8 is a cross-sectional view of a clutch mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, the body 1 of a washing machine is provided with legs 2 at the bottom and a lid 3 at the top end thereof. The lid 3 is provided therein with a washing inlet opening 3' and an inwardly expanding annular splashboard 4 is connected to the peripheral edge of said washing inlet opening. A packing 5 is provided at the joint between body 1 and the lid 3. A bottomed cylindrical water tank 6 is suspended in the body 1 by suspending members 7 fixed to the outer side wall of said tank and springs 9 having one of their ends anchored to said suspending members 7 and the other ends supported by brackets 8 fixed to the upper portion of the body 1. At the lower portion of the suspending members 7 is provided a friction stud 10, against which a leaf spring 12, connected to the lower portion of the body 1 through a bracket 11, is pressed in frictional contact therewith, thereby to damp vibration of the water tank 6 during the dehydrating operation. Disposed in the water tank 6 is a drum which serves both as a washing drum and as a dehydration drum and which has a number of apertures 14 perforated through the peripheral wall thereof. The drum 13 has an opening in the top wall thereof and the peripheral wall 13' of said opening is extending inwardly so as to be overlapped by the flare 4' of the annular splashboard 4 in opposed relation thereto. Such arrangement is made for the purpose of blocking the jumping of washing water as indicated by the dotted-line arrows in FIG. 1 and thereby preventing said water from splashing to the outside of the water tank 6. Provided at the top end of the water tank 6 is a barrier wall member 15 which is secured to said water tank by a band 16 consisting, e.g. of a wire. In the interior of the drum 13 is disposed an agitator 17 whose diameter is reduced stepwise downwardly so as to promote stirring of washings. The agitator 17 has a downwardly flaring elastic impeller 18 of such a material as rubber or synthetic resin fixed to the lower end thereof. As shown in FIGS. 4 and 5, the elastic impeller 18 has a plurality of notches 18' or projections 18'' formed in the lower peripheral edge portion thereof so as to prevent twisting of washing during the washing operation and thereby to enhance the washing effect. Therefore, it will be appreciated that the water stream caused by the up and down motion of the agitator is strong at the projections 18'' and weak at the notches 18' and as a result, twisting of washings in the shape of a doughnut, which tends to occur in a conventional washing machine of this type, can be eliminated and the washing effect can be enhanced.

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Besides the configuration illustrated in the embodiment described above, the elastic impeller may be of such a shape as shown in FIG. 6 which is composed of two arcuate lines 87 connected with each other by straight lines 88, or a shape as shown in FIG. 7 which is composed of three arcuate lines 89 and three straight lines 90 connected with each other alternatively in a substantially triangular shape, and in either case, substantially the same washing effect can be obtained. Namely, a considerable effect can be expected with an impeller of any configuration other than the circular configuration.

The agitator body 17 and the elastic impeller 18 are connected integrally with each other and rotatably mounted on a vertically movable shaft 18 by a screw. With such an arrangement, the rotation of the drum 13 is not interfered by the washings around the agitator body 17 or the elastic impeller 18 during the dehydrating operation and accordingly the dehydrating operation can be started with no difficulty.

A driving motor 20 is mounted to the bottom of the water tank 6 through a bracket 21. The machine operating mechanism, generally indicated by A, consists of a washing operation mechanism and a dehydrating operation mechanism. The drive of the driving motor 20 is transmitted to the washing operation mechanism through a pulley 23 mounted on one end of the drive shaft 22 of said driving motor and a belt 25, and to the dehydrating operation mechanism through a pulley 24 mounted on the other end of the driving shaft 22 of said motor and a belt 26. Between the ends of the drive shaft 22 and the pulleys 23, 24 are provided one-way clutch 27, 28 respectively, so that the drive of the motor may be transmitted to an impeller pulley 29 for the washing operation mechanism when the motor is driven in one direction (in a clockwise direction as viewed from the top), while the drive of the motor may be transmitted to an impeller pulley 30 for the dehydrating operation mechanism when the motor is driven in an opposite direction (in a counterclockwise direction as viewed from the top). The mechanism of the clutch is shown in FIG. 8. As seen, the clutch is a one-way clutch which is the so-called spring clutch and in which a device is made to simplify the mechanism and to prevent oil leakage. Namely, the pulleys 23, 24 are rotatably mounted on the drive shaft of the motor through a bushing 31 respectively. A clutch spring 32 is fitted on the boss of each of the pulleys 23, 24 and secured thereon under the tightening force of said spring, said boss being tapered upwardly with the diameter D of the bottom end being greater than the diameter d of the top end thereof. A clutch boss 33 is fixed to each end of the drive shaft of the motor by means of a nut 34 in slight frictional engagement with the clutch spring 32.

At the top end portion of the clutch boss 33 is provided a stop ring 35 by which the clutch spring 32 is prevented from slipping out from the boss of each pulley. A clutch cover 36 is securely mounted on each pulley 23 or 24 by means of bolts 37, and the interior of the clutch cover 36 is filled with grease to keep the clutch spring 32 and the clutch boss 33 lubricated. However, the clutch spring does not rotate relative to the tapered boss 23' of the pulley because it is tightly yieldingly fitted on said tapered boss as described above.

The bushing 31 of each pulley is provided with a flange 31' and this flange 31' is in frictional contact with the clutch boss 33, serving as a thrust metal. Therefore, the end face 23'' of the boss 23' will not be worn out by the engagement with the clutch boss 33 and for this reason, the pulleys 23, 24 may be made of an aluminum alloy or plastic of relatively low hardness. This is advantageous in simplifying the structure and reducing the cost of the clutch mechanism.

As is well known, the spring clutch described above operates in such a way that when the clutch boss 33 rotates in the winding direction of the spring, it is bound

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by said spring transmitting the drive of the motor to the pulley, whereas when the clutch boss rotates in a direction opposite to the winding direction of the spring, it only idles relative to the pulley 23 or 24, without transmitting the drive of the motor to the latter. Thus, it will be understood that by switching the rotating direction of the driving motor, the washing operation and the dehydrating operation can be shifted from one to the another.

Next, the machine operating mechanism A will be described. The operating mechanism A comprises a casing 39 with the open bottom end covered by a closure member 40, and a shaft 41 of an impeller pulley 29 for washing operation is rotatably journaled through a ball bearing 42 mounted in the closure member 40.

The top end of the shaft 41 is connected to an inclined shaft 43 by way of a joint 44. A T-shaped metal 45 is rotatably fitted on the inclined shaft 43 and a link 46 is rotatably slidably received in the leg portion of said T-shaped metal. Reference numeral 79 designates a thrust collar provided at the other end of the T-shaped metal 45 to prevent said metal from slipping out from the inclined shaft. That end of the link 46 projecting from the T-shaped metal is pivotally connected to an arm 48 which is connected to the lower end of the vertically movable shaft 19 by a pin 47. Reference numeral 49 designates a hollow shaft fitted in a boss 39' of the casing 39 with pressure and in which the vertically movable shaft 19 is vertically movably supported through a metal 50. The hollow shaft 49 extends through an outer hollow shaft 51 which is rotatably supported on the outer surface of the former through bearings 53 mounted in a pulley 30 for the dehydrating operation and in a flange 52 provided at the top end of the hollow shaft 51 respectively.

The flange 52 has the drum 13 fixed thereto, so that when the pulley 30 is rotated, the drum 13 is rotated by the flange 52 of the hollow shaft 51 fixed to said pulley, whereby centrifugal dehydration of the washings in the drum is effected. Reference numeral 54 designates a bracket by which the casing 39 is mounted on the bottom end of the water tank 6 and which is fixed to the bottom end of the water tank 6 by screws 57 together with a flange member 56 which has a ball bearing 55 for rotatably supporting the hollow shaft 51 for dehydration operation.

Reference numeral 58 designates a bellows provided between the vertically movable shaft 19 and the hollow shaft 49 to provide for a vertical movement of the shaft 19 as well as to prevent intrusion of water into the hollow shaft 49. Numerals 59, 60 designate sealing members fitted in the flange members 52, 56 respectively, 61 a sealing member to prevent oil in the casing 39 from leaking therefrom and 62 a protective column having the lower end secured to the bottom wall of the drum 13 and the flange member 52 by screws and the top end connected to a protective bellows 63 for protecting the bellows 58, the top end of said protective bellows 63 being rotatably secured to the vertically movable shaft 19 through a metallic member 64. Reference numeral 65 designates knock pins to fix the respective shafts and 66 designates a drain port provided in the bottom wall of the water tank 6, which drain port is in communication with a trap 67 through a hose 68. The trap 67 in turn is in communication with a water level controlling pressure switch 69 through an air pipe 70 and an air trap 71. An auxiliary drain hose 72 is connected to the lower end of the trap 67 for removing objectionable materials, such as stones, buttons and hair pins, accumulated in said trap therefrom and the other end thereof is connected to an auxiliary drain port 73 provided at the lower portion of the body 1 of the washing machine, said auxiliary drain port 73 being covered by a cap 74.

The trap 67 is also communicated with a drain pump through a hose 75 and the outlet port of the drain pump is communicated with a drain port 77 at the upper portion of the body 1 through a hose 78.

The washing machine of the present invention con-

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structed as described above will operate in the following manner. Namely, when the plug of the washing machine is connected with a power source and an automatic time switch (not shown) is set at a marking "washing" by rotating a knob, the contact of a pressure switch 69, shown in FIG. 2, is still held in the solid line position since water pressure has not been exerted thereon, supplying a current through water supply solenoid valves 80 and 81, so that water is supplied in the water tank. Here, the solenoid valve 80 is connected to a hot water supply conduit and the solenoid valve 81 is connected to a water conduit. Reference numeral 32 designates a manual switch to switch the connection with the hot water supply conduit and the water conduit from one to the other. During this period, as shown in FIG. 3, the contact S₁ of the time switch 83 is closed; S₂ is closed on the *a* side and S₄ is closed on the *a* side. When the water in the drum 13 has reached a prescribed level 84, the contact of the pressure switch 69 is switched to the dotted line position, whereby a current is supplied through a timer motor 85 to operate a cam of the time switch and also through the driving motor 20 of the washing machine, so that the driving motor 20 is set in motion and the drive of the motor is transmitted to the pulley 27. Thus, the impeller pulley 29 is rotated and the inclined shaft 43 driven by said impeller pulley 29 makes the so-called head-swinging motion causing the shaft 19 to move up and down to perform a washing operation. Upon completion of the washing operation, the contact S₂ is switched to the *b* side as shown under "Drain" in FIG. 3 and the current flows through the drain pump 76 to actuate the same for draining operation. During this period, the contact of a switch S₄ is held open and accordingly the vertically movable shaft 19 is held stationary. The following rinsing operation is conducted in the same way as the washing operation but in this case, pure hot water or cold water only is used since the washing solution has already been drained.

When the draining operation is reached after conducting the draining operation and rinsing operation repeatedly, the contact of the switch S₂ is moved to the position *b* to actuate the drain pump 76; the contact of the switch S₃ is brought into a closed position and the contact of the switch S₄ is brought into a closed position on the *b* side to rotate the driving motor in a direction opposite to that in the case of the washing operation, so that the drive of the driving motor is transmitted to the pulley 24 and pulley 30 to drive the same. Thus, the drum 13 is rotated at a high speed and centrifugal dehydration of the washings is effected. In the circuit shown in FIG. 2, reference numeral 86 designates a condenser for operating the motor 20.

What is claimed is:

1. A washing machine comprising a casing, a lid provided at the top end of the casing and having a washing inlet-outlet opening formed in the center thereof, a water tank disposed in said casing, a drum rotatably disposed in said water tank and serving both as a washing drum and as a dehydration drum and an agitator mounted in the center of said drum, said agitator being composed

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of a body mounted on a vertically movable shaft operatively connected to a driving mechanism exterior of said water tank and having the diameter reduced stepwise downwardly and a downwardly flared elastic impeller located below said body and having the peripheral edge thereof shaped in noncircular configuration.

2. A washing machine as defined in claim 1, wherein said driving mechanism for operating said agitator and said drum is provided within said casing at a location below said water tank and operated by a driving motor through two clutches mounted on the driving shaft of said motor and adapted to transmit the drive to the motor selectively depending upon the rotating direction of said motor and and impeller pulley for washing operation and an impeller pulley for dehydrating operation which are operatively connected with said clutches respectively by a belt, said impeller pulley for washing operation having an inclined shaft, a T-shaped metal and a piston-like link operatively associated therewith in the order mentioned, said T-shaped metal being rotatably fitted on said inclined shaft, said piston-like link being rotatably slidably fitted in the leg portion of said T-shaped metal and operatively connected with said vertically movable shaft through a link mechanism, and said impeller pulley for dehydrating operation having fixedly mounted thereon a hollow shaft through which said vertically movable shaft extends and through which the rotational drive is transmitted to said drum.

3. A washing machine as defined in claim 1, wherein said drum has an inwardly extending flange provided at the top end thereof and said flange is overlapped by a downwardly flared skirt of an annular splashboard fitted to the washing inlet-outlet opening of said lid in opposed relation to said flange.

4. A washing machine as defined in claim 2, wherein pulleys each having a flanged bushing fitted in the central hole thereof and having a tapered boss are rotatably mounted on the opposite ends of the driving shaft of said motor and each of said clutches comprising a clutch boss fixed to the end of said driving shaft, a clutch spring fitted on the tapered boss of said pulley and said clutch boss in such a manner that said clutch spring and said clutch boss are engaged with or disengaged from each other depending upon the rotating direction of the motor, and a cover fixed on said pulley, said clutch boss resting on the tapered boss of said pulley in contact with the flange of said flanged metal of the pulley.

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U.S. Cl. X.R.

68—131