Dec. 1, 1959 A. BERGER 2,915,167

MOTOR DRIVEN CONVEYOR ROLLER

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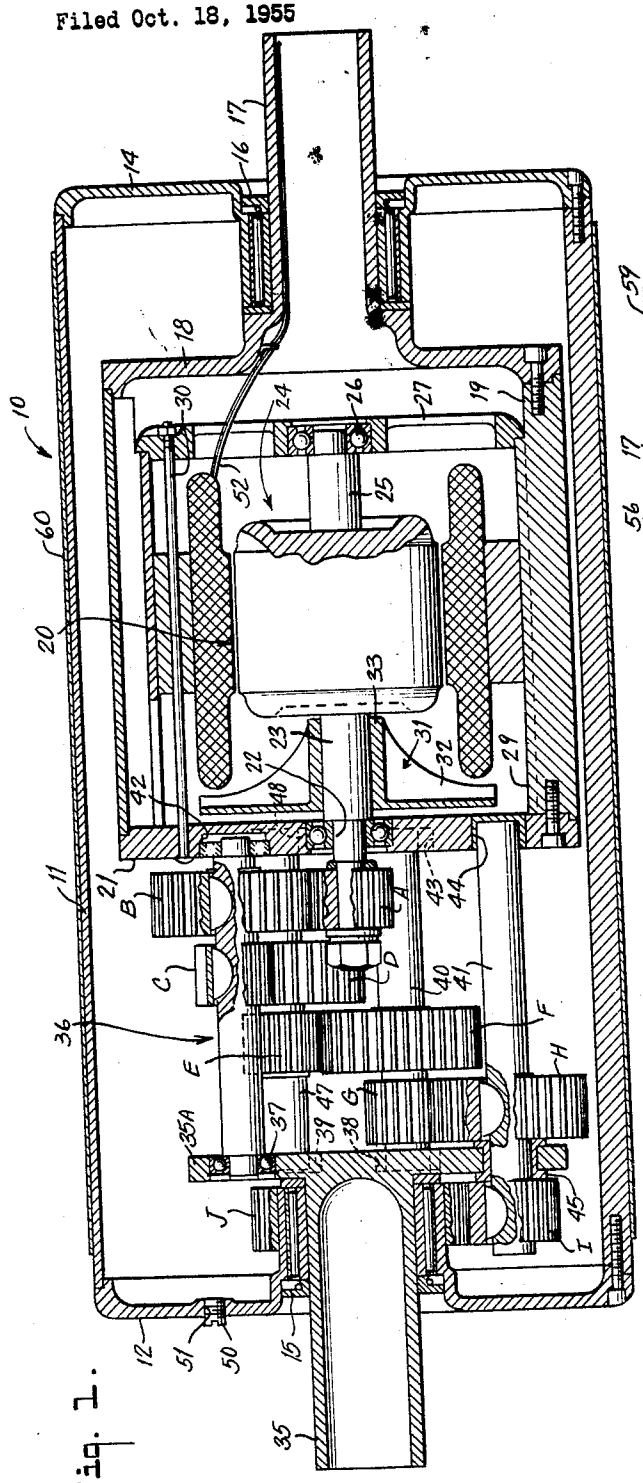


Fig. 1.

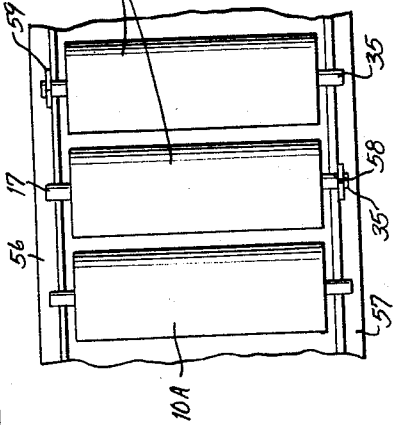


Fig. 3.

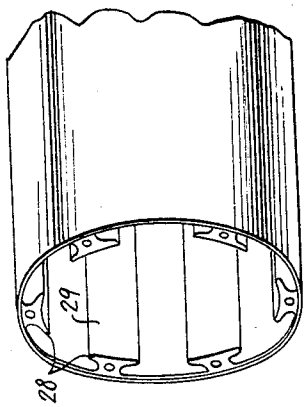


Fig. 2.

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Fig. 4.

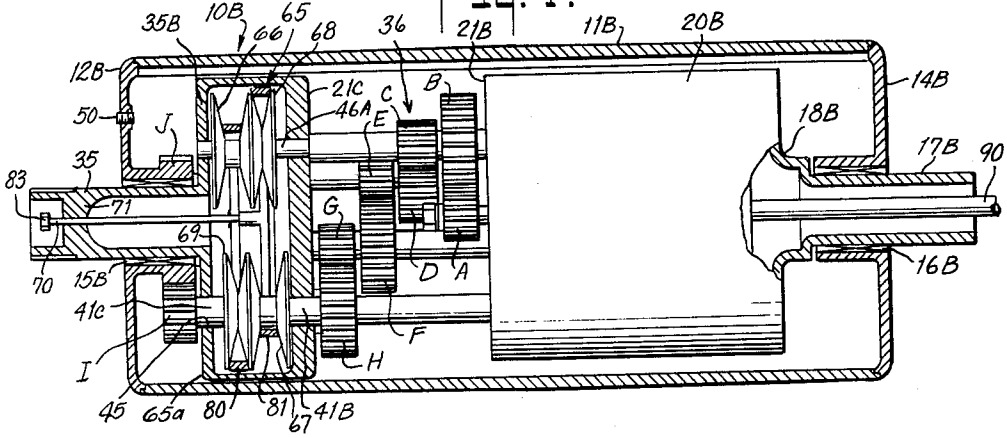


Fig. 5.

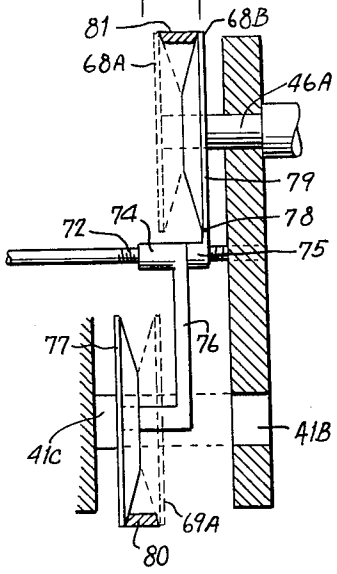
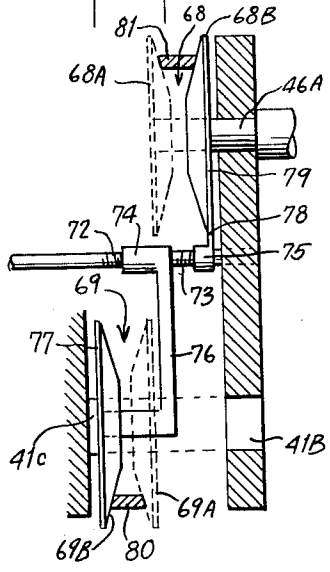


Fig. 6.



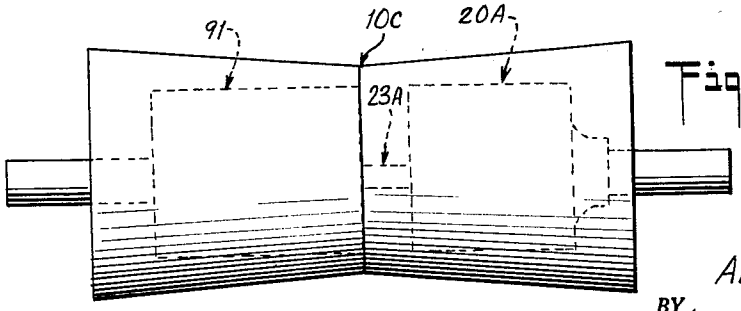


Fig. 7.

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MOTOR DRIVEN CONVEYOR ROLLER

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Application October 18, 1955, Serial No. 541,227

4 Claims. (Cl. 198—127)

This invention relates to conveyor rollers of the type in which the roller is driven by an individual motor and more particularly to a roller in which the motor is enclosed within the roller.

In the past there have been many examples of motor driven conveyor rollers and in some instances the motor has been enclosed within the roller. However in these instances the drive has been directly taken from the rotor of the motor without any reduction, thus the roller rotates at the r.p.m. of the motor. In most instances this direct drive has been due to the limitations of the roller. It is also to be noted that in the past the various motor driven rollers are provided with standard type bearings which require lubrication from an external source.

It is an object of this invention to provide a conveyor roller with the driving motor enclosed within said roller and in which the rotor of the motor is connected to a gear train, the gear train in turn being connected to the roller housing to drive the roller at a reduced r.p.m.

It is a further object of this invention to provide a conveyor roller in which the driving motor is enclosed within said roller and in which the rotor of the motor is connected to a gear train, the gear train in turn being connected to the roller housing to drive the roller at a reduced r.p.m. and in which all moving parts within said roller except the motor are immersed in a lubricating fluid and in which the lubricating fluid is hermetically sealed within said roller.

It is a further object of this invention to provide a conveyor roller in which the driving motor is enclosed within said roller and in which the stator of the motor is attached to a stationary hollow shaft which provides one end of the supporting axis of the roller and in which the motor is provided with a fan to draw air through the hollow shaft and circulate around said motor to provide a cooling means for said motor.

A still further object of this invention is to provide a conveyor roller in which the driving motor is enclosed within said roller and in which all moving parts within said roller except the motor are immersed in a lubricating fluid and in which the lubricating fluid is hermetically sealed within said roller to also provide a coolant for said motor.

A still further object of this invention is to provide a conveyor roller in which the driving motor is mounted within said roller and in which the stator of said motor and the supporting axis of said roller are stationary and in which said roller is provided with a hermetically sealed lubricant.

Further objects of this invention may be apparent by reference to the accompanying detailed description and the drawings in which

Fig. 1 is a cross sectional view of the conveyor roller,

Fig. 2 is a partial perspective of the stator housing of the motor,

Fig. 3 is a partial plan view of the roller mounted in use,

Fig. 4 is a cross sectional view of a further embodiment of the conveyor roller,

Fig. 5 is a partial view of the vari-drive shown in Fig. 4 showing the maximum r.p.m. position,

Fig. 6 is a partial view of the vari-drive shown in Fig. 4 showing the minimum r.p.m. position, and

Fig. 7 is a schematic illustration of the conveyor roller showing a further embodiment.

Referring to the drawings and especially Fig. 1 there is illustrated a conveyor roller 10 which may be designed for any particular length and diameter as the particular application calls for. The roller 10 is comprised of a hollow roller body 11 necessarily a cylinder in form. The cylinder 11 is supported by two closed ends 12 and 14. The ends 12 and 14 are provided with a hub structure to support bearings 15 and 16 respectively mounted on the central axis of ends 12 and 14. A hollow shaft 17 of an external diameter to match the internal diameter of the bearing 16 is mounted through bearing 16 and is provided with a flanged end 18. The flanged end 18 is in turn connected to a stator housing 19 of a motor 20. The stator housing 19 at its opposite end is connected to a plate 21. The plate 21 is provided with a central aperture 22 to support a driving shaft 23 of the motor 20. The driving shaft 23 is in turn connected to the rotor 24 of the motor 20. The opposite end of the rotor is provided with a shaft 25 which is supported in a bearing 26, the bearing 26 in turn being mounted in a plate 27. The plate 27 is supported within the stator housing and affixed to the ends 28 of the spacer ribs 29 (Fig. 2). In addition there are a plurality of bolts 30 which are passed through plate 21, through the spacer ribs 29 and through plate 27 to retain these elements in a tight fitting relationship. In addition to the rotor 24 there is a fan 31 which consists of a plurality of blades 32 mounted on a hub 33 with the hub 33 keyed to shaft 23 of the rotor. With plate 21 supported in a stationary position within roller 10 and with a stationary hollow shaft 35 at the opposite end of the roller 10, a transmission or gear train 36 is supported to provide a proper reduced drive from the rotor shaft 23 to the roller housing 11. The hollow shaft 35 is fitted through the bearing 15 similar to shaft 17 being fitted through bearing 16. Shaft 35 is provided with a flanged end 35A. The flanged end 35A is provided with sockets 37, 38 and 39 and in addition an aperture 45 into which bearings are mounted to support shafts 40, 41, 46 and 47. The shafts 40, 41, 46 and 47 at their opposite end are inserted in bearings, the bearings in turn being mounted in sockets 42, 43, 44 and 48, these sockets 42, 43, 44 and 48 being in the end plate 21. It is apparent that all of this structure remains in a stationary position with respect to shafts 35 and 17 except for the fact that shafts 40, 41, 46 and 47 will rotate in the position as illustrated. The gear train is supported on these various shafts and the gear train may be followed by reference to Fig. 1 in which the first gear A is mounted on the extension shaft 23 of the rotor and keyed to this shaft. Gear A is meshed with a gear B, gear B being keyed to shaft 46 of the gear train. Thus gear B will drive shaft 46. A third gear C is also keyed to shaft 46. Gear C is in turn meshed with a gear D, gear D being keyed to shaft 47 to drive shaft 47. Shaft 47 is also provided with a gear E keyed to shaft 47 and driven by shaft 47. Gear E is in turned meshed with a gear F, gear F being keyed to shaft 40 to drive shaft 40. Shaft 40 is also provided with a gear G keyed thereto and driven by shaft 40. Gear G is in turn meshed with a gear H that is keyed to shaft 41 to drive shaft 41. Shaft 41 extends through the bearing mounted in aperture 45 of the plate 35A and is

provided with a gear I keyed thereto and driven by shaft 41. Gear I is in turn meshed with a ring gear J which may be an integral part of the end portion 12 of the roller or may be sweated onto the portion 12 to become integral therewith. Ring gear J will of course transmit its rotary drive to the end portion 12 and the roller affixed thereto. It is apparent that this transmission or gear train will reduce the r.p.m. of the rotor supplied to gear A to a smaller r.p.m. on gear B, gear B and shaft 46 driving a smaller gear C so that gear C will provide a reduced r.p.m. on the larger gear D, gear D and shaft 47 driving the smaller gear E, gear E in turn providing a reduced r.p.m. on gear F, gear F driving shaft 40 and the smaller gear G, gear G providing a reduced r.p.m. on the gear H, gear H driving shaft 41 and the smaller gear I, gear I providing a reduced r.p.m. on the ring gear J. Thus the r.p.m. on the ring gear J is considerably reduced from the original r.p.m. of shaft 23 and gear A. It is to be noted that the bearings 15 and 16 are so constructed that they may be inserted between the hub structure of end plates 12 and 14 and the external bearing circumference of shafts 17 and 35 to not only provide a practically frictionless bearing but in addition provide a fluid tight seal between the elements so the the internal portion of the roller is hermetically sealed. It is also apparent that the flange 18 of the hollow shaft 17 is tightly affixed and sealed to the stator housing 19 and the opposite end of the stator housing 19 is affixed and tightly sealed to the end plate 21. The end plate 21 although provided with a bearing about the central aperture 22 is also provided with a seal to insure a tight hermetic seal around the complete enclosure of the motor. Thus the motor 20 although operating within the roller 10 is hermetically sealed from the fluid reservoir within the roller 10. The internal spacer within roller 10 is filled with a lubricating fluid such as oil and in order that the fluid may be easily charged into said roller, a plug 50 is threadably inserted in an aperture 51 in the end wall 12. Plug 50 must also insure a tight fluid seal. It is apparent that with the internal reservoir of oil in roller 10 that the moving parts associated with and starting with the shaft 23 of the rotor and all gears of the transmission as well as bearings will be completely lubricated and since the fluid is hermetically sealed within the roller, the lubricating fluid will last indefinitely. Whether the fluid retains its complete volume or is dissipated or leaks to a small degree is immaterial as the quantity of lubricating fuel insures sufficient lubrication throughout the life of the roller. Motor 20 is connected by means of a cable 52 to an external source (not shown). Since the stator of the motor is stationary, cable 52 remains stationary and passes out through the hollow shaft 17. It is to be noted that shaft 17 is fairly large to provide a substantial hollow internal diameter to permit the fan 31 to draw cool air in through this hollow shaft to permit cooling the motor 20. The air drawn through motor 20 is in turn expelled around the circumference of fan 31 by a centrifugal action forcing the air back between the spacer ribs 29 of the stator housing 19, the air flowing down along the surface of the end flange 18 and out through the hollow shaft 17. In a further embodiment of this invention it may be advantageous to insert a hollow tube 54 shown in dotted lines in Fig. 1, with the hollow tube 54 the cool air would pass through tube 54 to motor 20 while the hot air expelled from motor 20 would be forced out around the outer periphery of tube 54 as indicated by the small arrows. It is further apparent that the fluid filling the internal reservoir of the roller 10 will also provide a coolant effect upon the stator housing 19 to assist in cooling motor 20. The conduction of heat from motor 20 to the fluid in roller 10 will be easily

dispersed (air cooled) and in turn cooled by the complete external periphery of the roller 10.

Referring to Fig. 2 there is illustrated the general construction of the stator housing 19 showing the construction of the spacer ribs 29 which is more or less general practice in the construction of a motor, the rotor 24 being mounted within the internal periphery surrounded by the spacer ribs 29.

Referring to Fig. 3 there is illustrated one form of mounting for the type of roller illustrated in Fig. 1 in which a pair of structural elements 56 and 57 (such as an angle, a channel or equivalent) are spaced in parallel relationship as the supporting structure. Structural elements 56 and 57 are provided with a plurality of equally spaced apertures or U shaped slots 58 so that the rollers 10 may be positioned between the elements 56 and 57 with their hollow shafts 17 and 35 mounted in the aperture or U shaped slot 58. Since shafts 17 and 35 are stationary they may be retained in elements 56 and 57 by threading the end of the shaft and affixing a nut 59 thereto or shaft 35 may be keyed to the flange of the channel or shaft 17 or 35 may be welded or provided with a snap ring and groove or may standard form to provide a good fixed relationship with elements 56 and 57. It is to be noted in Fig. 3 that roller 10 may be mounted in any sequence along the conveyor. For example, as shown in Fig. 3 rollers 10 may be placed in parallel relationship with a predetermined spacing between rollers or roller 10 may have an idler roller 10A positioned between each driving roller 10. Or a plurality of idler rollers 10A may be inserted between each driving roller 10 depending upon the particular problems or driving need of the conveyor.

It is to be noted that the roller 10 may be formed as an aluminum extruded cylinder or may be formed as a hollow metal shell forged or machined according to the purpose of the roller. It is also to be noted that the roller 10 may be provided with an additional coated surface 60 or with a cover element 60 to provide a better adhesion or gripping between the roller 10 and the material or articles to be moved by the roller 10.

It is to be noted referring to Fig. 1 that the motor 20 is connected to a gear transmission 36 to produce a reduced r.p.m. drive to the shell structure of the roller. However since a fluid drive has become a standard equivalent or replacement for the direct gear ratio, it is to be understood that a fluid transmission may be utilized in place of the direct gear transmission 36 without departing from the spirit of this invention. In fact a fluid transmission may produce better results in some instances, that is, the r.p.m. of the roller may vary according to the load imposed upon the roller, as the fluid drive permits a considerable degree of slippage without harmful effect upon the motor. With a fluid drive transmission, the fluid content of the roller would necessarily be the same hydraulic fluid provided for the fluid drive so that the roller housing could be utilized as the housing for the fluid drive without increasing the general weight of the roller. The fluid drive may be in the form of any of the presently known fluid drives.

Referring to Fig. 4 there is illustrated a further embodiment of a conveyor roller. It this embodiment the conveyor roller 10B may likewise be designed for any particular length and diameter according to its application. The roller 10B is comprised of a hollow roller body 11B necessarily a cylinder in form. The cylinder 11B is similar to the cylinder 11 of Fig. 1 and is similarly supported by two closed ends 12B and 14B and the ends 12B and 14B are provided with a hub structure to support bearings 15B and 16B respectively. A hollow shaft 17B is mounted through bearing 16 and provided with a flanged end 18B, the flanged end 18B in turn supporting a motor 20B. The motor 20B at its opposite end is connected to a plate 21B. The plate 21B in turn supports the driving shaft of the motor

and a gear transmission 36 similar to that shown in Fig. 1. The gear transmission at its opposite end is supported by a plate 21C and the drive shaft 41B from the transmission 36 extends through plate 21C. A varidrive 65 is mounted between plate 21C and the flanged end 35B of the hollow shaft 35, the hollow shaft 35 extending through the end 12B of the roller similar to that illustrated in Fig. 1. In view of the fact that the internal area of the roller body 11B is provided with a lubricating fluid for the transmission, it is necessary to enclose the varidrive 65. Therefore, a casing 65A is provided, which spans the peripheral area of the varidrive and is affixed in a sealed relation to the periphery of plate 21C and the periphery of the flanged end 35B, thus retaining the varidrive separated from the lubricating fluid. The vari-drive 65 is comprised of shaft 46A and the extension of shaft 41B as a stub shaft extending into the vari-drive and a stub shaft 41C extending into the vari-drive and in alignment with shaft 41B and supported on these shafts are a V pulley 66 keyed to and supported on shaft 46A and a V pulley 67 keyed to and supported on shaft 41B. It is to be noted that these pulleys are spaced in parallel relationship. A second pair of adjustable V pulleys 68 and 69 are provided in which pulley 68 is keyed to and mounted on shaft 46A and is mounted in alignment with pulley 67 while pulley 69 is keyed to and mounted on shaft 41C and is mounted in alignment with pulley 66. It is to be noted that pulley 68 is provided in two halves. Referring to Figs. 5 and 6 it is to be noted that the half 68A is stationary while the half 68B is slideable longitudinally on shaft 46A. Similarly pulley 69 is comprised of two halves with the half 69A stationary and the other half 69B slideable longitudinally on shaft 41C. There is also provided a speed adjustment shaft 70 mounted through the hollow shaft 35 and supported by shaft 35 in a bearing 71. One end of shaft 70 extends to an easily accessible position adjacent to the exterior edge of the hollow shaft 35, while the opposite end of shaft 70 is provided with two threaded sections, a left handed thread 72 on one section and a right handed thread 73 on the other section. An internally threaded hub 74 is mounted on the thread 72 and an internally threaded hub 75 is mounted on the thread 73. The hub 74 is provided with an extended arm 76 which is connected to a ring 77, the ring 77 enclosing the largest diameter periphery of the half 69B of the V pulley 69. Similarly the hub 75 is provided with an extended arm 78 that is in turn connected to a ring 79, ring 79 enclosing the largest diameter periphery of the half 68B of the V pulley 68. The rings 77 and 79 are formed to permit free rotation of the V pulleys but at the same time provide the means to slideably shift the particular half of the pulley that is slideable longitudinally to thus adjust the size of the V area of the pulley. This adjustment of the V area changes the position at which either the belt 80 or 81 will be in a gripping relationship with the V pulley. In other words the variable r.p.m. produced through the vari-drive is attained by adjusting the V area of pulleys 68 and 69 which in turn adjust the position of the belts 80 and 81 within the V area. It is apparent that this adjustment is made by turning the end of shaft 70. The manner of gripping shaft 70 may be by providing a particularly shaped end such as a hexagonal 83 so that a socket wrench may be fitted to the end 83. Thus by turning shaft 70 in a clockwise direction, the hubs 74 and 75 will move away from each other due to the left hand and right hand threads until they have reached a maximum open position and in this position the vari-drive will produce the minimum r.p.m. Likewise by turning shaft 70 in a counterclockwise direction hubs 74 and 75 will be moved toward each other until they abut and in this position will produce the maximum r.p.m. Of course it is apparent from Fig. 4 that the r.p.m drive from the vari-drive will be through shaft 41C to the same gear I as illustrated in Fig. 1 and the gear I will be in mesh with the same ring gear J as shown in Fig. 1 to thus translate the drive to the roller 10B. In this embodiment the driving motor 20B is shown as a fluid or mechanical motor and in addition the connecting tube or rod 90 extending from motor 20B through the hollow shaft 17B provides the necessary connection with the motor 20B, that is, in the event motor 20B is a fluid motor, 90 will be a fluid intake or pressure inlet tube while the area between tube 90 and the internal periphery of shaft 17B would provide the outlet for the fluid motor. Or in the event motor 20B is a mechanical motor, the element 90 may be considered as a rod to permit winding motor 20B until it is fully wound and ready for operation. Although this embodiment includes the use of a fluid or mechanical motor 20B, it is apparent that the same electric motor 20 of the Fig. 1 may be utilized.

A further embodiment of this invention is illustrated in Fig. 7 in which there is shown a roller 10C having a different external configuration. In this particular instance it is generally V shaped rather than a symmetrical cylinder as illustrated in Fig. 1. It is also to be noted in this particular embodiment that the motor drive 20A which may be the electric motor 20 of Fig. 1 or the fluid or mechanical motor 20B of Fig. 4 without departing from the spirit of this invention. In this embodiment the motor 20A is connected by the driving shaft 23A to a fluid drive 91, the fluid drive 91 in turn being connected in the same manner in which the drive is connected in Figs. 1 and 4, the only difference being in the construction of the transmission 91 which is a standard fluid drive transmission.

Although there is shown an electric motor 20 as the driving element for a conveyor roller 10, it is apparent that a fluid motor or mechanical motor such as a spring wound motor could be utilized without departing from the spirit of this invention. Although the conveyor roller is illustrated as a perfectly symmetrical cylinder, the configuration of the roller may be varied even to the extent of forming a V shaped element to drive a V belt without departing from the spirit of this invention. As already stated above the particular means of varying the gear reduction may be changed such as introducing a vari-drive without departing from the spirit of this invention and the particular use of the conveyor rollers whether used singly, in pairs or mounted in spaced relationship with idler rollers between may be varied without departing from the spirit of this invention. Changes in material may be made, that is, to produce a better thermal conductivity or variation in external structure without departing from the spirit of this invention and changes in design or mechanical ribbing for strength may be provided and any other changes necessary in the development of this roller without departing from the spirit of this invention and this invention shall be limited only by the appended claims.

What is claimed is:

1. A motor driven conveyor roller which includes a stationary central structure and a rotatable hollow shell mounted on and rotatable about said central structure, said central structure including a driving motor and a transmission mounted between two stationary hollow shafts one hollow shaft providing the means to supply energy to said motor, said driving motor including a rotor, said rotor connected to said transmission to induce a drive through said transmission and produce a reduced r.p.m. drive to the roller housing and in which said motor is enclosed within a stator housing mounted within said roller and in which said stator housing encloses said motor to provide a fluid tight seal within said roller and in which the internal area of said stator housing communicates with the hollow center of the end supporting shaft.

2. In a device according to claim 1 in which said transmission includes a vari-drive and is connected to a control rod extending through one of said hollow shafts to produce a drive of said roller at any of the r.p.m. speeds within a predetermined range from minimum to maximum.

3. In a device according to claim 1, in which an impeller is mounted on the rotor of said motor to induce an air flow through said hollow shaft into said motor for cooling said motor.

4. In a device according to claim 1, in which an impeller is mounted on the rotor of said motor to induce an air flow and in which a tube is inserted through the

hollow shaft of said roller to divide said hollow shaft into an intake duct and an exhaust duct.

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