April 18, 1961 H. A. SCHURICHT ET AL 2,980,121

DEVICE FOR STORING, TREATING AND TRANSFERRING PARTS

Filed March 4, 1957 4 Sheets-Sheet 1

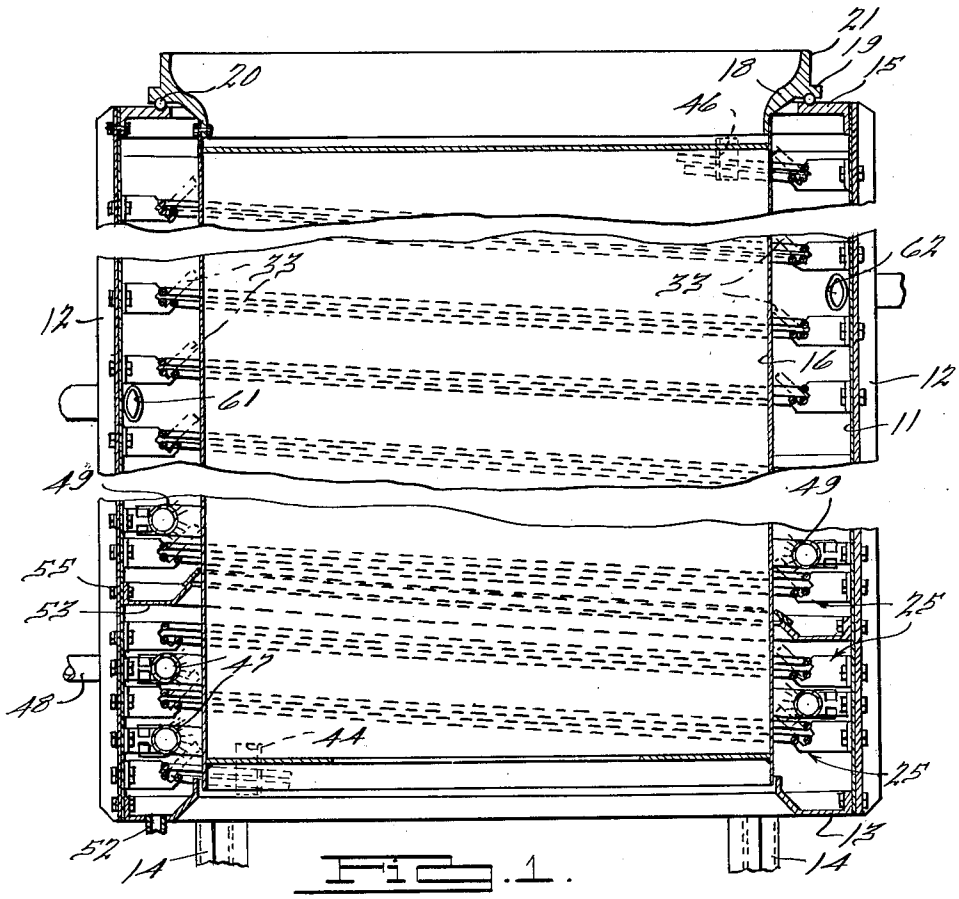

Fig. 1.

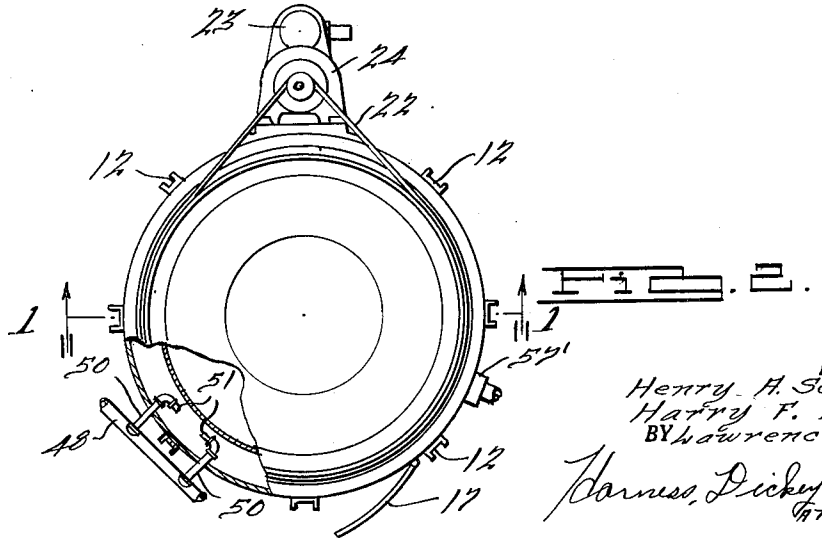

Fig. 2.

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DEVICE FOR STORING, TREATING AND TRANSFERRING PARTS

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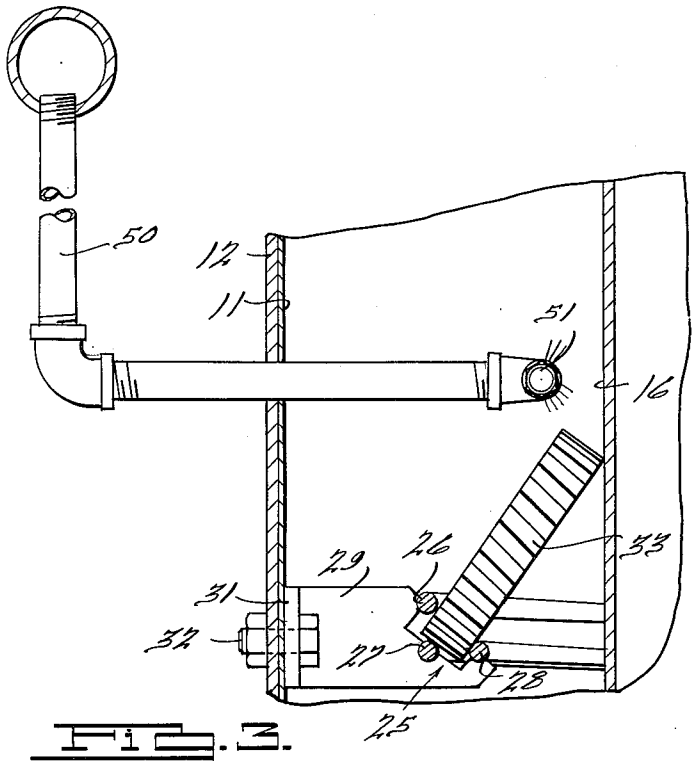

Fig. 3.

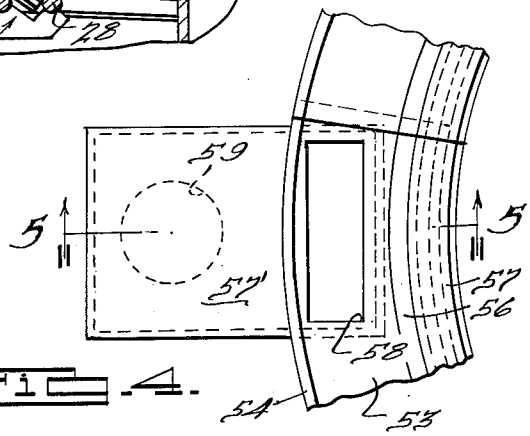

Fig. 4.

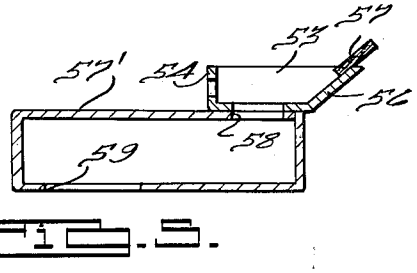

Fig. 5.

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DEVICE FOR STORING, TREATING AND TRANSFERRING PARTS

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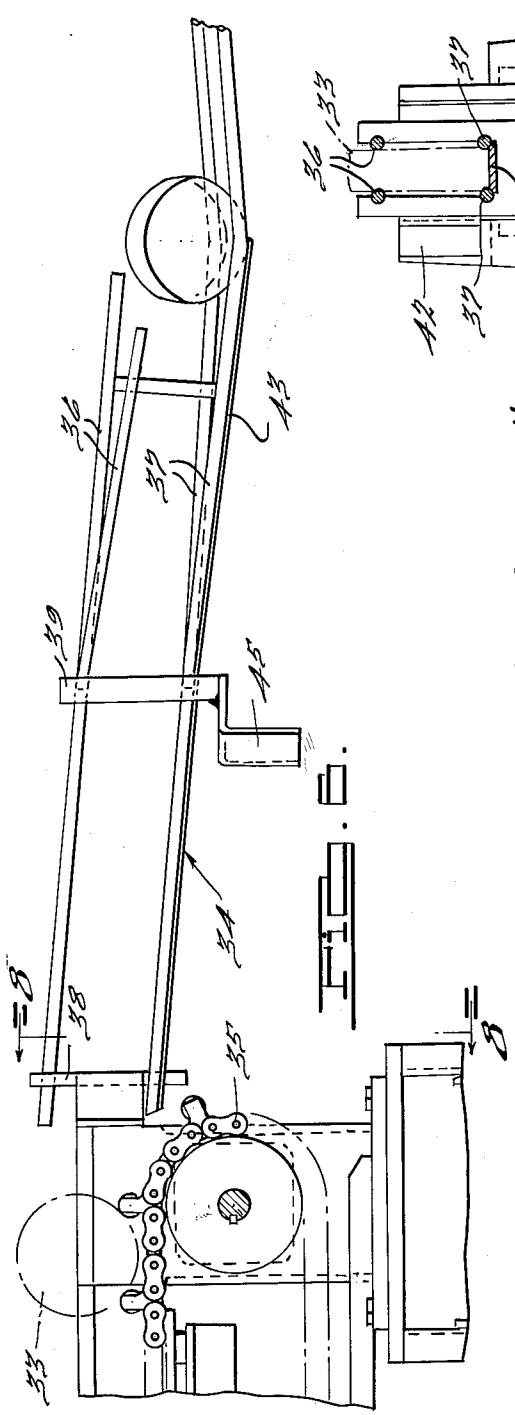

FIG. 6.

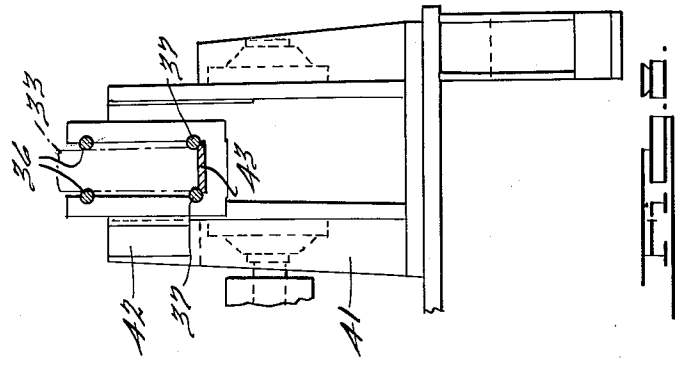

FIG. 5.

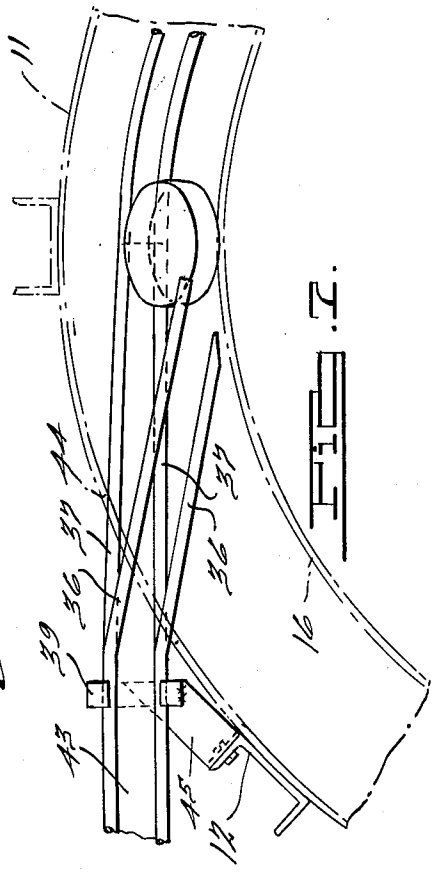

FIG. 7.

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DEVICE FOR STORING, TREATING AND TRANSFERRING PARTS

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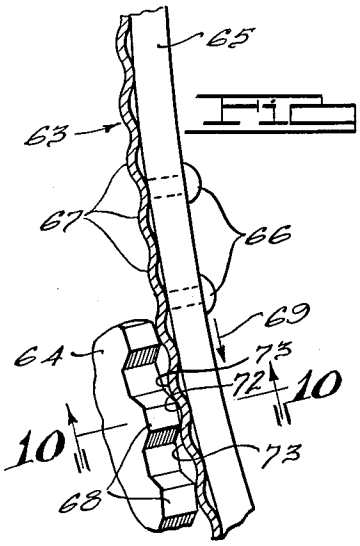

Fig. 9.

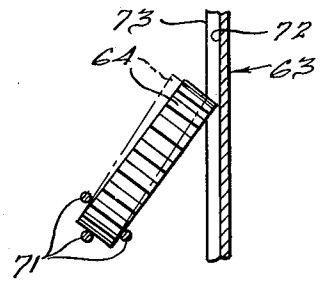

Fig. 10.

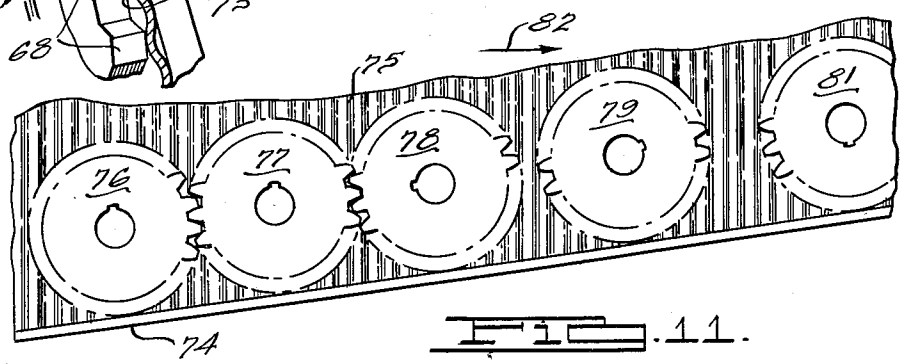

Fig. 11.

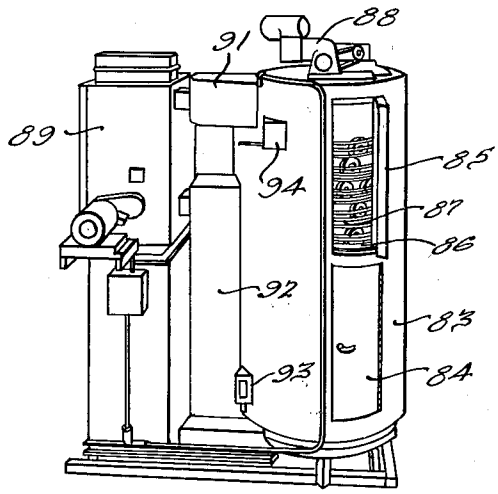

Fig. 12.

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United States Patent Office 2,980,121 Patented Apr. 18, 1961

2,980,121

DEVICE FOR STORING, TREATING AND TRANSFERRING PARTS

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Filed Mar. 4, 1957, Ser. No. 643,694

14 Claims. (Cl. 134—83)

This invention relates to storage, handling and treating devices, and more particularly to arrangements for transferring parts between adjacent stations in a factory production line. This application is a continuation-in-part of application Serial No. 515,662, filed June 15, 1955, by the present applicants and now abandoned.

The present day trend toward automation and other manufacturing processes in which parts are transmitted along a line of machine tools has increased the desirability for mechanisms which can perform storage, transferring and treating functions between these machine tools with a minimum of attention. Particular problems arise in the case of parts such as gears, which in their semi-finished state are especially liable to damage by impact with adjacent gears or with the handling machines.

It is an object of the present invention to provide a novel and improved device which is capable of transferring parts between adjacent stations at different levels in a production line, and in which the parts may be temporarily gathered and stored, when intermittent delivery of parts is required, and fed to the next machine as needed.

It is another object to provide a novel transferring and storing device of this character, which provides means for elevating the parts between stations, develops considerable discharge pressures on the parts being transferred, and at the same time eliminates the danger of damage to the parts due to impact with adjacent parts or with the device.

It is a further object to provide a novel and improved mechanism of this nature, in which the alternation between transfer and storage functions is automatic, but wherein the speed of delivery of parts may be manually or otherwise controlled.

It is also an object to provide a novel and improved device of the above character, in which other treatments such as washing, rinsing, and/or drying of the parts may be effected at the same time that the storage and transfer functions are being performed, and in which the nature of the transfer motion materially increases the efficacy of these treatments.

It is another object to provide a novel arrangement of this nature which occupies a minimum of space, can be cheaply and easily fabricated using standard materials, has elements which are interchangeable to accommodate various sizes of work, and can be used for either raising or lowering the parts.

It is a further object, in one form of the invention, to provide an improved storage and transfer mechanism of this character which is especially adapted for transporting spur gears and in which interlocking of the teeth of such gears during the storage phase is reversed and the gears are necessarily unlocked upon resumption of the discharge phase.

Other objects, features and advantages of the present invention will become apparent from the subsequent description, taken in conjunction with the accompanying drawings.

In the drawings:

Figure 1 is a cross-sectional view in elevation showing a preferred embodiment of the invention which incorporates washing, rinsing and drying operations together with storage and transfer functions;

Figure 2 is a top plan view of a device similar to that shown in Figure 1, parts being broken away for clarity, showing the motor drive, the rinse drain connection, and modified means for introducing rinse and wash water;

Figure 3 is a fragmentary cross-sectional view in elevation showing the cooperation of the track with the parts being transferred and the disposition of the wash and rinse nozzles shown in Figure 2 with respect to the gears;

Figure 4 is a fragmentary top view showing the construction of the shield between the wash and rinse sections and its connection to the drain;

Figure 5 is a fragmentary cross-sectional view in elevation taken along the line 5—5 of Figure 4 and showing the configuration of the shield and the drain connection;

Figure 6 is a fragmentary elevational view showing an entrance guide track for the parts;

Figure 7 is a top plan view of the track shown in Figure 6, indicating the manner in which the gears are led into a position leaning against the rotating drum;

Figure 8 is a cross-sectional view taken along the line 8—8 of Figure 6 showing the supporting means for the entrance track;

Figure 9 is a fragmentary plan cross-sectional view of a modified form of the invention especially aadpted for use in transporting spur gears;

Figure 10 is a fragmentary cross-sectional view in elevation taken along the line 10—10 of Figure 9 and showing the manner in which the corrugated drum moves the teeth of adjacent spur gears out of register with each other;

Figure 11 is a schematic elevational view showing the manner in which spur gears which have been stored in the device are separated from each other when their movement is resumed; and

Figure 12 is a perspective view of another embodiment of the invention which forms part of an apparatus for applying heat to metal parts.

In general terms, the invention comprises a cylindrical shell adapted to be stationarily mounted on a vertical axis between the discharge end of a machine tool and the feed end of a succeeding machine tool in a production line. A helical track is secured to the inside surface of this shell, and a cylindrical drum is supported concentrically within the shell and in predetermined spaced relation with the track. The elements are so arranged that round parts such as semi-finished gears riding on the track may lean against the drum, the exterior surface of which preferably has a smooth texture and a hardened finish. Means are provided for rotating the drum at a predetermined speed, and this rotation causes the gears which lean against the drum to travel along the track, all gears traveling at the same speed. The gears may thus be transported from an entrance to the shell, ordinarily at the lower end thereof, to an exit at the upper end. Should the machine to which the parts are being fed be temporarily shut down, the movement of the parts will be halted, and the drum will continue to rotate, the smooth-textured surface thereof sliding past the gears which lean against it with a relatively light force. A continuous discharge pressure is thus exerted on the parts, and succeeding parts will gather in succession along the track. Means may also be provided in the form of helical tubes or nozzles between succeeding levels of the tracks for washing and/or rinsing the parts, and drying connections may also be provided.

Referring more particularly to the embodiments illustrated in Figures 1–8 of the drawings, the device comprises a shell 11 of cylindrical shape which may be

provided with a plurality of reinforcing members 12. A flange 13 is secured to the lower end of shell 11 and extends inwardly therefrom, this flange having attached thereto posts 14 or other means for supporting shell 11 on a vertical axis. The upper end of shell 11 is provided with an inwardly directed flange 15, which serves as a bearing support for a drum 16 suspended within shell 11. In particular, the diameter of drum 16 is substantially less than that of shell 11, the space between the shell and drum being sufficient to accommodate the transfer and treating parts described below. One or more hinged doors 17 may be provided in shell 11 for access into the space between the shell and drum. The upper end of drum 16 is provided with a member 18 which has a portion serving as a race 19 for anti-friction bearings 20. These bearings are disposed between race 19 and a race portion of flange 15 so that drum 16 is suspended within the shell. A belt pulley surface 21 is also provided on member 18 for cooperation with a belt 22 connecting the drum with a driving motor 23. The driving motor is preferably provided with variable speed transmission 24 so that the rotational speed of the drum may be manually or otherwise controlled.

Disposed within the space between drum 16 and shell 11 is a track generally indicated at 25. This track is shown in enlarged scale in Figure 3, and comprises three rods 26, 27 and 28 which are bent or otherwise formed into a continuous helical track encircling drum 16 from the lower to the upper end thereof. The particular shape and disposition of the parts which make up track 25 can of course be varied within the principles of the invention to accommodate various types of gears and similar parts of different sizes. The rods which make up track 25 are secured to shell 11 by means of a plurality of spaced brackets 29. These brackets have base portions 31 secured to shell 11 by bolts 32 and extend inwardly from the shell. The inner ends of brackets 29 are notched and otherwise shaped to hold rods 26, 27 and 28, these rods being secured to the brackets by welding or other means.

It will be noted that in this particular embodiment, rods 26, 27 and 28 are so arranged as to support a semi-finished gear 33 on its bottom and sides in such a manner that the gear may loosely lean against the exterior surface of drum 16. The particular angle at which gear 33 leans against drum 16 may be varied in accordance with the desired characteristics of the device. Preferably, the exterior surface of drum 16 is smoothly finished and hardened, and the magnitude of the frictional forces existing between gear 33 and drum 16 will depend upon the weight and size of the gear as well as its angle of inclination. The angle of inclination of the gears should be so chosen as to permit the machine to properly perform its transfer and storage functions, exerting an optimum amount of frictional driving force on the gear while at the same time maintaining this force low enough to permit slipping. It should be observed that it is unnecessary to allow for slippage of the gears or other parts with respect to track 25, since a rolling motion of the parts is desired with respect to the track. It should also be noted that brackets 29 may be easily replaced by unscrewing bolts 32, so that alternate tracks may be installed either closer or further away from drum 16.

Means are provided for guiding the gears or other parts to and from the storage and transfer device in such a manner that the parts lean against the drum in position to be transferred. As shown in Figures 6, 7 and 8, an entrance track generally indicated at 34 is provided between the discharge end of the preceding machine tool and the handling device. For purposes of illustration, an endless sprocket chain transfer mechanism 35 is indicated as carrying parts 33 from the preceding machine tool onto entrance track 34. The entrance track comprises a pair of upper rods 36 and a pair of lower rods 37 supported by brackets 38 and 39.

Bracket 38 may be secured to a standard 41 on the sprocket conveyor by means of a clip 42. A flat bar 43 is also secured between brackets 38 and 39 just below rods 37 and extends toward an entrance 44 in shell 11, shown in dotted lines in Figure 1. Both upper rods 36 and lower rods 37 are twisted into a skew shape as shown in Figures 6 and 7 so that as they pass through entrance 44 the parts guided thereby are tipped over into inclined position. As seen best in Figure 8, the gears or other parts 33 will be guided between rods 36 and 37 and supported by flat bar 43. Bracket 39 is disposed adjacent the bending points of rods 36 and 37 and may be supported by a clip 45 secured to a channel member 12. It will be understood of course that other means for guiding parts 33 into entrance 44 of the shell may be provided. An exit 46 in shell 11, shown in dotted lines at the upper end of Figure 1, may be provided with a track similar to track 34 which moves parts 33 from their inclined position to an upright position for feeding into the next machine.

Means may also be provided for washing, rinsing and/or drying the parts while they are disposed between shell 11 and drum 16. In one form, shown in Figure 1, the washing means comprises a helical tube 47 disposed between turns of a lower section of track 25, the tube having a plurality of jet or spray openings trained on the tops and undersides of passing gears or other parts. A supply pipe 48 is connected to tube 47 through shell 11. A similar tube 49 for rinse water is shown between turns of the track above tube 47. In the form shown in Figures 2 and 3, a plurality of pipes 50 lead through shell 11 and have nozzles 51 at the inner ends thereof, the nozzles having jets playing on the top and bottom of the gears. Figures 2 and 3 show in detail the manner in which nozzles 51 may be connected to the space between the shell and drum.

In order to prevent the rinse water from draining down into the washing section, a helical shield 53 is provided. The disposition of this shield is shown in Figure 1 and its constructional details in Figures 4 and 5. The shield, which extends around slightly more than 360°, has an outer base portion 54 attachable to shell 11 by bolts 55, and an inclined portion 56 which carries a sealing member 57 engageable with the exterior surface of drum 16. The shield is disposed in helical fashion between the washing and rinsing sections of the track so that rinse water will be caught by the shield. The lower end of the shield is provided with a drain compartment 57' connected to the main shield surface by an opening 58. The drain compartment is secured to the outer surface of shell 11 and has an opening 59 connectible to a drain pipe.

Means are also illustrated in Figure 1 for drying the parts in the upper section of the device. As shown, a pipe 61 capable of supplying warm air or other drying medium is connected to shell 11 at one side thereof, and an exit pipe 62 for the air is connected to the other side thereof. Warm air will thus be caused to flow through the annular space between the shell and drum, drying the parts which have been washed and rinsed.

In operation, the device will be started by turning on motor 23 and setting speed reduction gear 24 to the proper rotational speed of drum 16. Gears or other parts will be fed from entrance track 34 into entrance 44 of the machine and will ride on track 25. The parts will lean against the drum so that as the drum rotates the parts will travel up the track, driven by the frictional forces existing between the smooth-textured surface of the drum and the edge of the part which rests thereagainst. It has been found that successive parts, no matter how closely spaced, will ride upon track 25 in such a manner that there is no rubbing action between the parts as they move. Even if a part be engaged with an adjacent part while these parts are stationary, immediately upon rotation of the drum the parts will separate

slightly so that further movement will not cause any rubbing or other damage to the parts. In the case of gears, this description of the engaging action with respect to the embodiments of Figures 1–8 should be construed as including all types except spur gears, since the teeth of the latter may tend to interlock upon engagement. It should be observed however that the transfer and treating functions of the mechanism are not affected by this limitation and are applicable to all types of gears.

The gears will travel past the washing jets which will wash both sides of the gears in a thorough manner. It will be noted that since the gears travel by a rolling motion, all parts of the gears will be exposed to the jets during their travel. The gears will next pass upwardly to the rinsing section where they will be rinsed. Water issuing from the rinse jets will be collected by shield **55** and drained through compartment **57'**. After leaving the rinsing section, the gears will enter the drying section wherein warm air supplied by pipe **61** will dry the parts. After reaching exit **46** at the top of shell **11**, the gears will pass out of the annular space between the shell and drum and into the feed end of the next production machine.

Should the machine to which the gears are being fed be temporarily shut down, the gears at exit **46** will be stopped. Drum **16** will continue to rotate, the smooth-textured and hardened surface thereof sliding past the gears which lean thereagainst. It should be observed that the rubbing or other wearing action by drum **16** on gears **33** will be negligible, since the only forces exerting between these parts are those produced by the relatively small weight component of the inclined gears against the smooth-textured surface of the drum. There will be no movement at all of the gears with respect to track **25** while they are stopped. The gears may thus be held indefinitely while drum **16** continues to rotate, with minimum wear or other damage.

As additional gears are fed into entrance **44** of the machine, they will roll up track **25** and will come to rest when they engage preceding gears which are stopped. Due to the relatively slow motion produced in the gears by the rotating drum, little or no impact will be produced when a moving gear comes into engagement with a preceding stationary gear. It has been found that the engaging forces created between a moving gear and a stationary gear are so slight as to minimize the possibility of any damage occurring to the gear teeth even when in finished condition. It should also be noted that due to the geometry of the helical track, a relatively large number of parts may be accumulated in the annular space between the shell and drum, so that the device may be used for storing purposes. The washing, rinsing and drying operations will of course not affect the storage ability of the device in any way. When the machine to which the parts are being fed is again started, parts will automatically be fed from the device. It should be observed that a continuous feeding force is exerted on the parts while they are being stored, this force increasing with the number of parts stored. If desired, the variable speed drive **24** may be adjusted to control the rate of discharge in accordance with requirements.

Figures 9, 10 and 11 illustrate another embodiment of the invention which is similar in principle to those shown in the previous figures, but in which the smooth-textured and hardened surface of the rotating cylindrical drum is provided with vertical corrugations. This modified form of the invention is especially adapted for the storage and transfer of spur gears which, as pointed out above, will become and remain interlocked if the outer surface of the cylindrical drum has a constant diameter. In addition to the advantage of its usefulness in transport and storing spur gears, a drum with vertical corrugations has also been found to be capable of imparting a greater driving force to the objects leaning against it, thus overcoming the effect of lessened frictional forces when relatively light parts are being handled, and permitting the use of a steeper rate of climb, other factors being equal.

Since the major portion of the embodiment of Figures 9–11 is similar to that of the previous embodiments, only the essentially different elements are illustrated in the drawings. A portion of a corrugated drum generally indicated at **63** is shown in horizontal section in Figure 9, together with a portion of a spur gear **64** which rests thereagainst and is supported by a track similar to that shown previously. Drum **63** is secured to rotating supporting members, one of which is shown at **65**, by fasteners **66**, and is provided with a plurality of vertically extending corrugations, the outer surface of the drum having a smooth texture and being hardened as in the previous embodiments. Preferably, the corrugations, generally indicated at **67** in the drawings, are of an undulating nature and are relatively shallow are compared with the depth of teeth **68** on gear **64**.

In describing the function of corrugations **67**, assume that drum **63** is moving in the direction of arrow **69** in Figure 9 while gear **64** is held in stationary position by the gears ahead of it on track **71**. In Figure 9, one tooth **68** is seen as resting in a trough **72** between two ridges **73** of corrugations **67**. As drum **63** advances in the direction of arrow **69**, the ridge **73** behind tooth **68** will slide under this tooth, causing gear **64** to tilt from the solid line position of Figure 10 to the dot-dash line position. Upon the next trough **72** reaching tooth **68**, gear **64** will again return to its solid line position in Figure 10.

It will thus be seen that with gears **64** in stationary position on track **71**, they will be continually oscillated between the solid and dot-dash line positions of Figure 10. When the gears are released for transfer along the track, these oscillations will assist in separating the interlocked teeth of adjacent spur gears so that they may roll along the track. During the rolling movement, the presence of corrugations **67** will enhance the driving force on the gears, since at least some of the teeth thereof will tend to be nestled within troughs **72** of the corrugations.

The pitch of corrugations **67** may be varied with respect to the pitch of the teeth on spur gears **64** in order to achieve the desired type of operation. If the pitch of the corrugations is the same as the pitch of the gear teeth, relatively good driving action will be achieved, since each succeeding tooth which engages drum **63** will be nestled in a trough **72**. However, with this arrangement there will be a minimum amount of oscillation of gears **64** between their solid and dot-dash line positions of Figure 10 while they are rolling along track **71**, since a tooth **68** will seldom come into contact with a ridge **73** of corrugations **67**. In order to achieve the maximum degree of gear oscillation, and therefore of separating action between the gears, the pitch of corrugations **67** may be so chosen as to cause ridges **73** of the corrugations to periodically engage teeth **68**. For example, a corrugation pitch which is one and one-half times the gear tooth pitch has been found satisfactory in this respect.

The manner in which a group of gears begin to separate under the influence of oscillations imparted by corrugated drum **63** is shown schematically in Figure 11. In this figure, the schematic representation of the track is indicated at **74** while the corrugated drum is designated **75**. A group of five gears **76**, **77**, **78**, **79** and **81** are shown as resting on track **74** and leaning against drum **75**. Originally, these five gears are assumed to have been in closely adjacent relation with their teeth interlocking as a result of interruption of the flow of parts from the outlet, gears **76**, **77** and **78** still being shown in this position. As drum **75** continued to move in the direction of arrow **82**, the five gears oscillated as described above. When the obstruction was removed from the outlet to permit a flow of parts, this oscillating motion tended to break or separate the interlocking teeth, and gear **81** began to move, being separated from its succeeding gear **79**. The latter gear, being freed from its forward ob-

struction by the advancing movement of gear 81, then began in turn to move away from gear 78. Figure 11 shows gear 79 just after it has begun to leave gear 78, with gear 81 a slightly greater distance away from gear 79. Remaining gears 78, 77 and 76 will then break away in that order and begin to advance on track 74.

It should be noted with respect to the embodiment of Figures 9–11 that the depth of corrugations 67 is relatively small, that is, the amount of oscillation of gears 64 between the solid and dot-dash line positions of Figure 10 will not be more than a few degrees. Generally speaking, however, the speed of drum 63 with respect to the pitch of corrugations 67 and the sizes of the gears, is such as to cause a combined oscillatory and vibratory effect which will readily dislodge spur gears whose teeth are interlocked. It will be appreciated that the corrugated drum construction could also be used in conjunction with parts other than spur gears, for example helical gears or other parts of this general nature. Means may of course be provided for replacing drum 63 and track 71 with parts of different dimensions to handle various workpiece sizes. As in the previous embodiment, the inclination of the gears will be predetermined in accordance with their shape, size and weight to achieve the desired results.

Figure 12 illustrates another embodiment of the invention incorporating the principles previously described. This modification is combined with a heating element which is intended to have a specified effect on the metallic structure of which the gears or other parts are composed. Since the constructional elements of the embodiment of Figure 12 are similar to those previously described, it is merely necessary to point out that the shell in this case is fabricated with an insulating material in order to retain the heat. Shell 83 is shown as having a pair of doors 84 and 85 for access purposes, door 85 being shown in its opened condition to illustrate the thickness of the shell wall. Within shell 83 is disposed a cylindrical drum 86 and a helical track 87 as in the previous embodiments. A driving assembly 88 for drum 86 is disposed above shell 84. Adjacent the shell is a heating element 89 the details of which form no part of the present invention. Air ducts 91 and 92 connect this heating element with shell 84 so that heat may be applied to the parts within the storage and transfer unit. Entrance and exit ports 93 and 94 are provided in shell 84 for passage of workpieces into and out of the device.

While it will be apparent that the preferred embodiments of the invention disclosed are well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In a device for transferring and storing a plurality of identical parts of a predetermined shape, size and weight, at least a portion of each part being circular, an upstanding stationary support of annular shape, a drum in concentric spaced relation with said support and having a smooth-textured and hardened surface, means for rotating said drum, a helical track disposed in the annular space between said support and drum, means mounting said track on said support, the track and support being of such construction that parts having their circular portions resting on said track and inclined toward said drum will be unrestrained, and means on said track for guiding and supporting said parts at an inclination preselected in accordance with said shape, size and weight, whereby the forces exerted by the parts leaning on said drum will be of a magnitude higher than that necessary to cause rolling of the circular portions of said parts on said track when said drum is rotated, and lower than that which would cause a wearing action of said parts on said drum surface during such rotation.

2. In a device for transferring and storing a plurality of identical parts of a predetermined shape, size and weight, at least a portion of each part being circular, an annular support, means for mounting said support in stationary position on a vertical axis, a drum disposed within said support and in concentric spaced relation therewith, said exterior surface of the drum having a smooth texture and hardened finish, whereby the frictional forces exerted by said drum on said parts when the parts are prevented from movement will be relatively slight, means for rotating said drum, a helical track disposed in the annular space between said support and drum, means mounting said track on said support, the track and support being of such construction that parts having their circular portions resting on said track and inclined toward said drum will be unrestrained, and means on said track for guiding and supporting said parts at an inclination preselected in accordance with said shape, size and weight, whereby the forces exerted by the parts leaning on said drum will be of a magnitude higher than that necessary to cause rolling of the circular portions of said parts on said track when said drum is rotated, and lower than that which would cause a wearing action of said parts on said drum surface during such rotation.

3. In a device for transferring, storing and treating a plurality of identical parts of a predetermined shape, size and weight, at least a portion of each part being circular, a cylindrical supporting shell, means for mounting said shell on a vertical axis, a drum disposed within said shell and in concentric spaced relation therewith, said drum having a smooth-textured and hardened exterior surface, means for rotating said drum, a helical track disposed in the space between said shell and drum, the shape of said track and shell being such that parts having their circular portions resting on said track and inclined toward said drum will be unrestrained, means on said track for guiding and supporting said parts at an inclination preselected in accordance with said shape, size and weight, whereby the forces exerted by the parts leaning on said drum will be of a magnitude higher than that necessary to cause rolling of the circular portion of said parts on said track when said drum is rotated, and lower than that which would cause a wearing action of said parts on said drum surface during such rotation, and fluid dispensing means disposed at spaced points adjacent a section of said track within said space, said fluid dispensing means being so located as to cause parts rolling along said track to be subjected to fluid on all portions thereof.

4. In a device for transferring and storing a plurality of identical parts of a predetermined shape, size and weight, at least a portion of each part being circular and having peripheral and side surfaces, a stationary annular support having a vertical axis, a drum disposed within said support and in concentric spaced relation therewith, means for rotating said drum, a helical track disposed in the annular space between said support and drum, and means for mounting said track on said support, said track comprising at least two rods in spaced parallel relation, one of said rods being so disposed as to be engageable by the peripheral surfaces of the circular portions of said parts, the other rod being so disposed in relation to said first rod as to be engageable by the side surfaces of the circular portions of said parts facing said drum, said rods being so arranged that parts resting thereon will be unrestrained and will lean against said drum at an inclination preselected in accordance with said shape, size and weight, whereby the forces exerted by the parts leaning on said drum will be of a magnitude higher than that necessary to cause rolling of the circular portions of said parts on said rods when said drum is rotated, and lower than that which would cause a wearing action of said parts on said drum surface during such rotation.

5. In a device for transferring and storing a plurality of identical parts of a predetermined shape, size and weight, at least a portion of each part being circular and

having peripheral and side surfaces, a stationary annular support having a vertical axis, a drum disposed within said support and in concentric spaced relation therewith, said drum having a smooth-textured and hardened outer surface, means at one end of said support for rotatably supporting said drum, means for rotating said drum, a helical track disposed in the annular space between said support and drum, and means for mounting said track on said support, said track comprising at least two rods in spaced parallel relation, one of said rods being so disposed as to be engageable by the peripheral surfaces of the circular portions of said parts, the other rod being so disposed in relation to said first rod as to be engageable by the side surfaces of the circular portions of said parts facing said drum, said rods being so arranged that parts resting thereon will be unrestrained and will lean against said drum at an inclination preselected in accordance with said shape, size and weight, whereby the forces exerted by the parts leaning on said drum will be of a magnitude higher than that necessary to cause rolling of the circular portions of said parts on said rods when said drum is rotated, and lower than that which would cause a wearing action of said parts on said drum surface during such rotation.

6. In a device for transferring and storing a plurality of identical parts of a predetermined shape, size and weight, at least a portion of each part being circular and having peripheral and side surfaces, a stationary annular support having a vertical axis, a drum disposed within said support and in concentric spaced relation therewith, means for rotating said drum, a helical track disposed in the annular space between said support and drum, and means for mounting said track on said support, said track comprising at least three rods in spaced parallel relation, one of said rods being so disposed as to be engageable by the peripheral surfaces of the circular portions of said parts, said second rod being so disposed in relation to said first rod as to be engageable by the side surfaces of the circular portions of said parts facing said drum, said third rod being adjacent the sides of the circular portions of said parts facing said support to prevent parts from falling off the track away from said drum, said rods being so arranged that parts resting thereon will be unrestrained and lean against said drum at an inclination preselected in accordance with said shape, size and weight, whereby the forces exerted by said parts on said drum will be of a magnitude higher than that necessary to cause rolling of the circular portions of said parts on said rods when said drum is rotated, and lower than that which would cause a wearing action on said parts of said drum surface during such rotation.

7. In combination, a vertical shell, a drum disposed within said shell and spaced therefrom, a helical track secured to the inner surface of said shell and spaced from said drum, said track being so formed as to support circular parts thereon in inclined relation against the outer surface of said drum, means for rotating said drum to cause said circular parts to roll along said track, wash fluid dispensing means disposed along one section of said helical track, rinse fluid dispensing means disposed along another section of said helical track above said first section, a helical shield disposed between said two track sections and operative to collect rinse fluid, and a drain connection from the lower end of said helical shield to the outside of said shell.

8. In combination, a vertical shell, a drum disposed within said shell and spaced therefrom, a helical track secured to the inner surface of said shell and spaced from said drum, said track being so formed as to support parts thereon leaning against the outer surface of said drum, means for rotating said drum to cause said circular parts to travel along said track, wash fluid dispensing means disposed along one section of said helical track, rinse fluid dispensing means disposed along another section of said helical track above said first section, a helical track shield disposed between said two track sections and operative to collect rinse fluid, a drain connection from the lower end of said helical shield to the outside of said shell, and warm air inlet and outlet connections to said shell at a third section of said helical track.

9. In combination, a cylindrical shell, means supporting said shell on a vertical axis, a cylindrical drum concentrically disposed in spaced relation within said shell, said drum having a smooth-textured and hardened outer surface, means at the upper end of said shell for rotatably suspending said drum, means for rotating said drum at a constant rate of speed, means for varying said constant rate, a helical track comprising a plurality of rods in spaced parallel relation disposed in the space between said shell and drum, said rods being so disposed as to support circular parts thereon in inclined position whereby said parts will lean against the outer surface of said drum, a plurality of brackets securing said helical track to the inner surface of said shell, an entrance opening at the lower end of said shell, an exit opening at the upper end of said shell, a guide passing through said entrance opening for tilting circular parts moving therealong so as to lean against the drum, wash fluid dispensing means passing through said shell between lower turns of said circular track and adapted to dispense wash fluid on all portions of parts rolling along said track, rinse fluid dispensing means passing through said shell between turns of said helical track above said first-mentioned turns and adapted to dispense rinse fluid on all portions of parts passing therealong, a helical shield between said first- and second-mentioned track turns, said shield being adapted to collect rinse fluid, a drain connecting the lower end of said shield to the outside of said shell, and warm air connections to said shell adjacent the upper turns of said track whereby washed and rinsed parts will be dried as they roll along said upper turns.

10. In a device for transferring and storing a plurality of identical parts of a predetermined shape, size and weight, at least a portion of each part being circular, an upstanding stationary support of annular shape, a drum in concentric spaced relation with said support and having a smooth-textured and hardened surface, said surface having a plurality of corrugations formed therein, the pitch of said corrugations being substantially less than the diameter of the circular portions of said parts, means for rotating said drum, said corrugations extending transversely to the direction of motion of said drum surface during such rotation, a helical track disposed in the annular space between said support and drum, and means mounting said track on said support, the track being of such construction that parts resting thereon will be unrestrained and will lean against said drum at an inclination preselected in accordance with said shape, size and weight, whereby the forces exerted by the parts leaning on said drum will be of a magnitude higher than that necessary to cause rolling of the circular portions of said parts on said track when said drum is rotated, and lower than that which would cause a wearing action of said parts on said drum surface during such rotation.

11. In a device for transferring and storing a plurality of identical parts of a predetermined shape, size and weight, at least a portion of each part being circular, an annular support, means for mounting said support in stationary position on a vertical axis, a drum disposed within said support and in concentric spaced relation therewith, the outer surface of said drum having a plurality of vertical corrugations formed around the entire periphery thereof, the pitch of said corrugations being substantially less than the diameter of the circular portions of said parts, means for rotating said drum, a helical track disposed in the annular space between said support and drum, and means mounting said track on said support, the track being of such construction that parts

resting thereon will be unrestrained and will lean against said drum at an inclination preselected in accordance with said shape, size and weight, whereby the forces exerted by the parts leaning on said drum will be of a magnitude higher than that necessary to cause rolling of the circular portions of said parts on said track when said drum is rotated, and lower than that which would cause a wearing action of said parts on said drum surface during such rotation.

12. The combination according to claim 11, said corrugated drum surface having a smooth-textured and hardened finish, the corrugations having a rounded and relatively shallow configuration.

13. In a device for transferring and storing a plurality of spur gears of a predetermined shape, size and weight and with a predetermined tooth pitch, an annular support, means for mounting said support in stationary position on a vertical axis, a drum disposed within said support and in concentric spaced relation therewith, the exterior surface of said drum having a smooth-textured and hardened finish, a plurality of vertical corrugations formed around the periphery of said exterior drum surface, the pitch of said corrugations being substantially less than the diameter of said gears, means for rotating said drum, a helical track disposed in the annular space between said support and drum, and means mounting

said track on said support, the track being of such construction that spur gears resting thereon will be unrestrained and will lean against said drum at an inclination preselected in accordance with said shape, size and weight, whereby the forces exerted by the gears leaning on said drum will be of a magnitude higher than that necessary to cause rolling of said gears on said track when said drum is rotated, and lower than that which would cause a wearing action of said gears on said drum surface during such rotation.

14. The combination according to claim 13, the pitch of said corrugations being approximately one and one-half times said predetermined gear tooth pitch.

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