United States Patent

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[54] **AUTOMATIC FLEXIBLE ICE TRAY**
5 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** 62/353, 62/72
[51] **Int. Cl.** F25c 1/10
[50] **Field of Search** 62/72, 353

[56] **References Cited**
UNITED STATES PATENTS

3,056,271	10/1962	De Turk	62/353
3,382,682	5/1968	Frohbeiter	62/72

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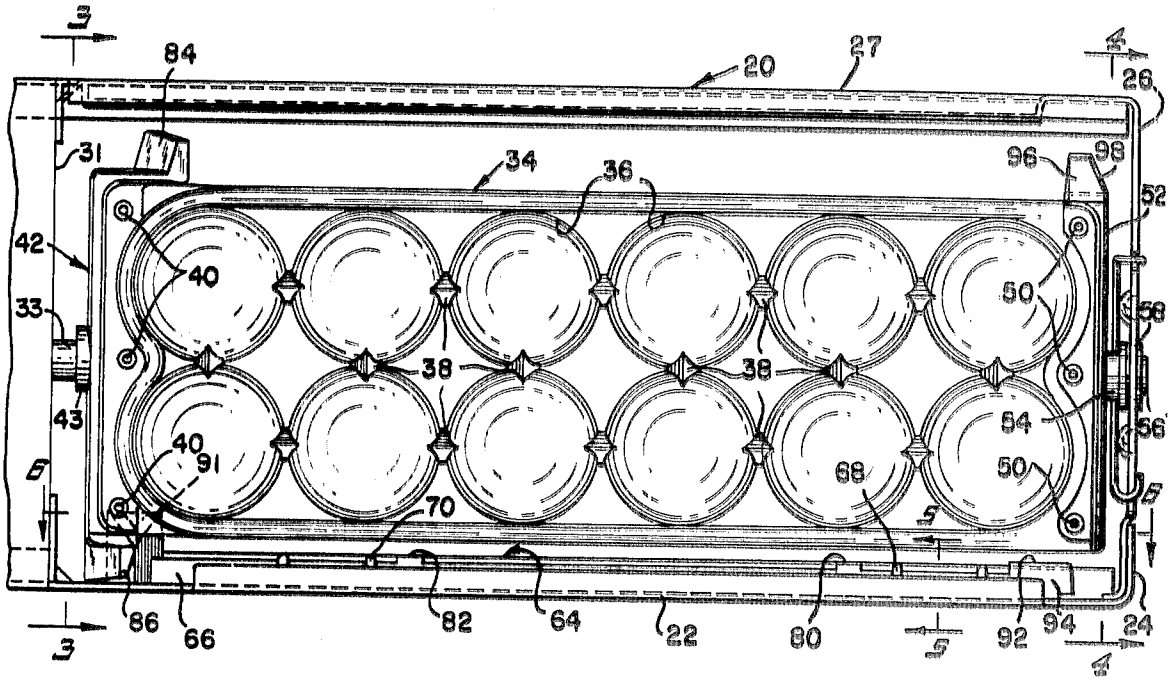
ABSTRACT: An automatic icemaker in which a flexible ice tray is twisted to loosen the ice blocks by rotating one end of the tray while restraining the other end. The continued rotation of the driven end of the tray releases the other end of the tray after a predetermined twisting motion of the tray has been effected.



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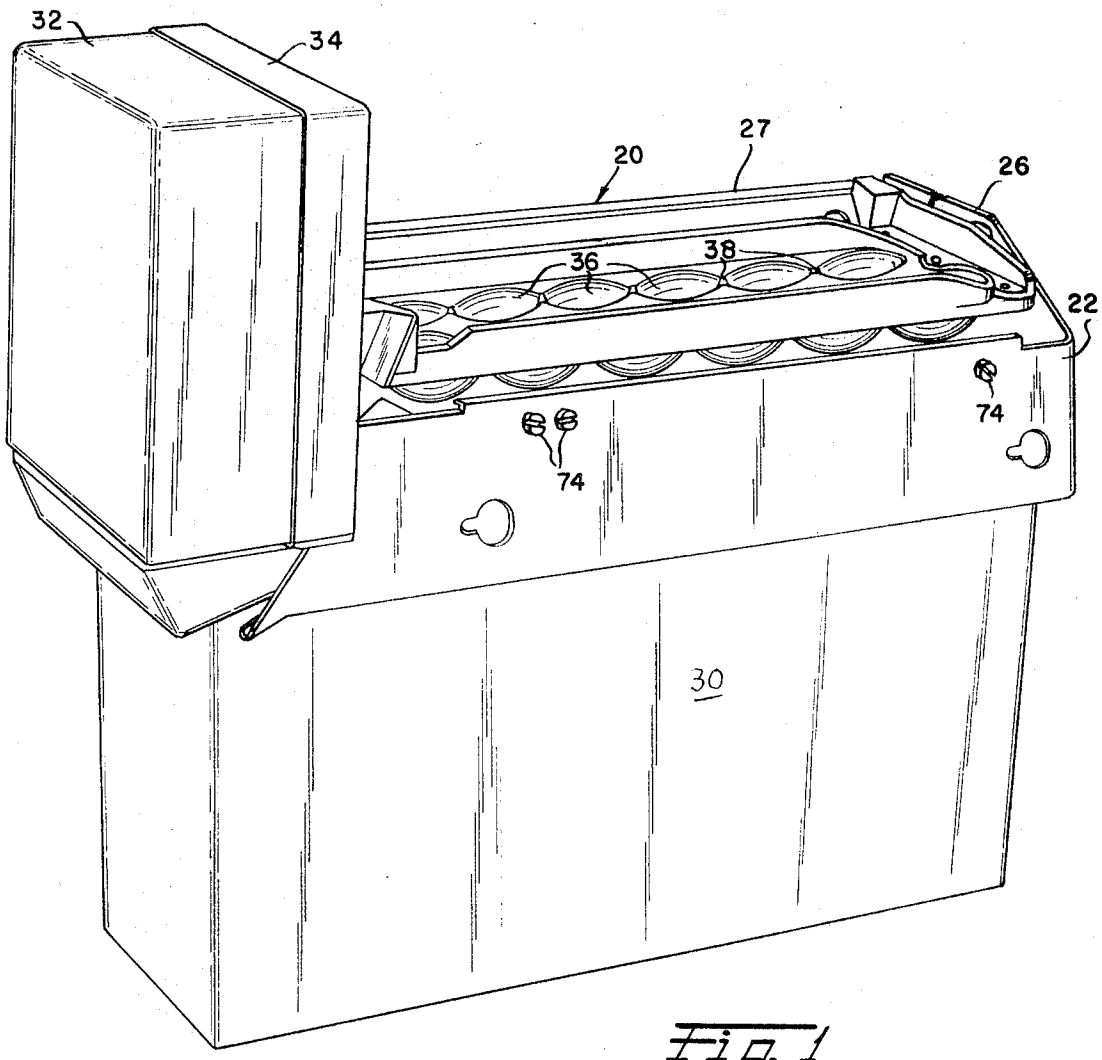

Fig. 1

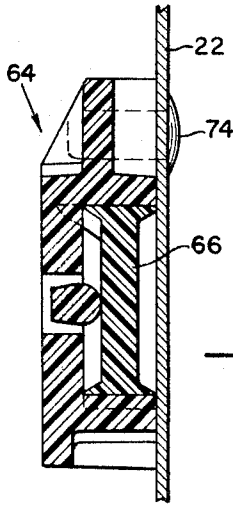

Fig. 5

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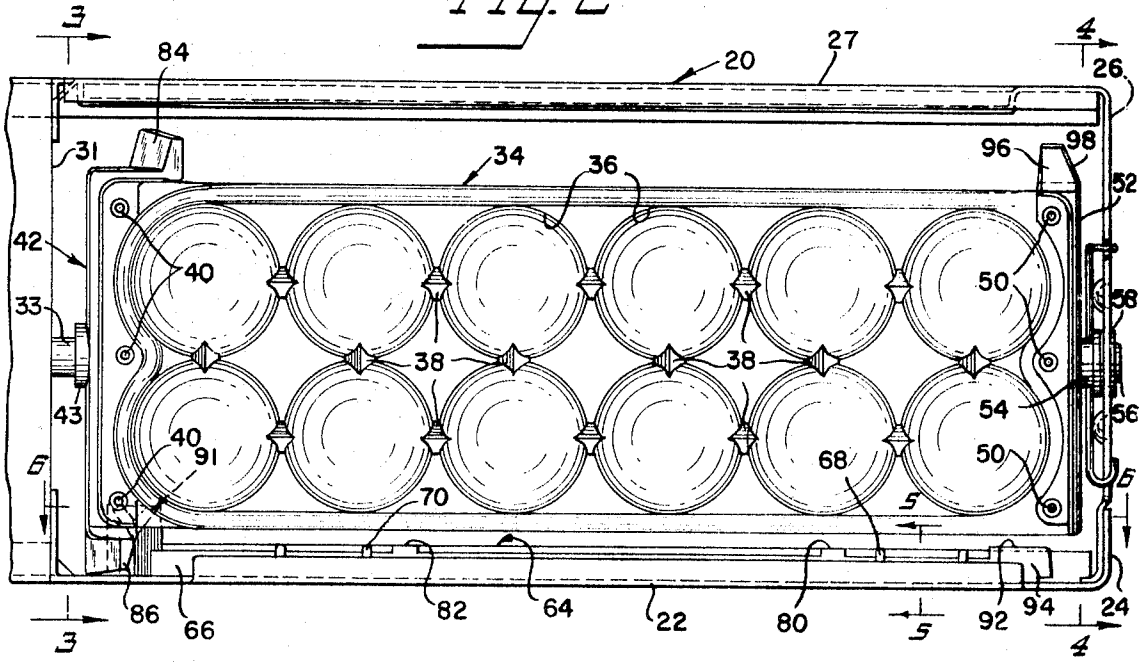
Fig. 2



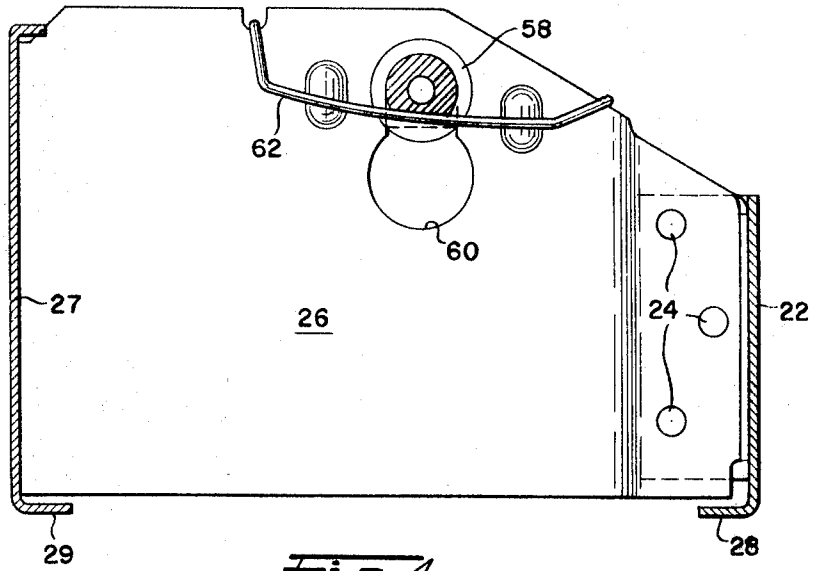


Fig. 4

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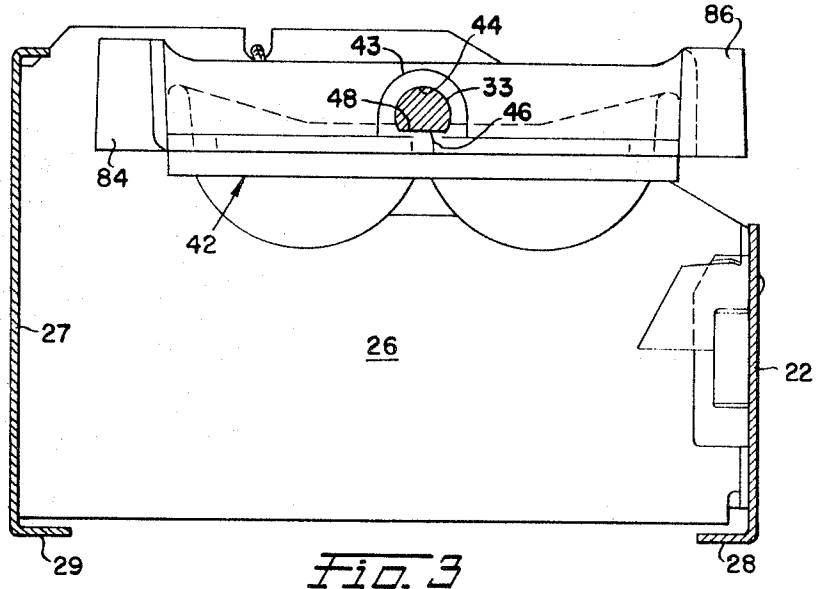

Fig. 3

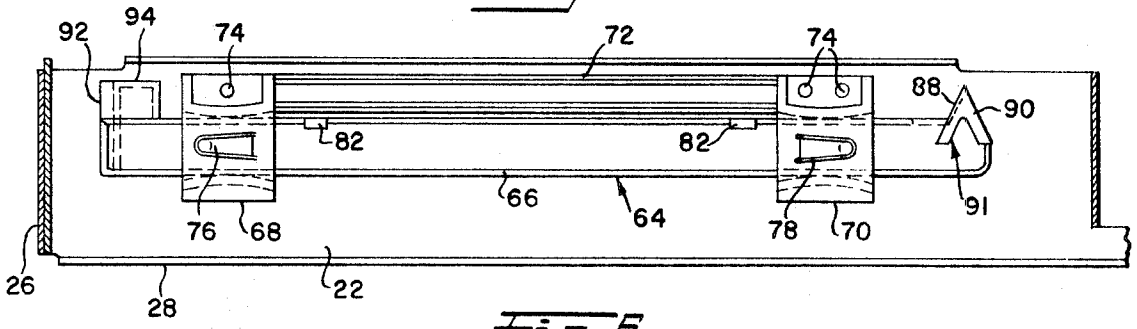

Fig. 6

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AUTOMATIC FLEXIBLE ICE TRAY

BACKGROUND OF THE INVENTION

In recent years automatic ice makers, particularly those for use in domestic refrigerators, have become increasingly popular. Most, if not all, of these units comprise a single flexible ice tray having a number of molds or pockets which are automatically filled with water which is then frozen. A sensing device or timer then actuates a drive mechanism which is effective to loosen the ice blocks and to invert or tilt the tray to deposit the ice blocks in a storage receptacle. The tray is then righted and the cycle is repeated.

While automatic ice makers now on the market are capable of performing these functions, they are, for the most part, characterized by high cost or lack of reliability or both. Certain of these units incorporate a complicated and expensive gear drive system for rotating and twisting the tray. Others use a system of springs or yieldable detents to provide the twisting action of the tray. Most, if not all, of these devices are subject to the adverse effects of the environment in which they operate and often after a relatively short period of use they become inoperative or fail to provide positive operation.

It has also been proposed to loosen the ice blocks by temporarily heating the molds in which they are formed. This apparatus and the associated control mechanism is relatively expensive and has an obvious disadvantage in that it introduces heat into the freezer compartment. The ice blocks, which are usually partially melted, tend to refreeze and adhere to each other or to the walls of the receptacle into which they are deposited.

SUMMARY OF THE PRESENT INVENTION

With the foregoing considerations in mind it is the principal purpose and object of the present invention to provide improved automatic ice makers, particularly adapted for use in domestic refrigerators, which are of simplified construction and which can thus be manufactured and sold at reduced cost and which are exceptionally rugged and durable and provide an extended trouble-free service life.

It is also an object of the present invention to provide an improved tray drive system which is positive in operation and substantially impervious to wear and to damage or deterioration or malfunction under the unfavorable environmental conditions in which it operates.

In attaining this and other objects the present invention provides, in an automatic ice maker, a tray drive system in which one end of the tray is motor driven unidirectionally 360° from an upright position to an inverted position and then returned to an upright position. The rotary motion of the remote end of the tray is delayed by a positive stop when the tray reaches or approaches its inverted position. Continued rotation of the driven end of the tray twists the tray to release the ice blocks which fall directly into a storage receptacle. The further rotation of the driven end of the tray also actuates a stop release mechanism to free the remote end of the tray for rotation with the driven end of the tray as the tray assembly is restored to its upright position. In the next succeeding cycle the stop mechanism is positively reset by rotation of the driven end of the tray as it passes between its upright and inverted positions. Thus the mechanism assures that on each cycle the tray will be given an identical twisting motion which occurs at the same point in the cycle.

Additional objects and advantages will become apparent as the description proceeds in connection with the accompanying drawings.

THE DRAWINGS

FIG. 1 is a perspective view of an automatic ice maker incorporating the present invention;

FIG. 2 is a top plan view of the ice tray and associated mechanism;

FIGS. 3 and 4 are transverse sections taken along lines 3–3 and 4–4 of FIG. 2;

FIG. 5 is an enlarged fragmentary section taken along line 5–5 of FIG. 2; and

FIG. 6 is a longitudinal section taken along lines 6–6 of FIG. 2 showing details of the stop mechanism.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring now more particularly to the drawings, the principal components of the ice maker are supported on a U-shaped sheet metal frame indicated generally at 20 adapted to be mounted in the freezer compartment of a refrigerator. The frame assembly comprises a side member 22 secured as by rivets 24 to a base or end member 26 formed integrally with the opposite side member 27. At their lower edges the side frame members 22 and 27 are provided with inturned flanges 28 and 29 which form a guideway and support for a removable storage bin 30 (FIG. 1). The free ends of the side members 22 and 27 are suitably secured to a plastic housing 31 having a removable plastic cover 32. The housing 31 and cover 32 enclose unidirectional motor, a drive train and electrical controls, which may be of conventional construction, and per se form no part of the present invention. In accordance with conventional practice the motor drive system is effective to produce rotation of the output shaft 33, which projects through the wall of the housing 31, at a relatively slow rate, for example one-third r.p.m., with relatively high torque.

The tray assembly 34 is preferably formed of a polypropylene plastic material which is capable of repeated flexing under low temperature conditions. The tray has a number of individual molds or pockets 36 interconnected by V-shaped channels 38. The channels 38 permit complete filling of the entire tray assembly by supplying water to any selected one of the pockets.

Secured as by rivets 40 to the driven end of the tray is a rigid, relatively heavy, plastic fitting indicated generally at 42. The fitting is provided with a boss 43 having a through opening 44 coaxial with the longitudinal axis of the tray 34. The drive shaft 33 and the boss 43 are provided with mating flats 46 and 48 to provide a positive drive connection between the shaft and the tray assembly.

Similarly riveted as at 50 to the opposite end of the tray is a second rigid plastic fitting 52 having a boss 54 projecting from the rearward face thereof, a reduced cylindrical extension 56 of which is rotatably received in a bearing 58 held in the upper portion of a keyhole opening 60 by a spring 62, the ends of which are hooked over the upper edge of the base 26.

The fittings 42 and 52 not only mount the tray for rotation about its longitudinal axis but also control the twisting action of the tray necessary for loosening the ice blocks for delivery to the storage bin 30. More specifically, the fittings cooperate with a stop mechanism, indicated generally at 64, which will now be described with particular reference to FIGS. 5 and 6. The stop mechanism 64 comprises essentially an elongated plastic bar 66 slidably mounted in a pair of plastic guides 68 and 70 secured to each other by a connector bar 72 and secured to the sidewall 22 of the frame 20 as by screws 74. The guides 68 and 70 are provided with friction tongues 76 and 78, respectively, which engage the side surface of the body of the stop bar 66 and are effective to retain the bar in any displaced position and yet permit axial movement of the stop bar under moderate force.

The bar 66 is displaced between limit positions determined by stops 80 and 82 by oppositely directed cam members 84 and 86 adapted to contact the sloping side faces 88 and 90 of a projection 91 formed integrally on one end of the bar. At its opposite end the bar 66 is provided with an integral upwardly extending projection 92 terminating at its upper end at a flat abutment surface 94. As the bar is displaced by the cam members 84 and 86 the abutment surface 94 is moved into or out of the path of a mating abutment surface 96 formed on a projection 98 on the tray fitting 52.

As stated above, the mechanism for periodically refilling the tray with water, for activating the drive motor and the related control mechanism may be of conventional construction. For present purposes let it be assumed that the tray has been filled with water and the ice blocks have been frozen causing an appropriate sensing device to activate the drive motor. This causes the output shaft 33 to rotate slowly in a clockwise direction as viewed in FIG. 3 to rotate the entire tray assembly correspondingly. After the tray has rotated approximately 30° from its upright position the cam member 86 will contact the cam surface 90 to displace the stop bar 66 to the left as viewed in FIG. 6 and to the right as viewed in FIG. 2 to dispose the abutment surface 94 in the path of the stop surface 96 on the tray fitting 52. The cam surface 86 then passes over the surface 90 and the bar 66 will remain in its displaced position since there are no appreciable forces to change its position and since it is held by the friction fingers 76 and 78. The rotation of the tray continues until the tray becomes fully inverted at which time the stop surface 96 contacts the abutment surface 94. At approximately the same time the cam member 84 will contact the surface 88. The driven end of the tray continues to rotate while the remote end of the tray is held against rotation. The tray is thus twisted throughout its full length.

As the rotation of the driven end of the tray continues, the stop bar 66 will be forced to the left as viewed in FIG. 2 or the right as viewed in FIG. 6. After the driven end of the tray has rotated approximately 30° with respect to the remote end of the tray to provide sufficient twist to loosen the ice blocks which fall into the receptacle 30, the abutment surface 94 is withdrawn from contact with the stop surface 96. Because of its inherent resilience the tray will then quickly resume essentially its original shape. Rotation of the tray is then continued until the tray is restored to its upright position at which time the automatic control system deenergizes the drive motor and the tray is again filled with water.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What I claim and desire to be secure by Letters Patent is:

1. In an automatic ice maker, a flexible tray rotatably mounted in support structure, means drivingly connected to one end of said tray for rotating said tray about a predetermined axis from an upright position through an inverted position to said upright position, a stop bar movable in a direction parallel to said axis between a first position for blocking rotation of the other end of said tray and a second position permitting rotation of said other end of said tray, and cooperating means on said bar and said one end of said tray for displacing said bar between said first and second positions upon rotation of said tray.

2. The combination according to claim 1 wherein said last-mentioned means comprises cam surfaces on said bar and on said one end of said tray, said cam surfaces being effective during a first portion of the rotation of said tray to move said stop bar to said first position and being effective during a subsequent portion of rotation of said tray to move said stop bar to said second position.

3. The combination according to claim 1 wherein the length of said stop bar is essentially the same as said tray and wherein said stop bar has an abutment surface adjacent one end thereof adapted to engage a stop surface on said tray when said bar is in said first position and wherein said cam surfaces are formed at the opposite end of said stop bar.

4. An automatic ice maker comprising a frame assembly, a flexible ice tray mounted in said frame assembly for rotation about a predetermined axis, unidirectional drive means for rotating one end of said tray to move said tray from an upright position, through an inverted position and then to said upright position, a stop movable between a first position for positively arresting movement of the other end of said tray adjacent said inverted position and a second position for permitting movement of said other end of said tray, and cooperating means mechanically connected to said one end of said tray and with said stop for moving said stop to said second position and thereafter returning said stop to said first position.

5. In an automatic ice maker, a flexible tray rotatably mounted in said support structure, unidirectional drive means connected to one end of said tray for rotating said tray about a predetermined axis from an upright position through an inverted position to said upright position, a stop member movable in a direction parallel to said axis between a first position for blocking rotation of the other end of said tray and a second position permitting rotation of said other end of said tray, and means driven by said drive means for displacing said stop member between said first and second positions during operation of said drive means.