Aug. 18, 1964 J. H. CARTER 3,145,055

SPRING MOTOR OPERATED TILTING DUMP TRUCK

Filed Feb. 12, 1959

Fig 2

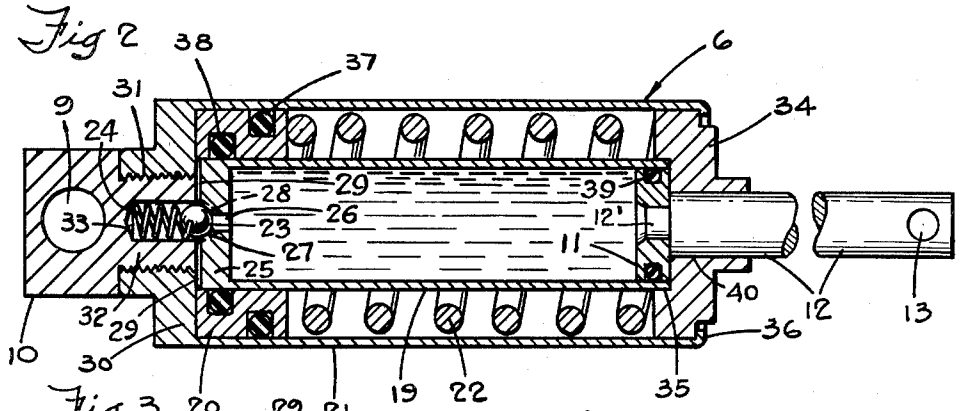



Fig 3

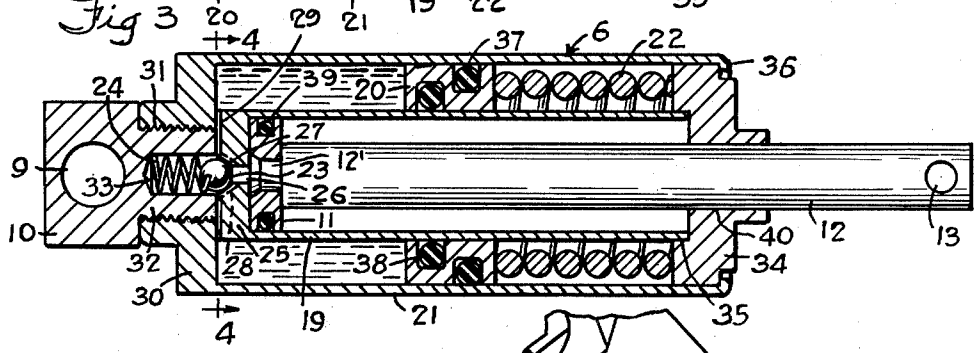



Fig 1

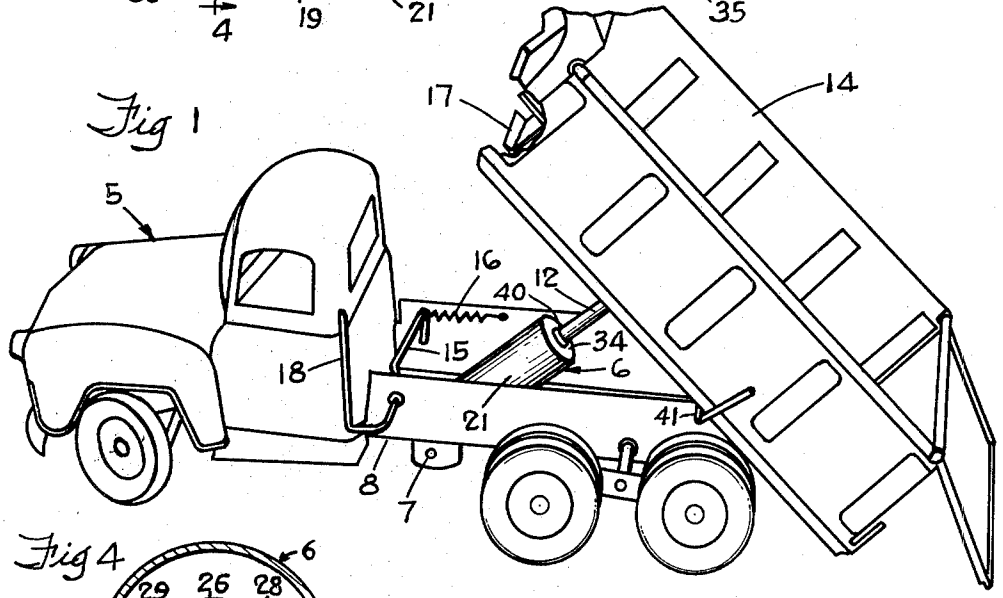
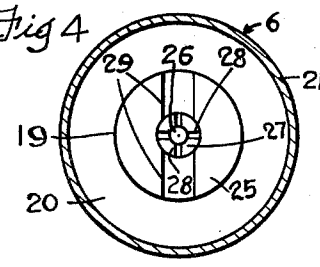



Fig 4




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# 3,145,055
# SPRING MOTOR OPERATED TILTING DUMP TRUCK

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This invention relates to a dual hydraulic piston and cylinder mechanism, which, while herein disclosed as a spring motor applied to a toy dump-truck, for which application it was specially designed, is adapted for use also in door checks and closers, and the like, and wherever a relatively long stroke for the operated piston is required, while a relatively short and compact mechanism is essential or at least advantageous.

Toy dump-trucks with hydraulically operated pistons for operating the dump body became veritable "booby traps" when a certain amount of fluid leaked out of the cylinder, because when the body catch was released under such conditions the spring in the absence of the necessary fluid to slow down the working piston would operate it at high speed, so that a child could easily sustain a serious injury by contact with the dump body under those conditions. Injuries due to this defect in design and construction became so common that retailers, with good reason, refused to deal in hydraulic toys for a long time. It is, therefore, the principal object of my invention to provide an improved design and construction in which the piston is operable solely by fluid, and, in the event any of the fluid leaks out, the only noticeable effect is a reduction in the length of the stroke of the piston, and there is definitely no longer any possibility of injury to the operator.

The long piston stroke is obtained in accordance with my invention by having the working piston disposed in an inner cylinder of smaller diameter, while an outer concentric cylinder of larger diameter (and larger capacity per unit of length) contains the power spring and an annular piston operated thereby to deliver fluid from in front of the piston under pressure of the spring at a controlled rated to the inner cylinder to move the working piston, the moderate speed of the piston being positively assured by the seating of a spring-pressed check-valve, leaving only a small bleeder port open for passage of fluid into the inner cylinder from the outer cylinder. This check-valve unseats in the return movement of the working piston so that there is no interference with the speedy return of the dump body by hand to loading position.

The invention is illustrated in the accompanying drawing, in which—

FIG. 1 is a perspective view of a toy dump-truck equipped with a dual hydraulic piston and cylinder mechanism made in accordance with my invention for the safer operation of the dump body regardless of possible leakage of fluid from the piston and cylinder mechanism;

FIGS. 2 and 3 are longitudinal sections through the piston and cylinder mechanism showing the parts in the opposite extreme positions, FIGURE 3 being the one extreme prior to release of the dump body catch with the piston holding its rod fully retracted, and FIGURE 2 the other extreme at the end of the operation of the dump body with the piston holding its rod fully extended, and

FIG. 4 is a cross-section on the line 4—4 of FIG. 3.

The same numerals are applied to corresponding parts throughout the views.

Referring to the drawing, the toy dump-truck indicated generally by the reference numeral 5 in FIG. 1 is of the conventional design and construction similar to that disclosed in Wood Patent No. 1,602,424, but, in contrast to the undependable single piston and cylinder of that



patent, is shown equipped with a dual hydraulic piston and cylinder mechanism made in accordance with my invention and indicated generally by the reference numeral 6. A horizontal cross-pin 7 suitably supported on the frame 8 extends through a hole 9 in the plug 10 provided on one end of the mechanism 6 for pivotal connection of one end of the mechanism with the frame, and the working piston 11 of the mechanism 6, which is fixed on the reduced and upset inner end 12' of the rod 12 in the manner shown, has the outer end of its rod 12 pivotally connected at 13 with the bottom of the rearwardly tiltable dump body 14 intermediate the ends thereof to tilt the body rearwardly for dumping, as seen in FIG. 1. The frame 8 is referred to elsewhere as the fixed one of two "relatively movable parts" and the dump body 14 as the other or movable one of said "relatively movable parts." A U-shaped catch 15 pivotally mounted in the frame 8 has a tension spring 16 normally urging the same in a clockwise direction toward engagement with a lug 17 provided on the front end of the dump body 14, the catch being so arranged with respect to the lug that it will be swung forwardly out of the way as the dump body is swung downwardly by hand to its normal loading position, and will under tension of the spring 16 swing back into position over the lug 17 to lock the body in place automatically and hold it in that position until the release level 18 is swung forwardly by the operator to release the catch 15 and allow the dump body to be tilted by means of the working piston 11 under hydraulic pressure. The long stroke of the piston 11 substantially the full length of the mechanism 6 necessary for the tilting of the dump body 14 to the extent shown is made possible by the dual piston and cylinder construction shown in FIGS. 2–4, and with this construction I also obtain absolute safety of operation, as will soon appear, because the piston 11 is not operated directly by a spring, as in the prior constructions referred to above but depends for its operation upon the delivery of the oil or other working fluid to the inner cylinder 19 in response to movement of the annular piston 20 in the outer cylinder 21 under pressure of the power spring 22, the oil flow in this direction being regulated by a check-valve 23, so that the working piston 11 can move only as far as the available supply of oil or other working fluid will permit and cannot possibly move fast enough to give rise to any danger of injury to the operator, the oil flow being positively restricted by the seating of the check-valve 23 under the action of its associated spring 24.

Referring to FIGS. 2–4, to separate the inner ends of the two cylinders 19 and 21, the inner cylinder 19 is closed by a wall 25 at its inner end and an opening 26 is provided therein behind a tapered seat 27 for the ball check-valve 23. Bleeder ports 28 are defined by radial grooves in the seat 27 allowing restricted flow of oil under pressure of spring 22 past the check-valve 23 and into the front end of cylinder 19 when the check-valve 23 is seated. One or more larger radial grooves 29 are provided in the outer side of the end wall 25 to deliver oil to the adjacent end of the outer cylinder 21 in front of the annular piston 20 when the working piston 11 moves inwardly on its return stroke as the body 14 is lowered by hand, expelling oil from the inner cylinder past the unseated check-valve 23. The oil entering the outer cylinder under pressure forces the annular piston 20 to the rear, compressing the power spring 22 to load it for the next dumping operation. The front end wall 30 of the cylinder 21 forms an abutment for the front end 25 of the inner cylinder 19 and has a threaded center hole 31 in which the reduced threaded portion 32 of the plug 10 is threaded. An axial bore 33 in the inner end of the plug accommodates the coiled compression spring 24 that

holds the check-valve 23 normally seated. A plug 34, which has the rod 12 slidable freely in a center hole provided therein at 40 so that there is no noticeable air-cushion action in the operation of the piston 11, forms a closure for the open rear ends of both cylinders and has a central depression 35 in which the open end of the inner cylinder 19 is engaged and centered accurately relative to the outer cylinder 21, the rear end of the latter extending slightly beyond the plug and being swedged inwardly, as at 36, to complete the assembly and hold all of the assembled parts together. The oil or other liquid used can be put in cylinder 19 through opening 26 before check valve 23 and plug 10 are put in and while piston 11 is in fully retracted position, as in FIG. 2. Oil or other liquid can also be added through this same opening 26 in the extent of leakage.

O-rings 37 and 38 are entered in annular grooves provided in the outer and inner peripheries of the annular piston 20, respectively, to prevent oil leakage past the piston by contact with the inside of cylinder 21 and outside of cylinder 19. Another O-ring 39 is provided in an annular groove in piston 11 for a similar purpose.

In operation, with the dump body 14 swung down about its pivot 41 and latched at 15–17, the parts are disposed as seen in FIG. 3, power spring 22 being loaded as a result of the previous downward movement of the dump body 14 by hand. When the catch 15 is released, oil under pressure of spring 22 is delivered at a predetermined rate past check-valve 23 through the bleeder ports or grooves 28, moving piston 11 outwardly and swinging the body 14 upwardly slowly, similarly as occurs in large dump-trucks. There is no danger whatever of the piston 11 moving too fast and causing an injury to the operator. If any of the oil leaks out, the dump body 14 will not be tilted quite as far, but otherwise the operation is the same. In the resetting of the dump body, the piston 11 is moved inwardly fast, the oil in front thereof being expelled past the open check-valve 23 and forcing the piston 20 outwardly and loading the power spring 22.

In closing, it will be obvious that the dual hydraulic piston and cylinder mechanism 6 could be used also in a door check or door closer, and wherever a piston having a relatively long stroke and the other operating characteristics described is required or would be advantageous.

It is believed the foregoing description conveys a good understanding of the objects and advantages of my invention. The appended claims have been drawn to cover all legitimate modifications and adaptations.

I claim:

1. A dual piston and cylinder structure comprising two cylinders having inner and outer ends, the inner ends having a wall separating them with openings provided therein through which said cylinders have communication, check valve means housed in said wall cooperating with said openings to control fluid flow between said cylinders to provide a certain rate of flow in one direction between said cylinders with said check valve means seated and a different rate of flow in the opposite direction with said check valve means unseated, the outer ends of said cylinders having walls therein, a piston reciprocable in one of said cylinders having a rod connected therewith and extending through an opening provided in the outer end wall thereof, a piston reciprocable in the other of said cylinders, and a spring compressible between said last named piston and the outer end wall of said last named cylinder.

2. A structure as set forth in claim 1, including a fill opening for hydraulic fluid provided in said first mentioned wall communicating with the first of said cylinders from outside of said cylinders, and a closure for said opening.

3. A structure as set forth in claim 1, including a fill opening for hydraulic fluid provided in said first mentioned wall communicating with the first of said cylinders from outside of said cylinders, and a closure for said opening, said closure being removable and replaceable so as to permit replenishing hydraulic fluid in event of leakage.



4. A structure as set forth in claim 1, wherein said cylinders are concentrically arranged, the spring pressed piston being annular and disposed in the outer one of said cylinders and the spring being coiled and being disposed in the outer cylinder behind the piston and encircling the inner cylinder.

5. A structure as set forth in claim 1, including hydraulic fluid in said cylinders between said pistons, whereby movement of one piston is transmitted through the intervening fluid to or from the other piston.

6. A dual piston and cylinder structure comprising an inner cylinder and an outer cylinder surrounding the same in rigid relationship thereto, end wall means closing one end of said cylinders, a piston reciprocable in the inner cylinder having a rod connected therewith and extending through an opening provided therefor in said end wall means, a piston reciprocable in the outer cylinder and arranged to compress a spring disposed in said outer cylinder between said piston and said end wall means, a second end wall means closing the other end of said cylinders and having openings provided therein through which the last mentioned end of said cylinders have communication, check valve means cooperating with said openings to control fluid flow between said cylinders to provide a certain rate of flow in one direction between said cylinders with said check valve means seated and a different rate of flow in the opposite direction with said check valve means unseated, and an end closure secured to the last named end wall means serving as a housing for said check valve means and as a closure for that end of said cylinders.

7. A structure as set forth in claim 6, including hydraulic fluid in said cylinders between said pistons, whereby movement of one piston is transmitted through the intervening fluid to or from the other piston.

8. A structure as set forth in claim 7, wherein the last named end closure and check valve means are both removable to enable filling the inner cylinder with hydraulic fluid or replenishing such fluid in event of leakage.

9. A structure as set forth in claim 6, wherein the last named end wall means comprises a separate inner end wall on one end of the inner cylinder with a port provided therein, and a separate outer end wall on the corresponding end of the outer cylinder abutting the inner end wall, the end closure closing an opening provided in the outer end wall which communicates with the port provided in the inner end wall, the check valve means cooperating with the latter port in the inner end wall.

10. In combination, a dump vehicle comprising a frame, a body pivoted with respect to said frame for tilting to dumping position, latch means releasably locking said body in lowered position relative to said frame, and a spring motor for said vehicle pivotally connected on one hand with said frame and on the other hand with said body, said motor comprising an inner cylinder and an outer cylinder surrounding the same in rigid relationship thereto, end wall means closing one end of said cylinders, a piston reciprocable in the inner cylinder having a rod connected therewith and extending through an opening provided therefor in said end wall means for pivotal connection to one of said body and frame, a piston reciprocable in the outer cylinder and arranged to compress a spring disposed in said outer cylinder between said piston and said end wall means, a second end wall means closing the other end of said cylinders and having openings provided therein through which the last mentioned end of said cylinders have communication, check valve means cooperating with said openings to control fluid flow between said cylinders to provide a certain rate of flow in one direction between said cylinders with said check valve means seated and a different rate of flow in the opposite direction with said check valve means un-

seated, and an end enclosure secured to the last named end wall means serving as a housing for said check valve means and as a closure for that end of said cylinders, said end closure being pivotally connected to the other of said body and frame.

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