Nov. 29, 1966 R. D. RUMSEY 3,288,202

PISTON-LEVER ROTARY ACTUATORS FOR HATCH COVERS AND THE LIKE

Filed Jan. 15, 1964 3 Sheets-Sheet 1

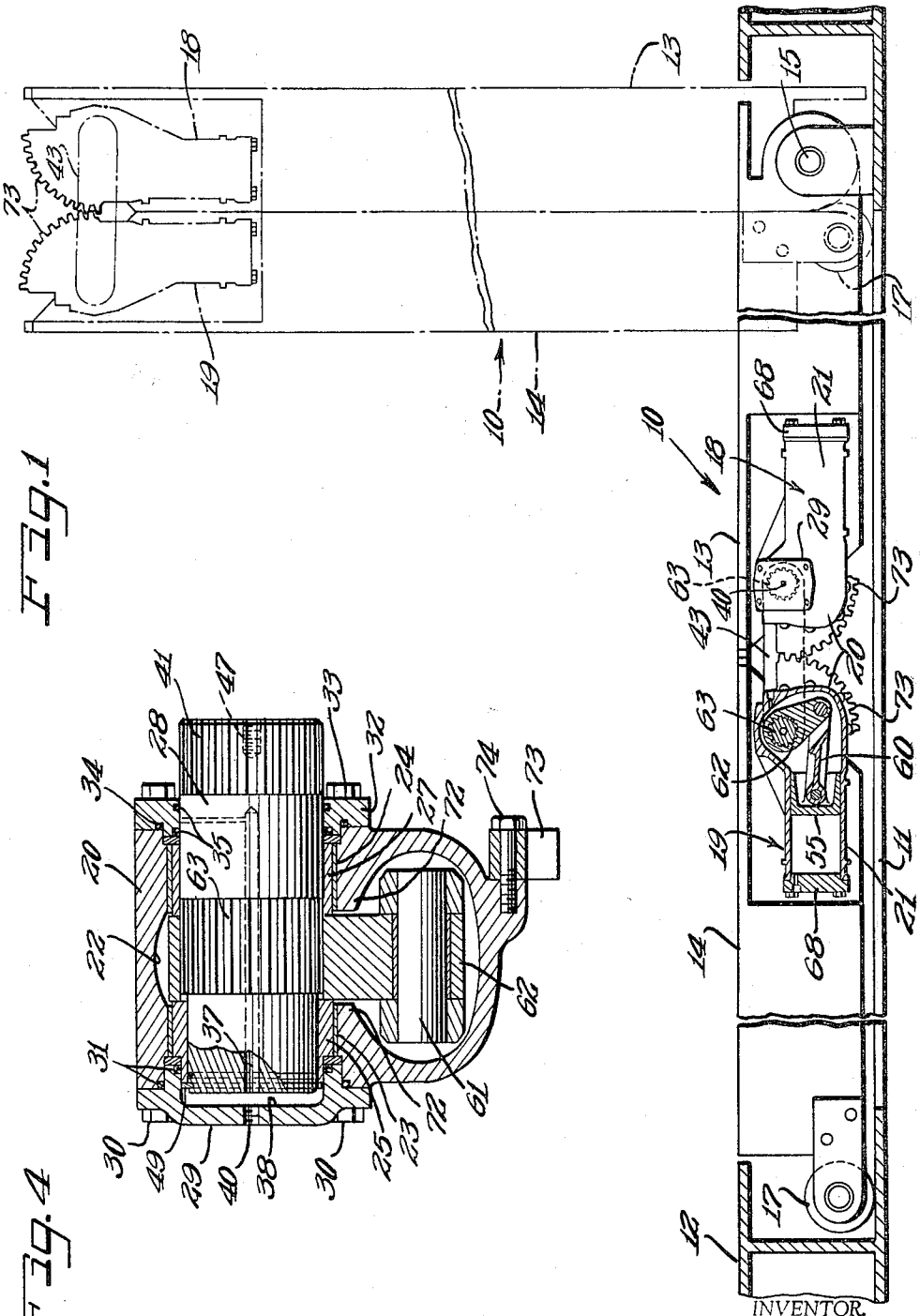


FIG. 1

FIG. 4

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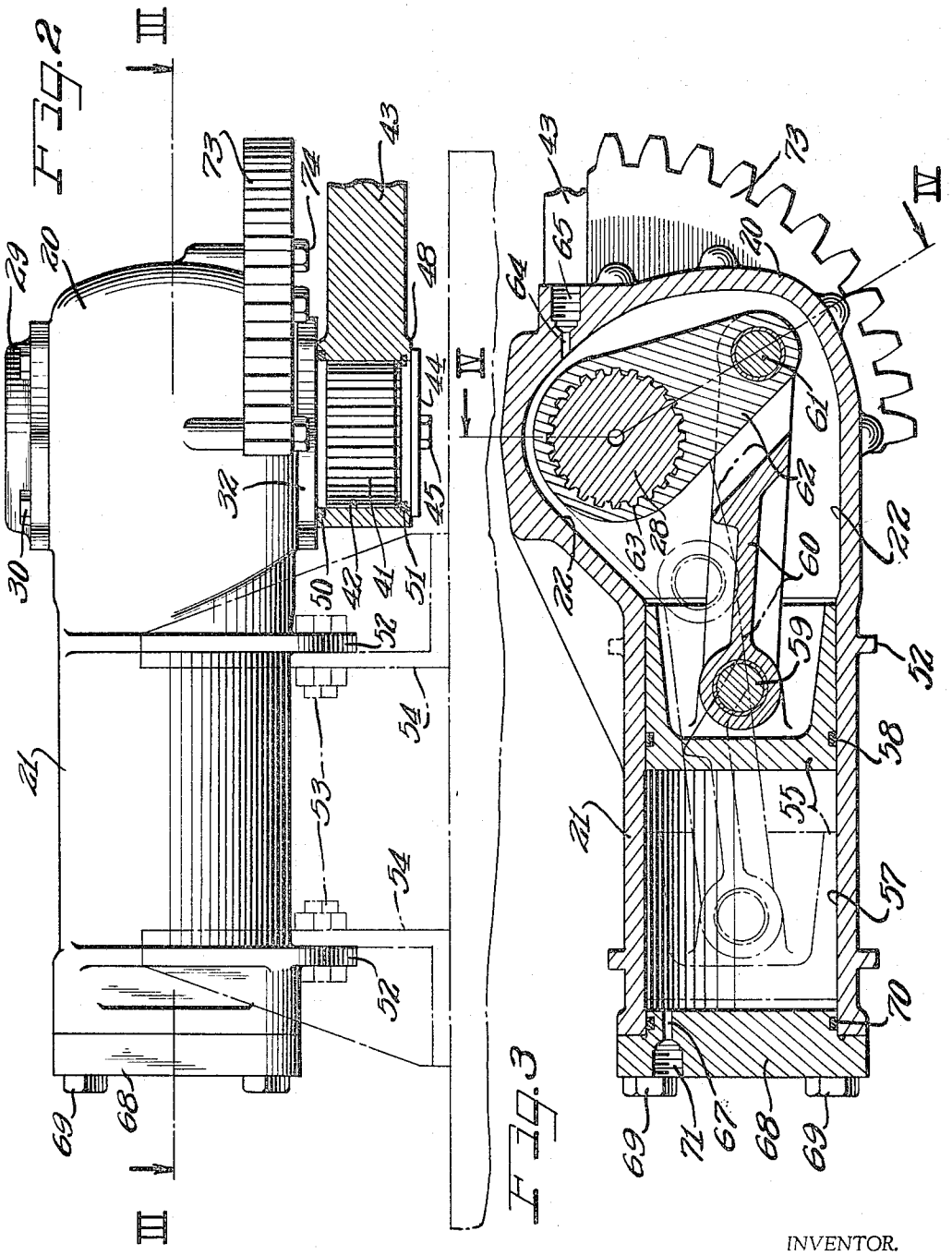


Fig. 2

Fig. 3

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Fig. 5

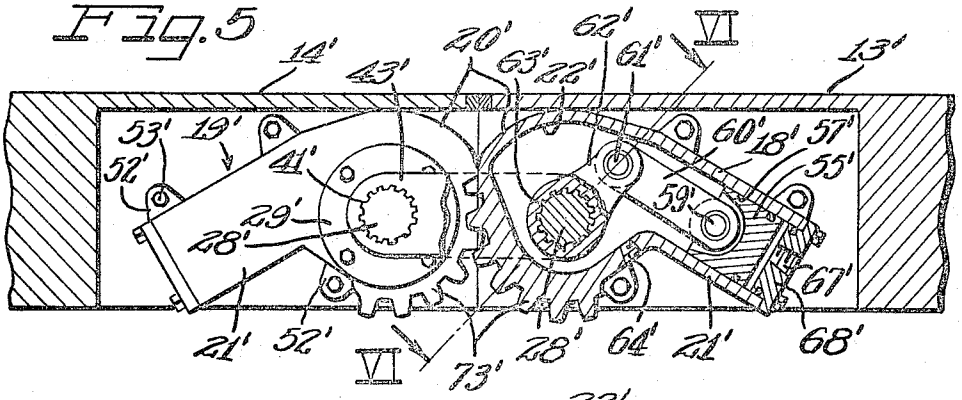


Fig. 6

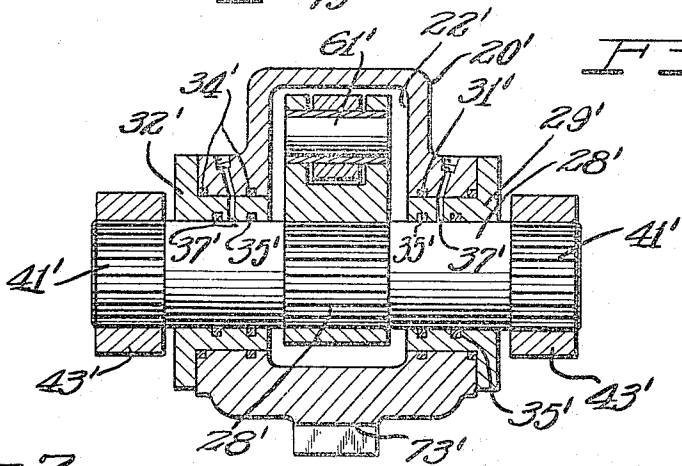
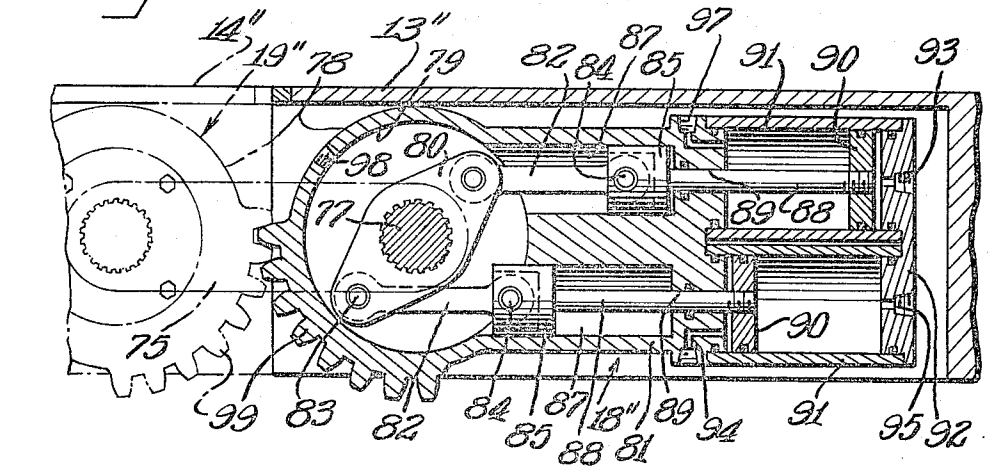


Fig. 7



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3,288,202

PISTON-LEVER ROTARY ACTUATORS FOR HATCH COVERS AND THE LIKE

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19 Claims. (Cl. 160—188)

This invention relates to improvements in means for efficient power operation of foldable closures such as hatch covers, doors, and the like.

Actuation of the generally fairly heavy movable sections of hatch covers, for example, has heretofore been effected by various devices using cables, winches, gears, cylinder, levers and the like, some having advantages over others for various reasons. Various of such devices have involved complexities, exposed mechanisms, parts projecting out of or away from the movable closure sections. Hydraulic devices have been objectionable due to external leakage, exposure of bearing surfaces to contamination and corrosion, etc.

An important object of the present invention is to provide new and improved rotary actuator means for powered operation of hatch covers and the like and possessed of high torque in small compact and rugged unit.

Another object of the invention is to provide a new and improved rotary actuator construction having few and simple parts and which can be produced and sold at relatively low cost.

Still another object of the invention is to provide a new and improved piston-lever rotary actuator construction.

Yet another object of the invention is to provide a novel piston-lever rotary actuator construction in which all of the moving parts are thoroughly protected.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a schematic vertical sectional elevational view through a representative hatch cover assembly embodying features of the invention;

FIGURE 2 is an enlarged bottom plan view of one of the piston-lever rotary actuators shown in FIGURE 1;

FIGURE 3 is a sectional detail view taken substantially along the line III—III of FIGURE 2;

FIGURE 4 is a sectional detail view taken substantially along the line IV—IV of FIGURE 3;

FIGURE 5 is a schematic sectional elevational illustration showing a modification;

FIGURE 6 is an enlarged fragmentary sectional detail view taken substantially on the line VI—VI of FIGURE 5; and

FIGURE 7 is a schematic sectional detail view showing a further modification.

In an illustrative embodiment of the invention as shown in FIGURE 1, a hatch cover assembly **10** is mounted for closing disposition over a hatch opening **11** in a deck **12**. Alternatively, the deck **12** may be a bulkhead or wall and the hatch cover **10** a foldable door or closure for the opening **11** serving as a doorway or similar access opening. In this instance the hatch cover **10** comprises two complementary cover sections **13** and **14** wherein the section **13** is pivotally mounted along one edge as indicated at **15** to the deck structure, while the other cover section **14** is provided with suitable anti-friction roller means **17** on its remote edge so that the cover sections can be conveniently actuated between the closed full line position shown and the dot dash open folded position. While for illustrative purposes the hatch

cover **10** is shown as comprising two sections, it may comprise additional sections in series, as preferred or required.

Powered hinge means are provided for not only connecting the cover sections **13** and **14** hingedly but for effecting opening and closing movements of the cover sections. To this end, the cover sections **13** and **14** carry within their adjoining margins complementary, aligned and coactively coupled respective piston-lever rotary actuators **18** and **19**. There may be as many sets of the actuators located along the joint between the cover members as necessary in view of the length and weight of the cover members, such as at each end of the joint.

Since each of the actuators **18** and **19** is of identical construction but in reverse order to be complementary in the set, description of details of one of the units will suffice for the other. Each of the actuators has a preferably unitary cast metal body comprising an as nearly as practicable spherical hollow head portion **20** and an aligned tubular cylindrical portion **21**. Within the head portion **20** is a chamber **22** provided with aligned, coaxial similar opening bores **23** and **24** through the opposite sides of the head within which are mounted respective bearings **25** and **27** in which is journalled a shaft **28** of substantial diameter. A flanged closure cap **29** encloses the adjacent end of the shaft **28** and closes the bore **23** and is secured fixedly as by means of screws **30**. Suitable sealing rings **31** prevent leakage through the joint between the housing head **20** and the cap **20**. The opposite bore **24** is closed by a ring flange **32** secured as by means of screws **33** and encircling the remaining end portion of the shaft **28** which projects outwardly therefrom. A fluid sealing ring **34** is disposed between the closure ring **32** and the contiguous face of the housing head **20**. Axially spaced pressure seals **35** in the inner perimeter of the closure ring **32** bearingly opposing the rotary shaft **28** have high pressure leakage drain back passage **37** in the shaft leading therefrom to a seal leakage sump **38** afforded within the end cap **29** having a port **40** therein to which a drain duct (not shown) is adapted to be connected.

On its outwardly projecting end portion, the shaft **28** is provided with splines **41** for rigid coupling engagement within a complementally splined socket bore **42** in the end portion of a rigid connecting bar **43**. To protect the splined connection, a closure plate **44** is secured across the outer end of the splined bore **42** as by means of a screw **45** threaded into a tapped bore **47** in the outer end of the shaft. This presses the cover plate **44** against the outer end of hub **48** on the bar **43** and thrusts the hub toward the closure ring plate **32** while at the same time drawing outwardly on the shaft **28** which is retained against axial withdrawal by means such as a snap ring **49** secured about its inner extremity and engageable as a stop against the adjacent end of the contiguous bearing **25**. Protective inner and outer sealing rings carried within the hub **48** adjacent to the opposite ends of the splines **41** exclude corrosive contaminates such as sea water and the like from access to the splines should any such contaminate escape into the joints between respectively the closure plate **44** and the hub **48** and the hub and the housing closure ring plate **32**.

By means of the rigid connecting arm bar **43** and the shafts **28** of the pair of motors or actuators **18** and **19**, a hinge connection is afforded for the door or cover sections **13** and **14** and the actuators are operatively coupled. Removable but rigid attachment of the respective actuators to the closure sections is effected in suitable manner as for example by providing longitudinally spaced parallel and coextensive attachment vane or ear flanges **52** on the cylinder extension portion **21** of the actuator and projecting toward the connecting bar side of the actuator unit to receive securing bolts **53** by which the flanges are

attached to means such as bracket structure **54** on the associated closure section.

As will be observed in FIGURE 1, the elongated lever cylinder portions **21** of the actuator units extend in respectively opposite directions from the closure section joint and in as nearly as practicable an equally balanced relationship with the head portions **20** of the actuators spaced by the rigid connecting hinge bar **43**. Through this arrangement, the actuators will serve as cranks about the pivots provided by the respective shafts **28** for effecting opening and closing movements of the associated cover sections **13** and **14**. Cranking torque is applied internally of the actuators **18** and **19** by means acting on the elongated extension portions **21** and secured to the respective rigid nonrotating shafts **28**. An efficient, positive, easily controlled device for attaining the cranking action comprises a hydraulic piston operator including a piston **55** reciprocably mounted within a cylindrical bore **57** within the elongated crank extension **21**. In this instance, the piston **55** is of the skirted type carrying a peripheral packing or piston ring **58** and in this instance the skirt of the piston projects toward the end of the cylinder **57** which opens into the head chamber **22**. Connected as by means of a connecting pin **59** within the skirted portion of the piston **55** is one end portion of a connecting link or piston rod **60** having its opposite end portion bifurcated and connected as by means of a wrist pin **61** to the distal end portion of a rigid torque arm **62** having a splined connection **63** with the associated shaft **28** within the head chamber **22**. In this instance, for maximum leverage advantage, to take maximum advantage of the limited envelope space within the respective cover section, and application of torque forces with minimum stresses, the construction and arrangement is such that the torque creating force is applied by a generally separating reaction force between the head portion **20** of the actuator unit and the piston **55**. For this purpose, the piston **55** is located in the closed position of the associated cover section adjacent to the head end of the cylinder **57**, and the torque arm **62** is angled downwardly and forwardly toward the joint end of the cover section, substantially as shown.

Power for motivating the actuators **18** and **19** is provided hydraulically to move the piston **55** away from the head **20** as indicated in dot dash outline in FIGURE 3, for opening the cover sections, and to drive the piston in the opposite direction for closing the cover sections. For this purpose, an inlet port **64** is provided in the normally upper portion of the head **20** into the chamber **22** and provided with a suitable external counterbore **65** into which a hydraulic conduit connection is adapted to be secured to place the actuator in communication with a hydraulic operating circuit (not shown) in which hydraulic fluid such as oil is caused to be delivered under pressure into the chamber **22** for effecting separating movement of the piston **55** and the head **20** to open the cover sections, and to drain the chamber **22** during closing movement of the cover sections.

At the opposite end of the actuator unit, a hydraulic connection is afforded through a port **67** through a closure plate **68** across the distal end of the extension portion **21** of the housing. This closure plate is removably attached as by means of screws **69** and has an inwardly extending boss portion which carries a pressure fluid seal **70**. A hydraulic conduit (not shown) is adapted to be secured as by means of a connector secured into a threaded counterbore **71** in the external portion of the port **67**. Through this port, hydraulic fluid is bled or exhausted during opening movements of the cover sections and delivered under pressure to effect relative separating movement of the piston **55** and the closure **68** during closing movements of the cover sections. It may be observed, that for attainment of maximum internal pressure resistance, the one-piece housing of the respective actuator units provides maximum rigidity in the head portion **20**,

including internal reinforcement **72** (FIG. 4) since torque forces in lifting the cover sections **13** and **14** must necessarily be rather high, especially where the cover sections are of substantial weight and size. In a practical installation, pressure within the chamber **22** may rise to 3200 p.s.i. Since the rotary bearings of the unit are all in this chamber, excellent lubrication is afforded. It will be observed that the ports **64** and **67** are located as high on the unit as practicable whereby any air entrapped in the unit will bleed from the system or will automatically be swept from the unit during operation.

For synchronizing action of the coacting actuator units, sector gear means **73** are provided. In a desirable arrangement, the sector gear means comprise respective sectors which are secured as by means of screws **74** to the head section **20** in each instance on the side thereof adjacent to the hinge arm bar **43**. These meshing sector gears **73** assure uniform, balanced unison hinging movement of the cover sections **13** and **14**.

Numerous advantages are apparent in the particular construction and arrangement of the actuator units **18** and **19** in addition to those already enumerated, including a pull load on the link **60**, the highest pressure being applied to the generally spherical head portion **20** of the actuator body with the relatively lower cover lowering pressure applied to the lever extension portion **21**, an actuating crank relationship which is of maximum length within the available space, the hinge pivot is near the top of the cover assembly facilitating utilization of available space and mounting of the actuator, there is efficient drain-back of pressure from the sealing means associated with the shaft **28** to avoid external leakage, torque is taken from one end of the shaft only thereby requiring only a single connecting hinge arm between the actuators and thereby avoiding serration alignment problems, the connecting arm is on the same side as the means for attaching the actuators to the supporting structure of the cover sections, thereby reducing overhanging mounting loads, the stabilizing gear segments **73** carry no loads, all bearings are fully submerged and lubricated, only an external seal is rotary and therefore complete safety from entry of contaminates into the unit is attained, all splines are sealed within the unit and therefore not subject to corrosion, there is simplified design with minimum number of pieces and all parts are arranged to enter through the distal end of the cylinder or through the side openings in the head, and all of the high pressure shaft seals are of equal diameter so that the shaft **28** is actually hydraulically balanced.

In FIGURES 5 and 6, a modified arrangement is depicted wherein cover sections **13'** and **14'** are provided with a power hinge assembly comprising actuators **18'** and **19'** coupled for unison operation and constructed and arranged to accommodate minimum clearance availability for the actuators at each side of the hinge line or access. To this end, each of the actuators comprises a one-piece rugged hollow housing including a head **20'** and a lever extension **21'** in the form of a cylinder and in this instance disposed to extend generally downwardly from adjacent the top of the head portion, with the hydraulic chamber **22'** within the head portion accommodating a shaft **28'** at a lower relative elevation than in the form of FIGURES 1–4 and journalled in respective opposite end closures **29'** and **32'**, respectively. Axially spaced pressure seals **31'** between the closure member **29'** and the housing and similar pressure seals **34'** between the housing and the closure member **32'**, and pressure seals **35'** between the closure members and the shaft **28'** are drained by lead-off passages which in this instance are suitably connected externally of the housing to bleed-off duct means (not shown).

In this instance each opposite end portion of the shaft **28'** extends outwardly beyond the adjacent closure member in which journalled end has a splined area **41'** to which is rigidly attached a complementally splined rigid connecting hinge arm **43'** by which the respective shafts

of the two actuator units are rigidly connected and the units operatively coupled.

Attachment of the housings of the units to the supporting structure within the respective closure section in each instance is effected as by means of attachment ear or foot flanges 52' integral with the housings and receptive of screws or bolts 53'. This rigidly attaches the respective housings to the associated cover section in each instance.

In the actuator units 18' and 19', the construction and relationship is such that respective piston 55' reciprocable in the cylinder 57' provided in the associated lever extension 21' is disposed in the distal end portion of the cylinder but with the skirted portion of the piston nevertheless extending toward the chamber 22' and having connected by a connecting pin 59' an end portion of a link or piston rod 60' attached at its opposite end by a connecting pin 61' to a lever arm 62' extending generally upwardly and divergently relative to the cover joint and having a rigid splined connection 63' with the associated shaft 28'. In this embodiment, a hydraulic communication port 64' through the head portion 20' into the chamber 22' affords means for introducing the hydraulic pressure fluid for lowering or closing the end cover section members 13', 14'. Hydraulic pressure fluid introduced through a port 67' in an end cover 68' across the distal end of the cylinder 57' affords communication for hydraulic pressure into the chamber between the piston 55' and the closure 68' for raising or opening the cover sections. Meshing, stabilizing segmental gear means 73' are, in this instance, provided as integral portions of the head portion 21' of the actuator housing and centered between the connecting hinge bars 43'.

For situations where great torque is required, the modification of FIGURE 7 may be adopted and in which shaft bearing loads are substantially equalized. To this end, closure cover members 13'' and 14'' which are relatively moveable about a hinge joint have mounted thereon respectively opposite sides of the hinge joint rotary hydraulic piston-lever actuators 18'' and 19'' mounted in substantially linear alignment with one another and at least one rigid connecting hinge bar 75 splined onto respectively spaced parallel coextensive non-rotary shafts 77 journalled in head portions 78 of preferably unitary body castings providing housings for the respective actuators 18'' and 19''. Within each of the respective head portions 78 is a working chamber 79 accommodating a cross head type rigid lever arm 80 splined onto the respective shaft 77. At one end, the lever arm 80 extends on a line generally convergent with the hinge joint, similarly as the lever arms 62 in FIGURE 1, while the opposite lever arm end portion diverges relative to the hinge joint substantially like the lever arms 62' in FIGURE 5.

Torque producing means are attached to the respectively opposite end portions of the cross head lever arms 80 for generating leverage to swing a respective lever extension 81 of the actuator housing projecting away from the hinge joint and rigidly secured to the supporting frame structure of the associated cover section. To this end, respective links or piston rods 82 are pivotally attached as by means of pins 83 to the respective end portions of the lever arm 80 and at their opposite ends are connected pivotally as by means of pins 84 to reciprocable guide heads 85 slidably engaged in respective cylindrical bores 87 in the lever extension portion 81. Projecting rearwardly from the guide heads 85 are respective piston rods 88 extending through bearing apertures 89 in the rear end portion of the lever extension 81 and attached to respective drive pistons 90 reciprocable in respective cylinders 91 attached to the rear or distal end of the lever portion 81 and closed at their distal ends by a closure cap member 92. The pistons 90 are of preferably equal diameter and equal stroke, with the uppermost piston 90, as shown, being located in the closed relationship of the cover sections 13'' and 14'' substantially at the rear end of the associated cylinder 91 while the lower piston 90 is disposed in the forward end of the associated cylinder.

For effecting raising, opening folding of the closure members, hydraulic fluid under pressure is introduced through a port 93 in the cap 92 into the working chamber space in the upper cylinder 91 between the closure plate and the piston 90 while hydraulic pressure fluid is introduced through a suitable port 94 in the distal end portion of the housing into the working chamber space in front of the lower piston 90, thus generating uniform, balanced torque force in the driving unit to pivot about the associated shaft 77 in response to respective push-pull reaction in the operating mechanism. To lower or return the cover sections to closed position hydraulic fluid is exhausted through the ports 93 and 94, while hydraulic fluid under pressure is introduced through a port 95 leading to the back of the lower piston 90 and a port 97 leading to the front of the upper piston 90, and which ports serve as exhaust ports during the raising of the closure sections. Continuous low pressure hydraulic fluid in the head chamber 79 may be maintained through a port 98 preferably located near the top of the head portion 78.

Each of the head portions 78 carries a gear segment 99 meshing with the companion segment for maintaining a synchronized, balanced coactive relationship of the actuators.

In all embodiments of the invention the pairs of opposed complementary coordinated rotary actuators afford effective torque leverage through the rigidly coupled lever arms. By virtue of the filled hydraulic systems in the actuators the associated closure members can be locked at any intermediate position desired and not drift. Extremely long closures such as hatch covers can be efficiently power operated by the embodiments of this invention. High operating efficiency is attained per unit mass of apparatus. Accommodation of the torque lever motor hinge units or actuators in limited space and mounting entirely within the respective closure members is accomplished.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. An assembly including members relatively movable about a hinge joint,

powered hinge means for hingedly relatively moving said members comprising a pair of opposed complementary coordinated rotary actuators having respective head portions adjacent to said joint and oppositely extending crank lever portions projecting away from said joint,

means operatively connecting the head portions for coordinated operation,

means mounting said crank lever portions rigidly on said members at respectively opposite sides of the hinge joint,

and means for driving the actuators comprising respective elements movable reciprocably relative to said members on respective axes angular to said joint and reacting with said crank lever portions to effect relative movement of said members.

2. An assembly as defined in claim 1, in which said head portions have stabilizing and directly meshing segmental gears.

3. An assembly as defined in claim 1, wherein said elements of the means for driving the actuators comprise hydraulically responsive piston structures.

4. An assembly as defined in claim 1, wherein said connecting means comprise at least one rigid coupling arm and shafts secured in rigid nonrotary relation to said arm and pivotally engaged by the respective head portions of the actuators.

5. An assembly of members mounted for hinged orientation between relatively extended and folded positions,
powered hinge means connecting the members and comprising a rigid bar extending across the hinge joint between the members,
journals rigidly carried by the opposite end portions of the bar,
means fixedly mounted on the respective members and pivotally engaging said journals,
one of said journals carrying a rigid lever extending angularly relative to said hinge joint,
means coupled to said lever and having reaction relative to said fixedly mounted means,
and means for effecting a powered reaction between said coupled means and said fixedly mounted means for developing a driving torque to effect relative movement of said members hingedly.

6. An assembly of closure or like members relatively movable about a hinge joint between extended and folded positions,
a rigid bar extending angularly across the hinge joint between said members,
said bar having respective levers rigidly coupled to its opposite ends,
actuators rigidly mounted on said members and having housings enclosing said levers,
and reaction means within said housings coupled to said levers and operable to effect torque thrusts within said housings to effect relative movement of said members between said positions.

7. An assembly as defined in claim 6, in which said reaction means comprise respective pistons and piston link rods connecting the pistons to said levers.

8. An assembly as defined in claim 6, in which said housings have lever cylinders and said reaction means comprise pistons reciprocable in the cylinders, with means for introducing pressure fluid between said pistons and opposing respective portions of the housings in said cylinders.

9. An assembly comprising closure members mounted for relative movement between extended closing and folded open positions,
power means mounted along a hinge joint between said members and comprising torque lever devices respectively rigidly mounted on said members adjacent to said hinge joint,
rigid coupling means extending across the joint and having respective shafts journalled on said torque lever devices,
respective rigid lever arms on said coupling means,
and reaction means operable between said lever arms and said devices for selectively effecting member-moving torque leverage in said devices.

10. A rotary actuatory assembly for effecting opening and closing movements of hatch cover, door and like movable members,
a pair of torque lever housings,
coupling bar means having rigidly connected thereto respective nonrotary shafts journalled in said housings,
reaction levers rigidly attached to the shafts within the housings,
means for rigidly attaching the housings to respective associated members which are movable relative to each other,
and reaction means within the housings operative upon said levers to effect coordinated pivotal movement of the lever housings about said shafts to move said members.

11. An assembly as defined in claim 10, in which said levers are of cross-head type having end portions thereof projecting beyond opposite sides of the associated shafts, and the reaction means comprise equally oppositely motivated piston structures.

12. A rotary crank actuator comprising a housing having a substantially monolithic body providing a head portion having a chamber therein and an elongated cylinder torque lever crank extension having a cylinder chamber opening into said head chamber,
said cylinder chamber being open at the distal end of said extension,
a closure member secured across said open end,
a shaft journalled in said head portion on an axis normal to and offset relative to said cylinder chamber,
a lever rigidly secured to said shaft within said head chamber and having its distal end portion accessible from said cylinder chamber,
a piston reciprocably mounted in said cylinder chamber,
a piston rod link connecting said piston and said lever,
means for introducing pressure fluid respectively into the head chamber and into the cylinder chamber between said closure member and the piston,
said shaft having a splined end portion externally of said head portion,
a coupling arm bar having a splined portion attached to said splined end portion,
and means protectively sealing the splined joint between the coupling arm bar and the shaft.

13. A rotary crank actuator comprising a housing having a substantially monolithic body providing a head portion having a chamber therein and an elongated cylinder torque lever crank extension having a cylinder chamber opening into said head chamber,
said cylinder chamber being open at the distal end of said extension,
a closure member secured across said open end,
a shaft journalled in said head portion on an axis normal to and offset relative to said cylinder chamber,
a lever rigidly secured to said shaft within said head chamber and having its distal end portion accessible from said cylinder chamber,
a piston reciprocably mounted in said cylinder chamber,
a piston rod link connecting said piston and said lever,
means for introducing pressure fluid respectively into the head chamber and into the cylinder chamber between said closure member and the piston,
said shaft having extensions from opposite sides of the head portion,
respective coupling arm bars secured to said extensions, and synchronizing sector gear means on said head portion centered between said arm bars and adapted for meshing with complementary sector gear means of a companion actuator.

14. A rotary actuator comprising a high-pressure hollow housing having head and lever extension portions,
means for attaching the housing rigidly to a member to be actuated,
shaft means journalled in said head portion and having a reaction lever rigidly thereon within the chamber of the head portion,
reaction means relatively movably mounted in said lever extension of the housing and coupled to said reaction lever,
means for introducing high pressure hydraulic motivating fluid into the housing,
and pressure fluid sealing means about said shaft means where it is journaled in said head portion and including means for draining off any leakage from within the housing to or past said sealing means.

15. An assembly comprising a hatch cover, door and the like including a pair of members providing therebetween a hinge joint;
a plurality of piston-lever rotary actuators hingedly connecting said members in the hinge joint and having respective piston-lever portions extending away

from the hinge joint and respective pistons reciprocably operable in said portions;

shaft means in said hinge joint non-rotatably connected together and rotatably respectively engaged by said actuators;

means operatively connecting said pistons to said shaft means;

means rigidly connecting the actuators to said members;

and means for powering said pistons for driving said actuators rotatably about said shaft means to move said members hingedly relative to one another.

16. A hydraulic rotary actuator structure of the character described operative under high internal pressure conditions and comprising:

a hollow housing having an as nearly as practicable generally spherical monolithic head portion defining a hydraulic pressure chamber therein and a piston-lever extension from said head portion defining a hollow cylinder opening into said head chamber;

a shaft journaled in said head portion across said head chamber on an axis transverse to, and offset substantially to one side of, the axis of said cylinder;

a reaction lever arm rigid on said shaft within said head chamber and extending across said cylinder axis;

a piston reciprocably mounted in said cylinder;

a piston rod link connected to the piston at one end and to the distal end portion of said arm at the opposite end;

means for introducing hydraulic pressure fluid into said cylinder to thrust said piston toward said arm and thus effect relative separating movement of the piston and the extension;

and means for introducing hydraulic pressure fluid into said head chamber to effect pulling of said piston on said arm and relative movement of the piston and cylinder toward one another.

17. An actuator as defined in claim 16, in which said head portion has bearings journaling said shaft and located in stabilizing relation close to each opposite side of said arm.

18. A double acting high pressure hydraulic rotary crank actuator comprising:

a housing having a substantially spherical monolithic head portion having a chamber therein;

an elongated hollow cylinder torque lever extension rigid with said head portion and having a cylinder chamber opening into said head chamber and opening from a distal end of said extension;

a closure on said distal end of the cylinder extension;

a shaft journaled in said head portion on an axis normal to and offset relative to said cylinder chamber; said head portion having aligned journal openings in size not substantially larger in diameter than said shaft, and at least one end portion of the shaft projecting outwardly beyond said head portion for attachment to a cooperating member;

a reaction lever rigidly secured to said shaft within said head chamber and having its distal end portion accessible from said cylinder chamber;

said cylinder chamber being of larger inside size relative to said lever to receive the lever therethrough for assembly with said shaft;

a piston reciprocably mounted in said cylinder chamber;

a piston rod link operatively connecting said piston and said lever;

and means for introducing pressure fluid respectively and alternatively into said head chamber to drive the link end of the piston and into said cylinder chamber between said closure and the piston.

19. A rotary actuator structure for powering closure members comprising,

a hollow housing having a head portion and a leverage crank extension,

a shaft journalled in said head portion and having a reaction lever arm rigid thereon within the head portion, means rigid on the shaft externally of the head portion and adapted to be held in a fixed position,

torque-generating means in said extension and pivotally coupled to said lever and operable for effecting swinging of said housing about said shaft,

and gear means on said housing adapted to mesh with corresponding gear means on a complementary and coactive housing to coordinate swinging movements of the housings.

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