Dec. 27, 1966 J. CABARET ETAL 3,294,255

LIFTING MECHANISM

Filed Sept. 25, 1964 4 Sheets-Sheet 1

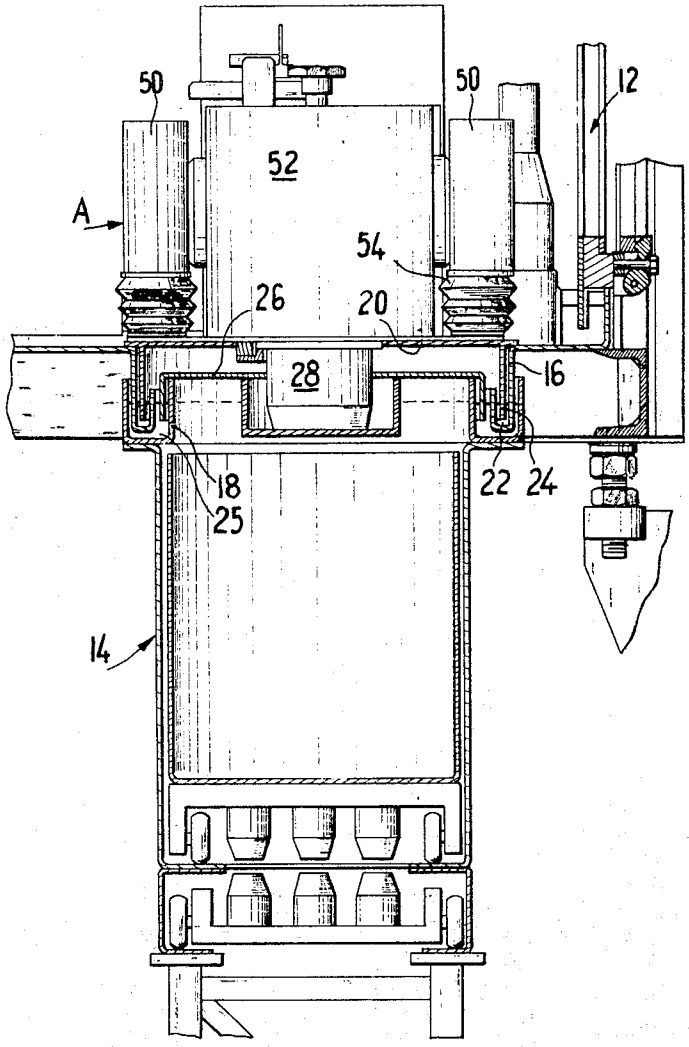


FIG.1

INVENTORS
JEAN CABARET
VICTOR GERARD
ANDRÉ VALENTIN

BY
Bacon & Thomas ATTORNEYS

Dec. 27, 1966 J. CABARET ETAL 3,294,255

LIFTING MECHANISM

Filed Sept. 25, 1964 4 Sheets-Sheet 2

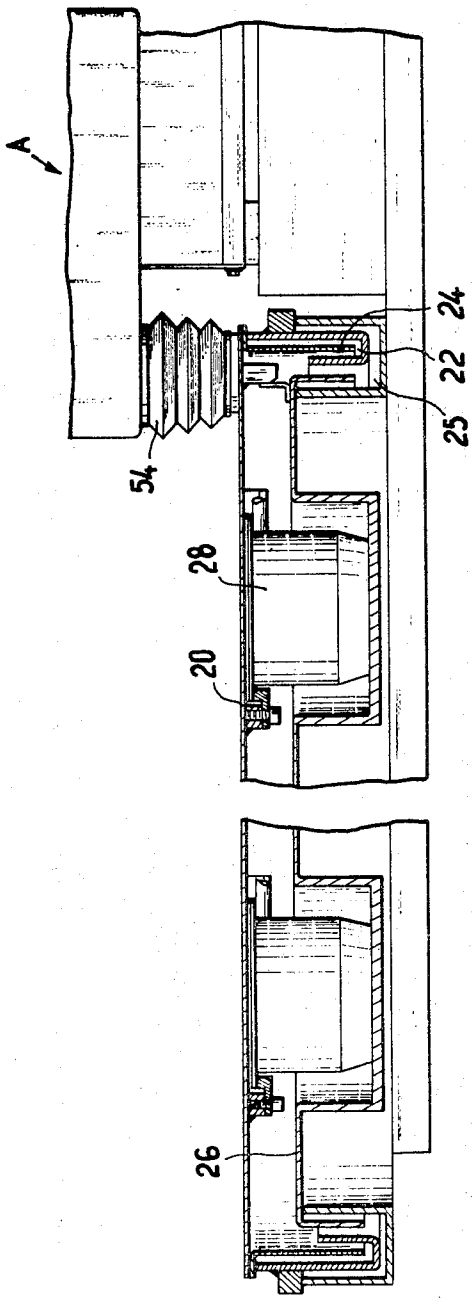


FIG. 2

INVENTORS
JEAN CABARET
VICTOR GERARD
ANDRE' VALENTIN
BY
Bacon & Thomas ATTORNEYS

Dec. 27, 1966 J. CABARET ETAL 3,294,255

LIFTING MECHANISM

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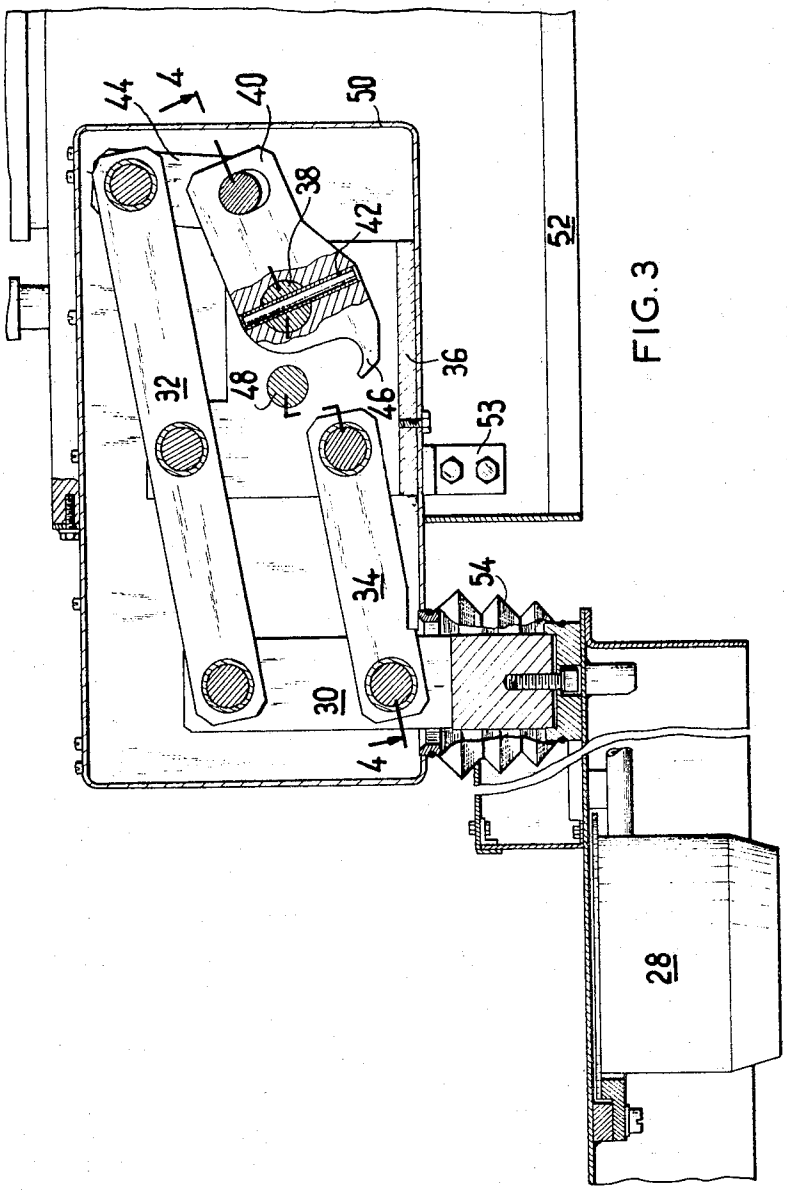


FIG. 3

INVENTORS
JEAN CABARET
VICTOR GERARD
ANDRÉ VALENTIN

BY Bacon & Thomas ATTORNEYS

Dec. 27, 1966 J. CABARET ETAL 3,294,255

LIFTING MECHANISM

Filed Sept. 25, 1964 4 Sheets-Sheet 4

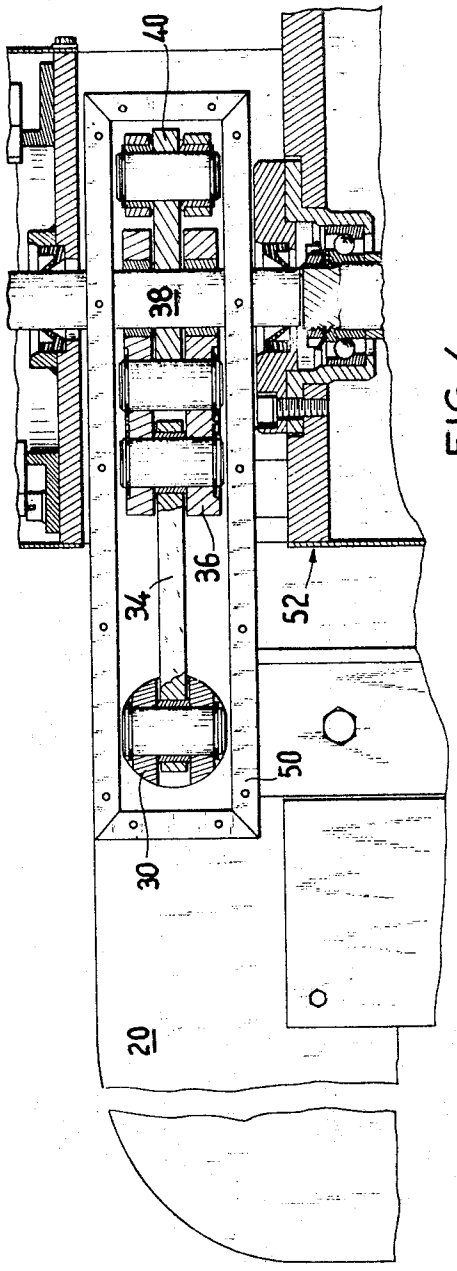


FIG. 4

INVENTORS
JEAN CABARET
VICTOR GERARD
ANDRÉ VALENTIN

BY Bacon & Thomas ATTORNEYS

United States Patent Office 3,294,255 Patented Dec. 27, 1966



3,294,255

# LIFTING MECHANISM

Jean Cabaret, Chatillon, Victor Gerard, Cachan, and André Valentin, Paris, France, assignors to Commissariat a l'Energie Atomique, Paris, France

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3 Claims. (Cl. 214—1)

The present invention relates to a lifting mechanism which is especially intended for use in a nuclear reactor facility for the purpose of lifting covers of tanks or leak-tight vessels.

In nuclear research laboratories, radioactive materials are manipulated within leak-tight and shielded vessels and in order to transfer the radioactive materials or products from one vessel to the other, use is made of totally enclosed conveyors for connecting said vessels to each other. When one of said vessels is removed, it is necessary to ensure that the vessel and conveyor both remain leak-tight; it is therefore necessary to close the openings which provide a communication between the vessel and the conveyor by means of covers with liquefiiable seals, for example. Such covers are normally closed, and when it is desired to transfer an object from a vessel into the conveyor or conversely, it is of course necessary to remove said covers.

In the case in which said covers are fitted with liquefiable seals, it is necessary to lift the covers to a height such that the seal is broken and to leave said covers suspended above the seal for a certain period of time prior to removing them in order to allow them to drip and thus prevent the liquid of the seal from being dispersed either within the vessel or within the conveyor.

The present invention is directed to the design of a lifting mechanism wherein the upward travel of the cover is broken down into two stages; in the first stage, the cover is lifted vertically while remaining parallel to the plane of the opening which it obturates, and in the second stage, the cover is removed so as to free the opening.

The lifting mechanism according to the invention comprises an articulated parallelogram formed by two parallel arms which are pivotally mounted on a base-plate so as to rotate about pivot pins which are in alignment on a vertical line, there being pivotally attached to the ends of said arms a vertical yoke which is fixed on the cover, said base-plate being mounted to rotate freely about a driving shaft to which it attached a crank-arm, said crank-arm being coupled to one of the arms of the articulated parallelogram and provided with a nose which is adapted to come into contact with a stationary abutment of said base-plate so as to drive said base-plate in rotation about the axis of said driving shaft, said nose being located at a distance away from said abutment when the cover is closed, so that the rotational movement of the driving shaft first produces the deformation of the parallelogram and consequently the vertical displacement of the cover and then, when the nose of the crank-arm is in contact with said abutment, produces the rotational motion of the combined assembly consisting of base-plate, arm, yoke and cover about the axis of the driving shaft.

The invention also consistn of other arrangements which can usefully be employed in conjunction with the foregoing arrangement but which can also be employed independently thereof. All of these arrangements will become apparent from a perusal of the following description of one mode of practical application of the invention as given by way of illustrative example without any implied limitation.

The description relates to the accompanying drawings, wherein:

FIG. 1 is a partial sectional view of an installation in which the lifting mechanism of the invention is employed;



FIG. 2 is another partial view of the same installation;

FIG. 3 is a sectional view of the cover-lifting mechanism which is employed in this installation; and

FIG. 4 is a sectional view along the line 4—4 of FIG. 3.

The lifting mechanism A in accordance with the invention is placed within the interior of a leak-tight tank or vessel **12** housed within a cell which is designed to contain a number of similar tanks and a conveyor **14** which is also leak-tight and which provides a communication between said tanks. This type of installation is employed in particular in the nuclear energy industry. As can be seen from FIG. 1, the conveyor **14** is placed beneath the tank **12** and openings **16** and **18** which are formed in the base of the tank and the conveyor shaft respectively permit the possibility of transferring objects from the conveyor into the tank or conversely. The opening **16** of the tank is normally sealed off by a cover **20** and leak-tightness between the cover and the base of the tank is ensured by means of a liquefiable seal formed of a material having a melting temperature which is slightly higher than room temperature such as pitch, said seal being placed within an annular trough **22** which is formed around the opening **16** and into which extends a flange **24** of the cover **20**. The annular trough **22** also extends within an annular trough or channel **25** which has a larger cross-section and which surrounds the edge of the opening **18** formed in the conveyor shaft. The said trough **25** is filled with liquefiable material in the same manner as the trough **22**. The opening **18** is normally sealed by a cover **26** which rests on the annular trough **25** and which is provided with a flange extending within said trough. It is thus possible to separate the tank **12** from the conveyor **14** while nevertheless retaining leak-tightness of the tank and of the conveyor and, in addition, when the tank is in position above the conveyor, both covers **20** and **26** can be removed without impairing leak-tightness of the assembly as a whole. The tank cover **20** is provided with magnetic suckers **28** which normally couple the conveyor cover **26** to the tank cover **20**. Provision is made for a device which makes said suckers inoperative when it is desired to separate the tank from the conveyor.

The mechanism A which is employed for the purpose of lifting the covers **20** and **26** is shown in detail in FIGS. 3 and 4. Said mechanism comprises two yokes **30**, one extremity of each yoke being attached to the cover **20** close to one edge of this latter. Each yoke is pivotally mounted on the extremities of two arms **32** and **34** which are placed in parallel relation to each other and pivotally mounted on a base-plate **36**. The pivot-pins on which the yoke **30** is pivoted to the arms **32** and **34** are in alignment on a vertical line whilst the fulcrum-pins of the arms are in alignment on another vertical line and the spacing of said fulcrum-pins is equal to that of said pivot-pins, with the result that the yoke **30**, the arms **32** and **34** and the base-plate **36** form an articulated parallelogram, the deformation of which produces the vertical displacement of the yoke and consequently of the cover. The base-plate **36** is supported on a driving shaft **38** and is freely rotatable on said shaft. A crank-arm **40** is secured to the shaft **38** by means of a locking-pin **42** and is coupled to the arm **32** by means of a connecting-arm **44** which is pivotally attached to the arm **32** at a point which is distant from the fulcrum of the arm. The crank-arm **40** is provided with a nose **46** which, when the cover **20** is in position, is located at a distance away from a stub shaft which is secured to the base-plate **36** as shown in FIG. 3 but is intended to come into contact with said stub shaft when the crank-arm **40** is caused to rotate. The entire mechanical assembly which has been described above is enclosed within a casing **50** which is secured to the base-

plate **36**, and the two mechanisms which are associated with the two yokes **30** are mounted on the shaft **38** on each side of a frame **52** which is secured to the base of the tank and which carries an electric motor and the speed-reduction gear for driving the shaft **38**.

When the cover **20** is in position, the casings **50** are supported on brackets **53** which are fixed on the frame **52** and which serve as a support for the base-plates **36** during the first stage of the lifting movement of the covers. The yokes **30** traverse the bases of the casings **50** through openings which are formed for this purpose and rubber protection sleeves **54** which surround the bottom portion of each yoke **30** are clamped around annular flanges provided on the cover **20** and on the casings **50**.

When the covers **20** and **26** are closed, the components of the mechanism A are located in the positions which they occupy in FIG. 3. When it is desired to lift the covers, the first step consists in heating the material contained within the annular troughs **22** and **25** by means of electric heating resistors placed within said troughs, with a view to liquefying said material. The second step consists in starting-up the motor which drives the shaft **38** on which the crank-arms **40** are mounted. In a first time-interval, the crank-arms **40** cause the arms **32** to swing about their pivotal axes, thereby producing the deformation of the articulated parallelograms which are formed by the yokes **30**, the arms **32** and **34** and the base-plates **36**; the covers **20** and **26** which are coupled together by means of the magnetic suckers **28** are then lifted vertically while remaining horizontal, with the result that, during this first time-interval, the cover flanges which had been immersed in the liquefied material of the sealing joint are able to drip into the troughs **22** and **25**. When the shaft **38** has rotated through a certain angle, the noses **46** of the crank-arms **40** accordingly come into abutting contact with the stub shafts **48** which are secured to the respective base-plates; and, starting from this moment, the rotation of the crank-arms initiates the movement of the base-plates **36** and the assembly consisting of arms **32** and **34**, yokes **30** and covers **20** and **26**, said assembly being thus displaced as a single unit together with the base-plates **36** inasmuch as the arms **32** and **34** can no longer pivot about their axes. Cams which are integral with the shaft **38** control contactors for the purpose of interrupting the circuit which supplies current to the motor when the covers have been lifted to a sufficient extent; an interlocking device then locks the covers in their lifted position. In order to replace the covers in position, said covers are allowed to fall back under the action of their own weight, provision being nevertheless made to brake their falling



motion. During this movement, the base-plates **36** are brought back so as to bear on the brackets **53** and the crank-arms **40** as well as the arms **32** and **34** are returned to their initial positions.

As will be apparent, the invention is not limited to the single form of construction which has been described and illustrated and it must be understood that the scope of this patent extends to any alternative forms of the arrangements hereinbefore described which remain within the definition of equivalent mechanical means.

What we claim is:

**1.** Lifting mechanism comprising an articulated parallelogram formed by two parallel arms which are pivotally mounted on a base-plate so as to rotate about pivot-pins which are in alignment on a vertical line, there being pivotally attached to the ends of said arms a vertical yoke which is fixed on the element to be lifted, said base-plate being mounted to rotate freely about a driving shaft to which is attached a crank-arm, said crank-arm being coupled to one of the arms of the articulated parallelogram and provided with a nose which is adapted to come into contact with an abutment fixed on said base-plate so as to drive said base-plate in rotation about the axis of said driving shaft, said nose being located at a distance away from said abutment when the element to be lifted is in position, with the result that the rotational movement of the driving shaft first produces the deformation of the parallelogram and consequently the vertical displacement of said element until the nose of the crank-arm comes into contact with said abutment, and then produces the rotational motion of the combined assembly consisting of base-plate, arm, yoke and element about the axis of the driving shaft.

**2.** Lifting mechanism in accordance with claim **1** wherein said base-plate is brought to bear on a stationary bracket when the parallelogram is deformed as a result of the rotational movement of the driving shaft.

**3.** Lifting mechanism in accordance with claim **1**, wherein said base-plate, arms and crank-arm are placed within a casing which rests on said bracket when the element to be lifted is located in the initial position thereof.

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MARVIN A. CHAMPION, *Primary Examiner.*