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MOTIVE MECHANISM UTILIZING CATALYTICALLY DECOMPOSABLE MATERIAL

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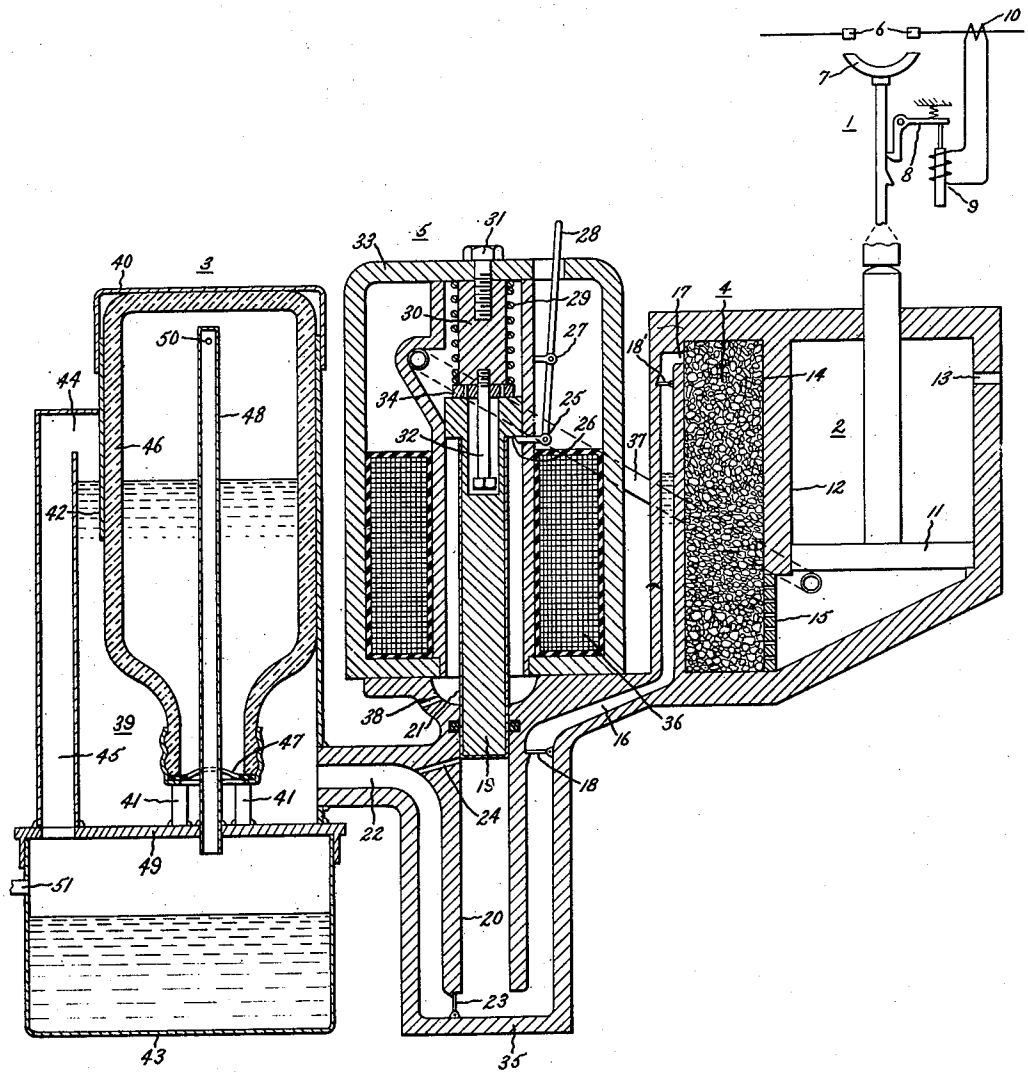

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MOTIVE MECHANISM UTILIZING CATALYTICALLY DECOMPOSABLE MATERIAL

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1

This invention relates to motive mechanisms utilizing catalytically decomposible material and more particularly to apparatus for intermingling such decomposable material with a suitable catalyst for the purpose of liberating useful energy in the form of instantaneously generated pressure gas.

Power for operating devices such as large capacity electric circuit breakers, for example, is commonly obtained from electric solenoids or motors, pneumatic operating means, and sometimes from mechanisms actuated by an explosive charge such as gun powder. Electric solenoids and motors inherently are too slow in operation for very high speed circuit breakers. Pneumatic mechanisms of necessity require a great amount of space for the pressure reservoir, compressor, valves, and control mechanism. Furthermore, pneumatic mechanisms are costly and complicated and are subject to improper operation due to moisture and other factors. Mechanisms operated from explosive charges are inherently dangerous and require a certain degree of vigilance on the part of maintenance and operating personnel.

An object of this invention is to provide a motive mechanism which is rapid and reliable in operation and which is compact and relatively inexpensive.

Another object of the invention is the provision of a motive mechanism utilizing decomposable material for generating gas and which is provided with an arrangement for rendering the decomposable material harmless should undesired decomposition by inadvertent contamination occur.

Still another object of the invention is to provide a motive mechanism utilizing decomposable material as its source of energy and which is arranged to cause a desired intermingling of the decomposable material with a suitable catalyst in order to effect the liberation of energy by gas generation therefrom.

According to the invention, a predetermined quantity of decomposable liquid is forced into contact with a suitable catalyst by means of a small piston-type pump or injector having suitable motivating means. Some of the pressure gas produced due to the intermingling of the decomposable material with the catalyst is directed back behind the injector piston in such a way as to aid the working movement thereof. Since impurities which may be present in, or which inadvertently enter into the decomposable material stored in a suitable reservoir, may cause undesired gas pressure from the decomposition thereof, an emergency discharge passageway is provided through which is effectively diverted the decomposable material into a diluting overflow chamber in response to the build-up of excessive pressure in the reservoir thereby to render the discharged decomposable material harmless as well as providing pressure relief for the generated gas.

2

The invention will be better understood with reference to the accompanying drawing in which the single figure thereof is a schematic representation of apparatus embodying the invention. While the arrangement shown in the drawing and to be described hereinafter comprises an operating mechanism adapted to motivate electric circuit breakers, it will be understood that the invention also is applicable to other types of apparatus as well.

In the drawing the circuit breaker generally indicated by the numeral 1 is motivated to the closed position by means of the fluid motor generally indicated by the numeral 2. Energy in the form of generated gas for operating fluid motor 2 is derived from the intermingling of a suitable decomposable liquid material normally stored in the reservoir generally indicated by the numeral 3 with the catalytic material 4. A predetermined charge of decomposable material derived from the reservoir 3 is supplied to the catalyst 4 by means of the pump mechanism generally indicated by the numeral 5.

Circuit breaker 1 is schematically represented and includes a pair of fixed contacts 6, a movable bridging contact 7 and a latch mechanism 8. Latch 8 is biased toward the latching position and is motivated to the tripping position by means of the electromagnetic device 9 which derives energy from the current transformer 10, the primary winding of which is in series with the contacts of the circuit breaker. Thus when latch 9 is tripped due to some abnormal current condition, bridging member 7 moves downwardly under the bias of gravity or suitable springs to the open position indicated in the drawing.

Circuit breaker 1 is moved to the closed position by upward movement of piston 11 which reciprocates in the cylinder 12 provided with a suitable exhaust port 13. Thus when adequate gas pressure is applied below piston 11, the piston and its operating rod move upwardly to close the circuit breaker. After the piston 11 uncovers the port 13, residual pressure is exhausted to atmosphere.

Gas pressure below the piston 11 is provided

according to the invention by injecting a predetermined amount of decomposable liquid material derived from the reservoir 3 into the enclosure 14 containing catalytic material 4. When a suitable decomposable material comes in contact with the catalytic material 4, gases are given off principally in the form of steam, if hydrogen peroxide is the decomposable material used. This pressure is applied through outlet means comprising the perforated wall 15 of enclosure 14 into the space below the piston 11 which thereafter effectively causes upward operating movement of the piston.

While there are a number of decomposable materials and catalysts which may be used, I have found that hydrogen peroxide H_2O_2 is a very satisfactory medium. This peroxide normally should be 90% concentrated. A suitable catalyst is calcium permanganate $[Ca(MnO_4)_2]$. The calcium permanganate mass 4 preferably is rendered foraminous, for rapid reaction, by the use of conventional small ceramic pellets onto which a permanganate coating has been deposited. Other suitable catalysts include permanganates of sodium, potassium and mixtures thereof. Furthermore, silver and platinum, preferably in granulated form would effectively cause decomposition of hydrogen peroxide.

The appropriate charge of decomposable material is forced from the pump 5 through the conduit 16 and the inlet port 17 to the enclosure 14 where intermingling with the catalyst takes place. Check valves such as 18 and 18' preferably should be included in the conduit 16 for the purpose of preventing the flow of undesirable back pressure from the chamber 14.

Decomposable material is forced through the conduit 16 from the pump 5 into enclosure 14 by means of downward motion of piston 19 riding in its cooperating cylinder 20 the volume of which constitutes one operating charge of the liquid. Since hydrogen peroxide has a corrosive effect on many materials, the cylinder 20 and the jacket 21 for the pump piston 19 preferably should be constructed of pure aluminum or high grade stainless steel. Hydrogen peroxide is drawn from reservoir 3 into cylinder 20 through conduit 22 in which a check valve 23 is provided. Check valve 23 is necessary to prevent any back flow of the charge of decomposable material when it is being forced from the cylinder 20. Preferably a passage 24 should be provided to avoid the possibility of vapor locks and also to insure that the interior of cylinder 20 would be filled with a full charge of decomposable material whenever the piston is returned to its normal uppermost position indicated in the drawing. From the description thus far, it will be obvious that downward motion of the pump piston 19 will force a predetermined quantity or charge of hydrogen peroxide upwardly through conduit 16 through inlet means 17 and into the gas generating enclosure 14.

While any suitable drive mechanism could be utilized for imparting downward motion to the pump piston 19, I have illustrated a spring actuated means for this purpose which normally is prevented from operating the piston by suitable latch means. For maintaining the piston in its uppermost position, the latch 25 is arranged so as normally to engage the shoulder 26 of the enlarged head of piston 20. Thus, the piston 20 really constitutes a differential piston for a purpose which will become evident as the description proceeds. Latch 25 is movable in the counterclockwise direction about its supporting pivot 27 by means of the manually operable handle 28. Obviously handle 28 could be operated automatically, or by any suitable control means, if desired. Furthermore the normal position of latch 25 could be determined by a suitable stop together with biasing means for holding the latch against the stop. The drive spring 29 encircles the cylindrical iron member 30 which constitutes a pole piece of the magnetic circuit about the associated solenoid coil the purpose of which soon will become clear. The pole piece 30 is secured to the magnetic frame structure 33 by any suitable means such as a bolt 31. The spring 29 exerts its downward urge upon the iron pump piston 19 (which also constitutes a movable magnetic armature) through a conventional non-magnetic metallic washer 34 for preventing actual contact between the cooperating magnetic members. This washer, perforated to minimize suction effect thereon, is anchored to the pole piece by the bolt or screw 32 which permits but a limited thrust by the spring 29 which may terminate, for example, at the half-stroke of piston 19 when the washer 34 encounters the head of the screw 32, it being understood that the piston continues down until arrested by engaging the bottom wall 35 of the enclosing housing. Thus, when resetting, the spring 29 offers no initial opposition to the return upward movement of the armature piston 19 so that its magnetic pick-up is thereby facilitated.

For the purpose of resetting the piston 19, I have indicated electromagnetic means comprising the coil 36 which establishes an effective magnetic path through the iron frame structure 33, the pole piece 30 and the armature piston 19. Thus when coil 36 is energized by suitable means not shown, the piston 19 is elevated to its upper latched position as shown.

For the purpose of aiding the spring 29 in imparting downward movement to the pump piston 19, a feedback conduit 37 is used. Feedback conduit 37 communicates at one end with the portion of cylinder 12 of fluid motor 2 which is below the operating piston 11, while the other end of feedback conduit 37 communicates with the space above the upper and greater surface of the differential pump piston 19. Thus, when pressure is generated below the lower surface of the drive piston 11 to operate the circuit breaker, such pressure feeds back to apply an operating downward force on the pump piston 19 which, because of the difference in upper and lower areas, produces a preponderating downward force even after the spring action has ceased near the half-stroke position as described.

During the downward stroke, pressure build-up in the space below the head of the differential piston 19 is relieved to atmosphere through the vent 38 which also serves as a drain in the event that liquid seeps upward into this space beyond the packing provided for the piston as shown. Thus, back pressure at this point is minimized.

Reservoir 3 includes a chamber 39 having a removable cover 40. Chamber 39, of course, communicates with conduit 22 and may conveniently include pedestal members 41 and a suitable partition 42 for supporting therein an appropriate container 46. The chamber 39 communicates with overflow chamber 43 through the opening 44 and the passage 45. Preferably chamber 43 would be partially filled with suitable neutralizing liquid such as plain water into which the contents of the main chamber may discharge in an

emergency as will appear later. Chamber 39 is constructed to receive conveniently therein and substantially as a part thereof a removable container such as 46 which is provided with a cover 47. Chamber 46 could be a conventional commercial shipping container for hydrogen peroxide and is so illustrated. Flexible synthetic rubber cover 47 is slit before shipment so as to constitute a simple safety valve to relieve any pressures that may be generated during shipment. Thus the upstanding pipe 48 which is affixed to the cover 49 of overflow chamber 43, readily passes through the slit in cover 47 and opens up the ends thereof as shown to provide communication for the liquid so that it may pass from the container 46 to the main chamber 39. Thus when it is desired to condition the apparatus for operation, the cover 40 having been removed, the container 46 filled with hydrogen peroxide would be inserted in an inverted position into the main chamber 39 when the pipe 48 would simply penetrate through the slit in the cover 47. Thereafter the container 46 would be lowered to the desired position and supported thereat by any suitable means such as the pedestals 41 after which the cover 40 would be replaced. The liquid decomposable material would assume a common level throughout the device such as is indicated within the container 46, the chamber 39 and the conduit 16 inasmuch as flow of the material from within container 46 to the outside thereof is provided for through the slit cover as already described. A restricted vent or metering means 50 is provided in the upper end of pipe 48 in accordance with the safety feature of my invention as will now be explained.

Impurities such as inorganic materials that may inadvertently enter the decomposable material may tend to cause undesired decomposition thereof resulting in gas accumulating within the container 46. If such decomposition occurs and if the rate thereof is within safe limits, the allowable safe pressure generated thereby would be harmlessly relieved through the small vent 50 and pipe 48 to the space above the diluting fluid in overflow chamber 43 and thence through an opening therein to atmosphere as indicated at 51. Here it should be understood that vent 50 must be of appropriate size to pass off to atmosphere predetermined permissible pressures and is in effect a metered flow passage. On the other hand, higher pressures will not be freely relieved therethrough. Should then the pressure generated within container 46, due to impurities in the decomposable material or for other reasons, be greater than could be relieved adequately through the metered vent 50, such accumulated pressure would force liquid through the slit cover 47, chamber 39, and opening 44 into the diluting liquid in the overflow tank 43. The effect of the diluting liquid would be to render the decomposable material harmless. In this way, destructive pressures are always relieved and the dangerous liquid neutralized in accordance with one feature of the invention. The apparatus should be arranged so that the inlet 17 is at a safe level above the opening 44 so that the decomposable material will not be forced into contact with the catalytic material 4 when abnormal pressure is developed in chamber 39 or container 46.

While I have shown and described a particular embodiment of the invention, I do not wish to be limited thereto, and in the appended claims I intend to cover all such modifications of the invention as fall within the true spirit and scope thereof.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A motive mechanism comprising catalytic material, an enclosure for said catalytic material having inlet means and outlet means, a pump including a piston and a cylinder, a reservoir containing decomposable material, conduit means interconnecting said pump with said reservoir and with said inlet means, valve means in said conduit means for preventing reverse flow of said decomposable material from said pump to said reservoir and from said enclosure to said pump, actuating means for initiating working movement of said piston, feedback conduit means communicating with said outlet means and said piston and arranged to supply pressure to said piston thereby to aid said actuating means in imparting working movement to said piston, said piston being constructed with one end larger than the other end so that one working face thereof which is exposed to pressure supplied through said feedback conduit means is greater than the other working face thereof which is exposed to said decomposable material, and an opening leading from said cylinder for affording an escape passage for fluid compressed in said cylinder by said one end of said piston and for allowing the escape of any portion of said decomposable material which leaks by said piston from said other end thereof to the portion of said cylinder which cooperates with said one end of said piston.

2. A motive mechanism comprising a reservoir containing decomposable material, a pump having a cylinder in communication with said reservoir and a piston movable from one position to an operated position, an enclosure in communication with said cylinder and having outlet means, catalytic means in said enclosure capable of decomposing said decomposable material upon contact therewith due to movement of said piston to its operated position, electromagnet means including a coil and a pole piece for returning said piston to said one position, a feedback conduit in communication with said outlet means and said piston for supplying pressure to said piston tending to move said piston to its operated position, perforated non-magnetic means interposed between said pole piece and said piston for preventing the magnetic attraction between said piston and said pole piece from materially interfering with movement of said piston from said one position, the perforations of said non-magnetic means being for the purpose of preventing pneumatic sealing of said non-magnetic means to said piston due to pressure supplied to said piston through said feedback conduit.

3. A motive mechanism comprising a main chamber containing a decomposable liquid, an overflow chamber containing a diluting fluid, a passage leading from said main chamber to said overflow chamber so that abnormal pressure in said main chamber will force liquid through said passage into said overflow chamber, an enclosure containing catalytic material, means for forcing liquid from said main chamber into contact with said catalyst, and metered venting means affording limited communication between the space above the liquid in said main chamber and said overflow chamber.

4. A motive mechanism comprising a main chamber, a removable container disposed in said main chamber and having an opening in the lower portion thereof, said main chamber and said container having therein a decomposable

liquid, an overflow chamber containing diluting fluid, means including a passage for conveying liquid to said overflow chamber in response to abnormal pressure within said container and said main chamber, a vent tube extending through the opening in said container and affording metered communication between the space above the liquid in said container and said overflow chamber, an enclosure containing catalytic material, and means for forcing liquid from said main chamber into contact with said catalyst.

5. A motive mechanism comprising a reservoir containing decomposable material, a pump having a cylinder in communication with said reservoir and a piston movable from one position to an operated position, an enclosure in communication with said cylinder and having outlet means, catalytic means in said enclosure capable of decomposing said decomposable material upon contact therewith due to movement of said piston to its operated position, electro-magnet means including a coil and a pole piece for returning said piston to said one position, and non-magnetic means interposed between said pole piece and said piston for preventing the magnetitc attraction between said piston and said pole piece from materially interfering with movement of said piston from said one position.

6. A motive mechanism comprising a reservoir containing decomposable material, a pump having a cylinder in communication with said reservoir, and a piston movable from one position to an operated position, an enclosure in communication with said cylinder and having

outlet means, catalytic means in said enclosure capable of decomposing said decomposable material upon contact therewith due to movement of said piston to its operated position, electro-magnet means including a coil and pole piece for returning said piston to said one position, means for supplying fluid pressure to said piston tending to move said piston to its operated position, perforated non-magnetic means interposed between said pole piece and said piston for preventing the magnetic attraction between said piston and said pole piece from materially interfering with movement of said piston from said one position, the perforations of said non-magnetic means being for the purpose of preventing pneumatic sealing of said non-magnetic means to said piston due to pressure supplied to said piston through said feedback conduit.

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