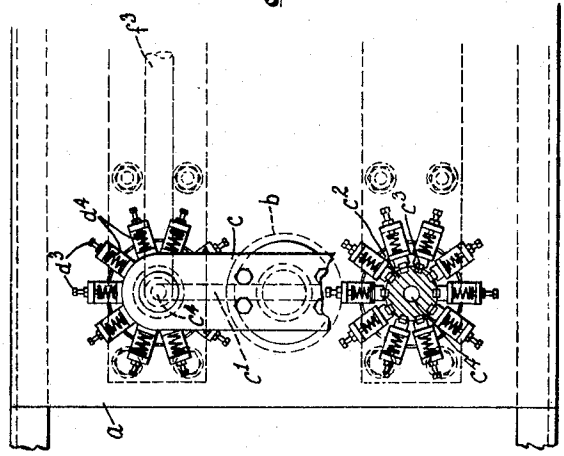
April 5, 1966 T. W. GILLETT ET AL 3,244,833

FLUID PRESSURE OPERATED SWITCH WITH LIQUID COOLING

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Fig. 1a



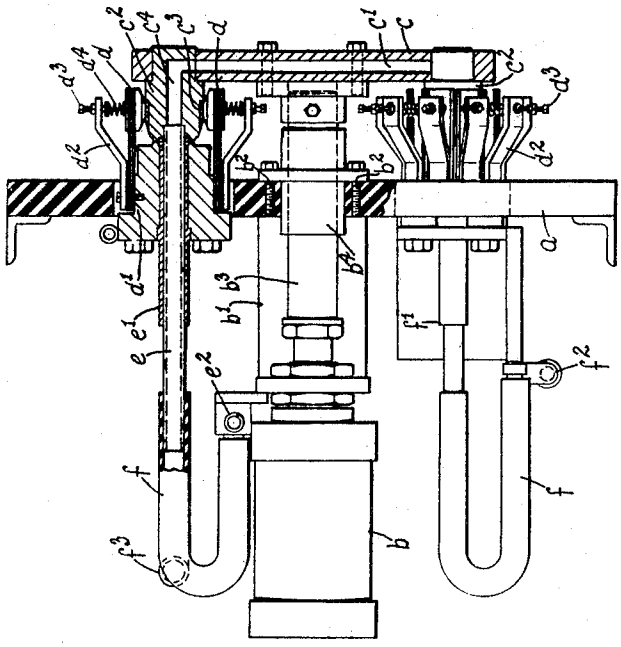


Fig. 1

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FLUID PRESSURE OPERATED SWITCH WITH LIQUID COOLING

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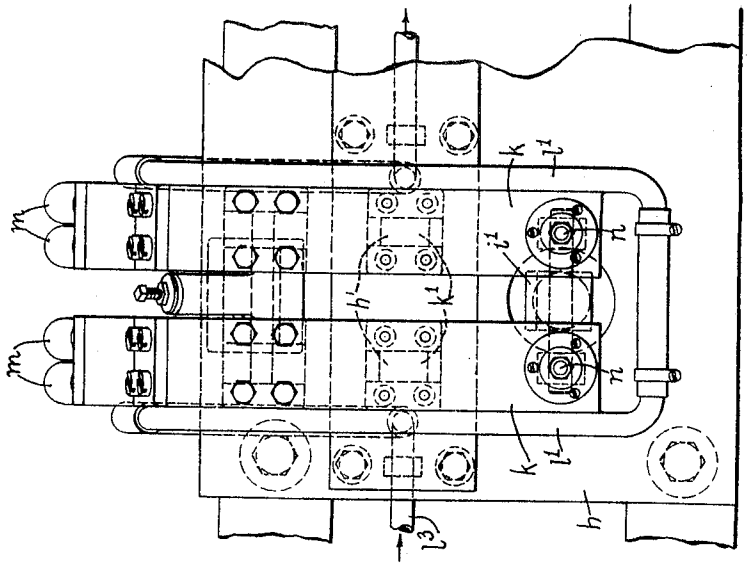


Fig. 2a.

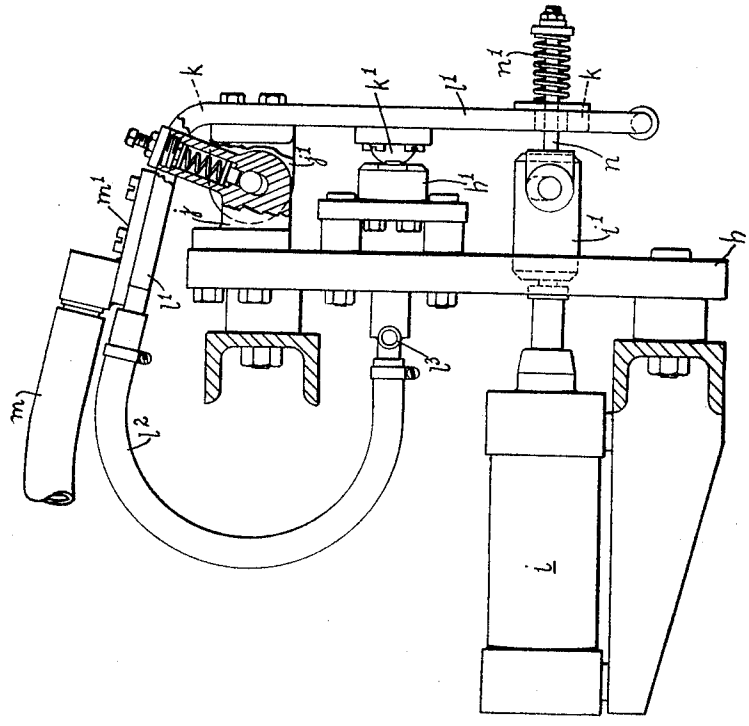


Fig. 2.

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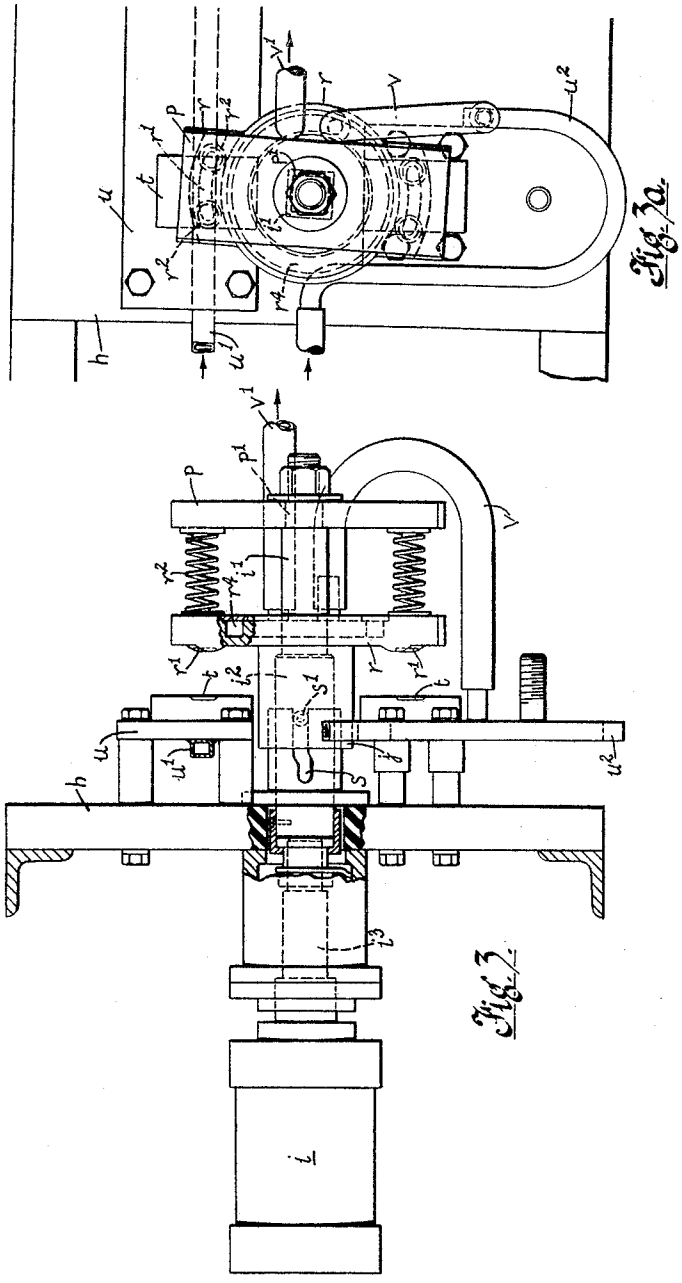


Fig. 3a.

Fig. 3

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FLUID PRESSURE OPERATED SWITCH WITH LIQUID COOLING

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10 Claims. (Cl. 200—82)

The present invention has relation to a fluid operated electric switch or contactor and is more particularly concerned with the water cooling of such a device where a heavy amperage is to be carried, the present mechanism being of a particularly efficient character both with respect to the operation and also with respect to cooling the heavy load amperage.

According to the present invention there is provided a pneumatically or hydraulically operated electric switch or contactor comprising in combination a pneumatic or hydraulic jack carried or adapted to be carried by a fixed panel or the like, a contact and current carrying water cooled bar, the contacts of which co-operate with contact means adapted to be fixed to the panel or the like, means for operatively displacing the said bar by means of the jack and a water cooling pipe system passing through or adjacent the bar and connecting with the contact means of the panel.

Further according to the present invention there is provided a pneumatically or hydraulically operated electric switch or contactor comprising in combination a pneumatic or hydraulic jack carried or adapted to be carried by a fixed panel or the like, a contact and current carrying water cooled bar attached to the movable ram or jack head, stationary radially disposed contacts carried or adapted to be carried by the panel or the like engageable with the contacts of the water cooled bar and flexible hose pipes connecting with the contacts on the water cooled bar and which pass through apertures in the panel or the like, said hose providing a water circuit through the movable contacts and current carrying water cooled bar.

Still further according to the present invention there is provided a pneumatically or hydraulically operated electric switch or contactor comprising in combination a pneumatic or hydraulic jack carried or adapted to be carried by a fixed panel or the like and a contact and current carrying water cooled bar slidably rotatably and resiliently mounted upon the ram of the jack so that in use a stressed wiping operation is imparted between the fixed and moving contacts. The stressed rotary wiping movement may be effected by a cam slot on the stationary part which is engaged by a pin on a moving part carrying the current carrying water cooled bar.

In order that the invention may be clearly understood and readily carried into practice reference may be had to the accompanying drawings, in which:

FIGURE 1 is a side elevation, with parts broken away and parts shown in section of one form of the improved switch.

FIGURE 1*a* is a front elevation, with parts broken away and parts shown in section of the switch shown in FIGURE 1.

FIGURE 2 is a side elevation, with parts shown in section, of another form of the improved switch.

FIGURE 2*a* is a front elevation of the switch shown in FIGURE 2.

FIGURE 3 is a side elevation, with parts broken away

and other parts shown in section, of another form of the improved switch.

FIGURE 3*a* is a front elevation of the switch in FIG. 3.

In FIG. 1, *a* is the insulating panel or like structure whereon the present mechanism is mounted and *b*, b^1 is the body of pneumatically operated jack mechanism having its body attached to the panel at b^2. b^3 is the extensible ram or plunger of the jack which operates in a bearing b^4 in the panel *a*. The said plunger b^3 has attached to its extremity by a clamp a water-cooled current carrying bar *c* having a water conduit c^1. This current carrying bar *c* carries a cylindrical movable contact part or member c^2 at each extremity having a group of 10 spaced fixed contact parts c^3. 10 resilient laminated contact blades *d* are attached at d^1 to an insert of the panel *a* and these carry the contact pads and are each reinforced by arms d^2 carrying adjustable screw pins d^3 which co-operate with the extremities of coil springs d^4 the remote extremities of which bear against the laminated contacts *d*. *e* is a copper tube brazed to the contact plug c^2 at its extremity and extending co-axially thereof, and said tube *e* is slidably mounted in the copper tube e^1. *f* is a flexible hose engaging the outer extremity of the tube *e*. e^2, f^2 illustrate terminal extremities of the hose and it will be appreciated that there is a water circuit through tube *e* and passages c^4, c^1 in current carrying member *c*, then back to composite copper tube inside the copper tube indicated by the reference letter f^1 and then to hose pipe *f*. When the plunger b^3 is operated water cooled current carrying bar *c* is displaced away from the contacts *d* with a wiping action and the water cooling system is still maintained. f^3 is a water inlet or outlet for an associate switch mechanism.

In that embodiment illustrated in FIGS. 2 and 2*a* *h* is the panel, h^1 is a stationary contact carried thereby, *i* is the jack or air cylinder body and i^1 the plunger or ram of the jack. *j* is a bearing member attached to the panel *h* and j^1 is a cooperating bearing or hinge member carrying movable bus bar or plate *k* on which is mounted moving contact part k^1. l^1 is a water tube which passes alongside and is brazed to the current carrying member *k* and continues at l^2 where it comes adjacent the fixed contact part at l^3 for cooling purposes. *m* is a hose which covers the 5000 amp cable which connects at m^1 with the current carrying member *k*. It will be noted that the ram i^1 operates the current carrying bar *k* by virtue of a pin *n* with intervening compression spring n^1 which encircles the pin, the spring n^1 being disposed to push the contacts k^1, h^1 efficiently together with a wiping movement in the closing operation.

In the embodiment of the invention illustrated in FIGS. 3 and 3*a* of the drawings, *h* is the panel and *i* is the body of the jack or air cylinder and i^1, i^2 is a sliding insulating rod attached to the cylinder ram i^3. *p* is a spring pressure plate attached at p^1 to the end of the insulating rod i^1. *r* is a current carrying water cooled bar or the like having movable contact parts r^1. r^2 are compression springs interposed between *p* and *r* and the bar *r* has a freedom of longitudinal movement under control of springs r^2 and is capable of rotation on the ram or plunger i^1 under control of a cam slot *s* mounted on a stationary part and which operates in conjunction with a roller or pin s^1 carried by insulating rod i^2 so that when the pneumatic or hydraulic mechanism is actuated in the closing of the contacts and pressure plate *p* and the current carrying bar *r* move towards the fixed contact parts *t* carried by the panel *h* until engagement obtains under the influence of the springs r^2 when the mechanism *s*, s^1 comes into operation to slightly rotate the current carrying bar *r* on its axis and this gives a wiping action to the contacts r^1

and t. u is a bus bar and u^1 a water cooling copper tube. In the lower part of the drawing cooling copper tube u^2 is shown but this conceals the adjacent bus bar to which it is secured and which carries the lower fixed contact t. v is a flexible water conduit which leads from u^2 so as to cool the current carrying water cooled bar r with an appropriate outlet at v^1.

The unit consists of an air cylinder i whose ram or plunger i^3 is connected to a sliding insulating rod i^1, i^2 mounted in a brass bearing arrangement j having slot s. Attached to, but free to move on the insulating rod, is the copper contact r. Fixedly attached to this same rod are insulated pressure plate p and four springs r^2. The assembly described above may be known as the moving contact assembly. The two fixed contacts consist of copper blocks t mounted on the insulated panel h. The operating sequence of the above unit is as follows: Air is applied to cylinder i which moves cylinder ram i^3 and attached insulating rod i^1, i^2 until the moving contact bar r and silver contacts r^1 mate with the fixed contacts t. Contact r now has completed its travel but pressure plate p continues to move under the action of the cylinder thus compressing springs r^2 and applying pressure to contact r and r^1.

During the operating sequence described above, a wiping action takes place between contacts r^1 and t. This is arranged by means of the roller pin s^1, situated in the insulated moving shaft i^2 and engaged in off-center slots in the main bearing j.

With regard to the cooling, this consists of a water circuit arranged as follows:

The lower fixed contact t has a copper pipe u^2 brazed to it. This pipe is connected to the moving contact r by means of a flexible rubber or polyvinyl chloride pipe v. This pipe v flexes during the opening and closing operation of the switch unit, the water then passes through a sealed circular cavity r^4 machined in copper contact r and then via another flexible rubber or polyvinyl chloride hose v^1, either to an outlet secured to the main mounting panel or to another switch which may be mounted adjacent, in the latter case the above procedure is repeated. The upper fixed common bus-bar cooling system simply consists of a copper tube u^1 brazed to the rear side of the copper section bus-bar u.

We claim:

1. A heavy current electric switch mechanism comprising an insulating panel, a pair of fixed contact parts spaced from one another and mounted on said panel, a bar, a fluid operated jack having a body and an extensible ram, said bar being connected to said ram, a contact part carried by each end of said bar, said bar comprising a conduit connected to passages extending through said contact parts which are carried by said bar, a pair of tubes extending through said panel, each of said tubes being connected to a corresponding one of said passages extending through said contact parts so that the bar and the contact parts carried thereby may be water-cooled when the ram carries the contact parts on the bar into electrical contact with the fixed contact parts and when said contact parts are separated by said ram.

2. A heavy current electric switch comprising two groups of contact parts, each group comprising a plurality of contact pads arranged in a ring, each pad being carried by a corresponding resilient mounting, a corresponding water tube extending co-axially through each group of said pads, each tube being connected to an associated flexible hose, a cylindrical contact member co-axially aligned with each group of said contact pads, a conduit, said cylindrical contact members being mounted on said conduit and extending therefrom parallel to one another, each cylindrical member having an internal passage and being connected to the associated tube so that a cooling water flow path through the one hose, tube, member and conduit, and then through the other member, tube, and hose is established, a fluid operated jack having a body and an extensible ram, said jack being located between said tubes and extending parallel thereto, and a clamp member secured to said ram and to said conduit for moving the latter to take the cylindrical members into and out of electrical contact with the said groups of contact parts with a wiping action.

3. A heavy current electric switch as claimed in claim **2** wherein said resilient mounting comprises resilient laminated blades secured at one end and carrying the contact pad at the other end, a rigid arm secured to the blades at said one end, an adjustable screw pin at the other end of said arm, and a coil spring abutting the blades at said other end thereof and the said pin at the respective ends of the coil spring.

4. A heavy current electric switch comprising an insulating panel, a fixed electric contact part carried by said panel, a bearing member secured to said panel, a part pivotally mounted on said bearing member, a rigid water tube secured to said part which is pivotally mounted on said bearing member, and a movable contact part mounted on said water tube for movement into and out of electrical contact with the said fixed contact part as the water tube pivots; a fluid operated jack having a body secured to said panel and an extensible ram connected to said water tube for pivotal movement thereof as the ram is extended or withdrawn.

5. A heavy current electric switch comprising an insulating panel, a fixed electric contact part, a bearing member and a fluid operated jack all mounted on said panel with said contact part between said jack and said bearing member, a current carrying bus-bar in the form of a tube, a clamp carrying said tube and pivotally mounted on said bearing member, a contact pad carried by said tube and located for movement into and out of contact with said fixed contact part as said tube pivots, said jack including a ram for pivoting said tube, and a spring interposed between said ram and tube for urging said fixed contact part and contact pad into good electrical contact.

6. A heavy current electric switch comprising a fixed contact part and a movable contact part, a current-carrying plate, a water cooled tube secured to said plate, said movable contact part being fixed to said plate, a pivot bearing mounting said plate and tube for pivotal movement about an axis on one side of said fixed contact part, a fluid operated jack located on the opposite side of said fixed contact part to said pivotal axis, said jack having an extensible ram, a pin carried by said ram and extending through a hole in said plate which carries said movable contact part, a spring encircling said pin and abutting said plate at one end, an abutment fixed to said pin and abutting the other end of said spring so that when said ram is moved to close the movable contact part on to the fixed contact part said spring urges said parts into good electrical contact; and a flexible hose connected to said tube for supplying cooling water thereto in any pivotal position of the water tube.

7. A heavy current electric switch as claimed in claim **6** wherein two sets of plates, tubes, and contacts are located side-by-side, said ram has its axis located between said plates, and the said two tubes are joined so that cooling water flows through the two tubes in turn.

8. A heavy current electric switch comprising an insulating panel, a fluid operated jack having a body and an extensible ram, said body being mounted on said panel and said ram extending through said panel, a fixed contact part mounted on said panel adjacent said ram, a movable contact part carried by said ram, said movable contact part having a water cooling passage therein, and a flexible hose connected to said passage so as to maintain a flow of cooling water to the movable contact part whilst permitting the latter to be taken into and out of electrical contact with the fixed contact part by the said ram.

9. A heavy current electric switch comprising an insulating panel, a fluid operated jack having a body secured to said panel, and a ram which is extensible in a direction normal to the panel, fixed contacts parts located on said panel and on opposite sides of said ram, said contact parts being provided with water cooled tubes, an annular movable contact part surrounding said ram, said movable contact part having an interior cooling-water passage, a flexible hose connected to said passage, an abutment carried by said ram, a plurality of springs interposed between said abutment and said movable contact part for urging the latter into good electrical contact with the fixed contact part when the ram is moved appropriately, and means for turning the ram angularly during said movement to cause wiping of the contacts.

10. A heavy current electric switch as claimed in claim 9 wherein said means for turning the ram angularly comprises a sleeve formed with a cam slot and a roller engaged in said cam slot, said sleeve and roller being secured relative to the jack body and to said movable contact respectively.

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