May 12, 1936. L. EMANUELI 2,040,204

MEANS FOR MAINTAINING FLUID PRESSURE IN SHEATHED ELECTRIC CABLES

Filed April 12, 1932

Fig. 1.

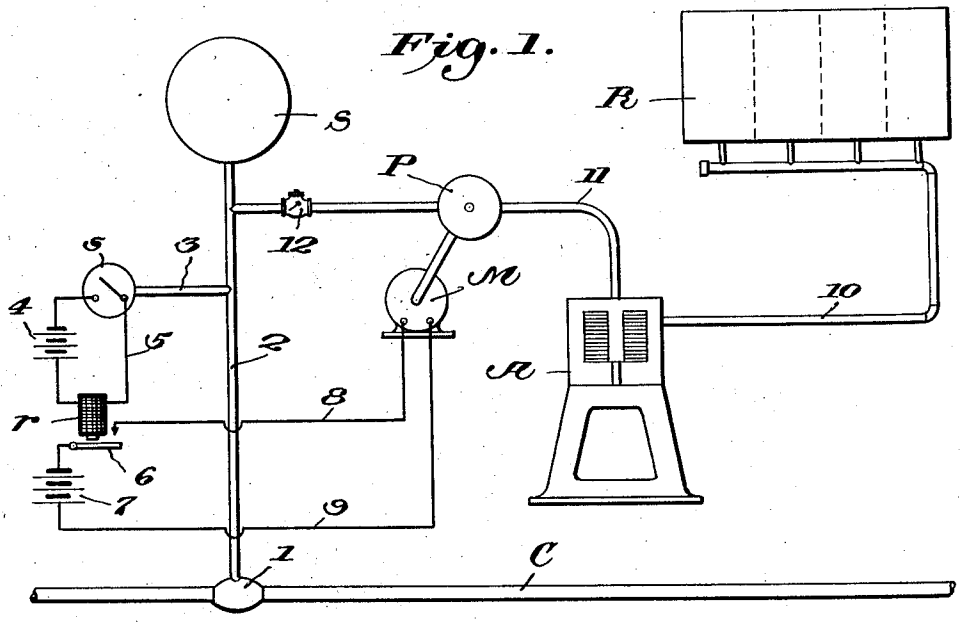
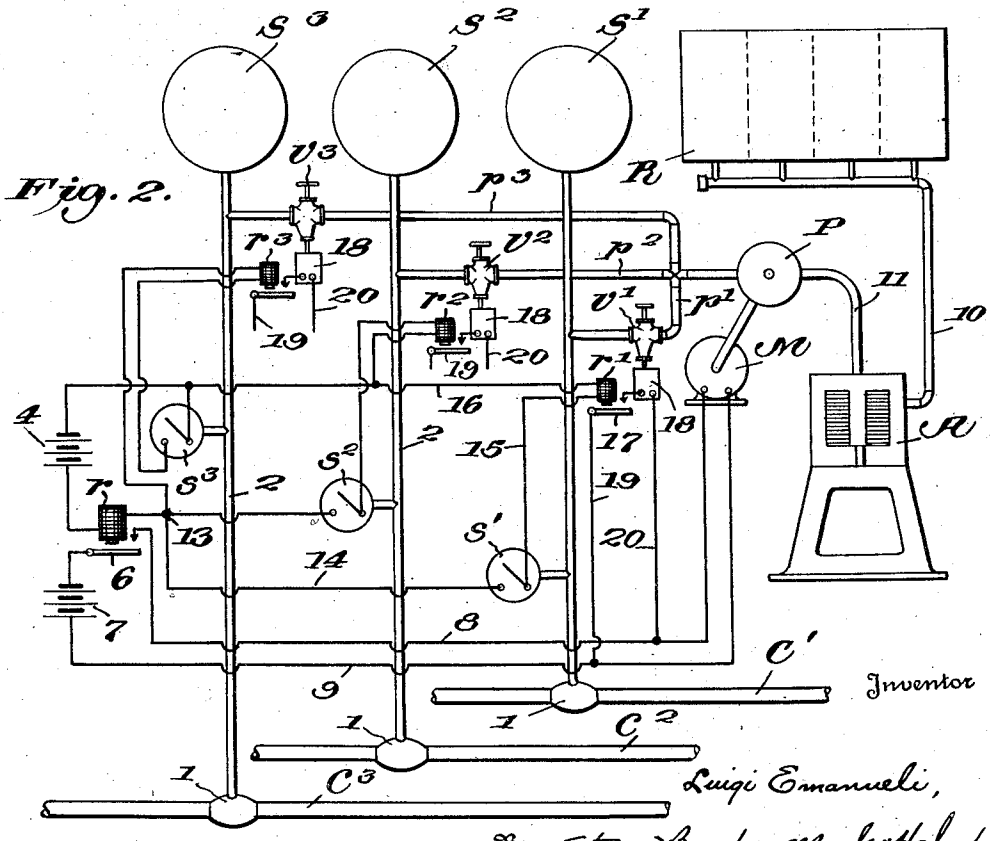


Fig. 2.



Inventor

Luigi Emanueli,

By Stone, Boyden, Mack & Hahn,

Attorneys

Patented May 12, 1936 2,040,204

UNITED STATES PATENT OFFICE

2,040,204

MEANS FOR MAINTAINING FLUID PRESSURE IN SHEATHED ELECTRIC CABLES

Luigi Emanueli, Milan, Italy, assignor to Società Italiana Pirelli, Milan, Italy

Application April 12, 1932, Serial No. 604,850
In Italy April 28, 1931

2 Claims. (Cl. 173—266)

The present invention relates to fluid filled electric cables of the type in which the factory insulation is surrounded by an impervious sheath such as lead, and in which the oil or other insulating fluid is contained in channels within the cable and impregnates the factory insulation.

This oil or other insulating fluid contracts and expands in accordance with the load on the cable or in accordance with variations in outside temperature, and consequently, means are provided for maintaining the pressure of the fluid within certain limits in order to avoid endangering the mechanical or electrical safety of the cable. This means in practice, takes the form of special fluid containers consisting of cells with deformable or expansible walls, which containers are connected to the cable to constitute fluid reservoirs of variable capacity, so that the insulating fluid may flow into or form such reservoirs in accordance with existing conditions, while at the same time, the fluid in the cable is maintained at a substantially constant pressure.

In the above described type of installation, it sometimes happens that, despite all precautions, a leak occurs in the cable sheath at some point and in this event it is obvious that the fluid containers or reservoirs, above mentioned, will empty themselves and the pressure in the cable will drop far below the safe minimum limit. In fact, if the leak persists for a sufficient length of time, the fluid will drain from the cable in places, thus permitting the entrance of air and moisture which diminishes the di-electric strength of the insulation to such an extent that a breakdown is likely to occur.

The object of the present invention is to devise means for avoiding such a possibility, and to this end I provide means for automatically replenishing the supply of insulating fluid to the cable should the pressure therein fall below a predetermined point. In this way the integrity of the cable may be maintained over long periods of time notwithstanding a more or less serious leak at some point.

In order that the invention may be readily understood, reference is had to the accompanying drawing forming a part of this specification and in which:—

Fig. 1 is a diagrammatic view showing the invention as applied to a single cable; and

Fig. 2 is a similar view showing the invention applied to a plurality of cables such, for example as might be employed in a polyphase system.

Referring first to Fig. 1, the sheathed cable is indicated at C and is provided at intervals with suitable joints 1 to which pipes 2 are connected, the other ends of such pipes communicating with a container or supply reservoir S in which the insulating fluid is held under substantially constant pressure. This container or supply reservoir may be of any suitable type, such for instance as that disclosed in Fig. 2 of my British Patent No. 267,059, accepted March 14, 1927.

In order to replenish the supply of fluid in the cable should a leak occur, I provide an auxiliary reservoir R in which additional insulating fluid is stored. As is well understood, it is highly desirable to remove the air or other gases from insulating fluid before injecting it into the cable, and for this reason I provide degasifying apparatus A and connect the reservoir R through this degasifying apparatus by means of pipes 10 and 11 to the pipe 2, a check valve 12 being interposed to prevent reverse flow.

Also interposed in the pipe 11 between the degasifier A and the pipe 2 is a rotary or other suitable pump P, adapted to be driven by an electric motor M.

Connected with the pipe 2, as by means of a branch pipe 3, is a fluid pressure switch *s*. This switch controls the flow of current from a battery 4 or other source over a circuit 5 through a relay *r*. This has an armature 6 adapted to control a circuit 8, 9 extending from a source of current 7 to the motor M.

So long as the pressure in the cable C and the pipe 2 remains above a predetermined point, the switch *s* is held open as shown. Should, however, a leak occur and the pressure in the cable be unduly reduced, the switch *s* will close and thus energize the relay *r*. This closes the circuit of the motor M and operates the pump P which serves to draw fluid from the reservoir R through the degasifier A and to force or deliver the same through the check valve 12 into the pipe 2, reservoir S and cable C. This forcing or feeding of additional insulating fluid into the cable and reservoir S will continue either until the supply in the reservoir R is exhausted or until the pressure is against built up to such a point as to cause the switch *s* to open again and thus stop the motor.

Referring now to Fig. 2, I have illustrated how the invention can be applied to a plurality of independent cables such as may be used in a polyphase transmission system. In this figure, three independent cables are indicated at C', C^2 and C^3. Each of these cables is connected by a pipe 2 to one of three independent supply reservoirs S', S^2 and S^3.

A degasifier A, a pump P and a motor M are

provided as before, but the pipe through which the fluid is delivered from the pump P is formed into three branches, p', p^2, and p^3, extending to the pipes connected with the several cables. Instead of a check valve as illustrated in Fig. 1, I interpose in each of these branch pipes a normally closed shut-off valve, these being indicated by V', V^2 and V^3.

In addition to the relay r I employ in this installation, three auxiliary relays r', r^2 and r^3, the circuit of each of which is controlled by a corresponding pressure switch s', s^2 or s^3 connected to the respective cables. The wires extending to these several pressure switches are tied together at a common point as indicated at 13, and the relay r', for example, is energized by the battery 4 over a circuit comprising the relay r, point 13, wires 14 and 15, and common return wire 16. When the relay r' is energized, its armature 17 closes a circuit 19, 20 extending from the source of current 7 through an electromagnetic device 18 arranged to operate or open the valve V'.

From the foregoing it will be seen that when the pressure in the cable C', for example, drops, the switch s' closes thus energizing relays r and r' in series. The relay r closes the circuit of the motor M and puts the pump P in operation while the relay r' energizes the electromagnetic device 18 and opens the valve V'. Thus insulating fluid is drawn from the reservoir R through the pipe 10, degasifier A, pipe 11 and pump P and is delivered through the pipe p' and valve V' into this particular cable, while the valves V^2 and V^3 controlling connection with the other two cables, remain closed. It will be seen, therefore, that I have provided, in connection with a plurality of independent cables, a system whereby each cable is normally supplied with insulating fluid from an independent reservoir, but whereby, should a leak occur, the fluid in any one of these cables may be automatically replenished from a single common auxiliary reservoir, and by means of a single pump.

What I claim is:—

1. The combination with a plurality of separate fluid filled electric cables, each having an impervious sheath, of means for normally maintaining fluid under pressure in all of said sheaths, a fluid reservoir, a pump associated therewith, and electrically operated automatic means responsive to a drop in pressure within any one of said cables for selectively connecting that particular cable with said pump and for simultaneously putting said pump into operation.

2. The combination with a plurality of separate fluid filled electric cables, each having an impervious sheath, of means for normally maintaining fluid under pressure in said sheaths comprising an independent supply reservoir permanently connected to each cable, a common auxiliary fluid reservoir, a pump associated therewith, independent connections between said pump and each of said cables comprising a normally closed valve, and automatic electrically operated means responsive to a drop in pressure within any one of said cables for selectively opening the valve corresponding to that particular cable and simultaneously operating said pump.

LUIGI EMANUELI.