It is well known that there are electric cables for high tensions in which the dielectric is made of paper impregnated with insulating fluid having a low viscosity, and in which the impregnating fluid can flow through a longitudinal passageway or channel formed inside the cable. In single core cables this longitudinal passageway is generally made inside of the strands of the conductor. It is possible to ship these cables from the factory completely filled with insulating fluid. To compensate for the change in the volume of the fluid, due to the variation of the temperature, there is, inside the drum on which the cable is shipped, a special tank filled with the insulating fluid and connected to the cable, for example as shown in English Patent No. 304,912 complete accepted January 31, 1929. The cable shipped as described above to the spot where it is to be installed is then laid and jointed, it being completely filled with insulating fluid.

The connectors of the joints between the different lengths of cable are jointed to the strands of the cable, usually without soldering, this being done by means of a special hydraulic press. The procedure for the making of a joint is fully described in the patent mentioned above.

If the length of cable ends in a terminal or in a special joint called "stop joint", (U.S. Patent 1,696,051 patented January 28, 1929) it is necessary to adopt a different method of procedure. The object of the present invention is to provide an improved method of and means for connecting a terminal, stop joint or other accessory to a cable which is filled with insulating fluid under pressure above that of the atmosphere without loss of an appreciable quantity of the fluid on the one hand, or the admission of air, moisture, or other impurities on the other, and which will permit of the easy evacuation of the casing which surrounds the terminal or joint.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the attached drawing which is illustrative of my invention, the figure is a longitudinal, sectional view of the cable end inserted in the insulator and showing special means employed during evacuation of the insulator.

Briefly stated, the terminal and the stop joint each comprise a cylindrical or conical insulator into which the cable end has to be inserted and into which the cable end has to be fixed and sealed.

To fit the cable end inside the insulator—when the cable is completely filled with insulating fluid, it being fed from the opposite end—it is necessary to cut the cable at one end permitting a limited amount of the fluid to flow therefrom, insert a suitable connector on to the strands with a special hydraulic press as in making a joint, strip the lead from a suitable length part of the cable, apply insulation, introduce the head of the cable so prepared inside the insulator and finally hermetically seal the whole joint between the cable and the insulator. All this must be done without appreciable loss of fluid or the admission of air or moisture, since otherwise the cable will have to be retreated in the field which is a very expensive operation.

The drawing represents the casing of the terminal or of the stop joint with the cable end already inserted. This casing is commonly made of insulating material. In the present illustration the casing has metallic heads which are sealed fluid tight to the connector and sheath. The conductor of the cable with the longitudinal passageway or channel for the insulating fluid; 3 is the insulation of the cable; 4 the lead sheath; 5 the connector pressed to the strand by means of a hydraulic press; 6 the insulating covering or tube; 7 the insulator; 8 and 9 the metal caps of the insulator (the cap 8 being soldered to the connector 5 and the cap 9 to the lead sheath 4); and 10 and 11 are two openings or holes in the caps which are closed by means of suitable plugs. The metal caps are hermetically sealed to the insulator by suitable material 8, such as cement, located between the exterior wall of the insulator and cylindrical flanges 9 formed on the caps.

During the operation of the installation as described above, only a very small amount of insulating fluid can flow out from the cable end after the connector has been pressed on to the strand, and it is an easy matter in accordance with my invention to complete the installation and to solder the connector 5 to the cap 8 and the lead sheath 4 to the cap 9. In this connection it is to be noted that there is located inside of the cable and connector a cylindrical member 5 which has a small central bore 6 that acts as a means to prevent the free flow of insulating fluid from the core of the cable when the end is open. The bore, although small, will not adversely affect the slow movements of the fluid due to temperature changes. The member is made sufficiently strong to withstand the crushing effect exerted by the means employed to compress the connector about the ends of the conductors.
When all the parts are connected together vacuum is applied to the chamber 12 of the insulator through either the opening 10 or 11, and then insulating fluid of the same quality as that used in the cable is admitted into the insulator, which fluid has been previously degassed.

It is well known, in the type of cable to which the present invention refers, that the insulating fluid must during the use of the line, flow freely from the cable to a suitable and hermetically sealed reservoir where it is heated and back from the reservoir to the cable when it becomes cool. The oil line leading from the reservoir is generally connected to the opening 11 in the terminals or stop joints.

It is of course necessary when the cable is in service to establish a communication between the fluid contained in the central channel 2 of the cable and that contained in the chamber 12 of the insulator. This communication cannot, however, be established during the installation of the terminal connections, and to make a suitable vacuum inside the insulator while insulating fluid is flowing out of the cable end. Should the chamber within the cable be left in free communication with the chamber in the insulator while a vacuum pump is used, the fluid from the channel would immediately be sucked into the pump and hence it could no longer perform its function as a gas exhausting means. It would merely be a fluid pump and would not be able to perform its function as a gas exhausting means.

If the valve is in position and the pressure of the fluid inside the cable is greater than the atmospheric no fluid can enter the port of the connector which is secured to the conductor, and which receives fluid from the connector, and a valve located within the bore of the connector which remains closed when the pressure within the chamber is lower than that within the channel of the cable and which automatically opens when pressure within the channel is greater than that within the channel.

The cable is then inserted in the insulator, and the various wipes made to finish the installation. Through the opening 10 vacuum is applied to the chamber 12 of the insulator, and the insulator is afterwards filled with degassed insulating fluid by means of a special separate reservoir. When the insulator is filled the full pressure in the chamber 12 is increased, for instance by means of a pressure pump, until it reaches a pressure greater than that existing inside the cable. When in this condition the cable is moved from its closed position and the communication between the channel of the cable and the chamber of the insulator is permanently established.

From what has been explained above it is apparent that the present invention involves a procedure and also a means for executing the same, for the purpose of installing in the end of a length of channel type cable containing fluid insulation under pressure, a terminal, a stop joint or any kind of accessory which contains a chamber filled with the insulating fluid and which is connected to communication channel of the cable when the latter is in service.

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

1. A high tension cable having an insulated conductor, a channel containing fluid under pressure and a sheath, in combination with a connector which is secured to the conductor, and has a longitudinal bore that is in communication with the channel, a chambered casing within which the connector-end is hermetically sealed and receives fluid from the connector, and a valve located within the bore of the connector which remains closed when the pressure within the chamber is lower than that within the channel of the cable and which automatically opens when pressure within the channel is greater than that within the channel.

2. A high tension cable having an insulated conductor, a channel containing fluid under pressure and a sheath, in combination with a connector which is secured to the conductor, and has a longitudinal bore that is in communication with the channel, a casing within which the connector is hermetically sealed and from which said connector projects, said connector having a lateral port establishing communication between its longitudinal bore and the interior of said sheath, and a valve between the channel of the cable and said port, which valve remains closed when the pressure within the chamber is lower than that within the channel of the cable and which automatically opens when pressure within the channel is greater than that within the channel.

3. A high tension cable having an insulated conductor, a channel containing fluid under pressure and a sheath, in combination with a connector which is secured to the conductor, and has a longitudinal bore that is in communication with the channel, a casing within which the connector is hermetically sealed and from which said connector projects, said connector having a lateral port establishing communication between its longitudinal bore and the interior of said sheath, and automatic means for preventing the flow of fluid from said channel through said port so long as the pressure in said channel exceeds that in said chamber and for permanently establishing free communication through said port when the pressure in said chamber exceeds that in said channel.

LUIGI EMANUELI.