To all whom it may concern:

Be it known that I, Nikola Tesla, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in the Manufacture of Electrical Condensers, Coils, and Similar Devices, of which the following is a specification, reference being had to the drawings which accompany the same and forms a part of the same.

My invention is an improvement in the manufacture of electrical condensers, coils, and other devices of a similar character in which conductors designed to form paths for currents of high potential are brought into close proximity with each other. Among such devices are included many forms of condensers, transformers, self-induction coils, rheostats, and the like.

It has heretofore been shown by me that the efficiency and practicability of such devices are very greatly enhanced by the exclusion of air or gas from the dielectric separating the conductors or remote portions of the same conductor; and the object of my present improvement is to secure such exclusion of air in as perfect a manner as possible in a convenient and practicable way. To this end I place the condenser or other device to be treated in a receptacle from which the air may be more or less perfectly exhausted, and while in vacuum I introduce an insulating substance, which liquefies when subjected to heat, such as paraffin, which surrounds the said device and finds its way into its interstices.

When the device has become thoroughly saturated with the insulating material, it is allowed to cool off usually until the material begins to solidify. Air is then admitted under pressure to the receptacle containing the device and the pressure maintained until the whole mass of insulating material has solidified. By this treatment the presence of air or vacuous spaces in the dielectric, which are otherwise liable to form by the contraction of the insulating material when cooling, is prevented.

Any plan may be followed or apparatus used for securing the two conditions necessary to the attainment of the desired result; that is to say, applying the fluid insulating material in vacuum and subsequently subjecting it to or solidifying it under pressure. The degree of exhaustion or of pressure may vary, very good results being secured by a vacuum of about twenty-nine inches and a pressure of about one hundred pounds. It may be stated, however, that when hydraulic pressure is applied very much higher pressures are readily secured and are of advantage.

In order to facilitate the carrying out of the process, I have devised a simple and useful apparatus, which is illustrated partly in section in the accompanying drawing. As the parts of said apparatus are all of well-known construction, the apparatus as a whole will be fully understood without a full description of its details.

A is a tank or receptacle that may be closed air-tight. Within this tank is a steam-coil C, surrounding a vessel B, preferably with slightly-sloping sides and provided with a tube or pipe D, opening into it near its base.

The condenser or other device to be treated is placed in the vessel B, and around the receptacle is packed a suitable insulating material in quantity sufficient when liquefied by heat to flow through the pipe D into the vessel B and fill the space in the latter up to the top of the condenser or other device placed therein.

It is desirable to run into the pipe D enough melted material to fill it before using the apparatus and to make the pipe of a poor heat-conducting material, so that a little time will elapse after the heat is applied to melt the material in the tank A before the flow through the pipe begins.

When the apparatus has been thus prepared, the air from the interior of the tank A is withdrawn as completely as practicable by an air-pump E and steam is passed through the coil C. In order to prevent access of any of the volatile constituents of the insulating material to the pump, a condenser F, with a cooling-coil G, is interposed in the piping between the tank and pump. After a partial vacuum has been secured in the tank A and the liquefied insulating material has been run into the vessel B the pump may be stopped and the tank connected with a receiver II, from which the air has been exhausted, and the apparatus allowed to stand until all the interstices
of the condenser have been permeated with
the insulating material. The steam is then
shut off and cold water passed through the
cell C. The connections with the pump are
then reversed and air is forced into the tank
and receiver H and the further cooling and
solidification of the insulating material car-
ried on under a pressure considerably greater
than that of the atmosphere. After the in-
sulating material has cooled and solidified
the condenser or other device, with the adher-
ing mass of insulating material, is removed
from the receptacle and the superfluous in-
sulating material taken off.

I have found that condensers, transformers,
and similar apparatus treated by this pro-
cess are of very superior quality and espe-
cially suited for circuits which convey cur-
rents of high frequency and potential.

I am aware that conductors covered with a
more or less porous material have been treated
by placing them in a closed receptacle, ex-
hausting the air from the receptacle, then in-
roducing a fluid insulating compound and
subjecting the same to pressure, for the pur-
pose of more perfectly incorporating the in-
sulating compound with the surrounding
coating or covering of the conductors and
causing such compound to enter the inter-
stices in said covering, and I apply this prin-
ciple of exhausting the air and introducing
the fluid insulating compound under pres-
sure in carrying out my improvement. My

process, however, differs from the foregoing
mainly in this, that I seek not only to fill the
pores of any porous material that may be in-
terposed between the conductors of such a
device as a condenser or coil, but to fill up
all the spaces in the dielectric, whereby air or
vacuous spaces, the presence of which in the
dielectric is so deleterious to the device, may
be effectually prevented. To this end I per-
mit the insulating compound after its incor-
poration with the device, under exhaustion
and pressure, to cool and solidify, so that not
only is the air replaced by a solid insulating
compound, but the formation of vacuous
spaces by the contraction of the mass on cool-
ing prevented.

What I claim is—
The improvement in the manufacture of
electrical devices such as condensers, which
consists in enclosing the device in an air-tight
receptacle, exhausting the air from the re-
ceptacle, introducing into a vessel containing
the device an insulating material rendered
fluid by heat, and then when said material
has permeated the interstices of the said de-
vice, subjecting the whole to pressure, and
maintaining such pressure until the material
has cooled and solidified, as set forth.

NIKOLA TESLA.

Witnesses:

M. LAMSON DYER,
PARKER W. PAGE.