

G. C. KNAUFF.
 PROCESS FOR UNITING MATERIALS.
 APPLICATION FILED MAR. 11, 1912.

1,165,680.

Patented Dec. 28, 1915.
 2 SHEETS—SHEET 1.

Fig. 1.

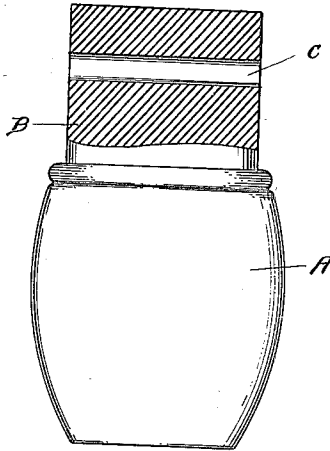


Fig. 3.

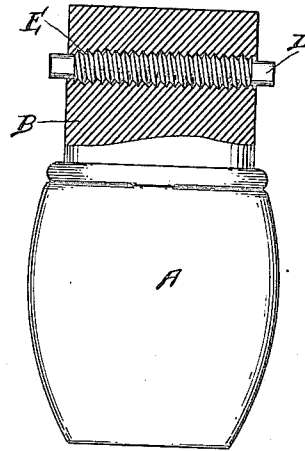


Fig. 2.



Fig. 4.

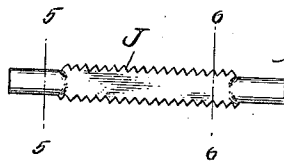


Fig. 5.



Fig. 6.



Fig. 7.

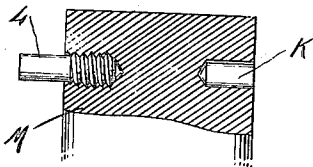
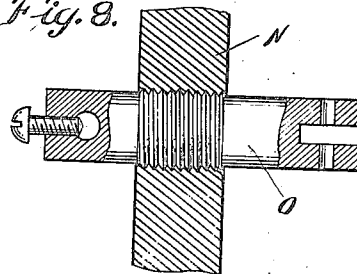


Fig. 8.



Witnesses:
Arthur M. S. S.
Monroe A. Smith Jr.

Inventor.

George C. Knauff

By *Albert J. Keith*
 Attorney

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2 SHEETS—SHEET 2.

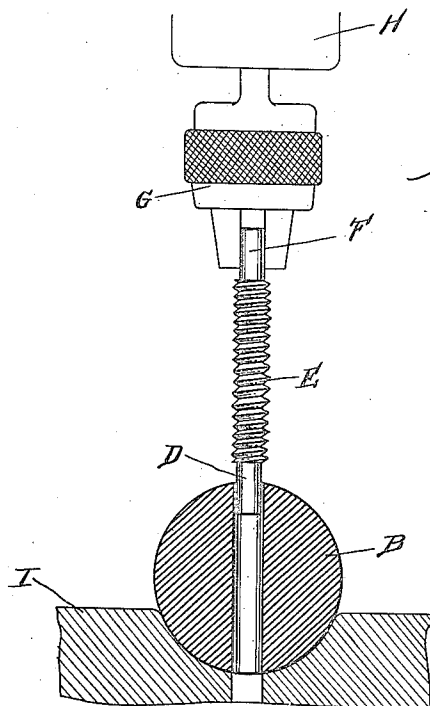


Fig. 9.

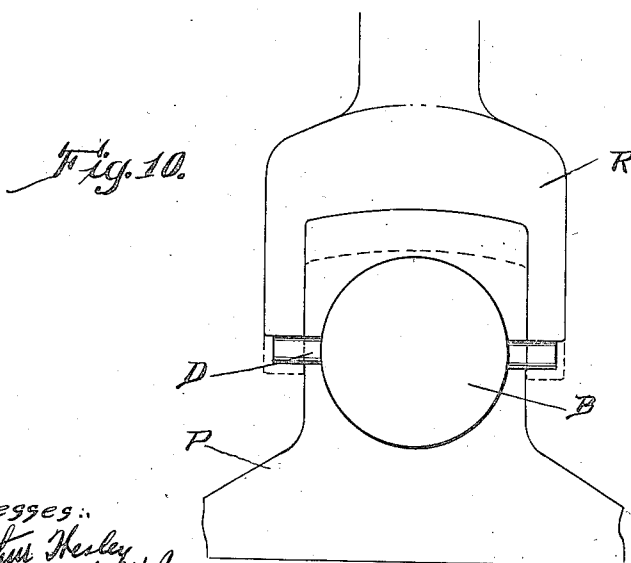


Fig. 10.

Witnesses:
Arthur Wesley
Morris A. Smith Jr.

Inventor:
George C. Knauff
By Albert J. Schick
Attorney.

UNITED STATES PATENT OFFICE.

GEORGE C. KNAUFF, OF CHICAGO, ILLINOIS.

PROCESS FOR UNITING MATERIALS.

1,165,680.

Specification of Letters Patent.

Patented Dec. 28, 1915.

Application filed March 11, 1912. Serial No. 633,058.

To all whom it may concern:

Be it known that I, GEORGE C. KNAUFF, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Processes for Unit-
ing Materials, of which the following is a full, clear, concise, and exact description,
reference being had to the accompanying
10 drawings, forming a part of this specifica-
tion.

My invention relates to processes for unit-
ing dissimilar materials to one another, its
object being to obtain a secure and rigid
15 fastening without the use of cement or
auxiliary retaining members.

It consists essentially in softening one of
the materials which are to be joined, forcing
the other material into it, and utilizing the
20 contractive force of the softened material
when hardening for gripping the other
material.

My invention is particularly applicable
to the construction of articles made in part
25 of hard rubber compositions, as for instance
in securing the anchoring pins to the rubber
plugs used with automobile lighting circuits.
In securing such pins to the rubber bodies, it
has heretofore been customary either to
30 cement them in place, or to depend on a
tight driving fit for holding them. Neither
of these methods have proven satisfactory
with changes in the temperature and hu-
midity of the air to which articles of this
35 class are exposed. Instead of depending on
such a driving fit or on the use of cement, I
have found that I can obtain a more secure
union of dissimilar materials by softening
one of the same and utilizing the pressure
40 due to the contraction of the softened ma-
terial when hardening.

My invention is particularly adapted for
making a firm union between a member
made of insulating material and another
45 member made of metal, and is shown in this
application in the accompanying drawing,
forming a part of this application.

In the drawings, Figure 1 shows an eleva-
tion of an attachment plug before the metal
50 member is inserted, a part of the plug being
cut away to show a section of the interior.
Fig. 2 shows an elevation of the metal mem-
ber before insertion. Fig. 3 shows a partial
section of the plug with the metal member
55 united with it by my process. Fig. 4 shows

an alternative form of metal member. Figs.
5 and 6 are sections along lines 5—5 and 6—6
in Fig. 4. Fig. 7 shows a partial section of
a plug with perforations passing part way
through the same. Fig. 8 shows a metal 60
member united with a rubber plate by my
process. Fig. 9 shows the method of in-
serting the metal member shown in Fig. 2 in
the plug shown in Fig. 1. Fig. 10 shows the
method of cutting off the surplus length of 65
the metal member required for inserting the
same by the method shown in Fig. 9.

In the drawings, A is an attachment plug
of hard rubber, having a body B with a
transverse perforation C. D is a metal 70
member having a section at both ends sub-
stantially equal in size to the bore of the
perforation C. E is a raised thread formed
on the central portion of the member D. To
insert this member D in the perforation C, 75
I soak the rubber body B for some time in
water heated close to its boiling point (or to
about 205 degrees Fahrenheit), thereby ex-
panding the rubber and softening its surface
portions, including the wall of the perfora- 80
tion, to a state in which they are plastic or
pliable, but not fluid. I then grasp one end
F of the member D between the jaws of the
chuck G of a drill press H as shown in Fig.
9 and rotate the chuck while the body B is 85
kept from turning by resting in a non-rotat-
able grooved support I. On raising this
support while the member D is being ro-
tated, the thread E compresses the softened
portions of the rubber body B adjoining 90
the perforation, thereby allowing the mem-
ber D to thread its way through the body B.
Then, when the assembled parts B and D are
allowed to cool, the rubber contracts in har-
dening, thereby gripping the surface of the 95
thread E so tightly that I have found it im-
possible to separate the united members B
and D as in Fig. 3 without damaging the
former.

In carrying out my process, I preferably 100
give the member which is to be inserted a
cylindrical form and roll raised threads upon
the same. The length of the threaded por-
tion of the insertible member is preferably
made somewhat less than the length of the 105
perforation. Then when the said member
is inserted until the perforated member
completely houses the threaded portion of
the other member (as in Fig. 3) the por-
tions of the perforated member at each 110

end of the perforation will contact with unthreaded portions of the inserted member. Consequently, when the perforated material hardens, it will form contracted portions around the inserted material at each end of the perforation, which portions will act as stops to prevent the unscrewing of the inserted member. However, I have found that instead of rolling the thread upon the member which is to be inserted in the other material, the central portion of the insertible member may be stamped out as in Fig. 2, and provided at opposite edges with staggered teeth J, which will press back the rubber and thread their way into the softened walls of the perforation C, thus serving the same purpose as the form shown in Fig. 2. I have also found that my process serves equally well with perforations extending only part way through the softenable body as shown in Fig. 4, in which K is a perforation entering the body from one side and L is a metal member inserted into a corresponding opening on the other side of the plug M.

I have also found that my process will serve equally well for uniting metal members with sheets of insulating material, as shown in Fig. 8, in which N is a plate of hard rubber, and O is a metal switch pivot inserted in the same by my process. In thus securing metal members to sheets or plates, it is not necessary to soak the whole plate in hot water, as the softening influence may be obtained in the form of a jet of hot water or steam sprayed upon the portions of the plate or sheet adjacent to the perforation in which the metal member is to be inserted.

For some uses of dissimilar combinations of materials, the non-softenable material must not project sufficiently beyond the surface of the softenable material to offer a proper hold for the jaws of the chuck used for rotating it, as for example in the attachment plug shown in my copending application, filed November 20th, 1911, Serial #661375. Moreover, even if the inserted member could be grasped by the short end which projects from the finished combination, it would be difficult to stop this in the process of insertion at just the right point to obtain the proper amount of projection. In such a case, I lengthen the member which is to be inserted, at one or both ends. Then, after insertion, I rest the rubber body in the socket portion of a die P as shown in Fig. 10, and cut off the projecting surplus length of the inserted member B with a die R.

While I have illustrated and described my process as applied in uniting metal to hard rubber and as using steam or hot water as the softening influence, I do not wish to be limited to the materials or the soften-

ing influences mentioned, as it will be evident that my process will be applicable to the uniting of other materials of a dissimilar nature and that other softening influences than water or steam may be used in the process; also that my process is particularly applicable to amorphous materials which are normally unyielding and incompressible.

What I claim as new and desire to cover by Letters Patent is:

1. The process of uniting a non-moisture-absorptive and normally hard body with a metal bar having end portions of uniform diameter and having a raised thread upon its surface intermediate of the said end portions, which consists in forming in the said body a perforation smaller in bore than the outside diameter of said raised thread: softening the perforation surface parts of the body to a plastic but non-fluid state by heating the same to about 200 degrees Fahrenheit: screwing the said bar forcibly into the perforation while the said parts are in their softened state, whereby the said raised thread compresses and reshapes the said parts of the body while being inserted: and hardening the said parts by cooling them, thereby anchoring the said bar by the pressure thereon of the said adjacent material.
2. The process of uniting a non-moisture-absorptive and normally hard body with a metal bar having end portions of uniform diameter and having a raised thread upon its surface intermediate of its said end portions, which consists in forming in the said body a perforation corresponding substantially in its bore to the diameter of the said end portions, the length of the said perforation being greater than the said threaded portion of the bar: softening the perforation surface parts of the body by heating the same to about 200 degrees Fahrenheit: forcing the said bar into the perforation, while the adjacent surface parts of the said body are in their said softened state, until the said body completely houses the threaded portion of the bar, whereby the said raised thread compresses and reshapes the said parts of the body while the threaded portion of the bar is being inserted, and whereby the compressed portions adjacent to one end of the perforation will expand after the threaded portion of the bar has passed the said end of the perforation: and cooling the said parts to harden the same and to anchor the said bar partly by the pressure thereon of the hardened adjacent material and partly by the annular wall formed around the bar between the said end of the perforation and the adjacent end of the threaded portion of the bar.

3. The method of uniting a non-moisture-absorptive and normally hard material with a metal bar equipped with surface eleva-

tions, which consists in providing in the said material an opening corresponding in dimensions with the body portion of the part of the bar to be received therein: heating the said material to about 200 degrees Fahrenheit to render the walls of the said opening plastic but non-fluid: inserting the said portion of the bar in the said opening while the said walls are plastic, thereby causing the said surface elevations to become embedded in the said walls: and then cooling the said material to cause the same to harden with the said body portion of the bar embedded therein.

4. The hereindescribed method of uniting hard rubber and a metal member equipped with projections, which consists in providing an opening in the hard rubber corresponding substantially in lateral dimensions with the body portion of the part of the said member to be received therein: exposing said hard rubber to a temperature of about 200 degrees Fahrenheit for a sufficient time to render the walls of the said opening pliable: inserting the said part of the member in the perforation with a gradually advancing rotary motion, thereby causing the said projection threadedly to embed themselves in the walls of the perforations: then allowing said rubber to cool and harden with the

said body portion of the metal member embedded therein.

5. The method of rigidly embedding in a normally brittle amorphous body a metal member having a portion equipped with at least one projection, which consists in providing an opening in said body of less transverse dimensions than the greatest transverse dimensions of the said portion of the metal member, subjecting the said body to the action of a heating influence at about 200 degrees Fahrenheit to render the peripheral wall of the opening plastic, but non-fluid, inserting said projection-bearing part of said member in said opening while the wall of the latter is plastic and capable of being distorted, whereby said projection will effect displacement and embed itself in said wall while the said part is being inserted: then allowing said material to cool and harden with the part of the metal member carrying said projection embedded therein.

In witness whereof, I have hereunto set my hand, this sixth day of March, A. D. 1912, in the presence of two subscribing witnesses:

GEORGE C. KNAUFF.

Witnesses:

ALBERT SCHAIBLE,
M. A. SMITH, Jr.