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C. H. VAN DUSEN, JR., ET AL
METHOD OF MAKING PYROPHORIC FLINTS

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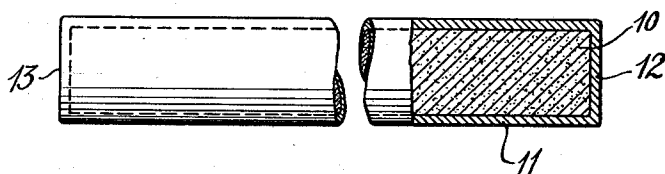


FIG. 1.

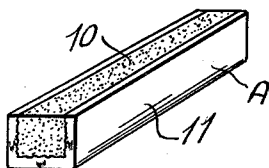


FIG. 3



FIG. 2

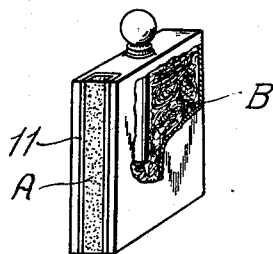


FIG. 4

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METHOD OF MAKING PYROPHORIC
FLINTS

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8 Claims. (Cl. 29—148)

The present invention relates to the fabri-
cating or working of pyrophoric alloys such as
cerium and mischmetal alloys, and more partic-
ularly to composite flints made of these alloys,
and a method of manufacturing the same.

In the familiar cigar and cigarette lighters
of commerce, small pieces of pyrophoric alloys,
commercially known as flints, are struck by suit-
ably constructed toothed wheels or sharp rods,
and give off sparks which usually ignite a suit-
ably placed impregnated wick. These flints are
usually rods or sticks of very small cross sec-
tion and comparatively short length, and since
the pyrophoric materials used are hard and
brittle, it is impossible to convert them to the
desired shape by the usual means of cold work-
ing such as hammering, rolling, drawing or
swaging, etc. On the other hand, hot working is
likewise impossible because of the great chemical
activity of the material.

An object of the present invention is the pro-
vision of a novel commercial method of manu-
facturing, fabricating, or working pyrophoric
alloys into useful shapes.

Another object of the invention is the pro-
vision of a novel commercial method of manu-
facturing flints of pyrophoric material which
consists in working pyrophoric alloys within a
protective metallic sheath to a desired shape and
subsequently removing a portion of the protec-
tive metallic sheath to expose the pyrophoric
alloy.

Further objects and advantages of the inven-
tion will be apparent to those skilled in the art
to which it pertains from the following descrip-
tion of the preferred embodiment of the inven-
tion described with reference to the accompany-
ing drawing, of which

Fig. 1 is an elevation of an ingot comprising
a pyrophoric material enclosed in a protective
sheath, with a portion of the sheath broken away
to show the pyrophoric material;

Fig. 2 is a section of composite rod produced
by the reduction of the ingot shown in Fig. 1;

Fig. 3 is a perspective of a composite flint em-
bodying the present invention; and

Fig. 4 is a perspective of a lighter embodying
the present invention.

According to the present invention, pyrophoric
material, such as alloys of cerium or mischmetal,
with iron, copper, nickel, zinc, or magnesium,
etc., is enclosed in a protective metallic sheath
and worked, usually by a plurality of successive
steps, to the desired shape, after which the pro-
tective material is removed to expose the pyro-
phoric material. We have found that pyrophoric
material lends itself readily to working and
change of shape when it is properly supported
on all sides, as is the present instance. This is
especially true when the composite article is

worked at moderate temperatures or periodically
annealed during the process of reduction. In
addition to confining the metal so that it can-
not separate while being worked, the protective
metal sheath prevents the same from burning,
and chemical reaction.

While individual articles of any size or shape
may be made it has been found advantageous
to make a rod of considerable length and subse-
quently cut the same to desired lengths. Prefer-
ably the pyrophoric alloy is first cast in rods of
comparatively large cross section and suitable
length, and slipped into a snugly fitting metallic
tube, slightly longer than the rod, after which the
ends of the tube are closed in any suitable man-
ner, as by burnishing, spinning, swaging or ham-
mering, etc., to form a composite rod or ingot.
The composite rod or ingot is then rolled, drawn,
swaged, or hammered etc., to form a rod of the
desired cross-section or shape. The ingot or rod
may be worked at a moderate temperature or may
be annealed between passes or operations. The
amount of work, that is, the percentage of reduc-
tion of cross section that is done at each pass
through the hammer, rolls, swager, dies, or the
like, is about the same as that with iron, copper
or any ordinarily malleable metal. The protec-
tive sheath is then removed from the reduced
composite rod to expose the pyrophoric material,
by grinding, milling or planing, etc., after which
the bar is cut to the desired lengths.

Referring to the drawing, Fig. 1 illustrates a
composite rod or ingot formed of a round cast
rod 10 of pyrophoric material, such as ferro-
cerium or ferro-mischmetal, enclosed in a snugly
fitting tube or sheath 11 made of copper or other
suitable metal, the ends 12 and 13 of which have
been tightly closed in some convenient manner.
The rod 10 illustrated is about one-half inch in
diameter and ten or twelve inches long, and the
copper tube or sheath 11 has a wall thickness of
about one-sixteenth or three-thirty-seconds of an
inch. The composite rod or ingot is reduced to
the desired cross section or shape which in the
present instance is illustrated in Fig. 2 as square,
either by cold working, such as drawing, rolling
etc., including inter-pass or inter-operation an-
nealing, or by hot working at a temperature not
to exceed 500° C. or a dull red heat. In the latter
instance, as the cross-sectional area of the rod
is decreased the working temperature may be
rapidly reduced, and inter-pass or inter-operation
anneals substituted for hot working. As the rod
approaches the finished size the last few passes
may be made without annealing which usually
also increases the strength of the enclosing or
supporting sheath.

After a composite rod of the desired cross sec-
tion has been formed, which in the present in-
stance is about one-eighth or five thirty-seconds

of an inch square, the enclosing sheath 11 is removed from one side thereof by passing the bar under a grinding wheel, etc., to expose the pyrophoric material. The sheath 11 supports the
 5 pyrophoric material which is quite brittle, in such a manner that the reduced bar may be cut with a shears, punch press, etc., without cracking or crumbling. A length cut from the bar in this condition forms a composite flint A, illustrated in
 10 Fig. 3, of the type adapted to be struck with a striking or scratch pin.

Flints of the present invention show a marked superiority of pyrophoric properties over those of the prior art, and are more resistant to deterioration due to oxidation, etc., caused by exposure to
 15 air, moisture, carbon dioxide, etc., because a greater part of the surface is protected by a tightly adhering protective sheath. The stream of sparks which are struck from the pyrophoric material, in operation, consists of small particles of metal which are torn off by the striker bar or toothed wheel. These small particles of metal
 20 are heated by the friction incident to the striking or scratching and burn as they fly into the air. The superiority of the pyrophoric properties of the present flint may be caused by the fact that apparently the working of the alloy produces a granular structure from which particles may be
 25 readily torn off by the striker bar.

While the specific embodiment of the invention illustrated shows copper as the supporting material, it is to be understood that metals such as iron, nickel, aluminum, tin, silver, or any
 30 other metal or alloy having sufficient strength and ductility, and a high enough melting point, may be substituted for the copper shown. It is also to be understood that while the copper sides are shown as being flush with the exposed surface of
 35 the pyrophoric material, they may project above the exposed surface or any configuration of surface may be exposed.

Fig. 4 illustrates the flint shown in Fig. 3 embodied in a cigar or cigarette lighter B of the scratch pin type and conventional construction.
 45 The flint A is embedded in the body of the lighter in any well known manner. As the exposed surface of the pyrophoric material wears down, the copper walls on the two sides act as guides for the striker or scratch pin and insure proper and
 50 successful action at each stroke. With the contact of the striker against the pyrophoric material insured, a smaller or narrower surface of pyrophoric material is required, with consequent economy in the amount of material used. It will
 55 be obvious that the cross section of the finished flint may be round as well as rectangular. In the manufacture of flints for use with toothed wheels it may be unnecessary to remove the protective covering as a separate operation since the pyrophoric material will be exposed at the ends upon
 60 the cutting of the reduced bar into the desired lengths.

From the foregoing description of the invention, it will be apparent that a novel flint has been produced, together with a novel lighter and a novel
 65 method of working pyrophoric material and manufacturing flints therefrom. It is not intended to be limited to the particular construction or method illustrated and described, as various
 70 changes therein may be made within the scope of the invention, but it is the intention to cover any and all variations, adaptations or uses thereof as

come within the knowledge or customary practice in the art to which this invention belongs, and we particularly point out and claim as our invention the following:

We claim:

1. The method of making a composite article of pyrophoric material and a protective metal covering a portion thereof, which comprises enclosing a pyrophoric alloy in a metallic sheath to form a composite ingot, reducing said ingot to the desired shape, and subsequently exposing a portion of the pyrophoric alloy.
2. The method of making a composite flint of pyrophoric material and a metallic protective coating, which comprises enclosing the pyrophoric material in a metallic sheath, working the article thus formed to a desired shape, and subsequently removing a portion of the protective coating to expose the pyrophoric material.
3. The method of making a composite flint of pyrophoric material and a metallic covering which comprises enclosing the pyrophoric material in a metallic sheath to form an ingot, reducing said ingot by a hot metal working process to form a rod of desired shape, and subsequently removing a portion of the enclosing sheath from the rod to expose the pyrophoric material.
4. The method of making a composite flint of pyrophoric material and a metallic protective covering which comprises enclosing the pyrophoric material in a metallic sheath to form an ingot, reducing said ingot by a metal drawing process to form a rod of desired shape, and subsequently removing a portion of the protective coating to expose the pyrophoric material.
5. The method of making a composite flint of a pyrophoric alloy and a metallic covering which comprises casting the pyrophoric alloy into the form of a rod, enclosing the cast rod in a snugly fitting metallic sheath to form a composite ingot, reducing the composite ingot to a desired shape, and subsequently removing a portion of the enclosing sheath to expose the pyrophoric material.
6. The method of making a composite flint of a pyrophoric alloy and a protective covering which comprises casting the pyrophoric alloy into the form of a rod, enclosing the cast rod in a snugly fitting metallic sheath to form a composite ingot, working the composite ingot to a desired shape by a cold working process, and cutting the rod to desired lengths.
7. The method of making a composite flint of a pyrophoric alloy and a protective covering which comprises casting the pyrophoric alloy into the form of a rod, enclosing the cast rod in a snugly fitting metallic sheath to form a composite ingot, reducing the composite ingot to form a rod of desired shape by hot working followed by cold working, removing a portion of the enclosing sheath from the rod to expose the pyrophoric alloy, and cutting the rod to desired lengths.
8. The method of making a composite flint of a pyrophoric cerium alloy and a protective metallic covering which comprises casting the pyrophoric alloy into the form of a rod, enclosing the cast rod in a snugly fitting metallic sheath to form a composite article, reducing the composite article thus formed by hot rolling followed with cold rolling, and removing a portion of the enclosing sheath to expose the pyrophoric alloy.

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