To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, and a resident of Llewellyn Park, West Orange, Essex county, New Jersey, have invented a certain new and useful Phonograph-Stylus, of which the following is a description.

My invention relates to phonograph styluses.

My object is the provision of a reproducing stylus formed of boron, which stylus because of its hardness is capable of operating upon sound records formed from hard materials without wearing away or otherwise deteriorating.

Crystallized boron is a substance which I have discovered to be well suited for the manufacture of reproducing styluses, since it is of an exceeding hardness, being very much harder, in fact, than sapphire. I have found that an exceedingly hard record material, such as that disclosed in applications of Aylsworth Serial Nos. 496,060, Plastic composition and process of manufacturing the same, filed May 14, 1909; 549,258, Phenolic condensation product and method of preparing same, filed February 11, 1910, and 549,256, Sound records and process for making the same, filed February 11, 1910, wears away the usual sapphire stylus to a considerable extent. Such a record material, or one of equivalent or greater hardness, harder, for example, than celluloid, is of the utmost value for the production of a molded phonograph record, since with a record formed of such material, a reproducer of considerable weight or provided with a heavy floating weight may be used with a consequent considerable improvement in the volume and quality of reproduction, if a stylus of sufficient hardness to withstand the wear caused by the hardness of the record is used therewith. A sapphire stylus is not appreciably worn when used in reproducing from such phonograph records, as are now on the market, of which those formed from celluloid are probably the hardest. When, however, the record material is substantially harder than celluloid, a sapphire stylus quickly wears out, and accordingly, I have constructed a stylus of crystallized boron which is adapted to coat with such a record and to withstand the consequent wear.

Boron is now formed in small crystals in the electric furnace, which crystals I propose to utilize in the manufacture of styluses in a manner to be described. In addition to its excessive hardness, boron has the advantages that it can be polished easier than diamond, and is not so fragile as the latter.

Reference is hereby made to the accompanying drawings forming part of this specification and in which—

Figures 1 to 4 inclusive represent side elevations, partly in section, of a holder of brass or other relatively soft material in the end of which a boron crystal is secured, Fig. 1 showing the rough crystal thus secured, Fig. 2 showing the crystal and holder after the lower end thereof has been lapped to a plane surface, Fig. 3 representing the crystal and holder ground or lapped to a taper, and Fig. 4 showing the same with the blunt end of the taper rounded. Fig. 5 represents diagrammatically in side elevation the process of lapping the flat end upon the crystal and holder. Fig. 6 similarly represents the process of lapping the crystal and holder to a cone shape, and Fig. 7 similarly represents in plan view the process of rounding the end of the crystal. Fig. 8 is an enlarged sectional detail view showing the method of grinding the rounded surface upon the end of the boron stylus. Fig. 9 is a partial cross section through a reproducer provided with my improved boron stylus traveling in the record groove of a suitable sound record formed of hard material such as described above.

It will be understood that the process by which my improved stylus is formed may be carried out by various apparatus, and is not limited to the particular mechanism described.

Referring to the drawings, my improved stylus is formed from a crystal of boron such as indicated at 1. A small boron crystal of irregular shape is secured within a holder 2 of brass or other relatively soft material by any of various means as cement 3. The rough lower edge of crystal 1 is then lapped to a flat surface indicated at 4 in Fig. 2. This operation is indicated diagrammatically in Fig. 5 in which the lap wheel 5 which rotates about the spindle 6 may be used for producing the plane sur-
face 4 upon crystal 1. The next operation is
girding the sides of the crystal to a taper,
resulting in the production of a conical sur-
face 7 upon the lower end of the crystal 1
as indicated in Fig. 3. This operation is
indicated diagrammatically in Fig. 6 in
which the holder 2 in which the crystal 1
is secured is chucking in a lathe in which the
spindle 8 is rotated by means of a belt pass-
ing over wheel 9 or by other power con-
nection. While the crystal 1 is being rotated,
it, together with the adjacent end of the
brass holder in which it is mounted, is
ground at a suitable angle, preferably of
approximately 30 degrees by means of the
lap wheel 10 which is charged with diamond
dust and mounted upon shaft 11 which may
be adjusted at any suitable angle and ro-
tated by any suitable means indicated dia-
grammatically by the belt wheel 12. If de-
sired, the two steps of the process so far
described may be transposed, and the sides
of the crystal adjacent to the end first
ground to a taper and the rough end sur-
face remaining then flattened. After the
end portion of the crystal has been reduced
sufficiently so that the blunt point of flat
surface 4 is of sufficiently small area, the
latter is rounded and polished by any suit-
able means, such as the ball polishing ma-
chine shown diagrammatically in Fig. 7.
As here shown, the crystal 1 secured in a
holder 2 is chucking in a lathe having a ro-
tating spindle 8 rotated from belt wheel 9.
The end surface 4 of crystal 1 is rounded
and polished by means of the grinding tool
13 which is provided with a concave surface
of the shape and size to which it is desired
to round the end of the stylus. The grind-
ing surface of the tool 13 may be charged
with diamond dust mixed with oil, as indi-
cated in Fig. 8 at 14. Either the stylus or
the tool grinding the same should partake
of an oscillatory movement during the ro-
tation of the stylus.

In the drawings I have illustrated the
grinding tool 13 as suitably mounted in a
spindle 15 which is revolved by means of
belt wheel 16, the spindle and belt being
mounted in a holder which is pivoted di-
rectly beneath the end of the stylus being
rounded, so that during the grinding opera-
tion the spindle 15 may oscillate about the
surface being ground, as indicated by the
position of the spindle 15 shown in dotted
lines in Fig. 7. The end of the stylus when
rounded is shown in Fig. 4 at 17, the said
figure illustrating the completed stylus which
is still secured within holder 2. The curve
17 should be of the proper dimensions to
travel within the exceedingly minute sound
record groove, the conical surface 7 of the
boron crystal preferably running smoothly
into the curve 17 of the record engaging
surface of the stylus. The stylus thus
formed may now be removed from holder 2
and suitably secured in a stylus lever or
otherwise mounted to reproduce from a
sound record.

In Fig. 9 I have illustrated a stylus 170
connected by lever 18 pivoted at 19 to dia-
aphragm 20 of reproducer 21. The boron
stylus may be secured directly in the stylus
lever or it may be mounted within a suit-
able holder which is secured in the end of
75 the stylus lever as shown. The reprodu-
cer 21 illustrated is preferably of consider-
able weight as, for example, from 3 to 5 ounces
or more, which weight holds stylus 1 firmly
in engagement with the record groove of
80 record 22 which is preferably formed of the
hard record material above referred to.

Having now described my invention, what
I claim and desire to protect by Letters
Patent is as follows:

1. As a new article of manufacture, a
stylus for talking machines formed of crys-
tallized boron, substantially as described.

2. As a new article of manufacture, a
stylus for talking machines formed of a
90 substance containing crystallized boron,
substantially as described.

3. As a new article of manufacture, a
boron stylus having a conical end with
rounded point adapted to travel in the 95
groove of a sound record, substantially as
described.

4. As a new article of manufacture, a
boron stylus having irregular contour and
a lapped tapered end with rounded point 100
adapted to travel in the groove of a sound
record, substantially as described.

5. As an article of manufacture, a boron
stylus having irregular contour and a ta-
ppered end with a rounded point adapted to
105 travel in the groove of a sound record, sub-
stantially as described.

This specification signed and witnessed
this 2d day of May 1910.

THOS. A. EDISON.

Witnesses:
FRANK L. DYER,
DYER SMITH.