The present invention relates to blasting materials and more particularly to blasting materials for cleaning and otherwise treating surface.

Prior to the present invention, blasting materials used for the cleaning of castings, rolling stock, and other materials and also for the descaling of surfaces were mainly produced by spattering a suitable iron or steel alloy in liquid form into water whereby substantially round smooth surfaced grains are formed. These grains are subsequently broken in order to create rough surfaces which will give these broken grains in operation a cutting, shearing, and nicking effect.

Two main disadvantages are connected with the use of such broken grains: First, in usage the jagged edges and projections which form most of their rough surface are soon worn down or rounded and consequently the useful life span of these grains is rather short.

Second, the moving parts of the centrifugal blasting machine that come in contact with these rough surfaced grains, especially the blades of the machine, show considerable wear after short periods of operation. The use of these machine parts and also of the rough surfaced metal grains increases with increased centrifugal speeds of the blasting machine. The wear is therefore technologically significant and in its economic consequences more marked at high centrifugal speeds. The recent tendency to increase the centrifugal speed of these blasting machines in order to improve the blasting effect and to shorten the blasting time, makes these discussed disadvantages of rough surfaced metal grains even more manifest.

It is therefore an object of the present invention to overcome these disadvantages.

It is a further object of the present invention to provide a blasting mixture which has both a hammering and a cutting effect.

It is still a further object of the present invention to provide a blasting material with improved properties which also increases the wearing ability of the moving parts of blasting machines.

Other objects and advantages of the present invention will be apparent from a further reading of the specification and of the appended claims.

With the above objects in view the present invention mainly comprises blasting material for cleaning and otherwise treating surfaces, the blasting material essentially consisting of a mixture of smooth surfaced metal grains and rough surfaced metal grains.

In a preferred embodiment of the present invention the rough surfaced and smooth surfaced metal grains are both formed from the same metal composition and are of substantially the same size.

The amount of the smooth surfaced metal grains is preferably between 20 and 50% by weight of the mixture of smooth surfaced and rough surfaced metal grains.

In a further embodiment of the present invention the rough surfaced grains are hardened to greater wear resistance than the smooth surfaced grains by a change in composition and/or heat treatment.

Preferably the grains are made of a metal such as iron or steel.

In another embodiment of the present invention the smooth surfaced grains are shaped substantially spherical or spheroidal and the rough surfaced grains have a jagged surface portion.

The use of only smooth surfaced grains, such as spheroidal grains achieves only a hammering effect which is insufficient for proper cleaning and descaling of surfaces as is normally required in blasting operations. Furthermore, such smooth surfaced grains could not properly penetrate into any recesses in the surface of the object to be treated.

It is one of the advantages of a mixture of rough surfaced and smooth surfaced metal grains to greatly prolong the useful life span of the rough surfaced metal grains, since the smooth surfaced grains in the blasting mixture, by exerting a hammering effect on the surface to be cleaned, reduce the amount of wear to which the rough surfaced grains are exposed during operation.

It is a further advantage of this invention to protect the blasting equipment from the wear experienced by using only rough surfaced metal grains, since the smooth surfaced grains execute essentially a rolling movement only, which in itself does not exert any substantial wear on the parts of the blasting machine, and also because these smooth surfaced grains prevent to a considerable extent direct contact between the surfaces of the blasting machinery and the wear exerting rough surfaced metal grains. Consequently, and especially important under present-day high centrifugal speed methods of operation, wearing out and replacement of exposed parts of the blasting machinery is considerably delayed. This results in substantial technological and economical advantages.

In another embodiment the size of the smooth surfaced grains is kept somewhat smaller than the size of the rough surfaced grains. It has been found that this size relationship gives best results in a great number of applications. However, certain variations in the size relationship are sometimes indicated depending on the specific operating conditions and the type and condition of the surface to be treated. Based on the present disclosure it is not difficult for one skilled in the art to experimentally determine the best sizes, and size relationship between smooth surfaced and rough surfaced grains as well as the best weight relationship between these two types of grains, applicable to the specific surface to be treated.

The most suitable weight relationship is determined experimentally in each case by ascertaining in which relationship the optimum blasting effect can be achieved by keeping at the same time the wear of the machine parts within tolerable limits. For instance in a given case an experiment with a mixture of 45% smooth surfaced grains and 55% broken grains showed a working life of the blasting material 2½ times as long as the working life of a blasting material consisting exclusively of rough surfaced grains of the same composition. Moreover, by using this mixture, the wear of the centrifugal blades of the blasting machine was only half of what it was when using exclusively rough surfaced grains.

To assure technologically and economically optimum blasting performance it should be endeavored to keep the mixing proportion constant, once it has been found to be the most suitable proportion. This is not automatically the case because of the faster wear of the rough surfaced grains. It can be achieved by imparting to the rough surfaced grains a higher wear resistance. If the rough surfaced grains are of the same composition as
the smooth surfaced grains, this can be done by subjecting
the rough surfaced grains to a thermal hardening
process as for instance to 6 to 8 hours annealing at 700
and subsequent quenching in water, oil, salt
solutions, or similar media. For the same purpose the
rough surfaced grains can also be made of a more wear
resistant composition with or without further heat treat-
ment.

The following examples are given as illustrative of the
present invention, the scope of the invention not however
being limited to the specific details of the examples.

Example 1

A blasting material is composed of a mixture of smooth
surfaces metal grains and of rough surfaced metal grains
the metal having a composition of:
Si 1.6%, Mn 0.5%, P 0.8%, S 0.11%, C 3.50%, re-
mainder iron,
in which the maximum diameter of the smooth surfaced
metal grains is between 0.22 mm. and 0.30 mm., and in
which the maximum diameter of the rough surfaced grains
is between 0.35 and 0.45 mm. The material is composed
of 20% by weight of smooth surfaced metal grains
and 80% by weight of rough surfaced metal grains.

Example 2

A blasting material is composed of a mixture of smooth
surfaces metal grains and of rough surfaced metal grains
the metal having a composition of:
the smooth surfaced metal grains: Si 0.8%, Mn 0.6%, P 0.8%, S 0.08%, C 2.10%, remainder iron.
the rough surfaced metal grains: Si 1.2%, Mn 0.4%, Ni 0.50%, Cr 0.50%, P 0.10%, S 0.08%, C 2.10%,
remainder iron
in which the maximum diameter of the smooth surfaced
metal grains is between 2.2 mm. and 2.6 mm., and
which the maximum diameter of the rough surfaced grains
is between 2.2 mm. and 2.6 mm. The material is com-
posed of 60% by weight of smooth surfaced metal grains
and 40% by weight of rough surfaced metal grains.

Example 3

A blasting material is composed of a mixture of smooth
surfaces metal grains and of rough surfaced metal grains
the metal having a composition of:
Si 1.5%, Mn 0.5%, Ni 0.4%, Cr 0.3%, P 0.3%, S 0.10%,
C 2.00%, remainder iron,
in which the maximum diameter of the smooth surfaced
metal grains is between 1.00 mm. and 1.40 mm., and in
which the maximum diameter of the rough surfaced grains
is between 0.8 mm. and 1.2 mm. The material is com-
posed of 45% by weight of smooth surfaced metal grains
and 55% by weight of rough surfaced metal grains.

Example 4

A blasting material is composed of a mixture of smooth
surfaces metal grains and of rough surfaced metal grains
the metal having a composition of:
the smooth surfaced metal grains: Si 1.8%, Mn 0.7%,
P 0.95%, S 0.08%, C 3.20%, remainder iron.
the rough surfaced metal grains: Si 1.7%, Mn 0.6%,
Ni 1.0%, Cr 0.70%, P 0.40%, S 0.12%, C 3.35%,
remainder iron,
in which the maximum diameter of the smooth surfaced
metal grains is between 0.7 mm. and 1.0 mm., and in
which the maximum diameter of the rough surfaced grains
is between 0.7 mm. and 1.0 mm. The material is com-
posed of 45% by weight of smooth surfaced metal grains
and 55% by weight of rough surfaced metal grains.

Without further analysis, the foregoing will so fully
reveal the gist of the present invention that others can by
applying current knowledge readily adapt it for various
applications without omitting features that, from the
standpoint of prior art, fairly constitute essential char-
acteristics of the generic or specific aspects of this inven-
tion and, therefore, such adaptations should and are
intended to be covered by the preceding and range of equivalence of the following claims.
What is claimed as new and desired to be secured by
Letters Patent is:

1. Blasting material for cleaning and otherwise treat-
ing surfaces said blasting material essentially consisting
of a mixture of substantially spherical smooth surfaced
metal grains composed of approximately 95.62% iron,
0.8% silicon, 0.6% manganese, 0.8% phosphorus, 0.08% sulfur
and 0.2% carbon and rough surfaced broken
metal grains composed of approximately 95.12% iron,
1.2% silicon, 0.4% manganese, 0.1% phosphorus, 0.08% sulfur,
0.1% carbon, 0.5% nickel and 0.5% chromium,
said smooth surfaced metal grains being present in an
amount of 20–50% by weight and said rough surfaced
broken metal grains constituting the remainder.

2. Blasting material for cleaning and otherwise treat-
sing surfaces said blasting material essentially consisting
of a mixture of smooth surfaced substantially spherical
hard iron alloy grains and rough surfaced hard iron
alloy grains, said smooth surfaced and said rough sur-
faces broken metal grains being formed of the
metal, said smooth surfaced metal grains being present in
an amount of 20–50% by weight and said rough
surfaces broken metal grains constituting the remainder,
and the largest diameter of said grains being between
2.2 millimeters and 2.6 millimeters.

3. Blasting material for cleaning and otherwise treat-
sing surfaces said blasting material essentially consisting
of a mixture of smooth surfaced substantially spherical
hard iron alloy grains and rough surfaced broken hard
iron alloy grains, said smooth surfaced metal grains being present in an amount of 20–50% by weight and said
rough surfaced broken metal grains constituting the
remainder.

4. Blasting material for cleaning and otherwise treat-
sing surfaces said blasting material essentially consisting
of a mixture of smooth surfaced substantially spherical
hard iron alloy grains and rough surfaced broken hard
iron alloy grains having a jagged surface portion, said
smooth surfaced metal grains being present in an amount
of 20–50% by weight and said rough surfaced broken
metal grains constituting the remainder.

5. Blasting material for cleaning and otherwise treat-
sing surfaces said blasting material essentially consisting
of a mixture of smooth surfaced substantially spherical
metal grains of substantially the same size and rough
surfaces broken metal grains of substantially the same
size having a jagged surface portion, said substantially
spherical metal grains being of a different size than said
rough surfaced metal grains, the largest diameter of said
grains being between 0.22 millimeters and 2.6 milli-
ometers, said smooth surfaced metal grains being present
in an amount of 20–50% by weight and said rough
surfaces broken metal grains constituting the remainder,
said grains consisting essentially of a hard iron alloy.

6. Blasting material for cleaning and otherwise treat-
sing surfaces said blasting material essentially consisting
of a mixture of smooth surfaced substantially spherical
metal grains of substantially the same size and rough
surfaces broken metal grains of substantially the same
size having a jagged surface portion, said substantially
spherical metal grains being of a different size than said
rough surfaced metal grains, the largest diameter of said
grains being between 0.22 millimeters and 2.6 milli-
ometers, said smooth surfaced metal grains being present
in an amount of 20–50% by weight and said rough
surfaces broken metal grains constituting the remainder,
said grains consisting essentially of a hard iron alloy.

7. Blasting material for cleaning and otherwise treat-
sing surfaces said blasting material essentially consisting
of a mixture of smooth surfaced substantially spherical
metal grains of substantially the same size and rough
surfaced broken metal grains of substantially the same size having a jagged surface portion, said substantially spherical metal grains being of approximately the same size than said rough surfaced metal grains, the largest diameter of said grains being between 0.22 millimeters and 2.6 millimeters, said smooth surfaced metal grains being present in an amount of 20–50% by weight and said rough surfaced metal grains constituting the remainder, said grains consisting essentially of a hard iron alloy.

8. Blasting material for cleaning and otherwise treating surfaces, said blasting material essentially consisting of a mixture of smooth surfaced substantially spherical metal grains of substantially the same size and rough surfaced broken metal grains of substantially the same size having a jagged surface portion, said substantially spherical metal grains being of a smaller size than said rough surfaced metal grains, the largest diameter of said grains being between 0.22 millimeters and 2.6 millimeters, said smooth surfaced metal grains being present in an amount of 20–50% by weight and said rough surfaced metal grains constituting the remainder, said grains consisting essentially of a hard iron alloy.

9. Blasting material for cleaning and otherwise treating surfaces, said blasting material essentially consisting of a mixture of smooth surfaced substantially spherical metal grains and rough surfaced broken metal grains, said smooth surfaced and said rough surfaced metal grains each being formed of a different metal, the largest diameter of said grains being between 0.22 millimeters and 2.6 millimeters, said smooth surfaced metal grains being present in an amount of 20–50% by weight and said rough surfaced metal grains constituting the remainder, said grains consisting essentially of a hard iron alloy.

10. Blasting material for cleaning and otherwise treating surfaces, said blasting material essentially consisting of a mixture of substantially spherical smooth surfaced metal grains composed of approximately 93.27% iron, 1.8% silicon, 0.7% manganese, 0.95% phosphorus, 0.08% sulfur and 3.2% carbon and rough surfaced broken metal grains having a jagged surface portion composed of approximately 92.13% iron, 1.7% silicon, 0.6% manganese, 0.4% phosphorus, 0.12% sulfur, 3.35% carbon, 1.0% nickel and 0.7% chromium, said smooth surfaced metal grains being present in an amount of 20–50% by weight and said rough surfaced broken metal grains constituting the remainder, the largest diameter of said grains being between 0.7 millimeters and 1.0 millimeter.

11. Blasting material for cleaning and otherwise treating surfaces, said blasting material essentially consisting of a mixture of substantially spherical smooth surfaced metal grains having a largest diameter of between 0.22 millimeters and 2.6 millimeters and composed of between 93.27 and 95.62% iron, between 0.8 and 1.8% silicon, between 0.5 and 0.7% manganese, between 0.3 and 0.95% phosphorus, between 0.08 and 0.11% sulfur, between 2.0 and 3.3% carbon, up to 0.4% nickel and up to 0.3% chromium and rough surfaced broken metal grains having a jagged surface portion and having a largest diameter of between 0.35 and 2.6 millimeters, composed of between 92.13 and 95.12% iron, between 1.2 and 1.7% silicon, between 0.4 and 0.6% manganese, between 0.1 and 0.8% phosphorus, between 0.08 and 0.12% sulfur, between 2.0 and 3.3% carbon, up to 1.0% nickel and up to 0.7% chromium, said substantially spherical metal grains being present in an amount of 20–50% by weight and said rough surfaced metal grains constituting the remainder.

12. Blasting material for cleaning and otherwise treating surfaces, said blasting material essentially consisting of a mixture of substantially spherical smooth surfaced metal grains and rough surfaced broken metal grains having a jagged surface portion, said substantially spherical metal grains being present in an amount of 45% by weight and said rough surfaced metal grains constituting the remainder, said grains consisting essentially of a hard iron alloy.

13. Blasting material for cleaning and otherwise treating surfaces, said blasting material essentially consisting of a mixture of substantially spherical smooth surfaced metal grains having a largest diameter of between 0.22 millimeters and 0.30 millimeters, and rough surfaced broken metal grains having a largest diameter of between 0.35 millimeters and 0.45 millimeters, and having a jagged surface portion, said grains composed of approximately 93.69% iron, 1.6% silicon, 0.5% manganese, 0.8% phosphorus, 0.11% sulfur and 3.3% carbon, said substantially spherical grains being present in an amount of 20–50% by weight and said rough surfaced grains constituting the remainder.

14. Blasting material for cleaning and otherwise treating surfaces, said blasting material essentially consisting of a mixture of substantially spherical smooth surfaced metal grains having a largest diameter of between 1 millimeter and 1.4 millimeters and rough surfaced broken metal grains having a largest diameter of between 0.8 millimeters and 1.2 millimeters, and having a jagged surface portion, said grains composed of approximately 94.9% iron, 1.5% silicon, 0.5% manganese, 0.3% phosphorus, 0.1% sulfur, 2.0% carbon, 0.4% nickel and 0.3% chromium said substantially spherical grains being present in an amount of 45% by weight and said rough surfaced grains constituting the remainder.

15. Blasting material for cleaning and otherwise treating surfaces, said blasting material essentially consisting of a mixture of smooth surfaced metal grains selected from the group consisting of iron and steel and rough surfaced broken metal grains selected from the group consisting of iron and steel, said smooth surfaced metal grains being present in an amount of 20–50% by weight and said rough surfaced broken metal grains constituting the remainder, said grains consisting essentially of a hard iron alloy.

References Cited in the file of this patent

UNITED STATES PATENTS

604,569 Ringstrom 24, May 1898
1,453,120 Beaver 24, Apr. 1923
1,937,476 Sherwood 28, Nov. 1933
2,600,358 Bolton et al. 10, June 1952
2,670,281 Hutchison 23, Feb. 1954

OTHER REFERENCES