

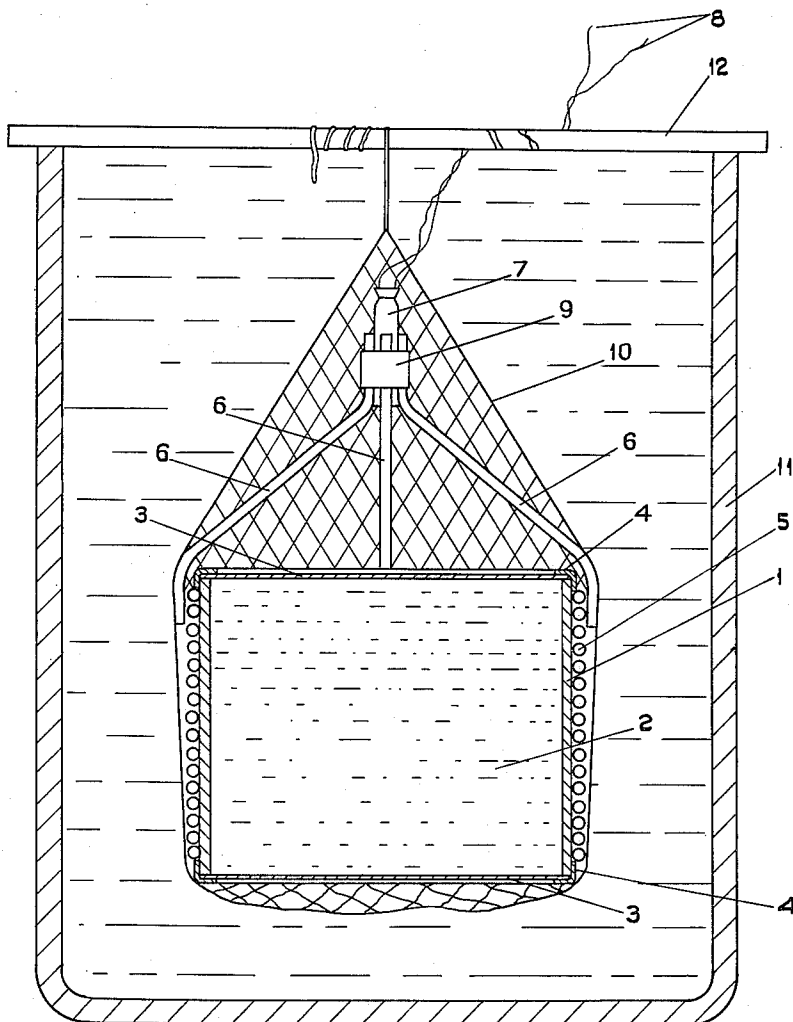
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EXPLOSIVE COMPACTION OF POWDERS

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EXPLOSIVE COMPACTION OF POWDERS

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The present invention is concerned with a new method for converting metal powder into a coherent mass. The method is of particular value for metal powders which are not readily converted into a coherent mass by other methods, e.g. titanium.

According to the present invention the method of converting metal powder into a coherent mass comprises positioning detonatable high explosive around and of at least sufficient power explosively to transmit pressure to the contents of a watertight container containing said metal powder, surrounding said container and the detonatable high explosive around it by a relatively large volume of liquid, and detonating said detonatable high explosive.

Said detonatable high explosive may be, for instance, a continuous cord of high explosive or a plurality of detonatable high explosive charges symmetrically surrounding and contiguous or in proximity to said container.

Said relatively large volume of liquid is preferably a non-explosive, non-inflammable liquid as for example water.

The detonation of said detonatable high explosive may conveniently be carried out from a position which may be slightly beyond the length of the metal powder.

A particularly convenient way of applying said detonatable high explosive is as a length of detonating fuse wound round the container as a helix.

Said relatively large volume of liquid must be of such dimensions that it will have sufficient inertia for the shock waves set up by the detonation of the detonatable high explosive to be transmitted towards the container. The larger the volume of the liquid the more effective is the cohesion of the powder under any given set of conditions. The relatively large volume of liquid may be contained in an expendable reservoir made for example of fibreboard. Alternatively the method of the invention may be carried out in a natural or artificial pond or similar natural or artificial static water mass.

Said watertight container may be of waterproofed cardboard or of thin metal foil.

There is no objection to there being a relatively small thickness of the liquid between the detonatable high explosive and the container as long as it will allow the

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pressure generated on the detonation of said detonatable high explosive to be transmitted across this thickness.

The container may, if desired, be provided with means to permit the removal or escape of air from the interstices between the metal powder particles which may otherwise tend to resist the pressure effecting the cohesion. Either said air may be extracted before the explosive is detonated or the air may be allowed to escape during the detonation.

Preferably the coherent mass produced is cylindrical.

The invention will now be described with reference to the following examples and the diagrammatic drawing attached hereto.

EXAMPLE 1

A thin-walled open-ended metal cylinder 1 is filled with granular titanium powder 2, 100% of which passes a No. 10 B.S. sieve and 40% of which passes a No. 40 B.S. sieve. The metal cylinder 1 is sealed and rendered watertight at its ends by celluloid discs 3 and adhesive tape 4. The cylinder 1 is surrounded by a closely coiled helix of textile detonating fuse 5 having a pentaerythritol tetranitrate core. Fuseleads 6 are arranged so that the helix of detonating fuse 5 can be detonated simultaneously at various points. The fuseleads 6 are held closely against a commercial electric detonator 7, having lead wires 8, by adhesive tape 9. The cylinder 1 filled with the granular titanium powder 2 and sealed by celluloid discs 3 and cellulose adhesive tape 4, the detonating fuse 5, the fuseleads 6, the electric detonator 7 are in a light net bag 10 which is immersed in water. The water completely fills an expendable cylindrical water bath 11, and the net bag 10 is suspended from a bar 12 which is supported by the rim of the bath 11. The containing walls of the water bath 11 may be of any water resistant material which is mechanically strong enough to withstand the static water pressure and weight of the net bag 10 with its contents. The fuseleads 6 are detonated simultaneously by the electric detonator 7 and this detonation is transferred to the helix 5 of textile covered detonating fuse. The blast from the detonation of the detonating fuse 5 is transmitted radially towards the centre of the sealed metal cylinder 1, being at least momentarily restricted from transmission radially outwards by the inertia of the mass of water surrounding the sealed metal cylinder 1. The granular titanium powder is thus converted into a coherent mass.

Table 1 is a record of the results obtained in one series of experiments when proceeding as aforesaid for 5 conversions of granular titanium powder of the aforesaid grist size into a coherent mass.

Table 2 is a record of the results obtained in a further series of experiments when proceeding as aforesaid for the conversion into a coherent mass of granular titanium powder of the aforesaid grist size, of aluminum powder, of copper powder and of iron powder.

Table 1

Shot	Description of container			Weight of titanium powder (g.)	Bulk density of titanium powder (g./cc.)	Length of detonating fuse (metres)	Weight of P.E.T.N. (g.)	Weight of titanium/weight of P.E.T.N.	Approx. diameter of coherent mass (cm.)	Approx. length of coherent mass (cm.)	Approx. average density of coherent mass (g./cc.)	Remarks
	Metal	Diameter (cm.)	Length (cm.)									
1....	Aluminum (24 gauge)	9	28.5	2,324	1.28	16.25 (1 layer)---	162.5	14.3	5.7	28	3.26	Compacting complete to center of mass.
2....	Tinned iron (24 gauge)	13	16.5	3,033	1.39	13 (1 layer)-----	130	23.3	9.5	15	2.85	Compacting not complete. Centre granular.
3....	do-----	13	16.5	3,033	1.39	27.5 (2 layers)---	275	11.0	8.0	15	4.02	Compacting complete to centre.
4....	do-----	18	23	7,754	1.33	55 (2 layers)-----	550	14.1	11.5	22	3.40	Compacting not complete. Centre granular.
5....	do-----	18.2	23	7,828	1.31	83 (3 layers)-----	830	9.4	11.0	22	3.75	Compacting practically complete to centre.

Table 2

Shot No.	Metal powder	Bulk density of metal powder g./cc.	Dia. of metal powder, cm.	Weight of metal powder, g.	Number of layers of Cordtex	Length of Cordtex, cm.	Weight of P.E.T.N. in Cordtex, g.	Wt. of metal powder/weight of P.E.T.N.	Average dia. of compacted mass, cm.	Average density of compacted mass, g./cc.	Absolute density of solid metal g./cc.	Remarks
1---	Titanium---	1.53	5.5	675	1	6	60	11.2	3.5	4.0	4.5	Good compacting. No granular core.
2---	Aluminum---	1.29	5.5	575	1	6	60	9.6	3.8	2.7	2.7	Do.
3---	Copper-----	5.25	5.5	2,154	1	6	60	35.8	4.4	8.08	8.9	Good compacting at edges. Granular core.
4---					2	13	130	16.5	4.2	8.45		Good compacting. Very small granular core.
5---	Iron-----	2.5	5.5	1,080	1	6	60	18.0	3.7	5.9	7.9	Good compacting at edges. Granular core.
6---					2	13	130	8.3	3.2	7.65		Good compacting. Very small granular core.

What we claim is:

1. A method of converting metal powder into a coherent mass which comprises positioning detonatable high explosive around and of at least sufficient power explosively to transmit pressure to the contents of a watertight container containing said metal powder, surrounding said container and the detonatable high explosive around it by a relatively large volume of liquid, and detonating said detonatable high explosive.

2. A method as claimed in claim 1 wherein said metal powder is titanium.

3. A method as claimed in claim 1 wherein said detonatable high explosive is a continuous cord of high explosive symmetrically surrounding and contiguous to said container.

4. A method as claimed in claim 3 wherein said continuous cord of high explosive is a length of detonating fuse wound round the container as a helix.

5. A method as claimed in claim 1 wherein said detonatable high explosive is a plurality of detonatable high explosive charges symmetrically surrounding and contiguous to said container.

6. A method as claimed in claim 1 wherein said relatively large volume of liquid is a non-explosive, non-inflammable liquid.

7. A method as claimed in claim 1 wherein the detonation of said detonatable high explosive is simultaneously

20 initiated at a plurality of points distributed around the periphery of one end of the container.

8. A method as claimed in claim 1 including the step of discharging air from the interstices between the particles of metal powder.

25 9. A method as claimed in claim 8 wherein the powder is positioned in a metallic container which is sealed at its ends only by celluloid discs and adhesive tape whereby air may be discharged from said cylinder during detonation.

30 10. A process for compacting powder which comprises surrounding a mass of powder with high-velocity detonating explosive and initiating said explosive.

35 11. A method of converting powder into a coherent mass which comprises positioning detonatable high explosive around and of at least sufficient power explosively to transmit pressure to the contents of a watertight container containing said powder, surrounding said container and the detonatable high explosive around it by a relatively large volume of liquid, and detonating said detonatable
40 high explosive.

References Cited in the file of this patent

UNITED STATES PATENTS

2,648,125	McKenna et al. -----	Aug. 11, 1953
2,711,009	Redmond et al. -----	June 21, 1955
2,781,273	Koch -----	Feb. 12, 1957