

[54] **HOLLOW SPHERICAL ICE BODIES
AND METHOD OF MAKING THE SAME**

[72] Inventor: **Edward H. Hadden**, Granby, Conn.

[73] Assignee: **Olin Mathieson Chemical Corporation**

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[52] U.S. Cl. **62/1, 273/105.5, 264/28**

[51] Int. Cl. **F25c 1/10**

[58] Field of Search..... **62/1, 529, 345, 66, 531;
273/105.4, 105.5, 58, 105.2, 75; 264/28, 312;
156/145**

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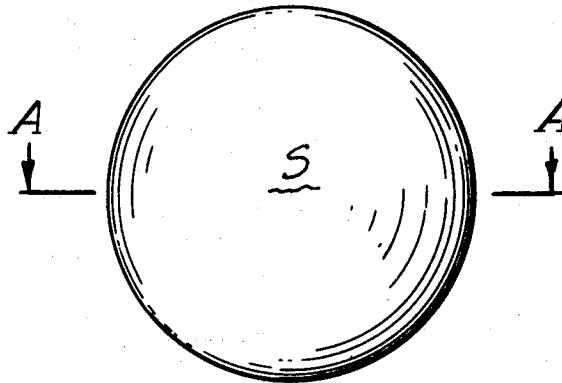
Primary Examiner—William E. Wayner

Attorney—H. Samuel Kieser, Donald R. Motsko, William W. Jones, Richard S. Strickler, Robert H. Bachman, Donald R. Motsko and Thomas P. O'Day

[57] **ABSTRACT**

A hollow body of ice for use as a target, the ice body being sufficiently frangible to shatter when struck by a fired pellet. A method of making the hollow ice bodies comprising introducing a measure of water into a mold cavity so as to cover substantially the entire surface of the mold cavity with water. The water is then cooled to a temperature below its freezing point to form a thin shell of ice adjacent to the mold cavity surface. The mold is then opened and the shell of ice is removed from the mold cavity.

11 Claims, 7 Drawing Figures



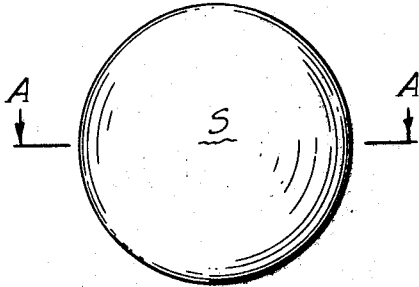


FIG-1

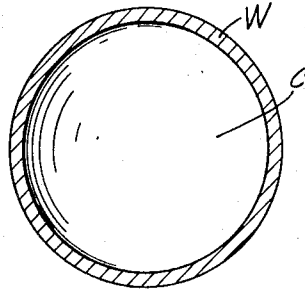


FIG-2

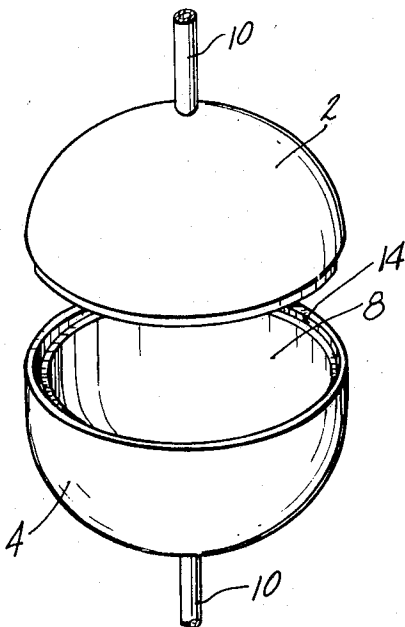


FIG-3

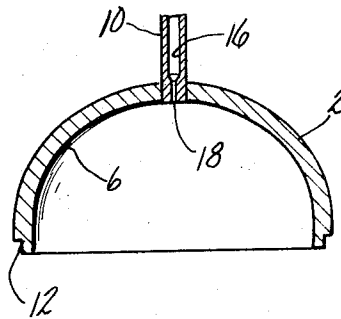


FIG-4

INVENTOR
EDWARD H HADDEN

BY *William W. Jones*

ATTORNEY

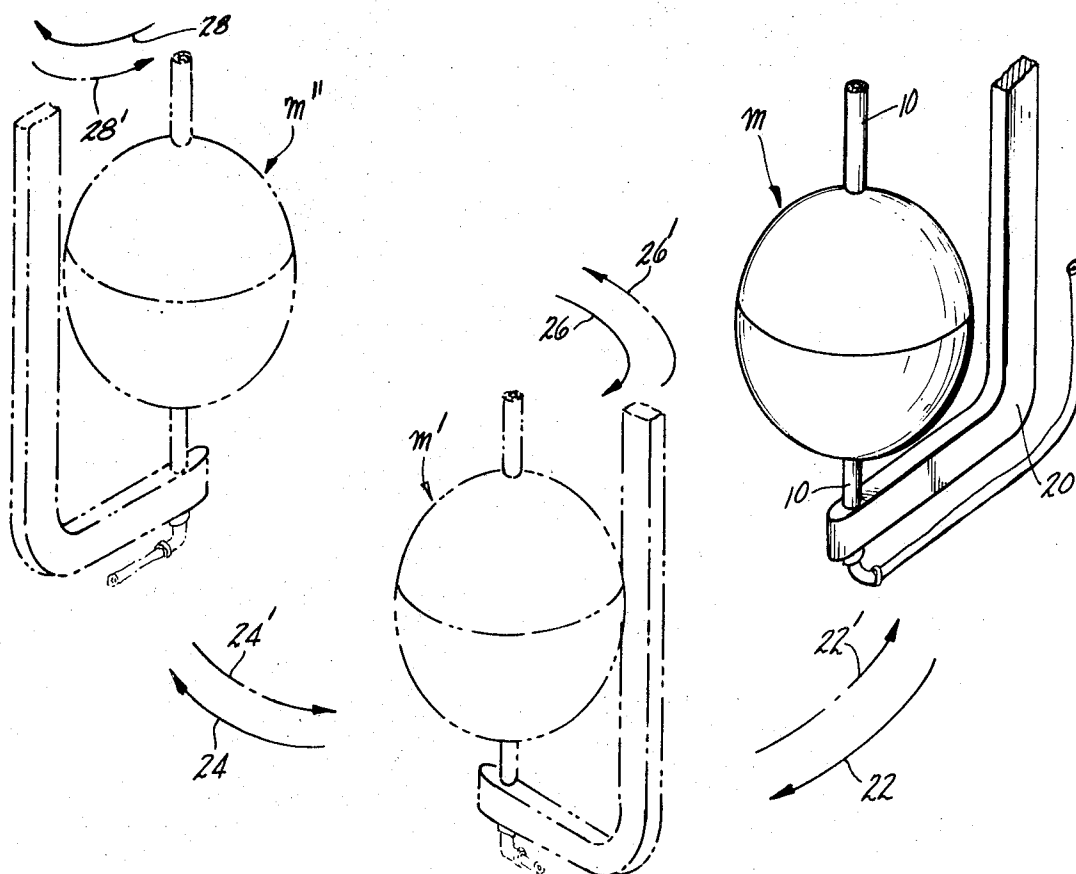


FIG-5

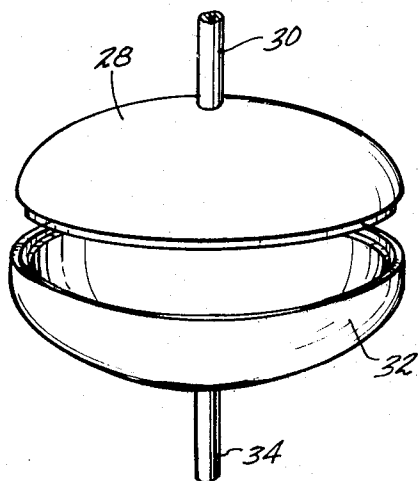


FIG-6

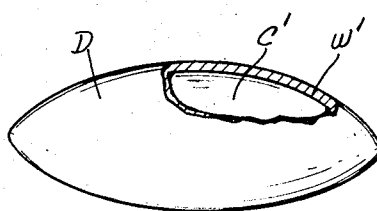


FIG-7

INVENTOR:
EDWARD H. HADDEN

BY *William W. Jones*

ATTORNEY

HOLLOW SPHERICAL ICE BODIES AND METHOD OF MAKING THE SAME

This invention relates to a hollow, frangible body of ice suitable for use as a target for shooters, and to a method of making the ice bodies.

The use of hollow, frangible bodies as launched targets for trap and skeet shooters is known to the prior art. Such targets are generally spherical and are fabricated, in accordance with the teachings of the prior art, from glass, plaster of paris, or the like. In the case of glass targets, the spheres are blown by conventional methods. The use of glass or other conventional material for targets has proven undesirable chiefly because of the debris which results when the target is broken. Fragments of the conventional targets are often sharp and dangerous, and must be periodically cleared away from the shooting area. The debris problem is of even greater magnitude when the targets are desired for use in indoor shooting.

A second disadvantage attendant to the use of glass or other conventional targets concerns the cost of producing the targets. Since the targets are destroyed by a single use, cost is a critical factor in determining the choice of material from which the targets are made. It has been determined that the present day cost of mass producing suitable hollow glass spherical shooting targets is approximately 2.5 per target. When one considers that millions of the targets are used per year at a single shooting range, this cost becomes prohibitive. Still other problems relating to the known targets concern storage, transportation, and other handling operations and their related cost.

The present invention contemplates the formation of hollow frangible bodies of a frozen liquid, which bodies are particularly desirable for use as shooting targets. More specifically, the formation of a hollow, frangible body of ice, preferably in the form of a sphere, is contemplated by the present invention. By forming targets of ice, the debris problem is completely eliminated since the target fragments simply melt. Furthermore, the cost of forming such targets of ice utilizing the method of this invention is reduced to about 0.007 per target. Still further advantages resulting from the use of ice targets relate to the fact that the targets can be formed at the shooting range immediately prior to their use, thereby eliminating storage and transportation problems and expenses. Furthermore, the targets of this invention can be produced at a rate directly proportional to their rate of use at any particular time at the range.

The hollow bodies of the present invention are preferably spherical and formed of ice. The ice spheres are sufficiently frangible to shatter when struck by only a fraction of the total number of pellets fired by a shooter, and yet sturdy enough to be launched by mechanical means. The ice targets are preferably substantially perfect spheres so as to present consistent trajectory characteristics regardless of their attitude in flight, and are large enough and of light enough weight so as to provide a clearly discernable target which remains in flight for a reasonable length of time so that one need not necessarily be an expert shot to hit the target. While the targets are preferably spherical, it is understood that they may be any other geometric shape so long as they are hollow and frangible.

The bodies are preferably made by providing a mold having a surface which defines a closed mold cavity, the shape of which cavity surface conforms to the desired shape of the body. In its preferred embodiment, the mold is a two-piece mold which has a surface defining a spherical cavity. A predetermined volume of water is placed in the mold cavity with the two pieces of the mold being pressed together to entrap the water therein. While water is the preferred liquid, any aqueous medium or other liquid may be used without departing from the spirit of the invention, as it pertains to method. The water is caused to cover substantially the entire surface of the mold cavity, preferably in a thin moving layer. A stream of air is preferably forced through the water layer in order to raise the air pressure within the mold to a point above at-

mospheric pressure thereby forcing a small quantity of water to leak through the seam between the mold halves and there to freeze in place to seal the mold cavity. Raising the air pressure within the water layer also forms an ice sphere in which the air pressure within the central cavity is greater than atmospheric pressure, thereby increasing the tendency of the sphere to explode when it is struck by a fired pellet. The temperature of the water is then lowered to a predetermined point below its freezing point for a time period sufficient to cause the water to form a thin shell of ice adjacent to the mold cavity surface. To remove the shell of ice from the mold, the latter is preferably warmed to a temperature slightly above the melting point of water so as to cause a slight surface melting to occur on the exterior of the frozen sphere. This surface melting eliminates any sticking which may occur between the frozen sphere and the cavity surface. The mold pieces are then separated to expose the frozen body. To further aid in removing the frozen body from the mold, a stream of air may be directed into the mold cavity against the exterior of the sphere to force the sphere away from the cavity surface. The airstream will eliminate any vacuum which may form as the mold pieces are separated, and will also tend to "pop" the sphere out of the mold.

It is, therefore, an object of this invention to provide a shooter's target comprising a hollow, frangible body of a frozen aqueous medium.

It is a further object of this invention to provide a target of the character described which is spherical and which displays consistent inflight trajectory characteristics.

It is yet another object of this invention to provide a target of the character described which is inexpensive and which leaves no debris cleanup problem after being broken.

It is a still further object of this invention to provide a method of making a hollow body formed from a frozen liquid.

It is still a further object of this invention to provide a method of the character described wherein the body formed has a continuous and uninterrupted surface.

It is yet another object of this invention to provide a method of making a target of the character described which is usable to produce targets at a shooting range in such quantity as is desired by the shooters.

These and other objects and advantages of the present invention will become more readily apparent from the following detailed description and accompanying drawings, in which:

FIG. 1 is a plan view of a preferred embodiment of the ice target of this invention, the preferred embodiment assuming a spherical configuration;

FIG. 2 is a sectional view of the target taken along line A—A of FIG. 1;

FIG. 3 is a perspective view of a preferred embodiment of a mold utilized in accordance with the method of this invention to form the target of FIG. 1;

FIG. 4 is a sectional view of one of the mold pieces, both pieces being of substantially identical configuration;

FIG. 5 is a perspective view of the mold of FIG. 3 in its assembled condition and showing how the mold is moved in the preferred manner of performing the method of this invention;

FIG. 6 is a perspective view of another embodiment of a mold which can be used in performing the method of this invention and;

FIG. 7 is a perspective view, partially cut away, of another embodiment of the target of this invention, which other embodiment is produced using the mold shown in FIG. 6.

Referring now to FIGS. 1 and 2, a preferred embodiment of the ice target of this invention is shown. The target is in the form of a unitary ball or sphere S, the sphere including a relatively thin seamless wall W which substantially surrounds and defines the limits of an internal cavity C. The sphere S is preferably of sufficient size so as to present a readily discernable target which can be hit by an average shooter. I have found that a sphere having an external diameter from about 2 to 3 inches presents a target which can be fairly consistently hit by a shooter having average skill from a distance of about 35 feet. The sphere S can, of course, be formed with a larger or smaller

diameter without departing from the spirit of this invention. In its preferred form, the wall W is continuous and uninterrupted; however, the wall W may include apertures of minor dimension which do not affect the in-flight trajectory of the sphere S after the latter is launched. The wall W is relatively thin and frangible so that the target will shatter when struck by only a small fraction of the total number of pellets fired by a shooter at any one time, and yet the wall W should be strong enough to permit the target to be launched by mechanical means. Experimentation has shown the temperature of the wall W as well as its thickness has a relationship to the frangibility of the body S. It has been found that the body S will display excellent frangibility characteristics if the temperature of the wall W is maintained at about 18° to about 26° F., and most preferably at about 22° F., and if its thickness is no greater than about one-eighth inch. It has also been found that the frangibility of the body S will be enhanced if the ice from which the wall W is formed is substantially free of suspended or entrained air. It is also noted that the shape of the cavity C is substantially the same as the exterior of the body S so as to present a target which is equally susceptible to shattering no matter where the pellets strike on the exterior of the body. Furthermore the pressure within the cavity C is preferably greater than atmospheric pressure so that the sphere will tend to explode when struck by a fired pellet.

Referring now to FIGS. 3-5, a mold is shown which is preferred for making the target shown in FIGS. 1 and 2. The mold M is preferably made up of two substantially identical pieces, in this case a pair of hemispherical members 2 and 4. The mold pieces 2 and 4 are hollowed out at 6 and 8 respectively so as to form a mold having a spherical cavity. Each mold piece 2 and 4 is mounted on a shaft 10 which is hollow and about which the mold M can be rotated. The shafts 10 are coaxial so as to define an axis of revolution for the mold M. Opposite faces of the mold pieces 2 and 4 are each formed with an annular notch 12 and 14 respectively, one of the notches opening into the mold cavity, and the other opening into the mold exterior so as to form a stepped interface between the mold halves when they are brought together to close the cavity. Each shaft 10 includes a passage 16 which opens into the mold cavity through a pin hole 18 which permits passage of air into the mold cavity, but which hinders passage of water from the cavity into the passage 16.

To form the ice target S shown in FIG. 1, one of the mold pieces is charged with a predetermined amount of water which may be precooled to a temperature of about 34°, and the other mold piece is brought into abutting engagement therewith so as to entrap the water in the mold cavity. FIG. 5 shows one manner in which the charged mold M may be moved to form the target. The shafts 10 are pivotally mounted on a fork 20 (partially shown), which in turn is rotatable. The charged mold is moved back and forth in a vertical plane along an arcuate path indicated by the arrows 22 and 24, and 22' and 24', intermediate positions of the mold during its arcuate travel being indicated by M' and M'' shown in phantom. As the mold is moved through its arcuate path, it is concurrently rotated back and forth about the axis defined by the shafts 10 by moving the fork 20 through a horizontal plane along the path defined by the arrows 26 and 28, and 26' and 28'. The concurrent arcuate and rotational movement of the mold M causes the charge of water to slosh about in the mold cavity so as to form a substantially even layer of moving water covering substantially the entire surface of the mold cavity. As the mold is moved, a stream of air is preferably fed through the water layer by way of one of the passages 16. The thusly moving mold is cooled in any conventional manner to a temperature below the freezing point of water to freeze the centrifugally formed water layer against the mold cavity surface thereby forming a hollow sphere of ice. By freezing a layer of moving water rather than a layer of still water, the ice formed is found to be of greater clarity and frangibility. Movement of the mold is then stopped and the mold is then warmed to a temperature which is slightly above the freezing point of water so as to

cause limited surface melting to occur on the exterior of the frozen sphere, thereby freeing the sphere from the mold surface. The mold pieces are then separated preferably by passing a stream of air through the shaft 10 and into the interior of the lower mold piece 4 only. The stream of air tends to force the lower half of the ice sphere away from the cavity wall, while also tending to break any vacuum which may form between the ice sphere and the lower cavity wall. The lower mold piece 4 is then moved away from the upper mold piece 2. A stream of air is then passed through the upper shaft 10 into the interior of the upper mold piece 2 thereby forcing the ice sphere to drop out of the upper piece 2.

FIGS. 6 and 7 disclose an alternative embodiment of the ice target of this invention, and a mold suitable for forming this alternative target. The target is shown in FIG. 7 and is in the form of a hollow disclike body D having a relatively thin wall W' formed of ice and surrounding an enclosed cavity C'. The mold for forming the target D includes an upper mold piece 28 secured to a hollow shaft 30, and a lower mold piece 32 secured to a hollow shaft 34. The target D is formed by utilizing the same procedure outlined above for forming the spherical target S.

The following is an example performed in accordance with the method of this invention to form a spherical ice target, such as is shown in FIG. 1. A two-piece mold was selected having a spherical cavity measuring 2½ inches in diameter. A supply of water was subjected to a vacuum to remove air entrained in the water. The lower half of the mold was charged with about 16 grams of the precooled and degassed water and the top half of the mold was then sealed against the bottom half to completely entrap the water within the mold cavity. The mold was then moved through the arcuate path at a rate of from 150 to 200 r.p.m. through the vertical plane, and concurrently rotated slowly at about ½ r.p.m. A stream of air was then fed into the mold to raise the pressure therein above atmospheric pressure. The moving mold was then immersed in a brine solution having a temperature below 26° F. and the mold movement was continued in the brine for a period of 2 minutes. The mold was then removed from the brine, and the movement was terminated. Warm water was then poured over the mold to cause limited surface melting of the exterior of the ice sphere within the mold cavity. A stream of air was then introduced into the interior of the lower half of the mold and the latter was separated from the upper half of the mold and the formed ice sphere. The ice sphere was then separated from the upper half of the mold by introducing a stream of air into the interior of the upper mold half. The separated ice sphere was then stored at a temperature of 22° F. The ice sphere thus formed was 2½ inches in diameter and had a constant wall thickness of one-sixteenth of an inch. The wall was continuous and uninterrupted and was formed of clear, air-free ice.

If so desired, in order to form a target which is more easily discernible to a shooter, the ice targets of this invention may be colored by merely adding a suitable water soluble dye to the charge of water introduced into the mold cavity. The formed ice targets may also be colored by spraying them after they are removed from the mold.

Targets formed in accordance with this invention are found to have sufficient strength to permit handling and mechanical launching with compressed air, while at the same time being sufficiently frangible to shatter and explode when struck by only one or two of the pellets in a shot load fired by the shooter. It is thus apparent that the ice targets of this invention eliminate debris problems and are, at the same time, considerably less expensive to produce than the conventional glass targets of the prior art. Handling and transportation costs of the targets are also eliminated since the ice targets of this invention can be formed at the shooting site as needed. The method of this invention provides an inexpensive and reliable way of forming the ice targets, with the total formation time being only a matter of minutes. The method insures that the targets will be in the form of continuous uninterrupted spheres with substantially smooth exterior surfaces. Ice targets formed

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in accordance with this method will exhibit desirable frangibility characteristics and consistent inflight characteristics.

What is claimed is:

1. A target having a cavity substantially enclosed by a relatively thin unitary frangible wall of frozen solidified aqueous medium.

2. The target of claim 1, wherein said wall is formed of substantially air-free ice.

3. The target of claim 1, wherein said wall has a thickness no greater than about one-eighth of an inch.

4. The target of claim 1, wherein said wall is continuous and uninterrupted.

5. The target of claim 1, wherein said wall has a temperature in the range of about 18° to about 26° F.

6. The target of claim 1, wherein said cavity is filled with a gas pressurized to a point above atmospheric pressure.

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7. A frangible, projectable target comprising a thin seamless wall of ice substantially enclosing a central cavity.

8. A molded target comprising a thin, frangible seamless shell of ice bounding a substantially enclosed cavity.

9. A target which will break up when struck by a projectile, said target comprising a relatively thin outer spherical seamless shell of a frozen aqueous medium surrounding an enclosed interior cavity.

10. A target comprising a frangible seamless body of ice, said body having a substantially closed cavity therein, the shape of which cavity substantially conforms to the exterior shape of said body.

11. A target comprising a frangible envelope having a relatively thin seamless wall of ice, said wall surrounding a closed pressurized pocket within said envelope.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,640,081 Dated February 8, 1972

Inventor(s) Edward H. Hadden

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In Column 1, line 26, after "2.5" please insert --ç--;

In Column 1, line 39, after "0.007" please insert --ç--;

In Column 3, line 21, after "exterior" please insert
--shape--;

In Claim 5, after "18°" please insert --F--.

Signed and sealed this 13th day of June 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents