Oct. 29, 1940. A. C. DUNN 2,219,951

CASTING METHOD

Filed May 6, 1938 2 Sheets-Sheet 1

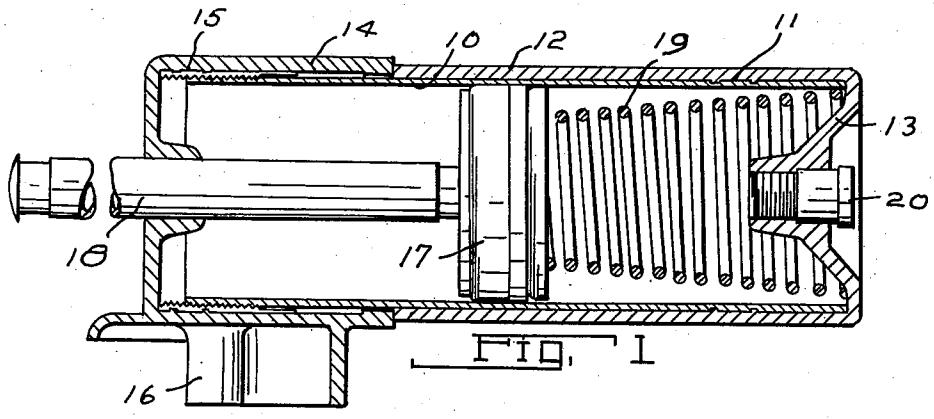


Fig. 1

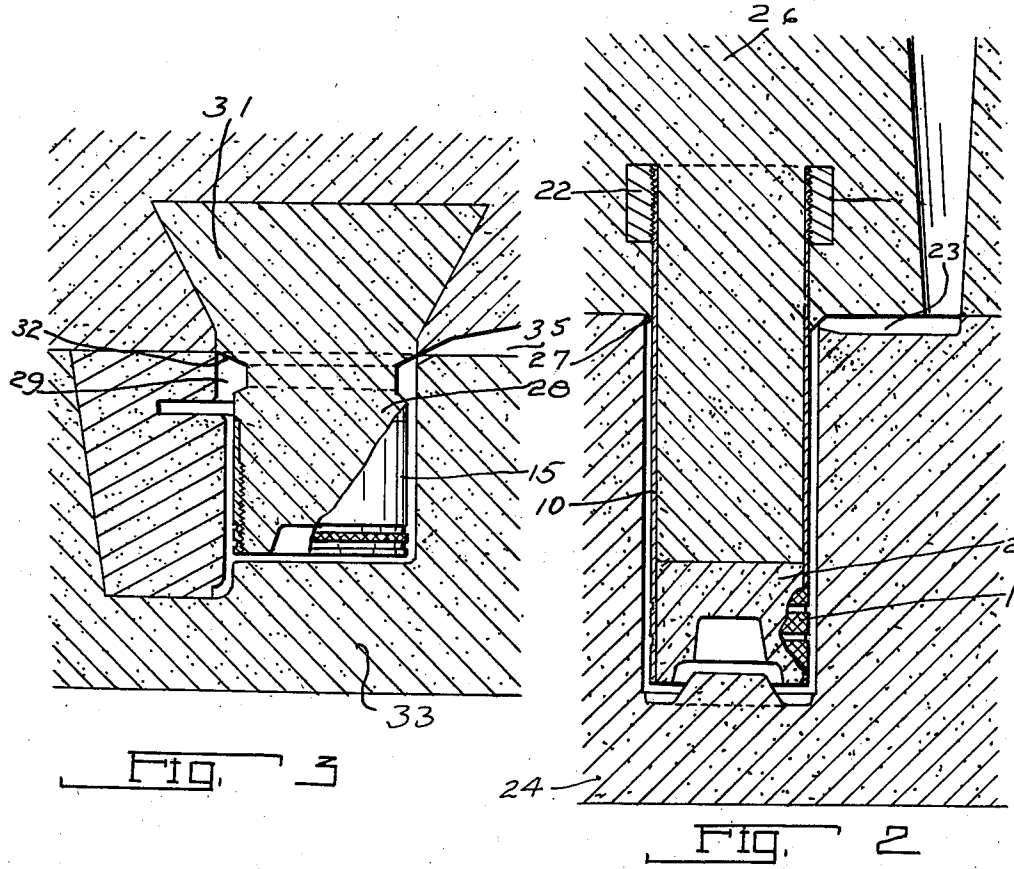


Fig. 3

Fig. 2

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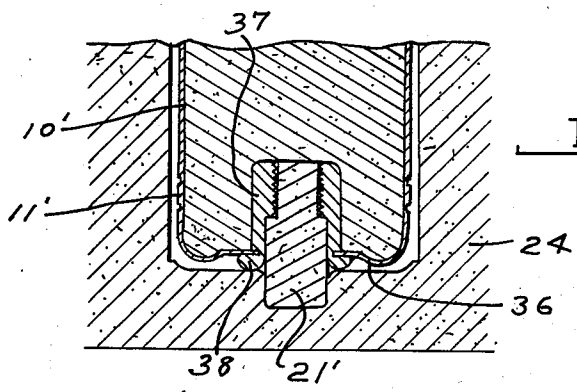


Fig. 4

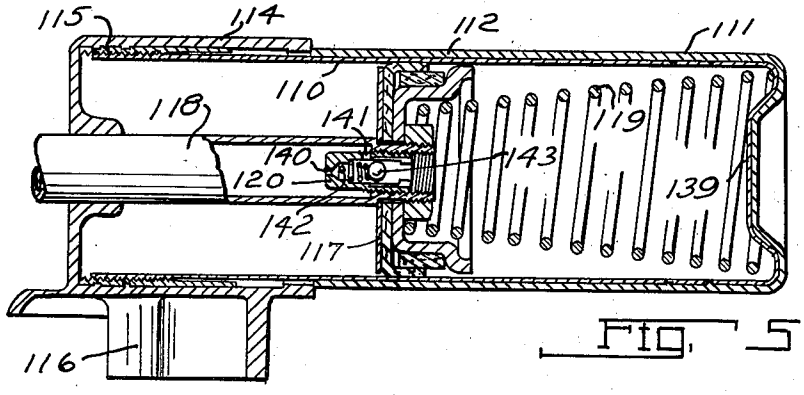


Fig. 5

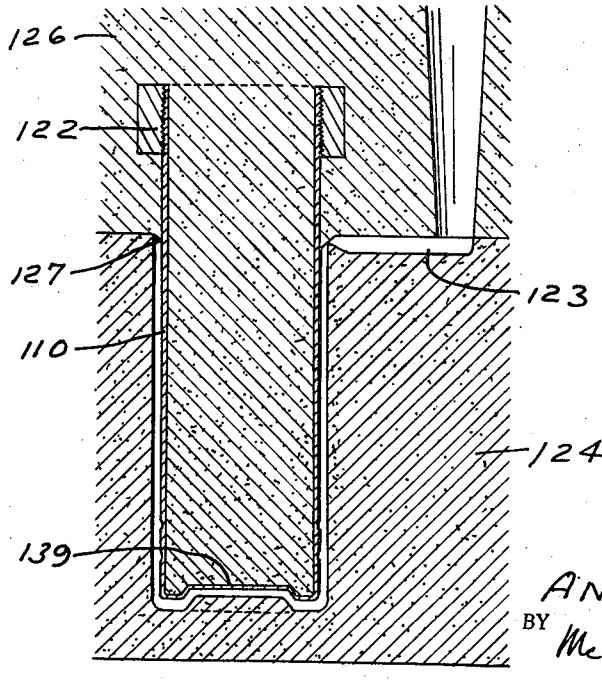


Fig. 6

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UNITED STATES PATENT OFFICE

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CASTING METHOD

Andrew C. Dunn, Chicago, Ill.

Application May 6, 1938, Serial No. 206,335

1 Claim. (Cl. 22—206)

This invention relates to casting methods and more particularly to a method of casting a relatively thin shell around a preformed metal body.

In casting metal around preformed bodies a great deal of difficulty has been encountered in getting the metal to flow properly around the body without chilling sufficiently to prevent proper flow. This difficulty is particularly pronounced where the mass of cast metal is relatively small and it has been proposed to preheat the body prior to pouring the metal around it to reduce the chilling effect. However, preheating is expensive and slow and it is therefore one of the objects of the present invention to provide a casting method in which no preheating is necessary.

Another object of the invention is to provide a casting method in which molten metal is poured into the top of a mold cavity around a preformed body. With this arrangement the molten metal falls rapidly to the bottom of the mold cavity before it has time to chill sufficiently to interfere with proper flow so that the cavity will be completely filled.

Still another object is to provide a method of casting relatively light cylinders or the like impervious to fluid pressure.

Still another object is to provide a method of casting a shell around a preformed tube or cylinder for decorative or mounting purposes.

Other objects and advantages of the invention will be apparent from the following description when read in connection with the accompanying drawings, in which:

Figure 1 is a central section of a door silencer constructed according to the invention;

Figures 2 and 3 are sections through molds illustrating steps in the method of manufacturing the silencer of Figure 1;

Figure 4 is a partial view similar to Figure 2 of a modification; and

Figures 5 and 6 are views similar to Figures 1 and 2 respectively showing a further modification.

Figure 1 illustrates a novel door silencer constructed according to the invention and constituted by a relatively thin metal tube 10 formed with a roughened portion 11 adjacent one end and external screw threads at the other end. A relatively thin cast metal body 12 is cast about one end of the tube and adheres to the outer surface of the tube throughout approximately two thirds of its length, the body 12 forming an end closure 13 for the tube. The opposite end of the tube 10 is closed by a cast metal cap 14 having an internally threaded sleeve 15 cast therein for engagement with the screw threads on the end of the tube and a mounting bracket 16 for mounting the silencer.

A piston 17 is slidably mounted in the tube and has a piston rod 18 extending out through the cap 14 and a spring 19 acting between the closure 13 and the piston 17 to urge the piston toward the cap. A suitable check valve 20 which may be of the type more fully described and claimed in my prior Patent No. 1,966,956 is mounted in the end closure 13 to control the ingress and egress of air.

In use the silencer is mounted adjacent a door on the bracket 16 with the piston rod 18 in the path of the door. As the door closes, it strikes the piston rod 18 causing air to be compressed in the tube 10 ahead of the piston 17, the air being gradually bled out past the valve 20 to permit slow closing of the door. When the door is opened the spring 19 returns the piston to the left end of the tube, the check valve 20 permitting free ingress of air during this movement.

In the manufacture of the door silencer of Figure 1, a tube 10 is first prepared with the roughened portion 11 adjacent one end and the screw threads at the other end. A suitable core 21 of core sand having the desired configuration for the end closure 13 is then formed in the end of the tube adjacent the roughened portion 11 and is baked in place.

The operator may then take a suitable pattern, not shown, which is formed substantially in the same shape as the cast body 12, invert it on a mold board, place the drag of a sand molding flask around it and pack the flask with sand. When the sand is packed, the flask is inverted and the tube 10 is placed in the pattern, a ring 22 preferably being screwed on the end of the tube to assist in holding it in the mold. A suitable gate 23 is preferably cut in the drag portion of the mold, it being noted from Figure 2 that the gate discharges substantially horizontally into the upper part of the mold cavity directly against a substantially vertical side of the tube 10. The cope is then packed with sand, it being noted that the remainder of the tube 10 is filled with green sand and that the tube is firmly held in the cope. If desired the core sand 21 may be omitted and the entire tube filled with green sand, the bottom of the pattern shaping the sand as desired. When the cope is removed the tube 10 will come with it, the pattern may be removed from the drag, and the mold put back together.

Instead of forming the molds singly as described above, a plural pattern or plate carrying a number of projections each shaped in the same manner as the single pattern may be employed. In this way a plurality of cavities will be formed in the sand each time and a plurality of units can be cast simultaneously in the same flask. It will also be noted that many of the advantages of my method are obtainable with permanent mold casting.

Figure 2 illustrates the mold with the tube in place ready for pouring. The mold is preferably formed entirely in the drag **24** and the tube **10** is supported in the cope **26** with a portion thereof projecting into the mold. Molten metal is now poured through the gate **23**, striking a vertical side wall of the tube **10** at substantially right angle and flowing down into the mold to fill the same. As the metal flows into the mold and hardens it will adhere firmly to the tube **10** but will not melt it since the heat will be conducted away with sufficient rapidity to maintain the tube **10** below its melting point. If desired, the tube **10** may be formed of a material having a higher melting point than that of the body **12** but I have found that this is not essential, satisfactory results being obtained with a soft steel tube **10** and a cast iron body **12**.

According to the invention, the casting of the relatively thin shell **12** around the tube **10** is made possible by pouring the molten metal into the top part of the mold and by correctly proportioning the mass of cast metal to the metal in the tube. It is desired to make the shell **12** thin to reduce the size and weight of the completed device and I have found that if this shell is less than three times the thickness of the tube wall the metal cannot be flowed up from the bottom of the mold cavity around the tube due to chilling and setting of the metal before the cavity is filled. However, when the metal is poured into the top of the cavity it will flow rapidly to the bottom before it chills and the cavity will fill properly and completely even though the cast shell is considerably thinner than three times the tube thickness.

As the mass the metal in the exposed part of the tube and in the cast shell become more nearly equal or the mass of the tube predominates, the mold cavity will still fill but the cast metal will be chilled to a greater extent and will tend to become hard and brittle. I have found that when the tube and shell are of the same thickness the shell is apt to be very hard and somewhat porous due to chilling. Therefore, I prefer to make the shell substantially twice the thickness of the tube, which results in a light, small device and a uniform good casting.

When the casting has hardened it may be removed from the mold with the tube **10** firmly embedded therein and the gate may be removed. It will be noted from Figure 2 that the upper edge of the casting will be formed with a taper away from the tube, as indicated at **27**, which facilitates machining a smooth shoulder on the edge of the casting without cutting into the tube **10**. This machining operation could be omitted if a smooth shoulder were not desired but where it is performed it is the only machining operation necessary aside from tapping a hole for the valve **20** and any desired exterior finishing for the sake of appearance, the tube **10** presenting a smooth inner surface for forming a sliding fit with the piston **17**.

In forming the cap **14**, an internally threaded sleeve **15** having a roughened outer surface is mounted on the end of a sand core **28** (Figure 3) which is substantially the same shape as the interior of the cap. The core **28** is formed with a groove **29** and a conical enlarged upper portion **31** separated by a sloping shoulder **32**.

A suitable hollow pattern having the external configuration of the cap **14** and a print for a core for the bracket **16** is rammed up in the drag **33** of a sand mold. The drag is then inverted, the core **28** inserted in the pattern with the shoulder **32** resting on a sloping shoulder at the outer edge of the pattern and the cope **34** of the mold is rammed up with the sand surrounding the portion **31** and holding the core in the cope. The cope may be removed taking the core with it, the pattern removed from the drag, a suitable gate **35** cut, a core **36** for the bracket **16** placed and when the cope and drag are reassembled the mold is ready for pouring. It will be noted that when molten metal is poured in the gate **35** it will surround and adhere to the sleeve **15** thus permanently fixing the sleeve in the cast cap. The groove **29** will form an internal annular projection and the sloping shoulder **32** will form a tapered edge to facilitate finishing.

In casting this cap the relationship between the thickness of the sleeve **15** and of the casting is the same as described above, the casting being substantially twice as thick as the sleeve. It will be noted also that the molten metal is poured into the top of the mold cavity so that it will flow down around the sleeve to fill the cavity properly.

When the metal has hardened it may be removed from the mold, the outer end finished off to abut the end of the body **12** squarely and a suitable hole drilled for passage of the piston rod **18**. The cap is then ready for use aside from any exterior finishing which may be desired.

Figure 4 illustrates a slightly modified arrangement, parts therein corresponding to like parts in Figures 1 and 2 being indicated by the same reference numerals primed. As shown in this figure the end of the tube **10'** is spun over as indicated at **36** and a sleeve **37** is secured thereto by crimping or the like as indicated at **38**. The sleeve **37** is internally threaded to receive a valve such as **20** in Figure 1 and is closed during the pouring operation by the core **21'**. Preferably this core extends into a suitable cavity in the mold to assist in centering the tube in the mold cavity.

Figures 5 and 6 illustrate a further modification, parts therein corresponding to like parts in Figures 1 to 3 being indicated by the same reference numerals plus 100. In this form the end of the tube **110** is completely closed at **139** and the valve **120** is placed in the piston rod **118** which is hollow and has a suitable air outlet outside of the tube. The valve is formed by a tube screwed into a reduced portion of the piston rod **118** and having an air inlet opening **140** in its end and an air outlet **141** in one side. The opening **140** is controlled by a check valve **142** and a spring pressed valve **143** is arranged to seat just to the right of the port **141** to close off the port.

When the piston is moved to the left both valves **142** and **143** will be unseated and air will be admitted freely behind the piston. If a sudden force is applied to the rod **118** as when a door is closing fast and strikes it, the valve **143** will be seated against its spring to trap air to the right of the piston thereby to stop movement thereof. As the sudden force is relieved and becomes a lighter, relatively steady force the valve **143** will be unseated and air will bleed out through

the port 141. The end of the valve is preferably provided with a screw-driver slot so that it can be adjusted to cover partially the port 141 thereby to regulate the speed of movement of the piston.

In forming the device of Figure 5 the tube 110 is supported in a mold cavity as described in connection with Figure 2 with the closed end 139 down and spaced from the bottom of the cavity. Molten metal is then poured into the top of the cavity through the gate 123 and flows down around the tube and across the closed end to form the shell 12. In this form as with those described above, the shell 12 is substantially twice the thickness of the tube.

While several illustrative methods have been described in connection with the making of door silencers it will be understood that the invention may be modified in various respects and applied to the manufacture of other articles. Thus the invention is particularly applicable to the manufacture of fluid pressure cylinders of all types in which the tube provides not only a smooth inner surface but also a relatively thin impervious wall and the cast shell provides a decorative exterior and a convenient method of mounting as by integrally cast brackets. Reference will therefore be had to the appended claim for a definition of the limits of the invention.

This application is a continuation in part of my prior application Serial No. 29,609 filed July 3, 1935.

What is claimed is:

The method of casting an iron shell around a steel tube having walls relatively thin as compared to the diameter of the tube without preheating the tube which comprises forming in a body of sand or the like an upwardly facing mold cavity slightly larger than the tube, supporting the tube in the cavity to leave an annular space around the tube less than three times the thickness of the tube walls and closing the top of the cavity with sand or the like, and pouring molten iron under atmospheric pressure so that it flows horizontally into the upper part of said space against a vertical wall of said tube and down around the tube.

ANDREW C. DUNN.