Aug. 23, 1932. F. B. COREY 1,872,899

METHOD OF FORMING TAPERED HOLES IN METAL CASTINGS

Filed Jan. 27, 1931 2 Sheets-Sheet 1

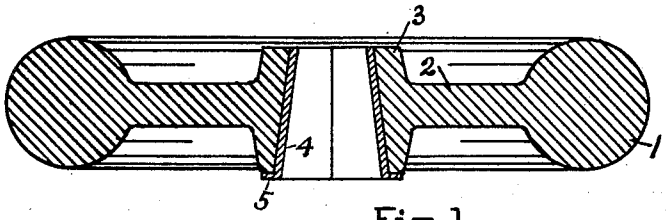


Fig. 1.

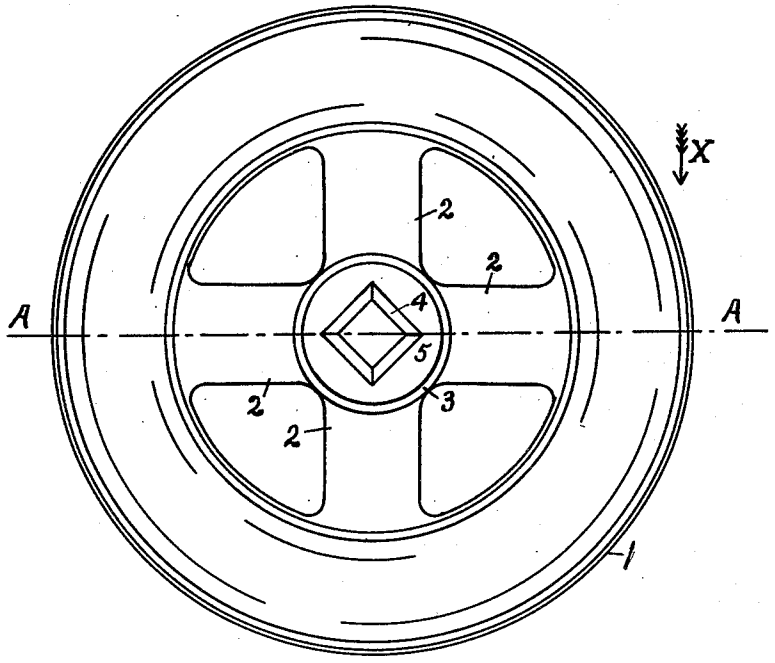


Fig. 2.

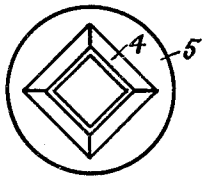


Fig. 3.

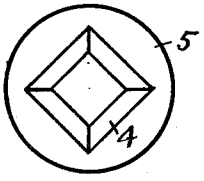


Fig. 4.

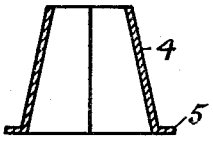


Fig. 5.

Inventor,

Fred B. Corey.

Aug. 23, 1932. F. B. COREY 1,872,899

METHOD OF FORMING TAPERED HOLES IN METAL CASTINGS

Filed Jan. 27, 1931 2 Sheets-Sheet 2

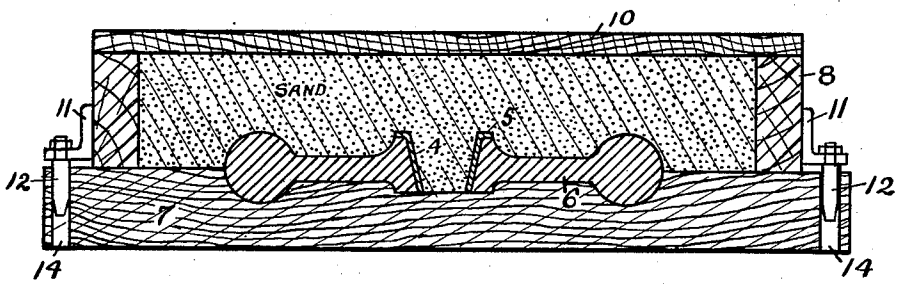


Fig. 6.

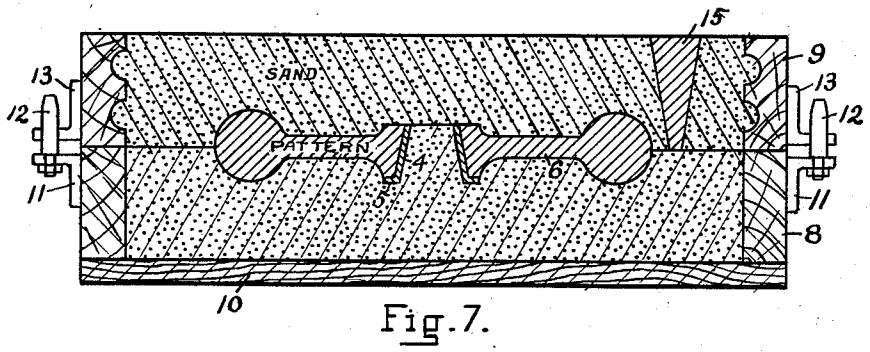


Fig. 7.

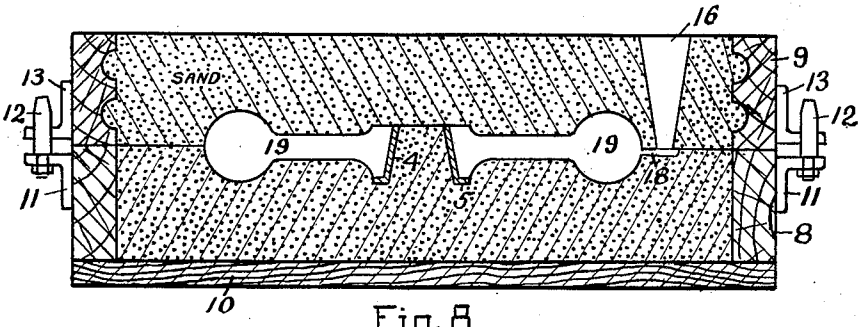


Fig. 8.

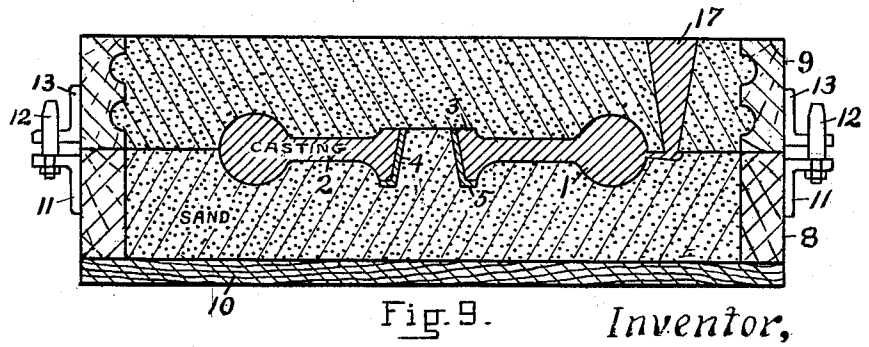


Fig. 9.

Inventor,
Fred B. Corey.

Patented Aug. 23, 1932 1,872,899

UNITED STATES PATENT OFFICE

FRED B. COREY, OF BARBERTON, OHIO

METHOD OF FORMING TAPERED HOLES IN METAL CASTINGS

Application filed January 27, 1931. Serial No. 511,542.

This invention relates to the production of castings having tapered holes therein and especially to those castings in which the holes are of such form that they are not easily finished with accuracy by any of the usual machine operations. Examples of such castings are valve wheels and brake wheels that have holes through the hubs to fit tapered square stems or shafts.

The objects of my invention are to provide a method of forming tapered holes in metal castings at the time the castings are made, to insure that the holes shall be accurate in dimensions and smooth in finish, and to form such tapered holes at a minimum cost.

In such castings the tapered holes heretofore have been made by two methods. According to one method the holes are formed by means of sand cores; either a dry sand core is placed in the mold after the pattern is withdrawn, or if the holes are not too deep, the core portion of the mold is formed in a corresponding tapered hole in the pattern by the green sand of the mold itself. This sand core method results in holes of variable dimensions with rough or irregular interior surfaces. Such surfaces necessitate expensive finishing operations if accurate and uniform holes are desired. Usually such holes are finished by hand filing and the results are far from accurate. According to the other method, the tapered holes are formed by means of metal cores known as chills. These tapered chills, before being placed in the molds, are coated with clay, graphite or other materials to prevent the hot metal in the mold from welding to the chill. If the protective coating on the chill is of considerable thickness, the chill may readily be removed from the casting, but the surfaces that were cast against the chill do not have the desired accuracy of finish. If the protective coating on the chill is very thin and the chill is carefully finished the surfaces of the hole will be more accurate in form and dimensions. However, with such thin coating the shrinkage of the casting causes it to grip the chill so that difficulty is encountered in removing the chill from the casting, many castings being broken and chills destroyed in the operation. While the chill process may produce tapered holes of fairly accurate dimensions, the excessive cost of manufacture and upkeep of the chills renders this process very expensive.

My invention consists in providing an accurately formed tapered tube, preferably punched from thin sheet metal, with a flange portion at the larger end, in inserting the tapered tube in a corresponding tapered hole in the pattern, the main body of the tube lying loosely in said tapered hole while the flange on the larger end of the tube lies in close contact with the pattern, in forming a sand mold in the usual manner, in withdrawing the pattern, leaving the tapered tube in the mold, and in pouring the molten metal into the mold where the hot metal fuses to the outer surface of the tapered tube and the inner surface of the flanged portion thereof so that the tube with the accurately formed hole therein becomes an integral part of the finished casting.

In the drawings that illustrate my invention, Fig. 1 is a sectional view of a hand-wheel such as is commonly used on gate valves, globe valves and the like. The square tapered hole in the hub of this wheel is made in accordance with my invention, the section shown being made through the axis of the wheel. Fig. 2 is a plan view showing the lower side of the hand-wheel shown in Fig. 1, the section in Fig. 1 being taken along the line A—A in Fig. 2, looking in the direction indicated by the arrow X. Fig. 3 is a top view of my preferred form of flanged tapered tube for producing square tapered holes. Fig. 4 is a bottom view of the same tube. Fig. 5 is a sectional view of the same flanged tube, the section being taken on a horizontal plane through the center of Fig. 4. Figures 6, 7, 8 and 9 show steps in the production of a casting having a tapered hole made in accordance with my invention. Fig. 6 is a sectional view of a hand-wheel pattern with follow-board, drag half of mold and bottom-board before the drag is rolled over in the molding operation. Fig. 7 shows a similar section of the entire mold with the pattern in place. Fig. 8 shows a similar section of the completed mold with the pattern removed and the mold ready

to pour. Fig. 9 shows a similar section of the mold with the casting poured therein.

Similar numerals refer to similar parts throughout the several views.

In the drawings, 1 is the rim and 2 the spokes of a hand-wheel. The hub 3 is perforated by a tapered hole of square cross-section. 4 is a tapered square tube preferably seamless and formed from a flat piece of sheet metal by means of a die, the flange portion 5 being formed at the large end of the tube. It is to be understood that the lines showing the boundaries between the tube 4 and the cast portion of the hub 3 are drawn for descriptive purposes, although in carrying out my invention the outer surfaces of the tube 4 are so fused and welded to the cast metal of the hub 3 that no sharp line of demarkation exists when the finished wheel is cut in section as in Fig. 1 or Fig. 9. 6 is the pattern used in the production of the hand-wheel. 7 is match-board used in hand molding, shaped to conform to the outline of the pattern 6. 8 is that part of the molding flask known as the drag and 9 is the complementary part known as the cope. 10 is the bottom board used to support the flask and the sand mold therein. 11 shows the ears which are attached to the drag 8 and serve to support the flask pins 12. 13 shows the ears that are attached to the cope 9 and engage by a sliding fit on the flask pins 12, to hold the cope and drag portions of the mold in the proper position of each with respect to the other. 14 shows the holes in the match-board 7 which engage the flask pins 12 at the beginning of the molding operation. 15 is the sprue plug which forms the sprue hole 16 in the cope portion of the mold and in which the sprue 17 is formed when the wheel is cast. 18 is the gateway through which the molten metal runs from the sprue hole 16 to the mold cavity 19 when the molten metal is filling the mold.

In producing a casting with a tapered hole therein made in accordance with my invention, I may use any of the sand molding processes that are in general use. For example, in producing a wheel having a tapered hole through the hub, I may use the hand molding process and proceed as follows. Referring to Fig. 6, the pattern 6 is placed in position on the matchboard 7 and the drag portion 8 of the flask is located by placing the flask pins 12 in the holes 14. The tapered tube 4 is then dropped in place in the tapered hole in the pattern with the flange portion 5 resting on the top of the hub of the pattern 6. The drag portion 8 of the flask is then filled with said and rammed in the usual way. The surplus sand is struck off and the bottom board 10 is placed over the drag as shown in Fig. 6. The whole assembly is then rolled over, bringing the drag part of the mold and the pattern 6 into the position shown in Fig. 7. The match-board 7 is then removed and the cope portion 9 of the flask is placed in position with the ears 13 engaging the flask pins 12. The cope portion 9 of the flask is then filled with sand, the sprue plug 15 being set in position at the same time. The sand so introduced is rammed in the usual manner. The surplus sand is then struck off, making the complete sand mold with the pattern inside, as shown in Fig. 7.

The sprue plug 15 is then withdrawn from the sand and the cope portion of the mold is lifted from the pattern 6 and drag portion of the mold. The pattern 6 is then drawn from the drag portion of the mold, leaving the tube 4 indisturbed in the mold. The gateway 18 is cut so as to form a passage from the sprue hole 16 to the mold cavity 19 when the cope is replaced as shown in Fig. 8. The mold is then ready for the casting process. To make the casting, molten metal is poured into the sprue hole 16 until the whole cavity 19 of the mold as well as the sprue hole 16 are filled with metal. The hot metal flowing around the tube 4 becomes welded thereto as it solidifies. Fig. 9 shows the mold filled with metal and the sprue 17 still joined to the rim 1 of the wheel.

When the casting is removed from the sand, the tube 4 forms the tapered hole in the hub 3. The dimensions of the hole and the finish of its interior are the same as those of the tube 4 that was placed in the tapered hole in the pattern 6 at the beginning of the molding operation. If the castings are to be made of iron, the tapered tubes forming the holes are preferably punched from sheets of ordinary tin plate, as the tinned surface unites readily with the molten metal making a perfect union in the finished casting. The ease with which these accurately finished tapered holes are produced and their low cost of production show a striking improvement over any previously used process.

The flange 5 on the tapered tube 4 has a two-fold function. During the molding operation it lies against the outer surface of the pattern 6 and prevents the tapered tub 4 from wedging in the pattern. Any wedging action between the tube and the pattern would tend to prevent the withdrawal of the pattern 6 from the mold without disturbing the location of the tube 4. In the finished casting the flange 5 serves to form a true face on the casting adjacent the tapered hole and thus contributes to the accuracy of the finished casting. If such a true face is not required the flange 5 might be changed in form or reduced in area and still serve to prevent the wedging action above described.

In carrying out my invention I do not confine myself to any specific process of molding. I have described one process of hand molding but those skilled in foundry processes will readily see that any process of sand

molding may be applied to the production of castings having the tapered holes formed in accordance with my invention. This invention lies in the use of a thin tapered metal tube flange at the larger end inserted in a corresponding hole in the pattern before the sand is put into the flask, the flange serving to hold the tube in proper position and to prevent the tube from becoming wedged in the tapered hole in the pattern, the tapered tube being filled with sand and retained by the sand when the pattern is drawn, and becoming a permanent part of the casting as it is formed in the mold.

What I claim as new and desire to secure by Letters Patent of the United States is:

A process for producing tapered holes in metal castings, which process consists in placing a tapered and flanged metal tube in a tapered hole in the pattern, the outside of said tube fitting loosely in said hole with the flange resting firmly against the surface of said pattern adjacent the large end of the hole, filling said tube with sand and making a sand mold about said pattern and flanged tube, withdrawing said pattern from said mold while leaving said flanged tube in the mold, filling the mold with molten metal and forming a continuous weld whereby the casting and the flanged tube unite as the casting is formed.

FRED B. COREY.