Feb. 27, 1945. R. L. WILSON 2,370,279

IRON CASTING

Filed July 9, 1943

FIG. 1.

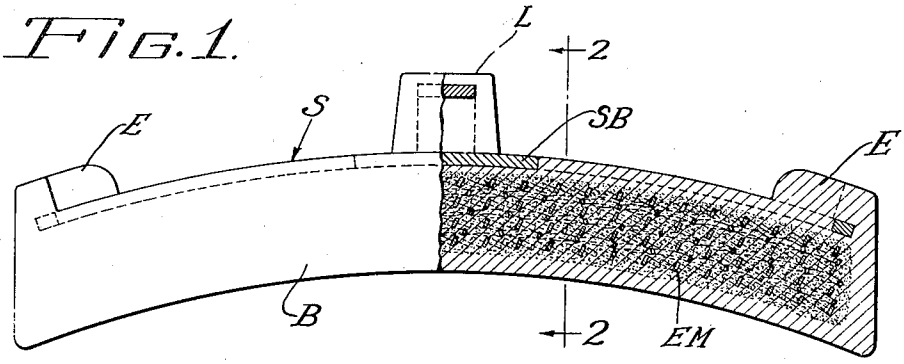
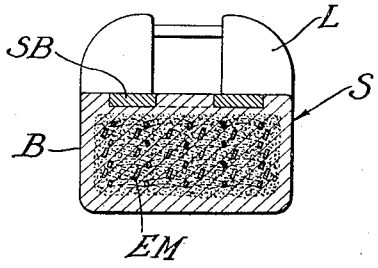


FIG. 2.



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IRON CASTING

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4 Claims. (Cl. 188—255)

This invention relates to iron castings, such as the brake shoes used on railway and like equipment, and to the production thereof.

The brake shoes that are used on railway and like equipment are examples of iron castings which may be produced in different degrees of hardness and in which it is usually desired to insure at least a predetermined degree of hardness. Thus, to refer to specific examples of brake shoes desirably having different degrees of hardness, those brake shoes which are used on equipment operated on elevated and subway lines in metropolitan areas, which equipment is decelerated at rather frequent intervals, are usually relatively hard so as to reduce the rate of wear thereof, whereas those brake shoes which are employed on mine or ore or other relatively heavily loaded cars, which are often operated on relatively steep inclines, are usually comparatively soft so as to embody relatively high frictional characteristics. The foregoing reference to specific types of kinds of brake shoes is merely exemplary since there are many other instances where brake shoes of varying degrees of hardness are advantageously employed. Moreover, to insure against an excessive rate of wear and in a measure to control the frictional characteristics, the degree of hardness of many brake shoes is desirably maintained above a predetermined minimum.

Brake shoes of the character to which this invention pertains are cast in molds that are set out on a foundry floor. In modern foundry practice, the molds which are set out on the floors for pouring are often produced in such a manner that molds for several different types of castings may be more or less indiscriminately distributed throughout a floor. This is particularly true in those instances where molds are produced at intervals along a conveyor which is effective to carry the molds from the point of production to the floor upon which the molds are set out. Thus, for example, a mold for a particular casting may be produced at a particular point along the conveyor while a mold for a different casting may be produced at another point along the conveyor and as the molds so produced are placed upon the carrier, molds for different castings collect one after the other along the conveyor. When molds so produced are picked up from the conveyor and are then set out on a floor, a more or less indiscriminate distribution of molds for different castings on the floor results. Hence, it may well be that molds for brake shoes or other castings in which a relatively high degree of hardness is desired will be distributed on a floor among molds for brake shoes or other castings which are to be relatively soft. Moreover, molds for relatively large and heavy shoes or other castings may be distributed among molds for comparatively small and light shoes or other castings. It is, however, highly desirable in such instances that adjacent molds on a floor be poured from the same ladle. Thus where, for example, molds for large and small shoes, or molds for brake shoes that are to be comparatively hard are distributed among molds for shoes that are to be comparatively soft, it is quite difficult to so control the iron that the proper degree of hardness desired in the various shoes may be realized when the molds are poured from the same ladle and, in the alternative, resort must be had to pouring the molds from different ladles which materially and objectionably increases manufacturing costs.

It is known, however, that iron castings of varying degrees of hardness may be produced by varying the chill effect to which the iron is subjected in a mold and where relatively hard castings are desired, this may be realized by effectively and quickly chilling the hot iron in the mold. It is comparatively easy to produce a relatively high chill effect by incorporating what are known as chill blocks into a mold but so to do produces a relatively hard surface on the castings, and brake shoes, such as are used on railway and like equipment, are examples of instances where chilled surface areas are desired only at determined or selected positions. Such shoes are, therefore, exemplary of instances where resort cannot be had satisfactorily to chill blocks in order to selectively produce castings of varying degrees of hardness in instances where the molten iron is poured from the same ladle into molds for shoes of varying desired characteristics and configurations.

In this respect, however, brake shoes such as are used on railway and like equipment are also exemplary of iron castings in which reinforcements are usually included. Thus it is customary to incorporate an insert in a brake shoe and such an insert usually consists of a plurality of layers of expanded metal. Such inserts, prior to the time they are incorporated into a mold, are usually coated with a refractory material so as to prevent objectionable burning thereof as the molten iron flows thereabout in the casting operation. Such a refractory coating has the effect of chilling the iron that flows into contact there-

with but such effect is so limited as to be negligible for all practical purposes.

There are, however, certain substances which exhibit a marked chilling effect upon hot iron and among such substances is tellurium which acts as a powerful iron carbide stabilizer, which is to say, a relatively small amount of tellurium is effective to keep whatever carbon may be present in the form of iron carbide during the pouring and solidification of cast iron. Therefore, in an instance where it is desired to provide iron castings of varying degrees of hardness and particularly where it is desirable or advantageous that the molten iron be poured from a common ladle into the molds in which the castings are to be produced, I propose to incorporate in at least selected of the molds varying quantities of a substance, such as tellurium, to control the degree of hardness in the resulting castings and so to do is the primary object of the present invention.

Moreover, in those instances where the castings are to include a reinforcement which is coated with a refractory material prior to incorporation thereof in the mold, I propose to incorporate into the refractory coating that quantity of a substance, such as tellurium, that will produce the desired degree of hardness in the resulting casting with reference, of course, to the chill effect of the molten iron. Thus, for example, where castings of varying degrees of hardness are to be produced in molds into which molten iron will be introduced from a common ladle, I so control the molten iron that those castings which are to be comparatively soft will be produced when the molten iron does not come into association with a substance such as tellurium in a particular mold and then by incorporating various quantities of a substance such as tellurium in at least selected of the other molds, I am enabled to produce castings of various degrees of hardness in molds into which iron is poured from the ladle, the greatest quantity of a substance such as tellurium being included in the mold in which the casting of the greatest degree of hardness is to be produced and to enable the foregoing to be realized in a novel and efficient manner is yet another important object of this invention.

It is particularly advantageous to include a substance such as tellurium in the refractory coating provided about an insert which is to be embedded or enclosed in an iron casting for so to do enables the greatest degree of hardness to be produced in the casting immediately about the insert included therein or, in other words, interiorly of the casting whereby, in effect, the softer iron will tend to enclose and surround the chilled and harder iron so as to thereby protect the same. This is particularly important in a casting, such as a brake shoe, which is to be subjected to thermal shock. Thus, for example, when the wearing face of a brake shoe is applied to the periphery of a rotating element to effect deceleration thereof, the wearing face of the shoe is rapidly heated to a comparatively high temperature while the remainder of the shoe may remain comparatively cool and this, of course, subjects the brake shoe to a severe thermal shock. However, where a brake shoe embodies a hard or white iron portion that is enclosed within a mottled or grey iron portion, very effective resistance to thermal shock is afforded and to enable this advantageous result to be realized is yet another object of this invention.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawing which, by way of illustration, shows a preferred embodiment and the principle thereof and what I now consider to be the best mode in which I have contemplated applying that principle. Other embodiments of the invention embodying the same or equivalent principle may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawing,

Fig. 1 is a side view, partly in elevation and partly in section, of a typical brake shoe embodying my invention; and

Fig. 2 is a transverse sectional view taken substantially on the line 2—2 on Fig. 1.

The brake shoe shown in the accompanying drawing is of the character adapted for use with the wheel of a railway car or the like but it will be understood that my invention may be embodied in a brake shoe adapted for use with the driver wheel of a locomotive or in any other casting in which it will be advantageous to have a hard iron portion enclosed within mottled or grey iron or in which casting it is desired to control the degree of hardness. The brake shoe illustrated in the accompanying drawing includes a cast iron body B in which a reenforcement EM is embedded, the illustrated reenforcement comprising a plurality of layers of expanded sheet metal. Moreover, a ductile metal reenforce SB, commonly referred to as a steel back, is provided at the back of the shoe. End stops E integral with the body B are provided on the back and at the ends of the shoe and a center attaching lug L is also provided on the back of the shoe midway between the ends thereof, the foregoing arrangement of a brake shoe being in accordance with well-understood practices.

Moreover, as is customary in the art, at least a part of the steel backing SB and the reenforcement EM are coated with a refractory material prior to the time they are introduced into a mold, and molten iron is poured thereabout to afford the body B of the shoe, for so to do protects such reenforcements against burning when the molten metal flows thereabout in the mold. A suitable refractory coating for reenforcements as SB and EM that has been used heretofore consists of silica flour, a carrier such as linseed oil and a thinner such as naphtha all intermixed in such proportions as to afford what may well be called a paint and usually the proportions are such that the paint has a specific gravity of from about 1.3 to about 1.4. The reenforcements are usually dipped into such a paint and are thereafter permitted to dry prior to being introduced into a mold in which a brake shoe is to be cast.

Of course any refractory material that is included in a mold will have some chilling effect on molten iron that flows into contact therewith, but it has been observed that the chilling effect of the refractory coatings that are included on reenforcements, such as those which are referred to hereinabove, is such that hardly more than a trace of hard or white iron will be found in a casting in which reenforcements so coated prior to the casting operation are embedded and therefore the presence of a refractory coating such as that described hereinabove does not enable the novel and advantageous results of the present invention to be realized inasmuch as, in

accordance with this invention, usually a substantial portion of the casting is to be comparatively hard as by being converted to white iron.

However, a relatively deep chill in the iron may be obtained by including in a refactory coating, such as that described hereinabove, a material that is effective to bring about chilling of the iron. One material which possesses this property to a marked degree is tellurium for the reason that tellurium acts as a powerful iron carbide stabilizer, which is to say, a small amount of tellurium is effective to keep the carbon in the form of iron carbide during the pouring and solidification of chilled cast iron. Therefore, in accordance with the present invention from about one-quarter ounce to about two ounces of tellurium is added to one pound of a paint of the aforesaid character for it has been found that so to do will afford from approximately .001 pound to about .005 pound of tellurium in a standard railway passenger car brake shoe including an expanded metal insert consisting of seven layers of expanded sheet metal as, for example, expanded eighteen gauge rolled sheet steel and approximately twenty-three pounds of cast iron along with a ductile metal reenforcing back weighing approximately one pound. This affords, in relation to the weight of the brake shoe, approximately .005% of tellurium in the shoe, and this enables the novel and advantageous results of the present invention to be realized.

Thus, when a metallic insert such as the reenforcement EM is dipped into a paint of the aforesaid character including tellurium in the quantity specified above and in the conventional manner and such reenforcement is thereafter placed in a mold in which a brake shoe is to be cast in the conventional manner from a chilling iron, a white iron core enclosed within a mottled or grey iron shell may be afforded since such amounts of tellurium will be effective to keep the carbon in the form of iron carbide during the pouring and solidification of an appreciable portion of the cast iron in the region about the coated insert. Moreover, in those instances where tellurium is present in the preferred proportions, such as those specified hereinabove, the chilling effect thereof will usually not be sufficient to chill the iron adjacent to the exterior surfaces of the shoe so that therefore a white iron core or center portion is afforded that is integral with and surrounded by a mottled or grey iron enclosure or shell, such a center portion being indicated by the dotted portion in Figs. 1 and 2.

It will therefore be appreciated that in accordance with the practice of this invention tellurium is introduced into a mold in such a way that the iron carbide stabilizing effect thereof will be effective to afford the inner or core portion in a casting, such as a brake shoe, but desirably the quantity of tellurium that is thus utilized is so related to the size of the casting that the iron carbide stabilizing effect thereof will be confined to the portion of the iron immediately thereabout so that an integral mottled or grey iron shell or enclosure will be afforded about that portion of the iron in which iron carbide is retained during the pouring and solidification of the cast iron. However, while the inclusion of minute quantities of tellurium in a paint into which a reenforce that is to be embedded in the casting is to be dipped is a convenient way of introducing tellurium into a mold so that the aforesaid results may be realized, it will be understood that resort may be had to other ways of introducing the tellurium into the mold without departing from the ambit of the present invention.

As is well understood, many castings of which brake shoes are exemplary customarily embody chilled portions. For example, it is customary to chill the end portions of a brake shoe adjacent to the wearing face thereof and this is realized by including what are customarily called chill blocks in the mold so that when the molten cast iron flows into the mold such blocks will be effective to bring about chilling of the iron in that portion of the casting that is formed immediately adjacent to such chill blocks. It is within the purview of my invention to permit the use of chill blocks and the like in connection with the castings embodying the present invention so that while in the main castings embodying this invention will include a core of hard or white iron integral with and enclosed within a shell of mottled or grey iron, it is not essential that all portions of the shell or enclosure be of grey iron. In those instances, however, where portions of the enclosure or shell are to be converted to hard or white iron, it is desirable, in accordance with the practice of my invention, that this be brought about other than by relying upon the effect of the tellurium that is to produce the hard or white iron core. Thus it is desirable in the practice of this invention, if portions of the mottled or grey iron enclosure are to be converted to white iron, that this be realized by utilizing chill blocks or other well-understood means to bring about the chilling of the desired portions of the enclosure or shell.

Moreover, resort may be had to my invention in those instances where it is desired to insure that castings such as brake shoes will embody at least a minimum degree of hardness. In such circumstances a small quantity of tellurium may be included in the coating applied to inserts to be included in the castings and in such circumstances the molten iron will be arranged so that those castings which are poured in molds in which no tellurium is included will be softer than the desired minimum degree of hardness. In such circumstances, however, those molds in which tellurium is included will produce castings embodying at least the minimum degree of hardness for the quantity of tellurium included in such molds will be such, with reference to the chilling effect of the iron, as to insure that at least the desired minimum degree of hardness will be afforded in the castings.

Another circumstance in which resort may advantageously be had to my invention is where the castings to be produced in molds set out on a particular foundry floor vary in size and configuration or where, for example, the castings are to have varying degrees of hardness. In such circumstances the molten iron will be of such nature that, for example, when it is poured into molds in which comparatively small castings are to be produced or into molds in which comparatively soft castings are to be produced, such castings will be afforded when the molds do not have tellurium included therein. In such circumstances, however, tellurium will be included in the other molds on the floor in amounts corresponding to the degree of hardness desired in the castings to be produced in such other molds, the greatest quantity of tellurium being included in the molds in which comparatively large and complicated castings are to be produced or in

which castings desirably having a high degree of hardness are to be produced. In such circumstances all of the molds set out on a particular floor may be poured out from a common ladle and yet the desired degree of hardness will be realized in all of the castings.

Hereinabove I have explained that where tellurium is included in the coating that is to be provided about an insert that is to be enclosed in a casting, the quantity of tellurium may be so regulated that the chilling effect thereof will be confined to the iron that is solidified immediately about the insert. In some circumstances, however, it may be desirable that the chilling effect of the tellurium be realized throughout the area of the casting and this may be accomplished by including such a quantity of tellurium in the coating about the insert that this result may be realized.

However, in those instances where the castings produced in accordance with my invention are to be subjected to thermal shock as are brake shoes which are applied to a rotating element to effect deceleration thereof, it will be advantageous to so regulate the quantity of tellurium introduced into the mold in which the shoe is produced that the chilling effect of the tellurium will be realized only in the iron that solidifies immediately about the insert or the like with which the tellurium is associated. Resort to such a practice will enable a relatively hard or white iron portion to be cast integrally with and enclosed within a mottled or grey iron portion and it is by reason of the provision of this mottled or grey iron portion that castings embodying my invention are enabled to effectively withstand thermal shock. Thus it is well-known that mottled and particularly grey iron withstand thermal shock to a much greater degree than does hard or white iron. Hence, in the case of a brake shoe where the arcuate wearing face thereof is frequently subjected to a relatively rapid rise in temperature and the remainder of the shoe does not have this effect impressed thereon, the provision of a mottled or grey iron portion will insure against damage to the shoe when it is subjected to thermal shock.

Furthermore, in those instances where it is desired to pour all the molds set out on a particular floor from a common ladle and varying degrees of hardness are to be afforded in the castings produced in such molds and such castings are to have a coated insert included therein, it will be advantageous to include different degrees of tellurium in the coatings applied to the various inserts for, as explained hereinabove, it is this that enables varying degrees of hardness to be afforded in castings produced in molds poured from a common ladle. In such circumstances, the paints or coatings into which the inserts are to be dipped, as explained hereinabove, will include varying quantities of tellurium and in order to insure that the proper inserts will be placed in the proper molds it may be advantageous to color the paints or coatings so that the inserts dipped thereinto will be of different colors. Thus, for example, the coating in which the greatest quantity of tellurium is included may be colored red while the paint in which the smallest quantity of tellurium is included may be colored green. This will enable prompt identification of the inserts which will produce varying degrees of hardness in the castings and will mitigate against the likelihood that an improper insert will be included in a particular mold.

Hereinabove I have set forth the preferred aspects of my invention and while I have illustrated and described a selected embodiment of my invention, it is to be understood that this is capable of variation and modification and I therefore do not wish to be limited to the precise details set forth but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. A cast iron brake shoe comprising a relatively hard white iron core having a metallic reenforcing insert embedded therein, said relatively hard white iron core comprising iron in the form of carbide stabilized in that form by means of tellurium and being encased by and being integral with a body of relatively soft and thermal shock resistant mottled gray iron including a portion providing a braking surface.

2. The method of making a cast iron brake shoe of the type which includes a body of cast iron having an expanded metal insert embedded therein which comprises coating said expanded metal insert with a surface coating containing tellurium and then casting ferrous metal about the thus coated expanded metal insert thereby forming a brake shoe which has a core of chilled relatively hard white iron in which the expanded metal insert is embedded and which has a shell of relatively soft gray iron, highly resistant to thermal shock, surrounding said relatively hard white iron core and including a portion providing a wearing face.

3. The method defined in claim 2 in which said surface coating contains refractory material and an oil vehicle and is allowed to dry upon the expanded metal insert before the ferrous metal is poured therearound.

4. A cast iron brake shoe, an expanded metal insert coated with a refractory surface coating containing tellurium, and a body of ferrous metal cast about said coated expanded metal insert to form a brake shoe having a core chilled by the tellurium of said coating to afford relatively hard white iron in which the expanded metal insert is embedded and which brake shoe has a shell of relatively soft gray iron, highly resistant to thermal shock, surrounding said relatively hard white iron core and including a portion providing a wearing face.

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