June 10, 1924. 1,496,996

A. MOORE

PROCESS OF MAKING REENFORCED CASTINGS

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Fig 1

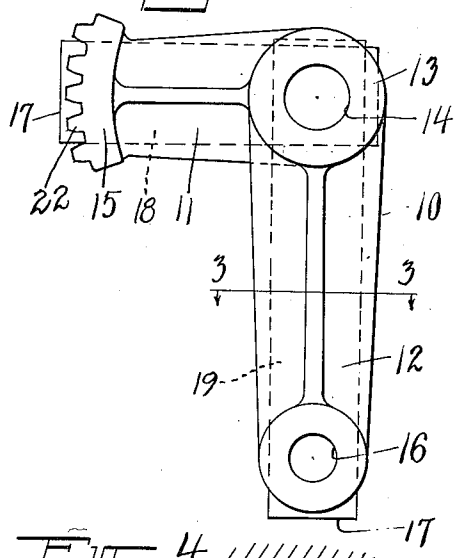


Fig 2

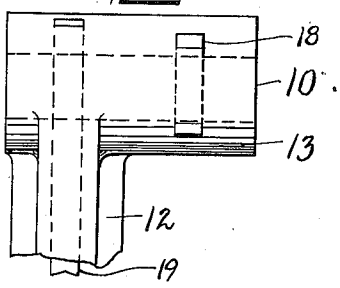


Fig 3

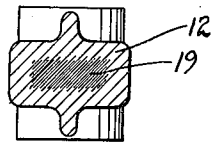


Fig 4

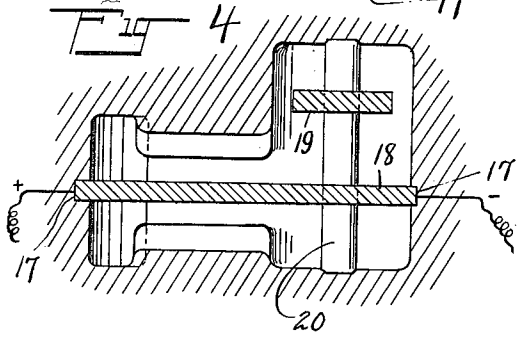


Fig 5

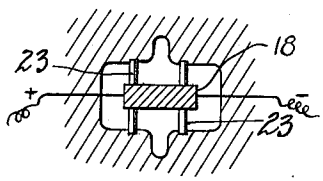


Fig 7

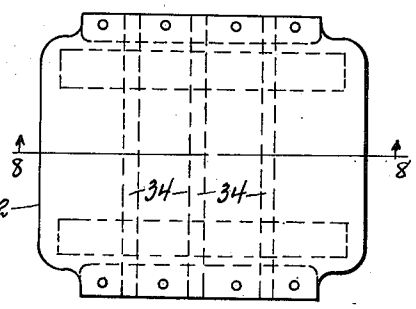


Fig 6

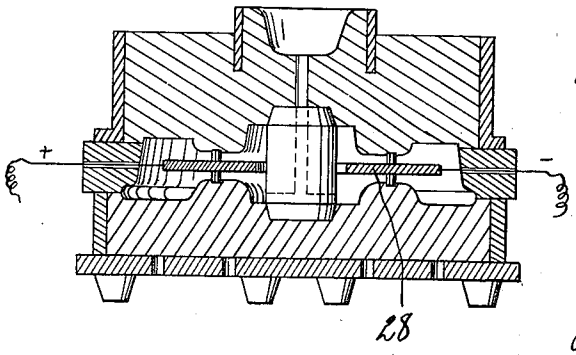
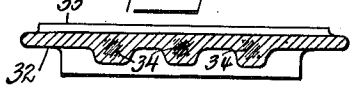


Fig 8



Arlington Moore INVENTOR

BY H. H. Dyke

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A. MOORE

PROCESS OF MAKING REENFORCED CASTINGS

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Fig 9

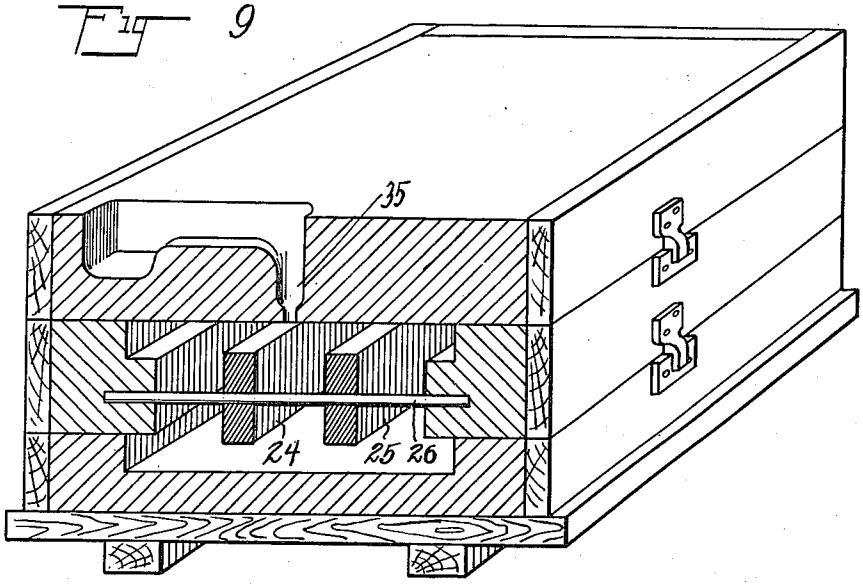


Fig 10

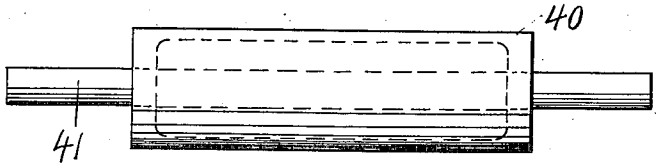
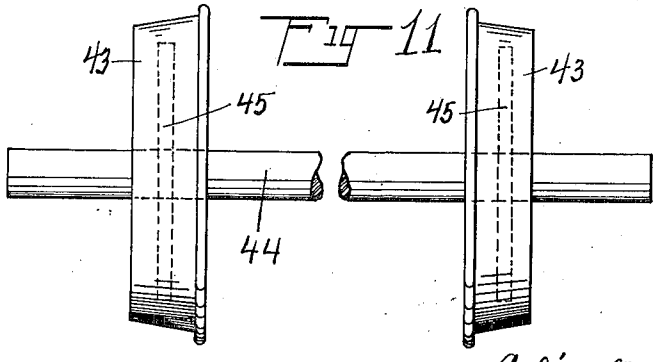


Fig 11



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Patented June 10, 1924. 1,496,996

UNITED STATES PATENT OFFICE.

ARLINGTON MOORE, OF NEW YORK, N. Y., ASSIGNOR TO MOORE INVENTIONS CORPORATION, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

PROCESS OF MAKING REENFORCED CASTINGS.

Application filed July 30, 1921. Serial No. 488,559.

To all whom it may concern:

Be it known that I, ARLINGTON MOORE, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented a new and useful Improvement in Processes of Making Reenforced Castings, of which the following is a specification.

My invention relates to reenforced castings and process of making same. According to the present invention a metallic core is placed in a mold and the same is brought up to a high temperature which, however, is below its melting temperature, preferably by electrical heating, whereupon the molten metal for casting is poured into the mold, and after cooling a reenforced casting is produced having the strength of the core material and having any desired form of exterior, as may be made by casting. While the invention is not so limited, it will be described herein, for the purpose of illustration and affording a sufficient understanding, in connection with the production of articles of cast iron with a reenforcing of wrought steel.

Articles of this character have very numerous industrial applications, taking the place in general of wrought or forged products which are difficult to produce and require much machining; of cast iron, which is very heavy in proportion to its strength, unreliable because of liability of breakage, and has relatively poor wearing surfaces; and of cast steel, which is highly expensive, very difficult to cast without voids and blowholes being uncovered in machining, and requires long continued annealing.

The steel for reenforcing is preferably steel which has been mechanically worked, either hot or cold, or both, in order to reduce the grain size and impart desirable mechanical qualities which are well understood to result from such treatment. The steel is preferably of higher melting point than the cast iron, and the strength of the steel is preserved substantially without impairment, and it becomes possible to produce reenforced or fabricated products, having in combination in the one structure the characteristics of the steel reenforcing portion of great strength combined with light weight and good wearing qualities, and also having the characteristic of iron castings, namely, readiness of production in any desired shape. At the same time various additional advantages are secured, in that, for example, the heat of the molten cast iron is not so rapidly lost as would be the case if the heated steel core were not present, thus insuring complete fluidity of the molten iron and perfect filling of the mold with all its corners, angles and the like, and the production of a casting of high density, free from chills, blowholes and the like.

The heating of the reenforcing cores also serves to bake or partially bake the mold in situ, securing all the casting advantages of a baked mold. The steel reenforce may be brought out to or beyond the surface of the casting to be machined off at places where the reenforced cast member is subjected to greatest wear, as for example, where the gear teeth of a sector are to be cut, thus securing wearing and stand-up qualities impossible to be secured in a simple iron casting. While the cooling of the reenforced casting is preferably carried out slowly in order to avoid setting up undue strains, little or no annealing is required and the products may be produced on substantially as short notice as ordinary cast iron products, without the annealing delays encountered with cast steel, and various other incidental advantages can be secured.

In the accompanying drawings, I have illustrated a few of the numerous ways in which my invention may be embodied. Fig. 1 is a side view of a machine element in the form of a sector. Fig. 2 is an end view of the structure shown in Fig. 1. Fig. 3 is a transverse sectional view on line 3—3, Fig. 1. Fig. 4 is a sectional view of a mold with reenforcing steel members in place therein preparatory to pouring the cast steel about the heated reenforcing members. Fig. 5 is a cross-sectional view showing an alternative mode of supporting the reenforcing members by means of pegs which become a part of the casting. Fig. 6 is a transverse sectional view of a mold for casting a car-wheel with a reenforced web. Fig. 7 is a plan view of a reenforced cast machine frame member in the form of a machine base. Fig. 8 is a cross-sectional view on line 8—8, Fig. 7. Fig. 9 is a perspective view partly in section of a flask with a mold having a reenforce supported on rods therein for forming a reenforced cast

column. Fig. 10 is a plan view of a roll cast about a steel shaft, and Fig. 11 is a plan view of a pair of car wheels cast on a steel axle.

The elbow lever 10 shown in Figs. 1 to 3 is presented as an example of a machine element constructed in accordance with my invention. Said elbow lever comprises two arms 11 and 12 offset in different planes from one another and connected by the shank 13 extending at right angles to arms 11 and 12. Shank 13 has a bearing opening 14 extending therethrough. Arm 11 has its end formed into a toothed sector 15 and arm 12 has a bearing opening 16 provided therein for connection with an actuating member, such as a link to which it may be connected, as by means of a pin passing through the opening 16.

In making up the mold shown in Fig. 4 for production of the machine elements shown in Figs. 1 to 3, core prints 17, 17 are left for the reception and support of the steel reenforcing member 18 which is to extend preferably centrally and longitudinally through the arm 11. The second steel reenforcing member 19 is supported to extend through and reenforce the arm 12 in similar manner, and a core 20 for forming the bore 14 of shank 13 extends through openings provided for its reception in reenforcing members 18, 19.

With the mold members arranged as described, the reenforcing members are brought up to a comparatively high heat by passing an electric current of low voltage and high amperage therethrough, and then the mold is filled with the molten cast iron and permitted to cool, the current preferably being shut off and the clamps or other electrical connecting means preferably being removed just before the iron is poured. When the completed renforced casting is removed from the mold, it may be subjected to a short annealing or permitted to cool slowly, preferably in a retarding medium such as lime. Slow uniform cooling is desirable in order to avoid setting up of undesirable stresses, but rapid cooling may be resorted to if desired, though same is ordinarily not advisable. When the reenforced casting is completed the transition from cast iron to steel parts is gradual and a thoroughly integrated structure is obtained.

When wearing surfaces as the surfaces of teeth 22 are cut directly within the steel reenforcing portion, as shown in Fig. 1, such members may be made very strong and wear resisting and may be case hardened or heat treated, if desired, in order to secure best wearing qualities. Various means of supporting and positioning the reenforcing members in place may be resorted to. Core prints are illustrated in Fig. 4. Pegs 23 such as are used in supporting ordinary cores in castings, are shown in Fig. 5, and in Fig. 9 the reenforces 24, 25 are supported on rods 26 which are preferably of material similar to pegs 23 and are adapted to form an integral part of the reenforced casting member when completed, and various other supporting means may be made use of.

Fig. 6 illustrates a preferred form of mold arranged for casting a car wheel with reenforcing steel web 28 which is here shown as being supported in place in the mold by pegs 23′.

Frame members for machinery can be made of great strength and lightness by use of my invention, and in Figs. 7 and 8 I have shown a machine base 32 having ribs 33 for attachment of the side members of the machine frame and reenforced by means of steel bars 34, 34, running transversely of the base 32. This showing is illustrative only and the location, number, size and arrangement of the reenforcing members may be varied in order to suit various conditions encountered in practice and to give strength where needed for withstanding strains to which the machine base or other part is subjected, and also to secure light sections and low weights.

The molds may be of various forms to produce the members of the shapes and sections desired. In Fig. 9 I have shown a flask with a three part mold for forming a reenforced cast column containing reenforcing members 24 and 25 which are shown as being supported on rods 26, and the molten iron is poured through the pouring opening 35.

Some further illustrative examples of devices in accordance with my invention are shown in Figs. 10 and 11. Fig. 10 shows a roll 40 cast upon a steel shaft 41. Shaft 41 may be solid or tubular, if desired. Fig. 11 shows a pair of car wheels 43 cast on a steel shaft 44, it being understood, of course, that the steel shafts of Figs. 10 and 11 are heated in the manner heretofore described when the molten metal is poured. The wheels 43 preferably are formed with steel disks 45 inserted therein and fitting about shaft 44.

Where the reenforcing material used is mild steel, for example, and capable of being machined with practically the same readiness as the cast iron, no difficulty is encountered in machining the composite surfaces presented and wearing surfaces of steel or steel and cast iron may be readily machined by various machine tools, such as gear hobbing devices and the like, and substantially no greater difficulties of machining are encountered with the composite article herein described than in the case of machining similar members made entirely from cast iron.

While it is usually preferable to entirely

surround the reenforcing member with the cast iron, this may not be essential in all instances, and numerous other modifications and changes may be resorted to, utilizing the principle of my invention and coming within the scope of my claims by which the invention is defined.

It is to be understood that the embodiments of the invention shown are intended merely for the purpose of disclosing the principle of the invention and some of its simple applications, and that the invention is capable of a very wide range of application of which those illustrated are but a few representative examples.

I claim:

1. The process of making reenforced castings of relatively high strength and low weight, which consists in providing a mold of sand or the like, placing therein in position where strength is needed a metallic reenforcing member of relatively high strength, supporting said reenforcing member in the mold so as to leave casting space on substantially all sides thereof, passing electrical current through the reenforcing member to thereby heat the reenforcing member in place in the mold and bake the mold, and casting metal of relatively low strength in the mold about the electrically heated reenforcing member.

2. The process of making reenforced castings, which comprises providing a mold of sand or the like, supporting therein a reenforcing member of wrought steel so as to leave a casting space above and below the reenforcing member, passing electrical current through the reenforcing member to thereby heat the reenforcing member in place in the mold and bake the mold, and casting cast iron in the mold about the heated reenforcing member.

3. The process of making reenforced castings, which comprises providing a mold of sand or the like, arranging therein a plurality of steel reenforcing members in position where increased strength of the finished casting is required, supporting said reenforcing members so as to leave a casting space thereabove and therebelow, electrically heating the reenforcing members in place in the mold, and casting cast iron in the mold about the heated reenforcing members.

In testimony that I claim the foregoing, I have signed my name hereto.

ARLINGTON MOORE.