Jan. 16, 1934. D. J. CAMPBELL 1,943,720

METHOD OF CASTING BRAKE DRUMS

Filed Nov. 2, 1932

Fig. 2

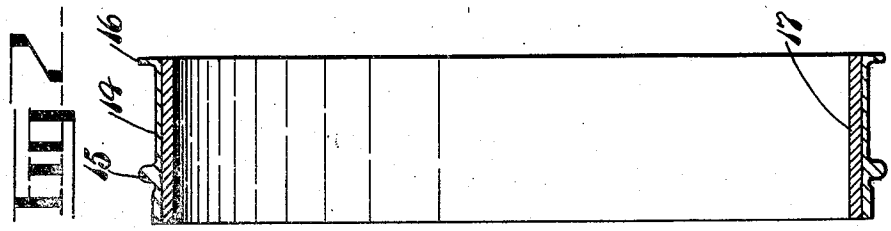
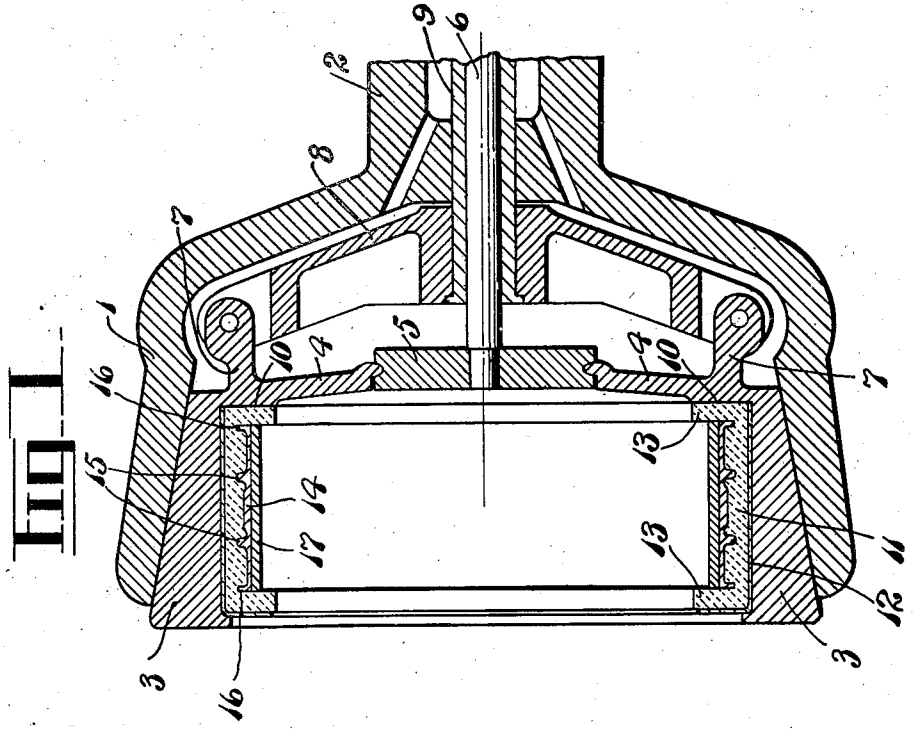


Fig. 1



INVENTOR
Donald J. Campbell
BY Livernance & Van Antwerp
ATTORNEY

Patented Jan. 16, 1934 1,943,720

UNITED STATES PATENT OFFICE

1,943,720

METHOD OF CASTING BRAKE DRUMS

Donald J. Campbell, Spring Lake Township, Ottawa County, Mich., assignor to Campbell, Wyant & Cannon Foundry Company, Muskegon Heights, Mich., a corporation of Michigan

Application November 2, 1932. Serial No. 640,793

6 Claims. (Cl. 22—206)

This invention relates to a method of producing compound brake drums for motor vehicles, used in conjunction with other braking mechanism for retarding and stopping such vehicles. The drum is also useful for braking other rotating mechanism.

It is an object and purpose of the present invention to produce brake drums of exceptional strength and resistance to fracture, and at the same time provide a frictional braking surface of a high degree of efficiency. More specifically the invention consists in making a drum as a compound casting, wherein the outer portion is of the proper grade of cast iron, there being combined the strength and toughness of steel with the advantageous braking characteristics of cast iron, it being against an inner cast iron surface that the braking shoes operate.

By reason of the necessity of using a particularly high grade of cast iron, one which is firm and dense in structure and the necessity that the same shall be free of pits, blow-holes or the like, and because of the difficulty in making proper joinder between cast iron and steel over all points of contact engagement, particularly where the body of cast iron is relatively small and the thickness of the cast iron band at the inner side of the drum is only approximately three-sixteenths of an inch or even less, the problem of producing such composite joinder of steel and iron is a difficult one and it is only after long experiment and trial that methods of properly and practically producing the same have been perfected.

An understanding of my invention whereby the complete, practical and successful attainment of the objects above stated are secured, as well as others not at this time specifically enumerated, may be had from the following description, taken in connection with the accompanying drawing, in which,

Fig. 1 is a fragmentary horizontal central vertical section illustrating an apparatus for centrifugally casting and producing the drum. Also the mold and a section of the brake drum of my invention are shown within the mold, and

Fig. 2 is a central vertical section of a brake drum as produced by the method of my invention.

Like reference characters refer to like parts in the figures of the drawing.

In practicing the method of my invention, a suitable apparatus is provided which may be similar in all essentials to that shown in my prior application for patent, Serial No. 573,949, filed November 9, 1931. The parts of the apparatus illustrated in connection with the present invention comprise a chuck housing 1, at the end of a rotatable shaft 2, which is mounted for rotation in suitable bearings, not shown. The chuck comprises a plurality of jaws, 3, which have inwardly extending arms 4 pivotally connected to a head 5 located at the outer end of a rod 6. Each jaw member 3 has an inwardly extending arm 7 pivotally connected to a radial arm 8 of a second head secured at the outer end of a hollow shaft 9 which extends through the main shaft 2, rod 6 passing through the shaft 9. As shown in my prior application for patent to which reference is made, this apparatus may be operated to project and open the jaws 3 of the chuck, or to draw the same inwardly and close the jaws as they bear against the inner tapered sides of the chuck housing 1.

Each of the arms 4 of the chuck jaws 3 at its inner side is formed with a flat surface 10, and all of the surfaces 10 on said arms, when the chuck is retracted into its housing, provide a back support for a mold. The mold 11 preferably is of baked sand similar to that used in a baked sand core, and may be formed within an outer thin steel or sheet metal band 12. The mold is of annular cylindrical form and at each end has an inturned annular flange 13; and the back flange 13 of the mold is what comes against the surfaces 10 after the mold has been placed in the chuck and the chuck drawn into the housing to the position shown in Fig. 1.

The apparatus described, after the mold 11 has been located within the chuck and the chuck drawn to closed position, is ready to receive melted steel which forms the outer portion of the brake drum. The mold is rotated first at a relatively slow speed, sufficient that when melted steel is placed therein the steel will be distributed by centrifugal force evenly over the inner surfaces of the mold and will enter the grooves formed at the inner side of the mold and thus provide the outer shell section 14 of the drum, with ribs 15 integral therewith and extending outwardly entirely around the same, said ribs being provided by forming the inner side of the mold at the first instance with suitable grooves for reception of the metal. And at each end of the inner portion of the mold other grooves are made, such that when the melted steel enters it provides outwardly extending flanges 16 of steel. The rotative speed of the apparatus, when the steel is deposited and while it is being centrifugally carried into place, cannot be excessive as

excessive speed would cause a detrimental effect upon the mold 11 but at a speed or rotation such that the peripheral speed at which the steel is moving is approximately 600 lineal feet per minute, the steel evenly distributes itself under the centrifugal action and takes a form within the mold whereby it is of substantially uniform thickness except where the grooves are made for the flanges and outwardly extending ribs described.

The temperature of the steel when introduced into the mold is very high and may at times reach 3600° F. This excessive temperature is not necessarily required but the temperature of the steel must be such that it is free flowing initially and is fluid enough that it will spread evenly over the inner face of the mold and provide a substantially uniform cross section so far as the steel outer portion is concerned.

After the steel has been poured and has thus been uniformly distributed it is permitted to cool until its temperature is below the melting temperature of the steel and at such temperature, the steel will be sufficiently congealed that it will not be penetrated and disrupted by the introduction of the molten iron lining band portion, but is of a sufficiently high temperature that when the melted cast iron at a proper high temperature is introduced into the rotating apparatus and the same stepped up in speed of rotation, a complete fused joinder of the steel and cast iron will take place and an integral compound casting produced.

Cast iron for brake drum purposes has to be of a high quality and, when the drum is finished at its inner surface, present no flaws such as would come from trapped gas, have no dirt or scale permeating the same and be of a dense and hard quality. Cast iron of this character can be produced in a cupola furnace and will melt and flow freely at 2400° F. but the temperature of the cast iron must be considerably in excess of this freely flowing melting temperature in the present invention. The melted cast iron is superheated several hundred degrees above its melted freely flowing stage. That is, in order to get a proper complete joinder of the iron and the previously cast but still a highly heated steel, there is a superheating of the melted cast iron to 2600° F. and preferably the temperature will be nearly 2800° or 2900° F.

The apparatus which supports the mold is rotated at a very high speed when the melted cast iron at the high temperature of about 2800° or 2900° F. is introduced into the mold. The limit of the rotative speed is governed only by the strength of the apparatus such that it will not disrupt and fly to pieces under centrifugal action. A speed of 3500 lineal feet per minute of the brake drum will produce a continuous homogeneous structure of the two metals and the speed may be increased above this amount for example as high as 4500 lineal feet per minute.

And it is not desired that the lower limit shall be considered strictly as 3500 lineal feet per minute as, depending upon the particular temperatures of the iron and steel when the same are brought together, there are variations in the necessary and essential speeds of rotation such that a complete fusion between the iron and steel would be obtainable at a lower rate of speed.

The high speed when the cast iron is introduced in the mold is desirable and in fact from a practical standpoint necessary in order that gases, scale, dirt, air and the like may move inwardly to the inner face of the cast iron, it being apparent that the differential in centrifugal forces at the outer side of the molten iron as compared with the inner side of the molten iron, the melted iron having a limited thickness usually one-eighth to three-sixteenths of an inch, necessarily is small at low speeds and the speed must be sufficient to carry the lighter materials such as scale, gas, air and other undesirable material inwardly to the inner side of the molten iron; and the temperature of the molten iron must be that such scale, gases, air and the like may pass through the iron while it is still in a very fluid condition, whereby when the casting is cooled the gaseous materials not wanted have escaped at the inner side of the cast iron and the scale, dirt or products from flux which may be used will evidence themselves as a scale at the inner side of the cooled cast iron bands 17 and which is removed on machining the drum on its inner side to provide a smooth braking surface.

In the illustration shown, a double width brake drum is shown as produced in a single operation, the casting made being divided midway between its two ends to produce two brake drums, one of which is shown in Fig. 2. It is of course apparent that the mold 11 may be provided with an inwardly extending annular rib half way between the two flanges 13 so that the two drums may be cast at one operation separate from each other. This, however, is a detail of apparatus and is not of importance in connection with the present invention which is more concerned in the practical and successful provision of brake drums in a compound casting of steel and cast iron, the steel at the outer portion and the cast iron at the inner portion, and the steel and cast iron homogeneously, continuously and intimately fused and connected together where the cast iron comes against the steel.

Having thus described my invention, what I claim as new and wish to secure by Letters Patent is:

1. The herein described method of producing brake drums which consists, in preparing a mold, rotating the mold, pouring molten steel into the mold while the same is rotating, cooling the steel until its inner surface is considerably less plastic than the interior of the body thereof, pouring melted cast iron into the mold against the steel and then cooling the metals.

2. A method as set forth in claim 1 in which the rotation of the mold is materially increased during or after the introduction of the cast iron whereby centrifugal forces will act thereon to cause interlocking between the cast iron and the inner surface of the steel, the plastic interior of the body permitting such action.

3. A method as set forth in claim 1 in which the cast iron is heated to a temperature above the inner surface of the steel whereby the same transmits heat thereto to soften the same and render it more plastic, such softening action occurring after the cast iron is in its concentric position.

4. The method of producing a composite brake drum which consists in preparing a refractory mold of comparatively weak construction, rotating the mold relatively slow, depositing molten steel therein, said rotation being sufficient to cause equal concentric distribution of the said molten steel, cooling the said steel to a predetermined degree, pouring molten iron against the steel before the steel has congealed, and then in-

creasing the speed of the mold to cause said molten iron to fuse with the steel.

5. A method as set forth in claim 4 in which the molten iron is superheated to a temperature above the melting point of the steel in order to form a safety factor.

6. A method of producing a brake drum from two metals having different melting points, said metal having the higher melting point also having the greater density, which consists in, providing a rotating mold, melting and pouring the metal of the higher melting point into the mold, cooling the same for a predetermined time, and then melting and pouring the other metal into the mold and then cooling the drum.

DONALD J. CAMPBELL.