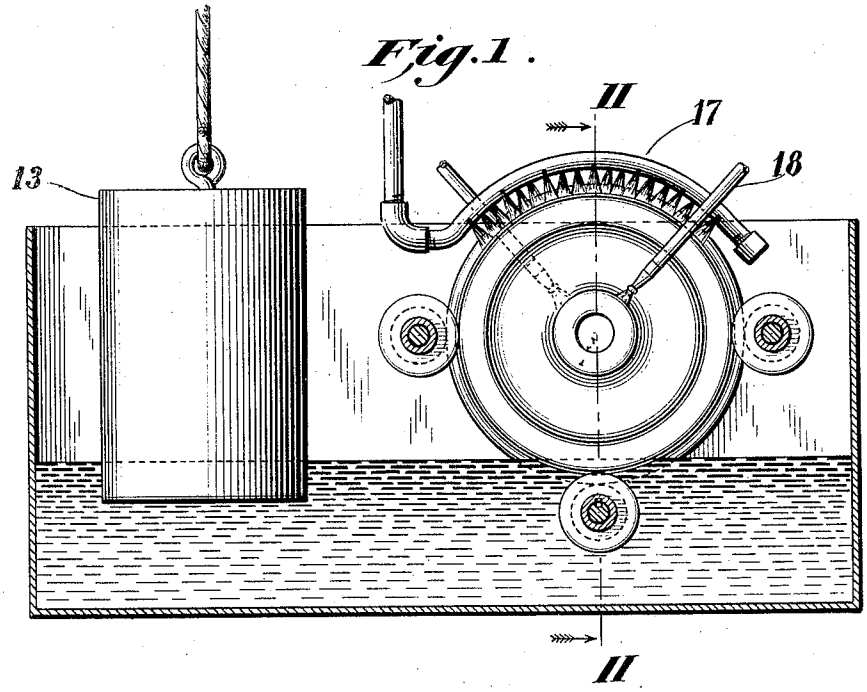
Jan. 1, 1929. 1,697,068

E. F. KENNEY

MANUFACTURE OF IRREGULAR SHAPED OBJECTS

Filed Feb. 1, 1926

Fig. 1.



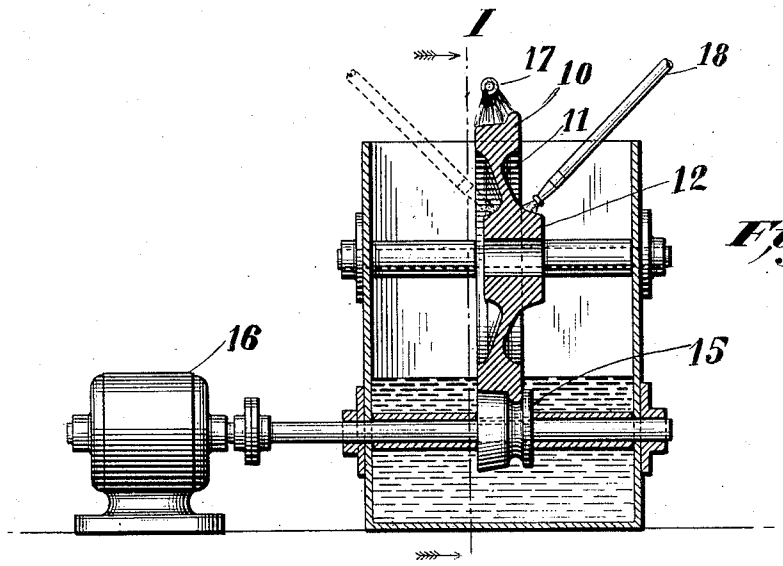


Fig. 2.

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UNITED STATES PATENT OFFICE.

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MANUFACTURE OF IRREGULAR-SHAPED OBJECTS.

Application filed February 1, 1926. Serial No. 85,112.

My invention relates to the manufacture of irregular shaped metallic objects and particularly to the manufacture of wheels for railway tender, passenger car, and freight car service.

Car wheels in railway service usually have heavy hub and rim portions and a light plate or web portion compared with the hub and rim portions, and when the wheel is completely immersed in or uniformly subjected to the quenching medium, so that it is cooled rapidly through the critical range, the plate portion cools much more rapidly than the hub and rim portion with the result that dangerous cooling strains are immediately set up in the metal constituting the plate portion and, the hub and rim portions continuing to shrink impose further stresses on the plate portion and increases the strains in the metal of that portion to such an extent that the metal may fracture. The rapid cooling of the wheel rim portion alone while allowing the plate and hub portion to cool slowly to room temperature may also result in the fracturing of the plate portion for the reason that while the rapid contraction of the rim portion does not strain the metal of the plate portion, owing to the latter being in a more or less plastic state, the plate portion cools much more rapidly than the hub portion and reaches a rigid condition before the metal in the hub portion, and the continued contraction of the latter portion imposes further stresses on the plate portion thus further increasing the strain in the material which may result in the fracturing of that portion. The material of the plate portion cools much more rapidly than the heavier portions thereof when the wheel is quenched in the above described manner, and the fracturing of the material forming the plate portion may result when it is subjected to severe stresses, such as are occasioned by the contraction of the metal while cooling. Such fractures are more liable to occur when the temperature passes through the blue heat zone. What I mean by the blue heat zone is a range of temperature, below the AC1 point, at which the steel when exposed to the air takes on a blue color, and about the point where the material changes from a somewhat plastic to a more rigid state. Through this range the molecular structure of the material exists in its most brittle state and if the metal is stressed at this stage, particularly if internal strains are present, there is a possibility of the material fracturing.

Because of danger of the fractures occurring when rapidly cooling the material, it is customary in the manufacture of wrought steel wheels to allow them to cool comparatively slowly through the AC3 to AC1 range. However, the rapidity of the cooling through this range determines the effectiveness of the treatment in preventing the segregation of the various constituents, and as the desired hardness and toughness in the treated steels are dependent on the degree to which the segregation of the ferrite, cementite, etc., has been prevented, it is clear that the comparatively slow cooling of the rim will not give the best results. I have discovered that even such intricate and ununiform sections as wheels can be very rapidly cooled through the AC3–AC1 range, if the cooling is so regulated that the various parts of the wheel are cooled as nearly as possible, at the same rate and the cooling stopped above the blue heat range, and the article equalized and held at a temperature above the brittle blue range, but below AC1, so as to relieve the material of internal strains before the temperature passes through that range.

My invention has for its object the manufacture of a forged steel railway car wheel which embodies a novel method of heat treatment to provide physical properties which are superior to the forged wheels now in use.

The novel features will be more fully understood from the following description and taken with the drawings in which

Fig. 1 is a diagrammatic view illustrating the apparatus for quenching certain portions of the wheel.

Fig. 2 is a cross section thru the wheel showing the position of the quenching sprays.

When practicing my method of manufacturing car wheels, I preferably heat a block of steel to forging temperature and place it in dies and upset it into disc form. I then reheat the disc and place it in dies to partially form the rim portion, the plate portion and the hub portion of the wheel. The partially formed wheel is then placed in the dies and the hub bore is punched out. The forged blank is preferably reheated and placed in a rolling mill and the plate portion and rim portion are rolled to finished size. Some of the heating and forming operations may be omitted, if the presses and mill are arranged so that the blank is transferred quickly from one press to the other so that there is comparatively little loss of heat between the op-

erations. The wheel is then placed in coning dies which gives the approved conical form to the wheel. After the latter operation is performed, the wheel is placed in the quenching bath, preferably without reheating, and is rapidly cooled so that the temperature will decrease as nearly uniformly as possible throughout the mass. I preferably perform the quenching operation in a tank provided with rolls which are shaped to conform to the tread and flange of the wheel blank and so placed in the tank that the wheel is supported in a vertical position. The level of water contained in the tank is quickly raised to just cover a segment of the rim portion, preferably by means of the displacement block 13 which may be quickly raised or lowered by suitable means, such as a hoist, so that the level of the water may be quickly raised to cover the segment portion or lowered out of contact with the wheel. The roller 15 frictionally drives the wheel and is operably connected to a motor 16.

The wheel is spun very rapidly while the quenching medium, preferably water, is sprayed by means of the pipes 17 and 18 solely on the rim and hub portion of the wheel blank. The spinning is very rapid and throws off the water tangentially so that very little of the water contacts with the plate and the spinning is continued until the temperature of the rim portion is under the AC1 point of the critical range, but still retains a substantial amount of heat. The wheel is then quickly removed from the tank and immediately placed in a heating furnace of suitable construction, that is maintained at a temperature which is sufficient to hold the temperature of the wheel at some point below the AC1 point of the particular grade of material, but above the temperature at which the material passes through the brittle, blue heat zone. The wheel is held at this temperature until it is uniformly soaked, in order to relieve the material of strains which may have developed in the rolling and quenching operation, and then allowed to cool down to room temperature. In order to illustrate my invention and by way of example, a wheel blank weighing approximately 970 lbs. and made from material comprising .65 carbon and .7% manganese leaves the coning press at about 1700° F. and is spun in the quenching tank for about one minute until the rim portion is cooled to a point somewhat below the AC1 point, which for this particular composition is about 1300° F. but is still at a temperature of above about 600°, that is, above the temperature at which the metal passes through the brittle blue-heat zone; at a temperature preferably about 750° to 1000° F. It is obvious that in this quenching operation, as in quenching operations generally, the temperatures of the superficial portions of the wheel may drop much lower than that of the major mass of the metal. Obviously the temperatures which I refer to are not those of the superficial portions but those of the major mass of the wheel metal. The wheel is then immediately placed in a furnace having a temperature sufficient to hold the wheel at a temperature above the blue-heat zone, but below the AC1 point, preferably at about 800° F. to 1100° F., so as to equalize the material and relieve it of internal strains and it is then allowed to cool slowly to atmospheric temperature.

Of course, it should be understood that the above figures are only given by way of an example and that the temperatures may be varied depending upon the location of the presses relative to the tank and heating furnace, the equipment available for transporting the blank, the size and shape of the object, and the chemical properties of the material used in the manufacture of the wheels. By abstracting heat from the hub and rim portions of the wheel more rapidly than from the plate portion fractures are avoided and the presence of dangerous internal strains minimized; by placing the wheel in an equalizing furnace after this quenching operation but before the temperature has dropped to the blue heat zone dangerous internal strains are eliminated.

It will be seen from the foregoing description that I have devised a novel method of treating car wheels which increases the strength, ductility and wearing properties thereof; regulating the treatment of the wheel to prevent the development of internal strains, due to quenching, which are invariably present in the material of wheels treated by treatments heretofore used.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claim.

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

The method of treating a metallic object having thick and thin portions, comprising cooling rapidly from above to below the critical range by abstracting heat more rapidly from the thicker than from the thinner portions, equalizing at a temperature above the blue heat zone but below the critical range before the object has cooled below the blue heat zone, and cooling.

In testimony whereof I hereunto affix my signature this 27th day of January, 1926.

EDWARD F. KENNEY.