Dec. 17, 1935. E. G. TOUCEDA 2,024,615

FUSION INDICATING MEANS

Filed May 22, 1934

Fig. 1.

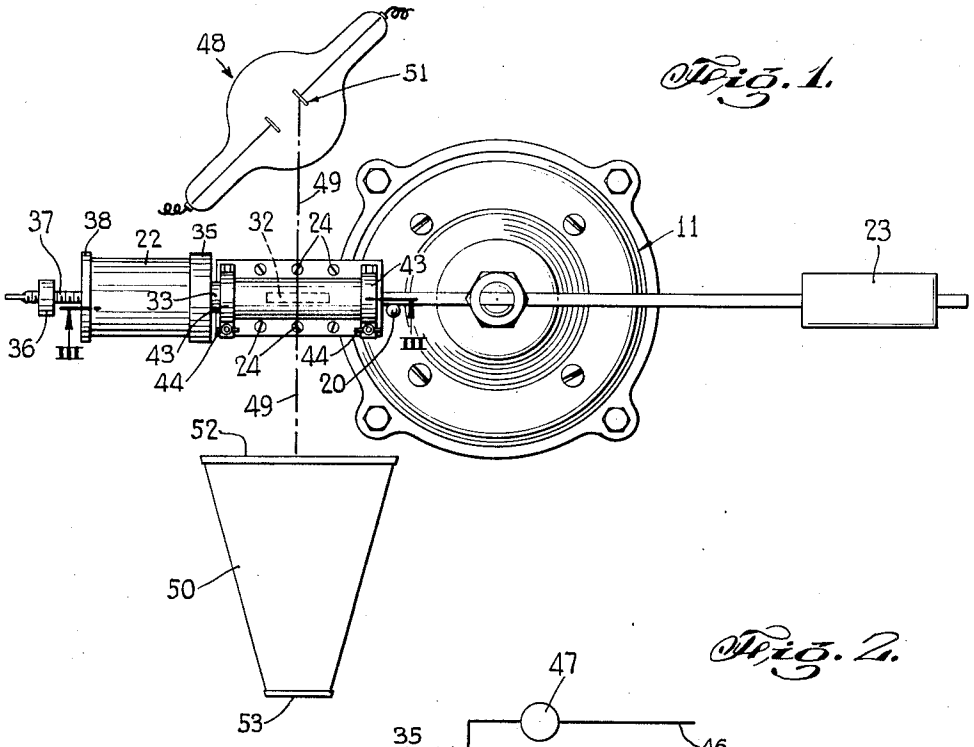


Fig. 2.

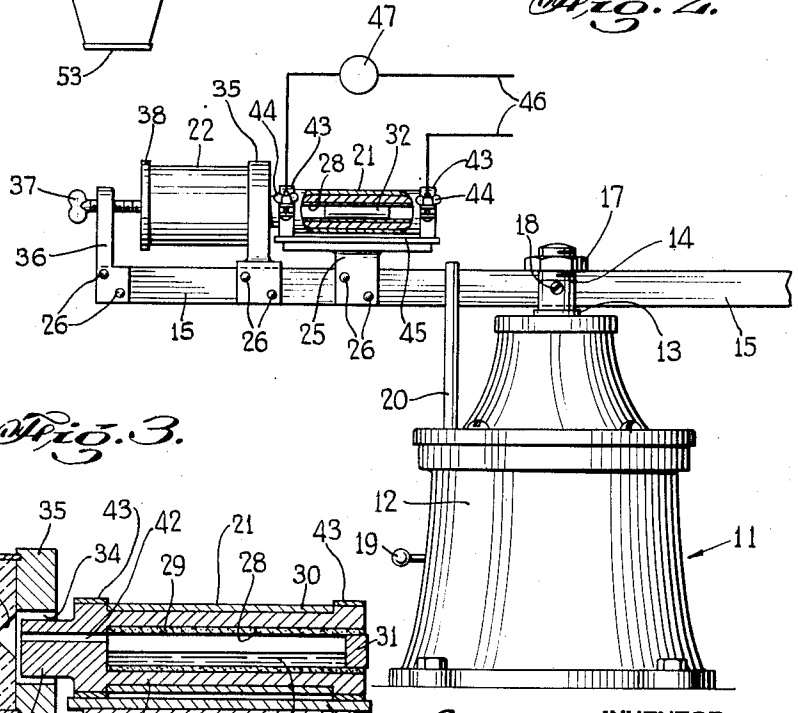
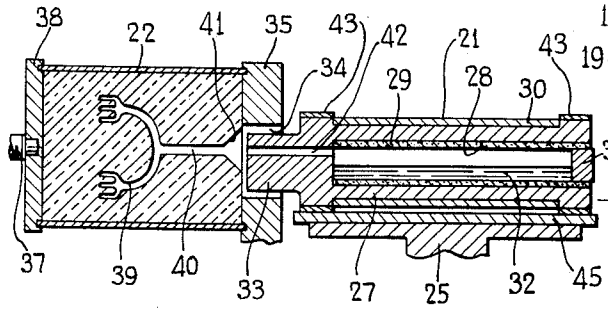


Fig. 3.



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FUSION INDICATING MEANS

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7 Claims. (Cl. 22—65.1)

This invention relates to metallurgy, especially to the casting of metals, and more especially to detection of the melting point of metals in course of fusion preparatory to the step of casting or molding.

A general object of the invention is to provide a method of, and means for, visualizing the change of shape or condition of a mass of metal or other material as it passes from a substantially solid stage to a substantially fluid stage, or at least a plastic stage, while being fused in an enclosure such as a furnace or crucible so closed as to prevent direct visual observation of the charge therein.

Another object of the invention is to provide cooperative radio-active means, such as a cathode or X-ray tube, and radio-responsive means, such as a fluoroscope, adapted to be so associated with an electrical furnace of the centrifugal type that a beam of rays originating with the cathode tube aforesaid, or from an equivalent electric generator of suitable rays, will be directed toward the fluorescent screen of such a fluoroscope, and impinge upon the furnace with its enclosed mass of metal, or other material relatively nonpermeable by the rays, placed in the path of the rays from source to screen, so that a spectral image of said mass will be formed, outside of the enclosure, and visible upon the screen in silhouette, and will furnish an indication of the incidence of fusion, and consequently of the readiness of the molten charge to be transferred to a suitable mold.

Instruments of the nature of thermometers or pyrometers do not furnish a direct indication that fusion has taken place, and the use of windows is impracticable at the high temperatures involved in many fusion operations, so that in conventional casting machines, particularly of the centrifugal type, it has been impossible heretofore to determine with accuracy the exact incidence of fusion, inasmuch as it is undesirable to open the furnace, in some fusion operations, even momentarily, while heated.

Aside from the mechanical difficulty of opening a hot furnace of this type for such a purpose, the fusion operation involves many variables, including such factors as different proportions of component metals, in the case of alloys; and/or adventitious variations of temperature, which are especially prevalent at the high critical temperatures necessary in many fusion operations; and the occlusion of unknown gases or gasifying reagents or other impurities may occur in the mass under treatment. Accordingly it has been found difficult and impracticable in many such operations to use a method of direct observation which involves so much trial and error.

Obviously when the furnace is opened, the temperature of the charge is likely to drop back rapidly below the "freezing" point, if it has already fused, so that the advantage of an accomplished fusion may be lost unnecessarily; and if it be opened more or less frequently, a great loss of heat and time ensues, with other disadvantages familiar to those skilled in metallurgy.

If the furnace be not opened, a degree of skill or intuition on the part of the operator is demanded which is seldom realized in practice, and the result is that casts are seldom made at the critical temperature, so that a cautious operator will play safe and use an excess of heat which is cumulatively more wasteful as soon as the high critical temperature is passed; while a less careful operator will encounter a larger number of failures in castings made with imperfectly fused "melts".

Accordingly, it is of primary importance to eliminate such casual and objectionable methods of detection or estimation of the condition of the charge, and this is accomplished by the novel method and apparatus herein disclosed.

Other objects and advantages will appear as the description of the particular physical embodiment selected to illustrate the invention progresses, and the novel features will be particularly pointed out in the appended claims.

In describing the invention in detail and the particular physical embodiment selected to illustrate the invention, reference will be had to the accompanying drawing and the several views thereon, in which like characters of reference designate like parts throughout the several views, and in which:

Figure 1 is a schematic plan view of apparatus in the construction of which the present invention has been embodied; Fig. 2 is a view in side elevation showing the centrifugal casting machine of Fig. 1 without the detecting means, and with the furnace partly broken away to reveal inner details of construction; and Fig. 3 is a fragmentary detail view on an enlarged scale of the furnace and associated casting box or flask, shown in vertical section on the plane of line III—III of Fig. 1, viewed in the direction indicated by the arrows at the ends of the line.

In the illustrative embodiment of the invention, the reference character 11 designates generally the base of a casting machine of the

centrifugal type, and more or less conventional form, comprising a casing 12 which encloses a suitable motor (not shown) adapted to rotate a vertical shaft or spindle 13. In the fork 14 of this spindle is mounted a horizontal bar 15 held firmly in fixed position by a nut 17 and a set screw 18, the action of the motor being controlled by a trip enclosed in a casing, with a hand lever 19 projecting from the casing and conveniently accessible to the operator.

A post 20 prevents swinging movement, until the proper moment, of the bar 15 on which are supported the furnace 21 and the associated casting box, mold or flask 22, a counter balance 23 (see Fig. 1) being provided at the other end of bar 15.

The furnace illustrated at 21 is of the electrically heated type, and is fixed by screws 24 upon a bracket 25 riveted to the bar 15 at 26. It comprises a cylindrical body member 27 of metal, having a cavity 28 which may be lined with a cylinder 29 formed of a suitable refractory material, such as alundum, and its exterior may, and preferably does, have a heat insulating jacket 30. At one end, as at 31, is provided a plug or closure which may be removed at will to permit introduction of the charge 32, indicated as a cylindrical mass ready to be fused.

The other end of the furnace body 29 preferably takes the form of an integral nozzle 33 projecting sufficiently to adapt it for entrance within a recess 34 in an upright 35 which serves as an abutment for the casting box or flask 22. This upright is secured to the bar 15 by rivets 26.

Another upright 36, also secured to the bar by rivets 26, carries a wing-headed thrust bolt 37 bearing against the head 38 of the flask, and the flask is shown as having a conventional mold 39 served by a channel 40 and funnel shaped mouth 41 adapted to be aligned with a channel 42 in the nozzle, through which the charge 32 may be discharged into the flask by centrifugal force after fusion and when the bar 15 is actuated by the motor in base 11.

In Figs. 1 and 2 the bar 15 is shown in the position in which fusion is to be accomplished before the bar is thrown around for the purpose of centrifugal discharge of the fluid mass from the furnace, this position being determined by the stop 20; and these figures show also the split straps 43 with wing nuts 44 by which the furnace is secured to its base 45, the latter being secured to bracket 25 by screws 24 as already described.

The wing nuts 44 serve also as terminals for convenient attachment of conductors 46 leading to a suitable source (not shown) of heating current, and this electrical circuit preferably includes a measuring instrument 47, to indicate the current strength.

In operation, when the current thus applied has heated the charge 32 to the critical fusion point, the charge assumes the position shown clearly in Fig. 3. The walls of the oven, of course, conceal the charge at all times.

In pursuance of the primary object of the invention, viz., to permit the operator to visualize this changed condition of the charge 32 which indicates that it has been fused and is ready for discharge to the flask, provision is made of suitable means 48 to project a radio active beam 49 through the furnace, and to receive said beam on a radio responsive means 50 in alignment therewith.

To this end, the radio active beam may be derived from any suitable source, such as the electrode 51 of a conventional or other suitable form of cathode ray or X-ray tube, 48, (energized from any suitable source of current (not shown), and any suitable radio responsive means may be used to receive the beam; as for example the fluoroscope 50, which is provided with a fluorescent screen 52, on which is projected, by the beam 49, the image of the charge 32, such projection producing a spectral image or silhouette which can be observed through the eyepiece 53 of the fluoroscope. It is to be understood that the showing of the tube 48 and fluoroscope 50 in Fig. 1 is schematic, and these detector members will be suitably mounted out of the path of bar 15.

It will be noted that the charge 32, as shown in its original condition in Figs. 1 and 2, is not only very perceptibly shorter than in its fused state shown in Fig. 3, but is also thicker, so that even if the material of a given charge should be somewhat more permeable by cathode rays than another material, still the careful observer can notice the very perceptible lengthening or change of shape of the shadow image projected by the fused charge 32 of Fig. 3, as compared with the original form of the charge in Figs. 1 and 2.

Therefore, as soon as the change occurs, the operator will know that the charge is fused, and he will at once throw the member 19 to cause the bar 15 to be swung around clockwise by motor in casing 11, which develops sufficient centrifugal force to drive the fused charge 32 through the nozzle channel 42 into the channel 40 and mold cavity 39 of flask 22, completing the casting operation swiftly and accurately.

Thus, there is no need for guessing nor uncertainty in the fusion operation nor in delivery of the product, and there is no need for opening the oven at any time, except to insert a fresh charge from time to time.

Although I have particularly described one particular physical embodiment of my invention and explained the operation, construction and principle thereof, nevertheless, I desire to have it understood that the form selected is merely illustrative, but does not exhaust the possible physical embodiments of the idea of means underlying my invention.

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

1. The method of fusing a solid and determining the incidence of fusion while said solid is inaccessible to direct visual observation, said method comprising the step of forming said solid into a blank having a characteristic contour; the step of fusing said solid blank in an enclosure preventing direct visual observation thereof but permitting change in said contour; and the step of forming a spectral image of said blank visible outside of said enclosure, and observing the changes in said spectral image accompanying the incidence of fusion.

2. The method of determining the incidence of fusion of a concealed solid during the operation of melting the same, said solid having a characteristic contour and a characteristic permeability with respect to a radio-active beam; said method comprising the step of fusing said solid under conditions preventing direct visual observation thereof but permitting change in said contour; and the step of forming a spectral image of said concealed solid throughout the operation of fusion, by projecting a radio-active

beam thereupon, and observing the changes in said spectral image accompanying the incidence of fusion.

3. The method of fusing a solid and molding the molten product, said method comprising the step of forming said solid into a blank having a characteristic contour with respect to a radioactive beam, the step of fusing said solid blank in an enclosure preventing direct visual observation thereof but permitting change in said contour, the step of forming by radio active means a spectral image of said blank visible outside of said enclosure, both prior and subsequent to fusion, and observing the changes in contour due to the incidence of fusion, and the step of molding the molten product immediately upon said incidence of fusion.

4. Apparatus for fusing solids comprising, in combination: means to enclose a solid blank in such a manner as to prevent direct visual observation thereof; means to fuse said solid blank while so enclosed; and means to form a spectral image of said blank visible outside of said enclosure to indicate the incidence of fusion.

5. A fusing and molding apparatus, comprising, in combination: means to enclose a solid blank in such a manner as to prevent direct visual observation thereof; means to fuse said solid blank while so enclosed; means to form a spectral image of said blank visible outside of said enclosure, to indicate the incidence of fusion; and means to mold the product of said fusion.

6. A fusing and molding machine of the class described, comprising in combination, an electric furnace adapted to fuse a solid blank enclosed therein while inaccessible to direct visual observation; means, connected with said furnace, to mold the fused product; means to form a spectral image of said blank visible outside of said enclosure, to indicate the incidence of fusion; means to actuate said furnace to transfer said product to said molding means by centrifugal force; and manually operable controlling means to initiate the operation of said actuating means.

7. Fusing apparatus comprising, in combination: means to enclose a solid blank in such a manner as to prevent direct visual observation thereof; means to fuse said solid while so enclosed; and means to form a spectral image of said blank visible outside of said enclosure, to indicate the incidence of fusion, said image forming means being characterized by a source of rays adapted to direct a beam thereof through said enclosure and blank and a fluorescent screen in the path of the emergent beam.

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