

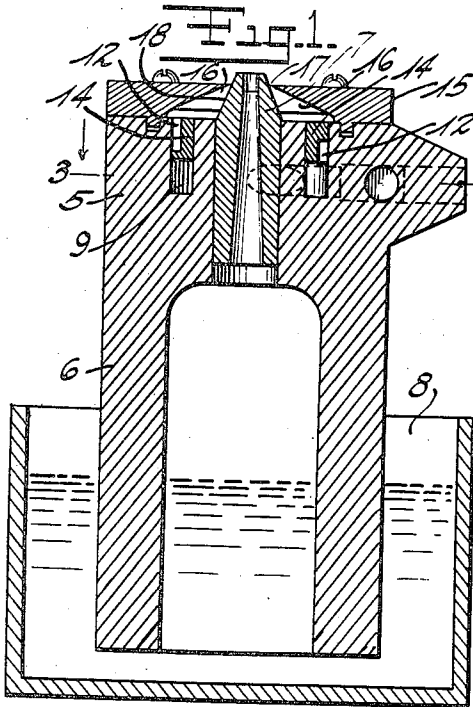
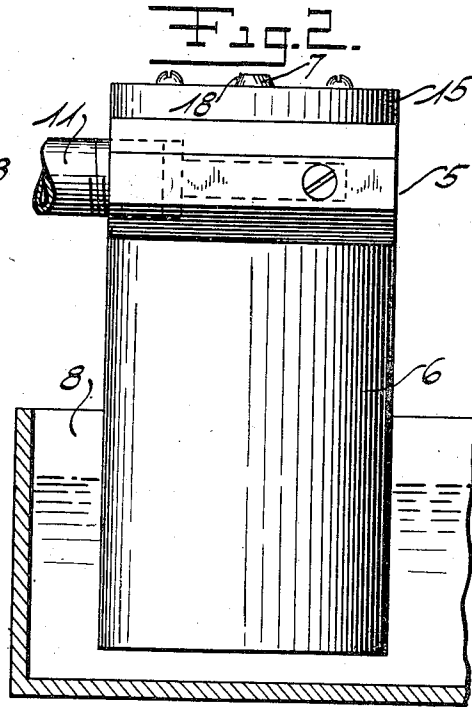
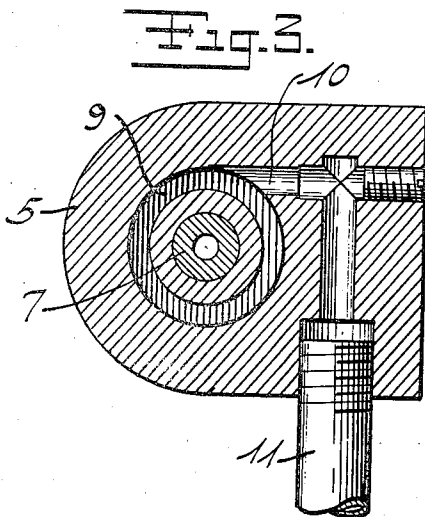
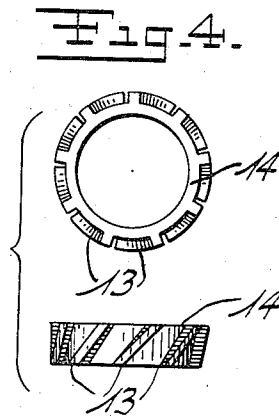
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E. J. HALL

METAL DISINTEGRATING APPARATUS

Original Filed Dec. 20, 1917



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METAL-DISINTEGRATING APPARATUS.

Application filed December 20, 1917, Serial No. 208,166. Renewed October 30, 1922. Serial No. 598,012.

To all whom it may concern:

Be it known that I, EVERETT J. HALL, a citizen of the United States, residing at Passaic, in the county of Passaic, and State of New Jersey, have invented certain new and useful Improvements in Metal-Disintegrating Apparatus, of which the following is a specification.

This invention has for its objects to provide simple and effective means for thoroughly disintegrating or reducing metal to finely divided condition, and for properly feeding the metal which is to be disintegrated.

Briefly stated, the invention comprises a nozzle for causing the feed of metal in a molten state, including means for directing a jet of steam or other disintegrating gas on converging lines into engagement with the molten metal issuing from the nozzle.

Another feature of the invention resides in the provision of means for imparting a rotary or whirling movement to the jet of disintegrating fluid.

Other features will appear as the specification proceeds.

I have illustrated in the accompanying drawing, a practical embodiment of the invention but would have it understood that changes and modifications may be made without departure from the true spirit and scope of the invention.

In this drawing, Figure 1 is a vertical sectional view of the apparatus; Figure 2 is a side view of the same looking at the right hand side of Figure 1; Figure 3 is a horizontal sectional view taken substantially on the plane of line 3—3 of Figure 1; Figure 4 is a representation in top and edge views of the jet rotating ring.

The apparatus, in the main, consists of a head or body member 5, having a dependent, preferably straight and vertical tubular extension 6, forming a supply conduit for the molten metal, this head carrying a preferably vertical discharge nozzle 7 for the molten metal, and carrying also the jet forming means.

Communication with a supply of molten metal is provided, in the illustration, by supporting the head with the supply conduit or neck thereof dipping into a tank or reservoir 8 containing molten metal. Also, in the illustration, the supply conduit is a relatively short straight passage and the nozzle is set

directly into the upper end of the passage with the bore therethrough forming a straight continuation of the supply passage. The heat of the molten metal in the tank, located as it is below, and around part of, the nozzle, is sufficient to keep the latter at the required temperature for most effective distintegration, and the relatively short vertical passage thus provided for the metal prevents undue cooling of the metal during its travel to the nozzle, and, by allowing the metal to drain back freely, prevents any clogging of the passage when the feeding of the metal is discontinued.

The metal feeding and disintegrating blast or jet is created in a chamber surrounding the nozzle and terminating in an annular discharge orifice about the axis of the nozzle. The innermost part of this chamber is designated 9, this being the part into which the steam or other disintegrating fluid is entered through a passage 10, which passage is preferably disposed tangentially as shown, to initially impart a whirling movement to the jet fluid. 11 designates the supply conduit for such fluid. A more thorough whirling movement is given the jet by causing it, as it issues from the forward end of this chamber, to flow through passages 12 inclined to the axis of the nozzle, these passages being herein provided by the inclined or helical vanes 13 on the periphery of a ring 14, set in the end of the chamber.

The outer end of the chamber is formed by a cap plate 16, applied over the ends of these helical passages, and having beveled walls 16, converging to a central opening 17, surrounding the tip portion of the nozzle and providing in connection therewith an annular discharge orifice for the jet, the end of the nozzle, as shown, extending appreciably beyond the outer surface of the cap. The tip portion of the nozzle is preferably beveled or tapered toward the discharge end thereof, as indicated at 18, to assist in converging the jet upon the stream of metal. The angle of this bevel affects the suction; the more acute the angle, the greater the suction, and the more obtuse the angle, the less the suction.

The effect of the blast of disintegrating gas directed on converging lines on all sides of the stream of molten metal is to disrupt the stream and reduce it practically to a powder, the blast tearing the metal apart as

fast as it appears at the mouth of the nozzle. The powdered or disintegrated metal is collected as fast as it forms, by suction means or other suitable collecting agency so as to prevent any accumulation at the nozzle. The bore of the nozzle is of a size to restrict the flow of metal to an amount that will be properly atomized or disintegrated by the flow of the blast or jet provided, but such bore is also made large enough to prevent clogging of the metal therein.

The whirling vortex produced by the means described provides sufficient suction to accomplish proper feeding of the metal and the operation therefore becomes entirely automatic upon the formation of the jet. It will be evident from this that by controlling the jet, and or the level of the molten metal in the supply tank, the production of the disintegrated metal may be controlled at will. That is, the suction and height of lift determine the amount of metal flowing, providing the metal passage of the nozzle is not less than a certain minimum, where friction must be considered. As the suction is dependent upon the amount of gas flowing, or pressure, and or upon the angle at which the blast strikes the metal stream, a drop in gas pressure means a correspondingly less amount of metal, thereby giving less capacity, but without impairment of quality, since the gas energy, though reduced, will still be ample for the disintegration of the reduced amount of metal. Thus I am enabled to use a nozzle with metal passage large enough to practically eliminate clogging; the size of the metal passage has, within limits, of course, nothing to do with the control of metal flow, but this control depends largely upon the height of the metal column (height of lift), and or the amount of disintegrating fluid flowing, or pressure, and or the angle at which the disintegrating blast strikes the metal stream. Less pressure of gas, or less suction, or a lower level of molten metal in the tank, means less metal at the nozzle; so that if the gas pressure fall, no more metal is lifted than may be effectively disintegrated; and assuming a constant gas pressure, the fineness of disintegration may be controlled by varying the height of metal in the tank. Or, assuming constant gas pressure, the control of feed as well as of fineness of disintegration, may be regulated by varying the angle at which the blast strikes the metal stream.

The whirling motion of the jet is of further benefit in assisting in the suction or feeding, as well as in the disintegrating action. It increases the degree of vacuum at the tip of the nozzle, thus promoting the feed of metal; and by reason of the centrifugal force generated, back pressure is prevented and disintegration much increased, so that I am able to produce dust of extra-

ordinary fineness and uniformity, and with a simple apparatus that requires but little attention in its operation, because of its automatic mutually compensating controls.

I claim:

1. Metal disintegrating apparatus comprising a tank for molten metal, a nozzle for the molten metal immediately above and dipping into the tank, and means for entirely surrounding the stream of metal issuing from said nozzle with an annular jet of disintegrating fluid directed on converging lines upon said stream of metal as it issues from the nozzle, whereby the metal is lifted from the tank to the nozzle and disintegrated.

2. Metal disintegrating apparatus comprising a tank for molten metal, a nozzle for the molten metal immediately above and dipping into the tank, and means for entirely surrounding the stream of metal issuing from said nozzle with a whirling annular jet of disintegrating fluid directed on converging lines upon said stream of metal as it issues from the nozzle, whereby the metal is lifted from the tank to the nozzle and disintegrated.

3. Metal disintegrating apparatus comprising a tank for molten metal, a nozzle for the molten metal located above and dipping into the tank, a jet chamber surrounding the nozzle short of the outer end thereof and open to discharge towards the outer end of the nozzle, and means at the discharge end of the chamber for imparting a whirling movement to the jet issuing therefrom, substantially as set forth.

4. Metal disintegrating apparatus comprising a tank for molten metal, a nozzle for the molten metal located above and dipping into the tank, a jet chamber surrounding the nozzle short of the outer end thereof and open towards the outer end of the nozzle, and a whirl-producing ring seated in the open end of the chamber and having inclined vanes on the periphery thereof establishing between them escape passages inclined to the axis of the nozzle, substantially as set forth.

5. Metal disintegrating apparatus comprising a tank for molten metal, a nozzle for the molten metal located above and dipping into the tank, a jet chamber surrounding the nozzle short of the outer end thereof and open to discharge towards the discharge end of the nozzle, and a fluid-supply conduit opening tangentially into said chamber.

6. Metal disintegrating apparatus comprising a tank for molten metal, a nozzle for the molten metal located above and dipping into the tank, a chamber having an annular discharge orifice surrounding the nozzle short of the tip portion thereof and having convergent walls for directing a flow of disintegrating fluid on converging lines to said orifice, and means for imparting a

whirling movement to the fluid prior to its passage through the orifice.

7. Metal disintegrating apparatus comprising a tank for molten metal, a nozzle for the molten metal located above and dipping into the tank, a jet chamber surrounding the nozzle short of the discharge end thereof and open toward the discharge end of the nozzle, and a whirl-producing ring seated in the open end of the chamber and having inclined vanes on the periphery thereof forming between them escape passages inclined to the axis of the nozzle, and an orifice member having an annular discharge orifice surrounding and below the tip portion of the nozzle and convergently inclined walls over the escape passages aforesaid.

8. Disintegrating apparatus for molten metal or the like material, comprising a tank for the material, a nozzle for the material, vertically disposed, and in communication with the tank, and means for entirely surrounding a stream of material as it issues from the nozzle with an annular jet of disintegrating fluid directed on converging lines upon the stream.

9. Disintegrating apparatus for molten metal or the like material, comprising a tank for the material, a nozzle for the material, vertically disposed, with its discharge end upward, and in communication with the tank, and means for entirely surrounding a

stream of material as it issues from the nozzle with an annular jet of disintegrating fluid directed on converging lines upon the stream.

10. Disintegrating apparatus for molten metal or the like material, comprising a tank for the material, a nozzle for the material immediately above and dipping into the tank, the nozzle being vertically disposed with its discharge end upward, and means for entirely surrounding a stream of material as it issues from the nozzle with an annular jet of disintegrating fluid directed on converging lines upon the stream.

11. The process of disintegrating metal or the like material which comprises striking a vertical stream of molten metal or like material simultaneously and equally on all sides thereof and on convergent angles with a rotating annular flow of disintegrating gas.

12. The process of disintegrating metal or the like material which comprises striking an upwardly directed vertical stream of molten metal or like material simultaneously and equally on all sides thereof and on convergent angles with a rotating annular flow of disintegrating gas.

In testimony whereof I affix my signature.

EVERETT J. HALL.