June 17, 1941. W. S. ENDERICH ET AL 2,245,578

APPARATUS FOR RAPIDLY COOLING BEARINGS AND THE LIKE

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FIG.1.

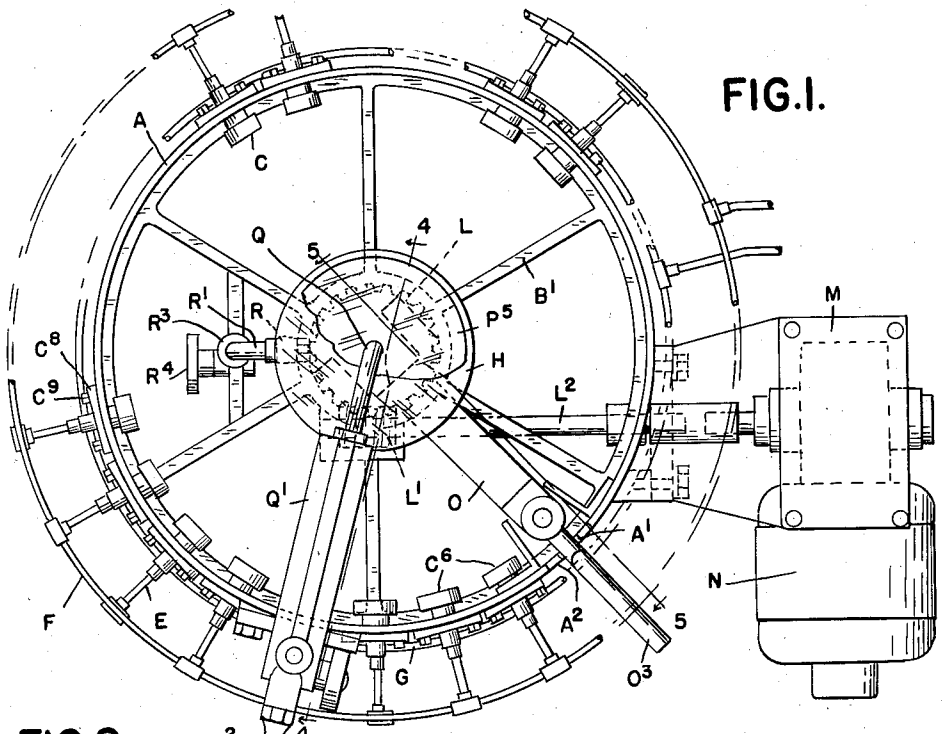
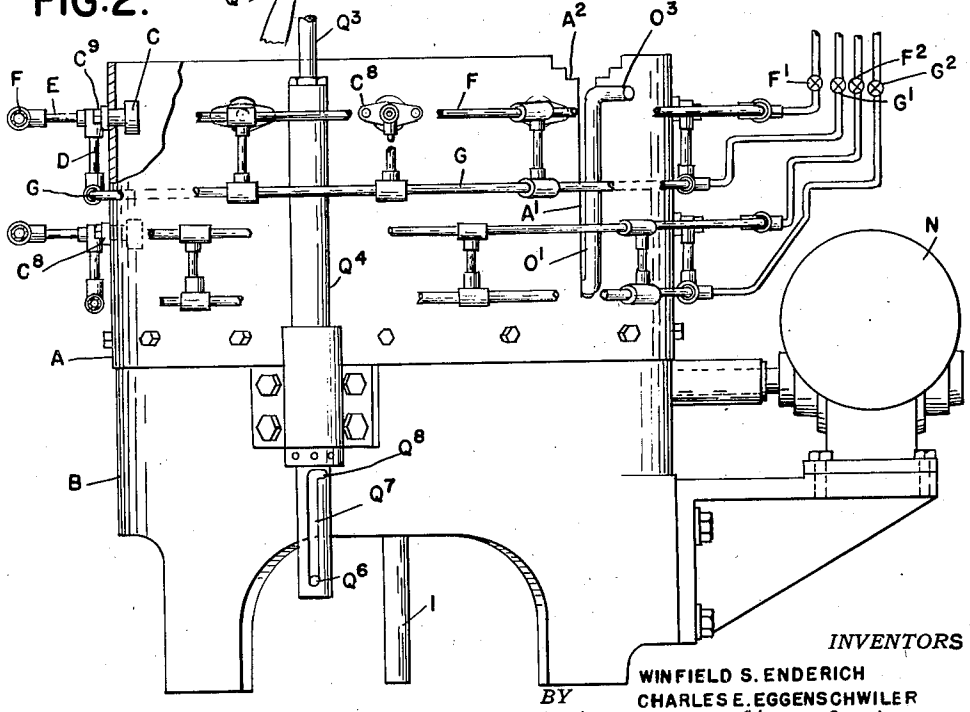


FIG.2.



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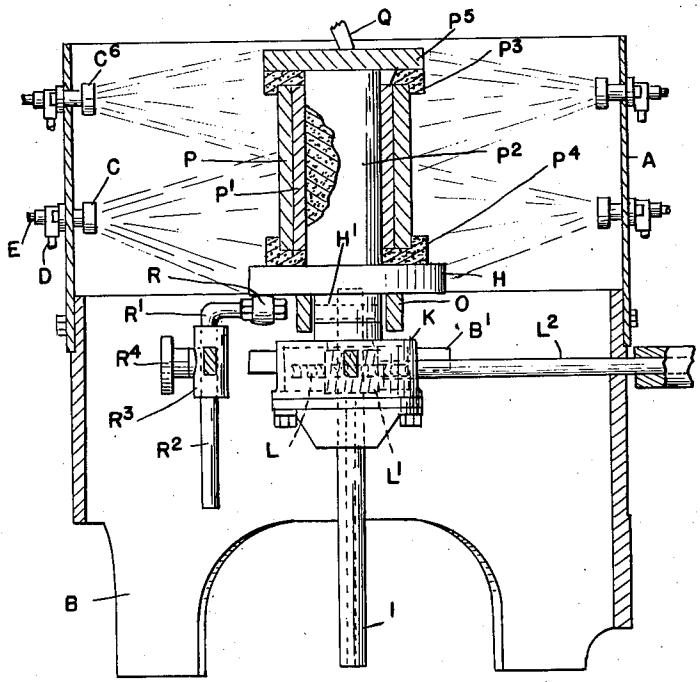


FIG.3.

FIG.7.

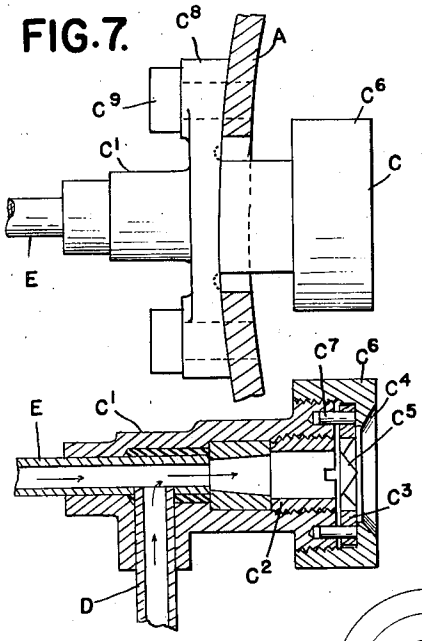
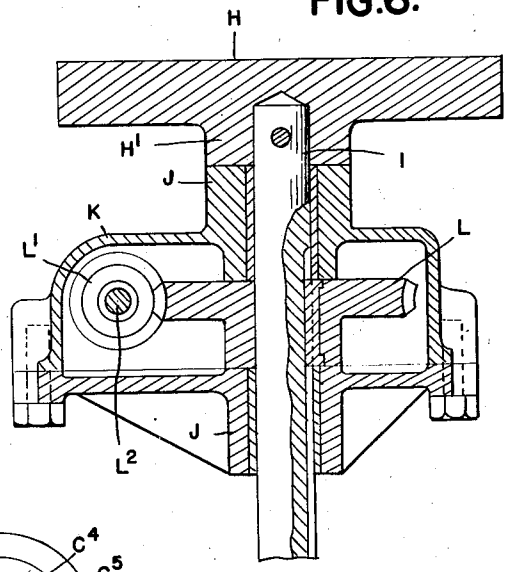


FIG.8.

FIG.6.



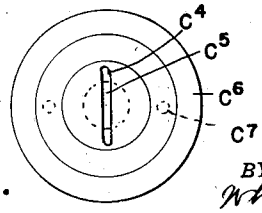


FIG.9.

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FIG.5.

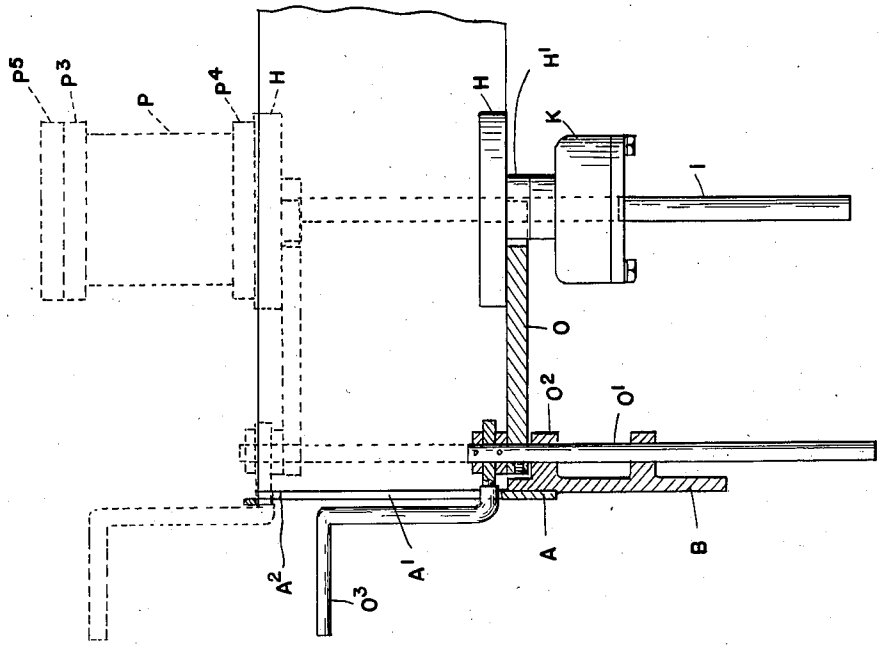
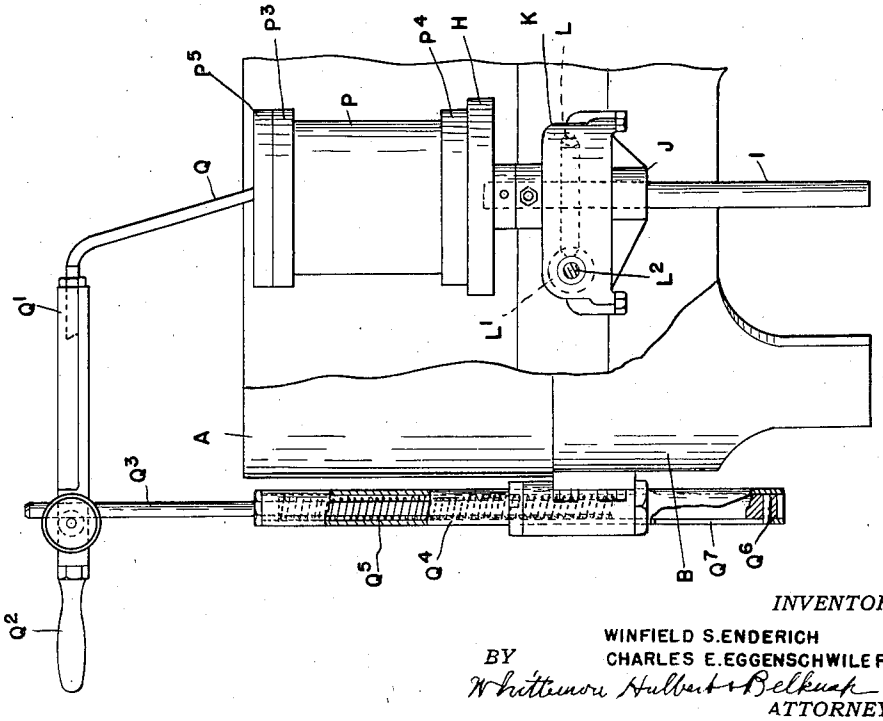


FIG.4.



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UNITED STATES PATENT OFFICE

2,245,578

APPARATUS FOR RAPIDLY COOLING BEARINGS AND THE LIKE

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Application March 4, 1940, Serial No. 322,258

5 Claims. (Cl. 266—6)

The invention relates to means for rapidly and uniformly chilling highly heated structures and has more particular reference to the manufacture of bearings. Certain alloys or mixtures of metal used in the manufacture of journal bearings can be greatly improved in physical characteristics by rapid solidification from a molten state. For instance, a molten mixture of copper and lead if permitted to gradually solidify, has very different physical characteristics from the same mixture if rapidly chilled. Also, where such metal mixtures are used for lining a supporting shell the whole structure is improved by rapid chilling from the exterior of the shell.

It is the object of the instant invention to reduce to the minimum the time required for complete chilling and it is a further object to obtain uniform chilling in all portions of the structure. With these objects in view, the invention consists, first, in the novel method, and second, in the apparatus as hereinafter set forth.

In the drawings:

Figure 1 is a plan view of the apparatus adapted for carrying out the improved method;

Figure 2 is a side elevation thereof;

Figure 3 is a vertical central section showing some of the parts in elevation;

Figure 4 is a sectional elevation on line 4—4 of Figure 1;

Figure 5 is a similar view on line 5—5 of Figure 1;

Figure 6 is a vertical central section through the vertically adjustable table and mechanism for rotating the same;

Figure 7 is an enlarged plan view of one of the jet nozzles;

Figure 8 is a vertical central section thereof;

Figure 9 is an end elevation.

Rapid chilling of articles is sometimes effected by immersing the same in water or other cooling liquid. When, however, the temperature of the article before immersion is relatively high in comparison with the boiling point of the liquid, this method is not very effective, for the reason that a vapor envelope is formed around the article which holds the liquid out of contact therewith. A much more effective method is by spraying the liquid against the surface of the article, but here there is danger that all portions of the surface may not be chilled at the same rate. With our improved apparatus a high degree of uniformity in chilling is obtained by the use of a circumferential series of closely spaced spray nozzles for directing jets radially inward against an article arranged at the center of the series. Each nozzle is constructed to form a thin fan-shaped jet in a plane extending axially of the article so as to cover all portions of the length thereof and where the spread of the jet is insufficient for the entire length, a plurality of circumferential series of jets may be employed. To further insure uniformity a relative rotation is imparted to the article and jets, preferably by supporting the article on a slowly revolving table coaxial with a series of stationary jets. This table is also preferably vertically movable so that it may be elevated above the jets into a position for instantaneously receiving the article when removed from the heating furnace and quickly lowering it into operative relation to the jets.

In detail, A is a cylindrical casing or shell supported on a suitable standard B and having mounted thereon the radially extending jet nozzles C. The latter are arranged in circumferential series and are connected by conduits D and E with circular conduits F and G, respectively for supplying water and air. As specifically shown, there are two such series surrounding the casing A; one arranged above the other.

Arranged axially within the casing A is a rotary table H which is mounted on the upper end of a shaft I vertically slidably engaging bearings J on a housing K. This housing is supported by a spider B' on the standard B and encloses a reduction gearing including a worm gear L and worm L'. The worm is mounted on a horizontally extending shaft L^2 which at its outer end enters a housing M for enclosing further reduction gearing (not shown). N is an electric motor or other driving means mounted adjacent to the housing M from which power is transmitted through the gearing and shaft L^2 to the worm L' and worm gear L. The shaft I is splined to the worm gear L so as to permit raising and lowering the table H while continuing to rotate the same. This raising and lowering is effected through the medium of a shifter member O forked at its inner end to embrace the hub H' of the table H, while its outer end is connected to a vertically slidable rod O' engaging bearings O^2 on the inner face of the standard B. A handle O^3 also connected to the rod O' extends outward through a vertically extending slot A' in the casing A. Thus, by lifting on this handle the table can be raised to the upper end of the casing where the work can be easily placed thereon. A step or shoulder A^2 at the upper end of the slot can be engaged with the handle to hold

the table in its raised position while the work is placed thereon.

The jet nozzles C may be of any suitable construction, but as specifically shown in Figure 8, C' is a casing having the conduit E connected axially thereof and the conduit D connected to extend transversely into communication with the conduit E. Within this casing C' is a bushing C^2 having a threaded engagement therewith so as to permit of axial adjustment. At the end of the nozzle is a disk C^3 having a vertically extending slot C^4 therein. This slot intersects a conical recess C^5 in the inner face of the disk which directs the stream of commingled water and air through the slot and in a fan-shaped jet. The disk C^3 is secured to the nozzle by a threaded cap member C^6, and pins C^7 on the disk engaging corresponding apertures in the casing C' serve to hold the disk with the slot C^4 in a vertical plane. Also, the cap C^6 is axially adjustable which in combination with the adjustable bushing C^2 permits of radially adjusting the nozzle. The casing C' is secured to the casing A by ears C^8 and bolts C^9, thereby supporting not only the nozzles, but also the conduits D, E, F and G. Valves F' and G' control the supply of air and water to the conduits F and G, and valves F^2 and G^2 similarly control the supply to the corresponding conduits of the second series.

Operation

The construction as above described, is adapted for the rapid chilling of a bearing, such as shown in Figure 3. This bearing comprises the outer shell P of steel or other relatively high fusing metal, a lining P' of molten bearing metal such as a copper lead mixture, a central core member P^2 preferably formed of graphite and end caps P^3 and P^4 for securing this core in proper relation to the shell. There is also a clamping plate P^5 at the upper end of the bearing. This structure is preheated to a temperature considerably higher than the melting point of the bearing metal, after which the molten bearing metal is poured into the cavity between the shell and the core. The latter operation may, if desired, be performed after the structure is placed on the table H in its raised position. The table is then lowered by means of the handle O^3; the motor N is energized to communicate rotary motion, and the valves F', F^2, G', and G^2 opened to supply water and air to the jets.

To hold the structure in place during the cooling operation, we preferably provide a clamping means comprising the plate P^5 placed above the cap member P^3, and a clamping finger Q. The latter is specifically shown in Figure 4 and depends from a radially extending arm Q' provided at its outer end with a handle Q^2 and mounted on a vertical rod Q^3 slidably engaging a tubular housing Q^4 mounted on the supporting standard B. A coil spring Q^5 sleeved upon the rod Q^3 within the tubular housing Q^4 bearing at its upper end against said housing and its lower end on a shoulder on said rod, serves to resiliently draw the rod in a downward direction. However, by means of the handle Q^2 the rod may be raised or lowered. A pin Q^6 projects from the lower end of said rod through a slot Q^7 in the tubular housing, which slot at its upper end is laterally offset to form a shoulder Q^8 on which the pin Q^6 can rest. This permits of first raising the rod together with the arm Q' and finger Q, and then swinging it laterally out of the path of the table L, when the latter is raised or lowered. Thus, during the placing of the bearing on the table and the pouring of the molten metal, the finger Q is out of the way, but after the table is lowered the handle Q^2 may be operated to lower the parts and to arrest the finger Q at the center of the clamping plate P^5. This will hold the work in place during the rotation of the table and the cooling of the external surface of the shell through the impinging jets of air and water.

Bearings as above described are of different lengths so as to require differently positioning the table during the cooling operation. This we accomplish by a supporting roller bearing R which is mounted on a laterally extending arm R' having a vertically extending shank R^2 passing through a stationary bearing R^3 supported on the spider B' and vertically adjustably secured therein by a set screw R^4. Where the bearing to be chilled is relatively short, the shank R^2 is raised in the bearing R^3 and clamped by the set screw R^4 so that the roller R will support the table in this raised position. Thus, the most favorable adjustment with respect to the spray jets may be obtained.

What we claim as our invention is:

1. The combination with an annular casing, of a circumferential series of radially inwardly directed jet nozzles mounted on said casing, each nozzle being adapted to form a thin fan-shaped jet in an axial plane, and means at the center of said casing for supporting and relatively rotating work to be chilled, said jets impinging upon closely spaced parallel lines in the surface of the work and extending throughout the length thereof.

2. The combination with an annular casing, of a circumferential series of radially inwardly directed jet nozzles mounted on said casing in substantially equispaced relation to each other, means for supplying air and water to said nozzles, the latter being adapted to form thin fan-shaped jets in axial planes, and means at the center of said casing for supporting and relatively rotating work to be chilled, said jets impinging upon closely spaced parallel lines in the surface of the work and extending throughout the length thereof.

3. The combination with an annular casing, of a circumferential series of substantially equispaced radially inwardly directed jet nozzles, means for supplying air and water to said nozzles, the latter being adapted to form thin fan-shaped jets in axial planes, a table located at the center of said casing and vertically adjustable to receive the work above said casing and to lower it within the same, and means for rotating said table relative to said casing, said jets impinging upon closely spaced parallel lines in the surface of the work and extending throughout the length thereof.

4. The combination with an annular casing, of a circumferential series of radially inwardly directed jet nozzles mounted on said casing, means for supplying air and water to said nozzles, the latter being adapted to form thin fan-shaped jets in axial planes, a rotary work supporting table located at the center of said casing, means outside said casing for raising and lowering said table, and means for rotating said table relative to said casing, said jets impinging upon closely spaced parallel lines in the surface of the work and extending throughout the length thereof.

5. The combination with an annular casing, of a circumferential series of radially inwardly

directed jet nozzles mounted on said casing, means for supplying air and water to said nozzles, the latter being adapted to form thin fan-shaped jets in axial planes, a rotary work supporting table located at the center of said casing, means outside said casing for raising and lowering said table, means for rotating said table relative to said casing, and means for clamping the work upon said table during the rotation thereof, said jets impinging upon closely spaced parallel lines in the surface of the work and extending throughout the length thereof.

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