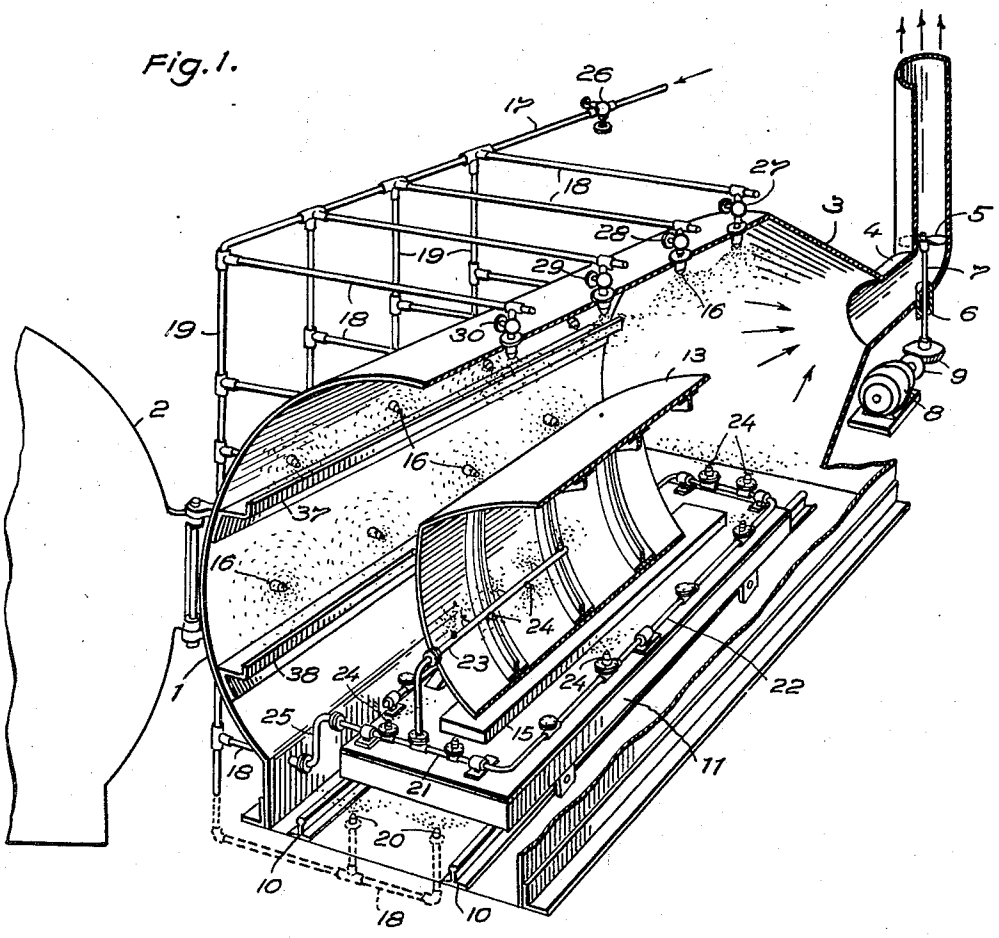
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COOLING SYSTEM

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Fig. 1.



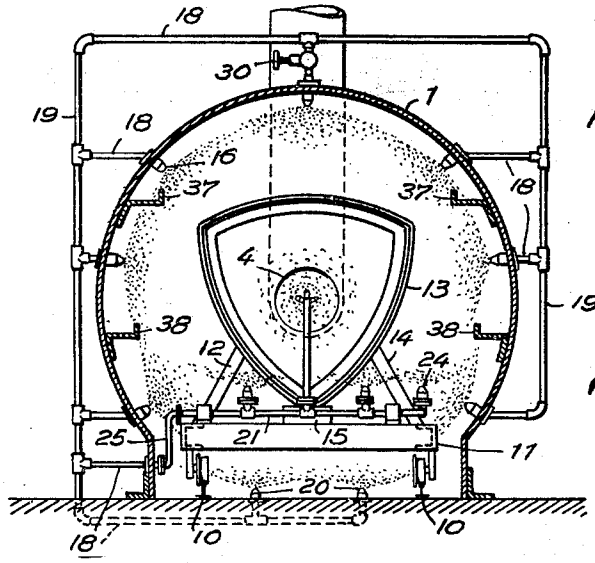


Fig. 2.

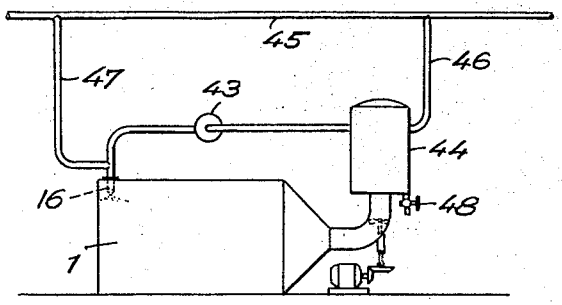
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COOLING SYSTEM

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Fig.5.



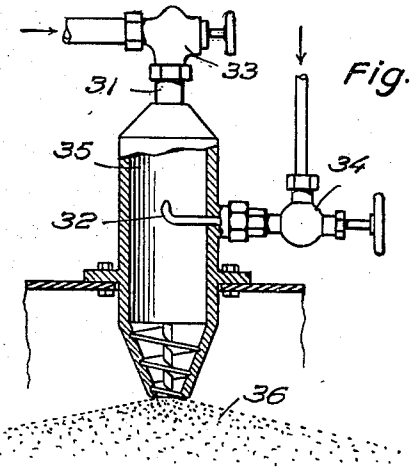


Fig.3.

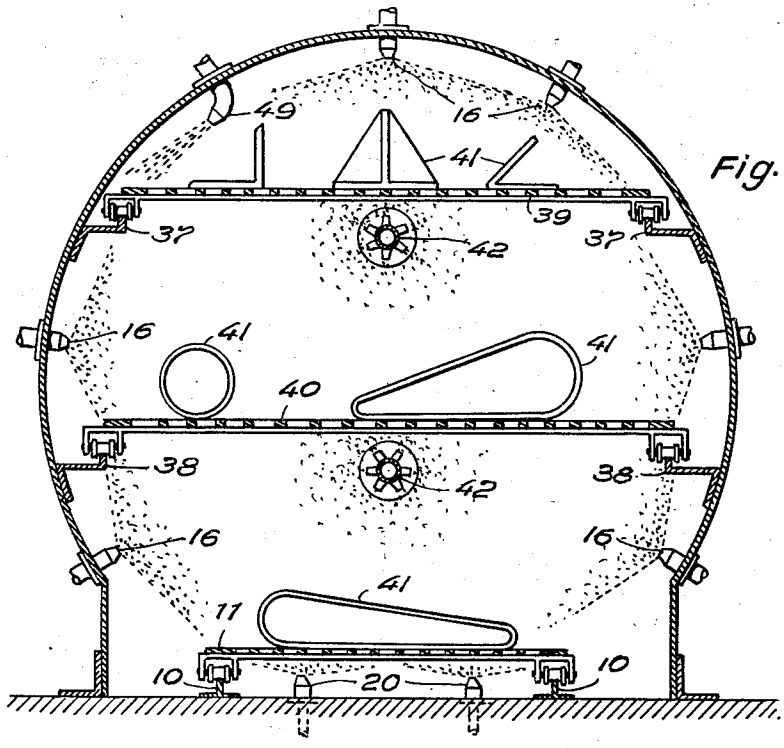


Fig.4.

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UNITED STATES PATENT OFFICE

2,305,811

COOLING SYSTEM

Otto Oeckl, Berlin-Schoneberg, Germany; vested in the Alien Property Custodian

Application June 13, 1939, Serial No. 278,961
In Germany June 17, 1938

3 Claims. (Cl. 266—6)

This invention relates to apparatus for the heat treatment or thermal refinement of light metal work pieces. The mechanical strength of various light metal alloys, such as that known as "Duralumin" can be enhanced by a special heat treating or tempering process which must be applied to the work piece after the same has obtained its final shape. The said thermal refinement consists of a heat treatment and a subsequent rapid cooling or quenching. The temperatures and treating periods must be accommodated to the special properties of the material and the kind of working to which the work piece has been subjected. For best results regarding the increase of the strength of the material the same should be cooled down as quickly as possible. The constructional parts used in the construction of aircrafts in view of their complicated shape and long working periods oftentimes require a repeated annealing and cooling treatment of the material.

It is an object of the present invention to provide means for carrying out the cooling operation in a manner to ensure optimum conditions with respect to the structure, shape and dimensions of the work piece.

A special object of the invention is to avoid the use of a cooling bath which would cause corrosion of the work piece and to cool the work piece very uniformly so as to avoid detrimental mechanical stresses and deformation of the work piece.

With these and further objects in view, as may become apparent from the within disclosures, the invention consists not only in the structures herein pointed out and illustrated by the drawings, but includes further structures coming within the scope of what hereinafter may be claimed.

The character of the invention, however, may be best understood by reference to certain of its structural forms, as illustrated by the accompanying drawings in which—

Fig. 1 is a perspective, sectional view of a cooling chamber adapted for carrying out the invention.

Fig. 2 is a cross section of the cooling chamber shown in Fig. 1.

Fig. 3 is an axial section of a nozzle for use in said cooling chamber.

Fig. 4 is a similar cross section as Fig. 2, showing the cooling chamber equipped for the cooling of small work-pieces.

Fig. 5 is a working diagram of a cooling system having the invention applied thereto.

Similar reference numerals denote similar parts in the different views.

As here shown, I enclose the annealed articles in a quenching chamber which is filled with a gaseous fluid and I produce around the article a substantially homogeneous and slowly moving cloud of a quenching fluid by exhausting the gaseous fluid from the chamber and feeding simultaneously fresh quenching fluid to said cloud in such a manner that said fresh quenching fluid is prevented from directly impinging upon said articles in the form of a cold stream. In this manner, the whole work piece or pieces are uniformly and homogeneously cooled and deformation or warping or structural tensions in the work piece are avoided. It is thus possible to produce very complicated parts by pressing, stretching or bending in a single operation, because subsequent working of the work piece is no more required. The work piece may be of any desired size, and assembled airplane parts, for example, tail plane surfaces, body parts etc. may be made of soft sheet metal and soft rivets and refined in their finished shape.

The cooling fluid may be supplied through nozzles in the walls of the cooling chamber and, additionally, supply means may be provided centrally in the chamber, for instance, for the cooling of hollow bodies from the interior and exterior side.

According to a special feature of the invention, separate control means may be provided for the various nozzles so as to provide a different supply of the cooling fluid at the various points of the work piece in accordance with the different wall thicknesses, shape or other features which may require different cooling action at the respective points. Also, the exhaust can be provided with regulating means.

As here shown, a single cooling chamber may be used for quenching any work pieces of different size and shape. To this end, a great number of supply nozzles are uniformly distributed on the cylindrical walls of the chamber and additional supporting means may be inserted in the chamber for supporting additional supply nozzles and/or for carrying smaller work pieces.

Referring now to the drawings in greater detail, and first to Figs. 1 and 2, it will be seen that a substantially cylindrical cooling chamber 1 is provided with a hinged front cover 2 and a fixed conical end cover 3 which terminates in an exhaust pipe 4 in a bend of which an exhaustor 5 is rotatably mounted by a bearing bush 6 through which the exhaustor shaft 7 extends.

The shaft 7 is driven from the motor 8, through a bevel gear 9. A work piece 13 which may be a body of an airplane is placed on a platform car 11 on rails 10 and held thereon in position by means of stays 12 and 14 and a strip 15. Radially mounted in the cylindrical shell 1 of the chamber are feed nozzles 16 communicating with a feed pipe system 17, 18, 19. Further feed nozzles 20 are provided in the floor and communicate with the same pipe system. Moreover, a pipe system 21, 22, 23 on the platform car, carrying nozzles 24 in a predetermined relationship within and around the work piece, can be coupled with said feed pipe system, by a flexible pipe or coupling hose 25. Control valves 26, 27, 28, 29, 30 permit individual adjustment of the quantity of the cooling fluid or fluids supplied to each nozzle so as to adapt the cooling action of the various nozzles to the special requirements of the different portions of the work piece. For example, portions of a greater wall thickness will require a more intensive cooling action than portions of a smaller wall thickness in order to ensure a uniform cooling of the whole work piece without structural tensions.

The nozzles may be of any suitable construction to permit atomising of the cooling fluid as it leaves the nozzle and to form a substantially homogeneous cloud of the cooling fluid around the work piece. Advantageously the nozzles are provided to permit the discharge of a mixture of two or more different cooling fluids, for instance, air and water, as will hereafter be described.

A type of nozzle which is suitable for the said purpose is illustrated by way of example in Fig. 3, from which it will be noted that two separate passages 31, 32 which can be controlled separately by control valves 33 and 34, serve for the supply of compressed air and water to the chamber 35 in which the air and water streams are mixed with each other; the mixture leaving said chamber 35 is atomised to form a cloud of air and water vapour 36, without forming a jet or sharply defined current of cooling fluid in the axial direction of the nozzle or in the radial direction of the chamber which might impinge upon the work piece directly and cause excessive cooling of any small regions of the work piece.

It will be noted from Figs. 1 and 2 that angle rails 37 and 38 are secured to the sides of the chamber 1. Said angle rails may serve to carry additional platform cars 39 and 40, as shown in Fig. 4, for the reception of smaller work pieces 41. Supply pipes 42 for the cooling fluid may be secured to these cars if desired. Additional pipes 42 can be attached to suction devices in the case of different work piece shapes; in any case, with such additional pipes, the distribution and the movement of cooling agent can be affected as desired and adjusted to the requirements of the work pieces.

Where feed nozzles are used which produce a more or less sharply defined jet or current, the same will be directed tangentially with respect to the cylindrical chamber, e. g., as indicated at 43 in Fig. 4, so as to avoid any direct contact of the said cold jet with the work piece.

Referring to Fig. 5, it will be seen that the gaseous cooling fluid which has been supplied to the cooling chamber 1 from a compressor 43, through the nozzles 16, after its discharge through the exhaust pipe 4 is recooled by passage through a recooling apparatus 44 to which cooling water may be supplied from a main water pipe 45 through a duct 46, and then recycled by the compressor 43. A pipe 47 communicating with the same water pipe 45 may feed fresh cooling water to the nozzle as illustrated. The water may be separated from the air in the recooling apparatus and drawn off by a tap 48.

It will thus be seen that the work piece or work pieces are enclosed in a substantially homogeneous and uniform cloud of the cooling fluid which proceeds slowly to the exhaust, along the walls of the work piece, without causing any excessive cooling action at the points where the fresh cooling fluid enters through the nozzles, so that the work pieces are cooled rapidly but uniformly, and warping or deformation or structural tensions of the work pieces are avoided.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention.

I claim:

1. In a cooling system for quenching annealed articles formed of light metal, especially annealed articles stamped or drawn from sheets of light metal, of the type including a closed cooling chamber, means for supporting the annealed articles at locations adjacent the center of said chamber, and an exhaust port adjacent one end of said chamber, the combination of a plurality of diffusing nozzles disposed in spaced relation about the walls of said chamber on opposite sides of the central portion of the latter and adapted to discharge into the peripheral zone only of said chamber an aeroform quenching fluid free from liquid components, means for supplying a quenching fluid component, under pressure, to said nozzles, and means in cooperation with said exhaust port for slowly moving said quenching atmosphere from said peripheral zone over the supported annealed articles and to said exhaust port as fresh quenching atmosphere is formed in the peripheral zone of said chamber, said atmosphere-moving means and said nozzles cooperating to surround the supported annealed articles substantially on all sides with a slowly moving, homogeneous and uniform, quenching atmosphere consisting of said aeroform quenching fluid.

2. In a cooling system for quenching annealed articles formed of light metal, especially annealed articles stamped or drawn from sheets of light metal, of the type including a closed cooling chamber, means for supporting the annealed articles at locations adjacent the center of said chamber, and an exhaust port adjacent one end of said chamber, the combination of a plurality of diffusing nozzles disposed in spaced relation about the walls of said chamber on opposite sides of the central portion of the latter and adapted to discharge into the peripheral zone only of said chamber an aeroform quenching fluid free from liquid components, means for supplying a vaporizable liquid and cold gaseous fluid, under pressure, to said nozzles, and means in cooperation with said exhaust port for slowly moving said quenching atmosphere from said peripheral zone over the supported annealed articles and to said exhaust port as fresh quenching atmosphere is formed in the peripheral zone of said chamber, said atmosphere-moving means and said nozzles cooperating to surround the supported annealed articles substantially on all sides with a slowly moving, homogeneous and uniform, quenching atmosphere consisting of said aeroform quenching fluid.

3. In a cooling system for quenching annealed

articles formed of light metal, especially annealed articles stamped or drawn from sheets of light metal, of the type including a closed cooling chamber, means for supporting the annealed articles at locations adjacent the center of said chamber, and an exhaust port adjacent one end of said chamber, the combination of a plurality of diffusing nozzles disposed in spaced relation about the walls of said chamber on opposite sides of the central portion of the latter and adapted to discharge into the peripheral zone only of said chamber an aeroform quenching fluid free from liquid components, means for supplying a quenching fluid component, under pressure, to said nozzles, means for separately controlling the discharges through said nozzles, and means in cooperation with said exhaust port for slowly moving said quenching atmosphere from said peripheral zone over the supported annealed articles and to said exhaust port as fresh quenching atmosphere is formed in the peripheral zone of said chamber, said atmosphere-moving means and said nozzles cooperating to surround the supported annealed articles substantially on all sides with a slowly moving, homogeneous and uniform, quenching atmosphere consisting of said aeroform quenching fluid.

OTTO OECKL.