March 19, 1946. W. L. CARSON 2,396,940

CONTROLLED CHILLING OF PRECISION METAL PARTS

Filed June 29, 1942 2 Sheets-Sheet 1

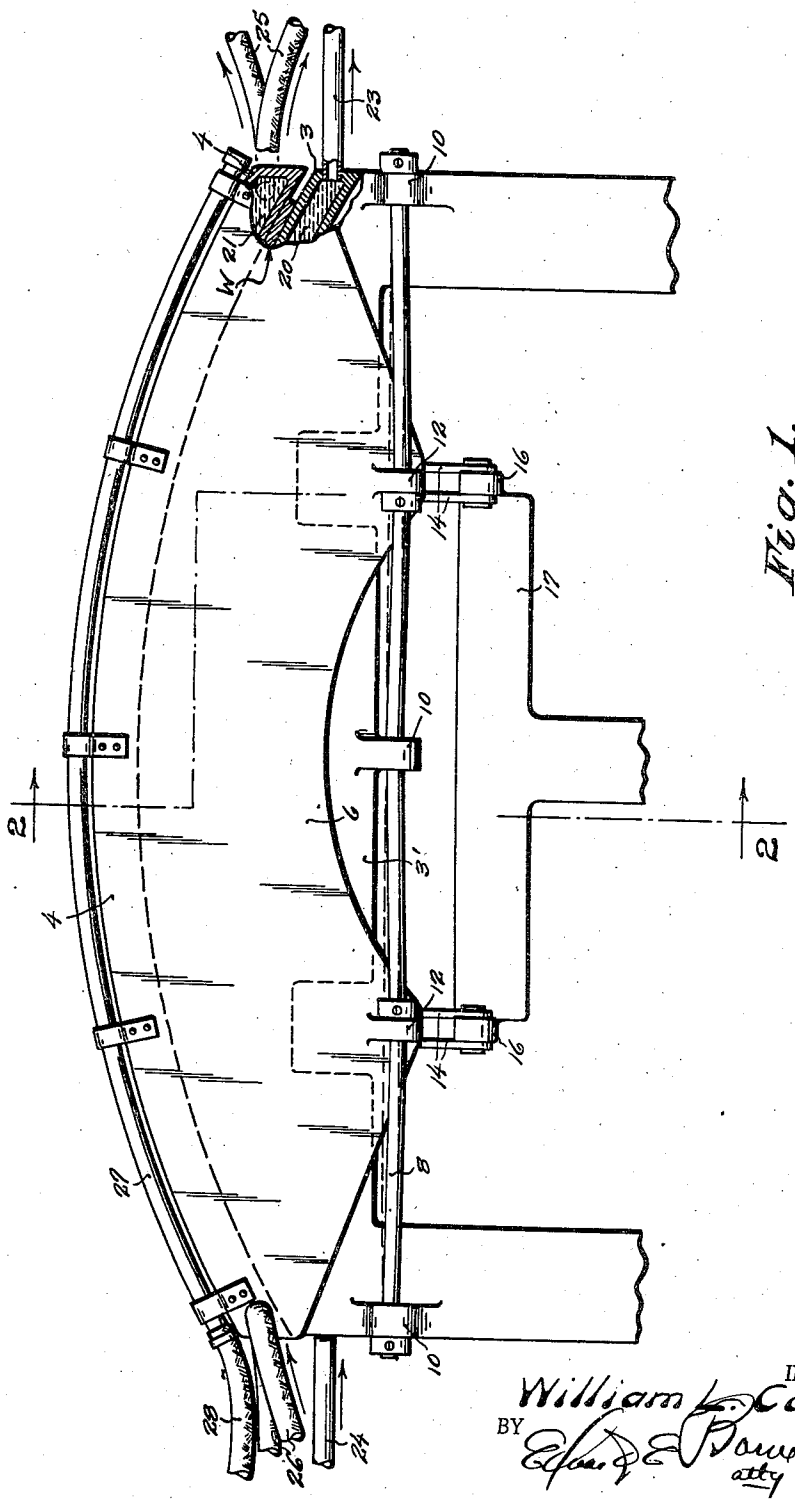


Fig. 1.

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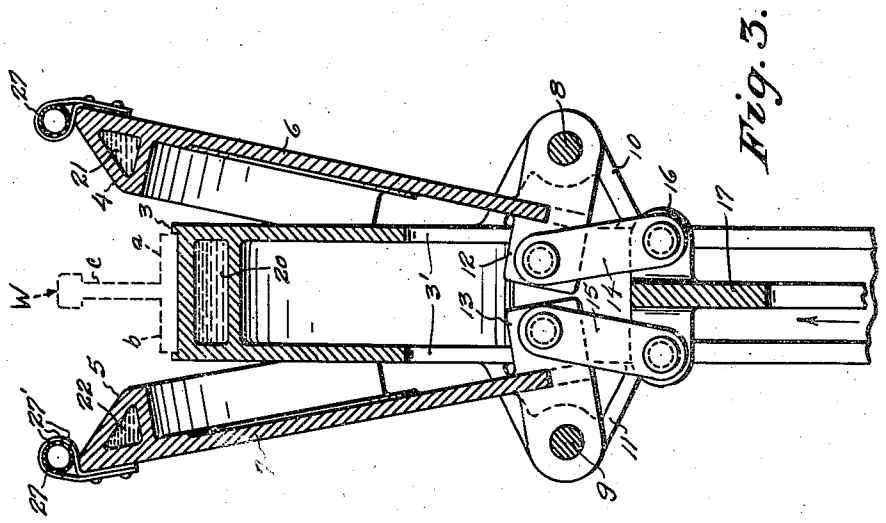


Fig. 3.

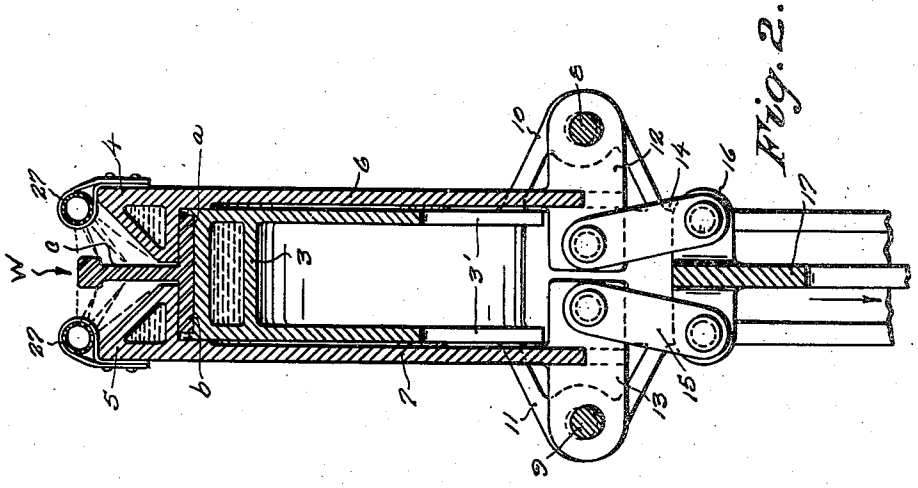


Fig. 2.

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CONTROLLED CHILLING OF PRECISION METAL PARTS

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6 Claims. (Cl. 266—6)

This invention relates to the production of precision metal parts requiring surface hardness, and resides in the novel treatment of the part which, after being forged or otherwise formed to shape, is first rough-machined, then heated and subjected to a rapid chill while restrained against distortion, and finally given a finish grinding. The invention resides further in a perfected mold or die for accomplishing the chilling step.

Looking, therefore, to a treatment of metal forgings requiring precision surfaces and which will permit large-scale production, the invention consists in the perfected process and in the construction, adaptation and combination of parts embodied in a novel mold characterized by a clamping function and which operates to carry the essential chilling step of the treatment into effect, all of which will be hereinafter fully described and claimed.

In the accompanying drawings:

Figure 1 is a side elevational view of a chilling mold constructed in accordance with the preferred embodiment of the present invention, and showing fragmentarily the supporting standards for the machine frame, the water-circulating and air-supply lines, and the operating bar which transmits clamping pressure to a work-piece received within the mold.

Fig. 2 is a transverse vertical section thereof taken to an enlarged scale on line 2—2 of Fig. 1; and

Fig. 3 is a transverse vertical section showing the mold in open position.

It will of course be understood that the invention is in no sense limited to any specific design of work-piece, and that a functional counterpart of the machine illustrated in the drawings could, without invention, be readily engineered to accommodate a differently designed metal part. By way of exemplifying a precision part which lends itself to a fast-chilling within a mold embodying the teachings of the present invention, I have selected a work-piece as indicated by the letter W and which is produced to a T-form considered in transverse vertical section and has a quadrantal configuration in side elevation. This particular work-piece is one which finds usage as a track-way in the construction of bomber planes with the track being described by the two facing surfaces which lie at opposite sides of the T wings.

There is no novelty inherent to performing, upon a part which has been formed to shape, the initial step of rough-machining and then heating the part followed by a subjection of the same to a chill operation, with a final finish-grinding of the precision surface or surfaces. The treatment of a precision part by this process has been long practiced, and substantially the only objection to the operation has been the extended period of time required in bringing the heated part to atmospheric temperature for the final precision-grinding, this from the fact that a slow chilling has been deemed necessary to preclude distortion. It can be readily appreciated that this objection would be normally of far less import than it is during the present emergency, but it now becomes a matter of necessity to expedite the production schedule on any part used in the war effort. The present invention accomplishes the very desirable end of appreciably reducing the period of time required for the distortion-free production of such a precision part as I have described, and it is in the chilling step that the time saving is attained.

Describing, therefore, the structure which I have illustrated for performing this fast-chilling of a precision part, there is provided a mold assembly—as well termed a die—comprised of a foundation block 3 complemented by paired clamping jaws 4 and 5, the block being stationary and functioning as the floor or bottom wall of a mold cavity of which the clamping jaws act as the top and sides. Such cavity corresponds in shape to the wing principals *a* and *b* of the work-piece, these being the parts whose surfaces are to be precision-ground, and there is provided a longitudinally extending median slot in the top wall of the mold—defined between the two jaws—which accommodates the projection therethrough of the web element *c* of the work-piece.

The said jaws, for lateral swinging movements into and from work-clamping positions, are each an integral part of a respective cheek plate, as 6 and 7, which lie at opposite sides of the foundation block, and each such plate finds a hinge mounting upon a related hinge pin, as 8 and 9, which extends longitudinally of the foundation block and is supported by mounting lugs 10 and 11, respectively, integral with leg dependencies 3' of the block. For the purpose of permitting the hinge pins to be sprung slightly by application of pressure upon the clamping jaws at the extreme of their closing movements, and which will be explained hereinafter in the course of describing the operation of the mold, the mounting lugs 10 and 11 for the hinge pins lie in distal relation to cross-arms 12 and 13 which provide the connection to the cheek plates. These cross-arms are spaced longitudinally upon each of the plates

and provide outer extensions for engagement with the related hinge pin, while connecting by inner extensions with drop-links 14 and 15 which in turn connect with actuating cross-arms 16 fixedly supported upon a longitudinal operating bar 17 reciprocally operated through a vertical path of movement from a suitable source of power, the travel of the bar in its mold-opening movement being sufficient to retract the jaws laterally beyond the side limits of the foundation block for permitting a straight-draw feed of the work-pieces into and from the mold cavity.

Salient to both the foundation block and the clamping jaws is a cavitary construction thereof to describe water-jackets as indicated at 20, 21 and 22, and each said jacket is tapped at the two ends for the reception of nipples or other suitable fittings accommodating water-circulating pipes 23—24 to and from the stationary block, and flexible hoses 25—26 to and from the movable jaws. There is additionally provided upon each of the movable jaws a pipe 27 having connection through a flexible hose 28 with a pressure source of cooling air, and formed in such pipes 27 are foramina 27' through which the pressure air is discharged in a multiplicity of jets over the surfaces of the protruding web *c* of the work-piece.

In closing the jaws 4 and 5 upon a work-piece which has been introduced over the floor-forming block 3 of the mold, it is necessary that the jaws be caused to bear firmly upon the upper faces of the precision wings *a* and *b* throughout the surface which is to be precision-ground, and I accomplish this end by converting the swinging travel of the jaws to a rectilineal action at the inner extreme of the jaws' closing movement. It is to permit this action that the hinge pins, at their points of connection with the cross-arms 12 and 13, are permitted to spring slightly from axial prolongations of the bearing lugs 10 and 11, respectively.

The complete process including the fast-chilling of the precision part by the instrumentality of clamping the same securely within a water-jacketed mold formed substantially in correspondence with the said part is thought to be clear from the foregoing. The rapidity with which the water jackets acting in complement with the air manifolds radiate the heat from the clamped part permits the latter to be ejected—chilled to the required atmospheric working temperature at which the required final step of precision-grinding may be performed—at intervals of 10 minutes.

It is intended that no limitations be implied, and that the hereto annexed claims be read with only such restrictions as are necessarily introduced thereto to distinguish from prior knowledge in the art.

What I claim is:

1. In the art of fast-chilling a heated metal part: a clamping die comprising the combination of heat-conductive stationary and movable jaws acting in complement to describe a mold cavity for the part and each water-jacketed for accelerating the dissipation of heat from the same; water-circulating connections to and from the jacketing of the respective jaws; and devices functional to the movable jaws for swinging the same into mold-closing positions and operating at the inner extreme of the closing travel to convert the swinging to a rectilineal clamping pressure applied in a direction substantially at right angles to the surface being clamped.

2. A clamping die according to claim 1 for use in chilling a metal part having both precision and non-precision surfaces of which the precision surfaces are clamped by the die to restrain the same against distortion, and the non-precision surfaces exposed, the die providing foraminated air manifolds having connection with a pressure source of cooling air and functioning to discharge jets of cooling air over the exposed non-precision surfaces of the part being chilled.

3. In the art of fast-chilling a heated metal part: a clamping die comprising the combination of heat-conductive stationary and movable jaws acting in complement to describe a mold cavity for the part; and devices functional to the movable jaws for swinging the same into and out of mold-closing position and operating at the inner extreme of the closing travel to convert the swinging to a bodily rectilineal movement exerting clamping pressure in a direction substantially at right angles to the surface being clamped.

4. In the art of fast-chilling a heated metal part: a clamping die comprising the combination of complementary jaws arranged to be opened and closed and acting in complement to describe a mold cavity for the part; and devices functional to said jaws for swinging the same into and out of mold-closing position and operating at the inner extreme of the closing travel to convert the swinging to a bodily rectilineal movement exerting clamping pressure applied in a direction substantially at right angles to the surfaces being clamped.

5. A die for clamping a production part and comprising, in combination: a movable jaw acting as one element of the clamping structure; and means functional to the jaw for swinging the same into and out of a position whereat the same closes upon the part to be clamped and operating at the inner extreme of the closing travel to convert the swinging movement of the jaw to a bodily rectilineal movement.

6. A die for clamping a production part and comprising, in combination: a stationary jaw; a movable jaw acting with the stationary jaw to describe a mold cavity for the part to be clamped; and means functional to the movable jaw for swinging the same into and out of mold-closing position and operating at the inner extreme of the closing travel to convert the swinging movement of the jaw to a bodily rectilineal movement exerting clamping pressure upon the part in a direction substantially at right angles to the surface being clamped.

WILLIAM L. CARSON.