

UNITED STATES PATENT OFFICE.

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METHOD OF MACHINING METALS AND OTHER VERY HARD AND HIGHLY-RESILIENT MATERIALS.

1,156,892.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, CHARLES ALPHONSE CLÉMENT DE LA POIX DE FRÉMINVILLE, a citizen of the Republic of France, and resident of Paris, France, have invented a new and useful Method of Machining Metals and other Very Hard and Highly-Resilient Materials, which is fully set forth in the following specification.

The present invention relates to a method of machining metals and other very hard and highly resilient materials.

The method consists broadly in a combination of means which, in order to render the action of the tool on the hard material possible and effective, previously place the tool and the metal in conditions of molecular equilibrium which are most suitable for the said action.

The method is based, on the one hand, on a well known fact which may be commonly rendered by saying that "cold renders brittle," and on the other, particularly upon the observations and experiments made by the applicant with regard to the production of chips during the machining of metals. From these observations and experiments it was found that the effort exerted by a tool does not produce its maximum effect at the point of contact. The resultant of the action called into being by the tool, and of the internal reactions, has its point of application in a subjacent center which, if the developed or liberated energy is sufficient, becomes a center for the production of a "cracking" or "splintering" effect.

It will now be understood that the formation of a chip of a very tough and hard material is possible only owing to the propagation, to within proximity of the point of contact of the tool, of the "cracking" effect which has been originated from the said centers and which causes the steel to be divided into splinters.

The particular means which forms the subject matter of the invention, broadly consists in facilitating and producing within a certain measure, in the working material the formation of centers for the "cracking" when the action of the tool intervenes, through the medium of an energetic refrigeration extending in depth at least down to the zone which may be considered as that of the said centers; the tool having, at the be-

ginning of the work, its temperature preferably raised to a certain degree in order to avoid a deterioration thereof by the effect of the low temperature at the contact with the metal or other material which it is desired to machine. By effecting a refrigeration to a temperature which in any case is below zero and capable of attaining, according to the nature of the material under treatment, a temperature of -15 or even -20° C., the deep zone in which the centers for the production of "cracking" is located, is placed in a particular condition of equilibrium which greatly facilitates the production of "cracking," a result which it would be impossible to obtain with a superficial cooling by spraying a lubricant or any other liquid, or by a sprinkling of the tool and of its point of contact with the material.

In order to apply this new method in practice it is possible, according to the nature and importance of the work to be done, to have recourse, for instance, to the following means:—1. The cooling may be limited to the part or region of the piece where in the tool is to act. Briefly, the converse is done of what is realized, when the cutting of metals is effected with an intensive localized heat while it is by means of a localized intensive cold that the metal of the region to be machined, is placed in suitable condition for permitting of the action of the perforating tools. To this end, use may be made, according to requirements of various refrigerating products existing in the trade, for instance, such as liquid air, carbonic acid and so on. In order to localize the action of the refrigerating means to the region in which the machining will be effected and also with a view to economy, a kind of basin or cup may be provided around the point where the tool is to act, made for instance of clay asbestos paste or the like or even of spongy materials which, by lowering the temperature which solidifies the moist parts, permit of obtaining a sufficient fluid-tightness for containing the cold liquid. In certain cases, the temperature furnished by the ordinary refrigerating mixtures may be sufficient. The metal is then bathed in a brine contained in a basin which is maintained at the desired temperature by a suitable refrigerating mixture or other medium, circulating in a coiled tube. In this case, the basin may be of metal and fluid-tightness obtained by

a moderate tightening and a joint of india-rubber, asbestos or felt. Finally, in other cases, the cold liquids are maintained in contact with the face opposite to that on which the tool acts. They are then contained in a suitable box and maintained at a low temperature by an appropriate circulation. 2. Furthermore, the whole work piece may be placed in a bath or freezer. In order to effect an appreciable cooling of the said piece it has only to be maintained in that condition during the machining work. The work piece or the machine may also be provided in a cold chamber wherein the machining is effected which may be controlled through the inspection openings.

In order to prevent the tools from being spoiled by the action of the low temperature at which the work is effected, it is advisable, at the beginning of the work, to keep the tools warm by any of the well known means, after this operation the machining work itself is adequate to maintain the tool at a sufficiently high temperature to have no fear as regards its deterioration.

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

1. A method of machining metals and other very hard and highly resilient materials, consisting in facilitating and producing to a certain degree, in the work to be machined, the formation of centers for the

production of a "cracking" or "splintering" effect when the action of the tool intervenes, this result being obtained by an energetic refrigeration extending to a depth at least reaching the zone which, for the effort developed by the tool, may be considered as that containing the said centers.

2. A method of machining metals and other very hard and highly resilient materials, consisting in facilitating and producing to a certain degree, in the work to be machined, the formation of centers for the production of a "cracking" or "splintering" effect when the action of the tool intervenes, this result being obtained by an energetic refrigeration extending to a depth at least reaching the zone which, for the effort developed by the tool, may be considered as that containing the said centers, the tool being raised, at the beginning of the work, to a suitable temperature in order to avoid its deterioration by action of the low temperature at the contact with the work under treatment.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHARLES ALPHONSE CLÉMENT
DE LA POIX DE FRÉMINVILLE.

Witnesses:

HENRI MONIN,
CHAS. P. PRESSLY.