UNITED STATES PATENT OFFICE.

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GUN-BARREL AND ANALOGOUS OBJECT.

1,005,115. Specification of Letters Patent. Patented Oct. 3, 1911.

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To all whom it may concern:

Be it known that I, FRANZ HATLANEK, a subject of the Emperor of Austria-Hungary, residing at Kladno, Bohemia, Austria-Hungary, have invented certain new and useful Improvements in Gun-Barrels and Analogous Objects, of which the following is a specification.

It is a well known fact that at high temperatures iron and steel possess less power of resistance to every kind of mechanical strain than they do at normal temperatures. The result of this fact is that for many purposes of use the desired end cannot be accomplished in a satisfactory manner even with the kinds of special steel already known at the present time. Moreover further increase in the efficiency even of the best special steels is desirable in many branches on account of the prevailing competition in respect of economy. The repeated heatings which take place in the use of articles of iron and steel are however particularly injurious. When such repeated heatings occur, constantly repeated heatings and coolings must obviously take place in a portion of the article, such heatings and coolings occurring mostly in a probably comparatively thin layer on the outer surface. This heating and cooling causes a continual expansion and contraction and reëxpansion and re-construction of the portion of the article subjected to the heating. In consequence of this continual expansion and contraction there ensues in time a destruction, or change in the structure or texture, of the material, which is finally no longer equal to these repeated strains and still less capable of enduring any other additional strains.

Articles of the kind in question are:—barrels of guns and cannon, those parts of explosion motors which are subjected to the gases of combustion, and like parts. An extensive improvement in such steel and iron articles can be attained, if the kinds of iron and steel employed for such articles be alloyed according to the present invention with copper. The amount of copper to be added depends upon the carbon content of the steel, and the other metals which may be already alloyed therewith. In most cases an addition of about 5% of copper may be made. It is not sufficient however for the purposes of this invention simply to use ordinary steel containing a comparatively great quantity of copper, say 0.1% to 0.2%, as an impurity, which kind of steel is frequently produced industrially for general purposes, and is the result of an already existent higher copper content of the ore *per se*. The action of so small an amount of copper yields no discernible effect for the above purpose. On the contrary a steel with a considerably higher copper content must be employed, and therefore the steel must be intentionally alloyed with copper unless ores extraordinarily rich in copper, such as have hitherto not been used in the manufacture of iron and steel, can be employed. To cite a numerical example, about 4% to 5% of Cu may be added to a steel which is used at the present time for the barrels of cannon and which contains about 0.45% C, 0.5% Cr and 3% Ni. If on account of the hardening properties of the copper the percentage of carbon be decreased below 0.3%, a material will be obtained which will yield almost the same or, in view of the special purpose to which the material is to be applied, even better figures under tensile tests, will forge well and at the same time suffer less destruction at the inner surface of the barrel of a cannon, and will therefore permit of a greater number of shots being fired, than the material of the above described composition without any copper.

The strain produced by the above described repeated heating results in erosions which, in the case of barrels of guns from which a large number of shots are fired in rapid succession, are termed burn outs. There is however, especially in the case of these parts of firearms which are brought into contact with the powder gases, such for example as the barrels of cannon or guns, the actions or locks thereof and the like, a second cause, which is quite different from the one above described, and through which such parts can be rendered useless, namely the rust-forming action of the residues from the combustion of the explosive substances employed.

It is well known that the residues of the combustion of the explosive substances employed adhere to those parts of firearms which are brought into contact with the powder gases and cause rusting of these parts, where they are made of steel and are not thoroughly cleaned very soon after shooting. This rusting action is so powerful that the spots and pits of rust, which

form when the weapon is insufficiently cleaned, impair its shooting accuracy to such an extent as to make the weapon quite useless. This rusting becomes still worse if accompanied by moisture for which reason it makes itself evident with particular unpleasantness in damp weather. Now, experiments which have been carried out show that nickel steel alloyed with copper possesses, in addition to the power of resistance imparted to it against repeated heating and cooling by alloying it with copper, an additional and surprising power of resisting the rusting action of nitric acid, nitric anhydrid, carbonic acid and moisture, whereby a steel of this kind is particularly suitable for resisting the rust producing action of the residues of the explosive substances used in firearms. This power of resistance to rusting becomes specially evident when the percentage of nickel is made slightly higher, notwithstanding the fact that it is well known that nickel possesses little power of resistance to nitric acid. It has been found that a steel containing 7% of nickel in addition to 4% of copper remains practically free from rust being subjected for days to the simultaneous action of the vapors of nitric acid, nitric anhydrid, carbonic acid and a moist atmosphere.

With regard to the manufacture of a steel of the composition forming the subject matter of this invention, it is advisable to use as pure copper as possible as copper frequently contains substances which are injurious to steel. The copper may be added at any desired time to the steel. If the steel be manufactured in crucibles, the copper is best melted simultaneously with the steel; if on the other hand the steel be manufactured in a Martin or electrical furnace it is advisable not to put the copper into the furnace until the end of the process, as it is easier in the absence of the copper to determine the progress of the metallurgical process by the aid of tests taken from the bath. Earlier addition of the copper is of course not impossible. The nickel for the production of the nickel steel containing copper may of course be added in exactly the same way and at the same time as in the production of a nickel steel which does not contain any copper. An alloy of copper and nickel may of course also be used for the production of the copper nickel steel.

I claim as my invention:

As a new article of manufacture, a gun barrel or analogous object subject to repeated heating during use made of metal composed principally of ordinary steel alloyed with form 4 to 5 per cent. of copper.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

FRANZ HATLANEK.

Witnesses:

THEODORE HARTUNG,

ADOLPH FISCHER.