UNITED STATES PATENT OFFICE.

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FIREARM AND ALLOY FOR MAKING SAME.

1,346,190. Specification of Letters Patent. Patented July 13, 1920.

No Drawing. Application filed December 15, 1919. Serial No. 345,081.

To all whom it may concern:

Be it known that I, FRANK A. FAHRENWALD, a citizen of the United States, residing at Cleveland Heights, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Firearms and Alloys for Making Same, of which the following is a full, clear, and exact description.

This invention relates to firearms and ordnance and has for its particular object the provision of a metallic alloy for use in the construction of the same which shall be more resistant to corrosion by the combustion products of the explosive as well as less corroded by atmospheric conditions and salt solutions (such as sea-water or perspiration) than any of the materials now in use for this purpose, as well as having sufficient mechanical strength to endure the strains to which such devices are subjected and at the same time being sufficiently soft and workable for manufacturing purposes.

Hitherto the universal substance for use in the manufacture of the barrels and working parts of firearms (including both hand-arms and fixed or heavy ordnance) has been a steel of some nature, consisting essentially of carbid of iron dissolved in an excess of iron, sometimes also including up to one or two per cent. of other metals such as nickel, tungsten, vanadium, etc. These materials offer the disadvantage of rapid corrosion by powder gases and residues, particularly those of smokeless powder, and rapid rusting as a result of atmospheric and salt conditions besides being subject to warping both during the course of manufacture and during the vicissitudes of operation. I have discovered that these disadvantages can be avoided by the employment of certain alloys containing a decreased amount of iron alloyed with a considerable amount of various protective metals of which the chief are nickel and chromium. In the case of chromium, nickel and iron are the only logical carriers, and the use of these metals for the purpose is fully set forth and claimed in my applications Serial No. 319,822, filed August 25, 1919, Serial No. 330,943, filed October 15, 1919, and Serial No. 345,083, filed December 15, 1919. In the case of the nickel, however, I have found that while iron is the best carrier (see applications Nos. 330,943 and 319,822, above mentioned) copper also may be used successfully. Alloys having between about forty per cent. and about sixty per cent. of nickel lie in the preferred range although any amount of nickel up to about ninety-nine per cent. can be employed with success. Alloys of the nickel-copper series containing less than about twenty-five per cent. of nickel are too soft and do not possess sufficient chemical resistance for severe requirements.

In case it be desired to increase the hardness and mechanical strength of this alloy, as it will be for some purposes, this can be done by the addition of any one or more of the following: chromium, molybdenum, tungsten, cobalt, vanadium, tantalum, zirconium, titanium, aluminum, iron, manganese, zinc, cadmium, all of which are soluble in one or the other of the primary ingredients, principally in the nickel. In this series of alloys nickel can properly be considered the basic element, since with a small nickel content not enough chromium molybdenum or other chemically resistant element can be caused to alloy with copper to result in a substance of sufficient non-corrodibility.

The amount of hardening metal permissible depends upon the amount of nickel present, since of the above hardening metals only aluminum, zinc and cadmium are soluble in copper to an appreciable extent. Besides the copper itself exerts a hardening effect on the nickel and when used in the larger proportions dispenses proportionally with any necessity for their use. Thus while the alloy containing the minimum of nickel above mentioned, namely 25%, is sufficiently strong for low power arms like .22 caliber rifles, the nickel content permits the addition of up to about 5% of chromium, molybdenum, tungsten, cobalt, vanadium, tantalum, zirconium, titanium, or iron; or manganese can be added up to about 10%; and owing to the copper content about 5% of aluminum could be added or somewhat larger amounts of zinc or cadmium; any of which additions serves to increase the hardness and tensile strength to a degree sufficient for practically any firearm requirement.

Within the preferred range of between 40% and 60% of nickel it is possible to increase the amounts of the nickel-soluble hardening ingredients in like proportion although the solubility of the copper-soluble constituents is correspondingly reduced. For practical purposes I recommend the use

of one or more of the above named nickel-soluble hardness up to a maximum of about 20% of the nickel content, which maximum is rather high in the case of zirconium, titanium, vanadium, or tentalum, and can be considerably exceeded in the case of iron, chromium, or manganese. The desired hardness is most economically attained by the use of iron or manganese. The use of chromium would of course offer the additional advantage of increased chemical resistivity, but as this is already sufficiently high I prefer the cheaper ingredient.

In any case it is necessary to use small amounts of dioxidizer or scavenger such as manganese, titanium, aluminum, magnesium, vanadium, or chromium, even though none of the same be desired in the resulting alloy, and of these I prefer manganese as being the cheapest.

Having thus described my invention, what I claim is:

1. A firearm barrel made of an alloy containing copper alloyed with not less than about twenty-five per cent. of nickel.

2. A firearm barrel made of an alloy containing copper alloyed with not less than about twenty five per cent. of nickel together with smaller amounts of one or more additional metals in or adjacent to the iron group in the periodic table.

3. A firearm barrel consisting of an alloy containing from about twenty-five per cent. to about ninety-nine per cent. of nickel and the balance principally of copper.

4. A firearm barrel made of an alloy consisting essentially of from about twenty-five per cent. to about ninety-nine per cent. of nickel, the balance being principally copper together with smaller amounts of one or more of metals, iron, manganese, chromium, molybdenum or tungsten.

5. A firearm barrel made of an alloy containing from about forty per cent. to about sixty per cent. of nickel together with about one per cent. to fifteen per cent. of iron, manganese, or chromium and the balance principally copper.

In testimony whereof I hereunto affix my signature.

FRANK A. FAHRENWALD.