Aug. 21, 1945. M. H. WALKER 2,383,356

FIREARMS

Filed April 5, 1944 2 Sheets-Sheet 1

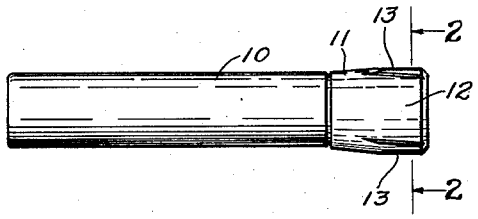


Fig. 1

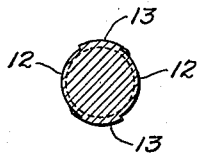


Fig. 2

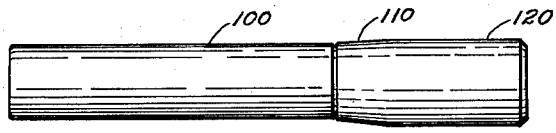


Fig. 3

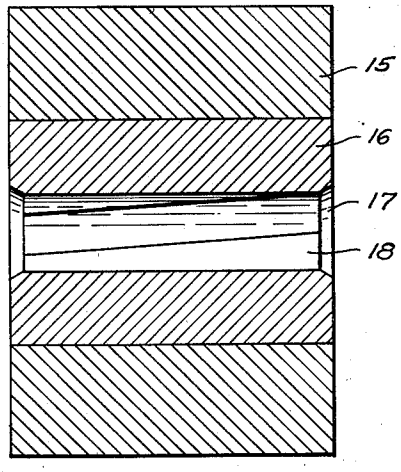


Fig. 4

INVENTOR.
MERLE H. WALKER
BY
D'Verner Smythe
ATTORNEYS

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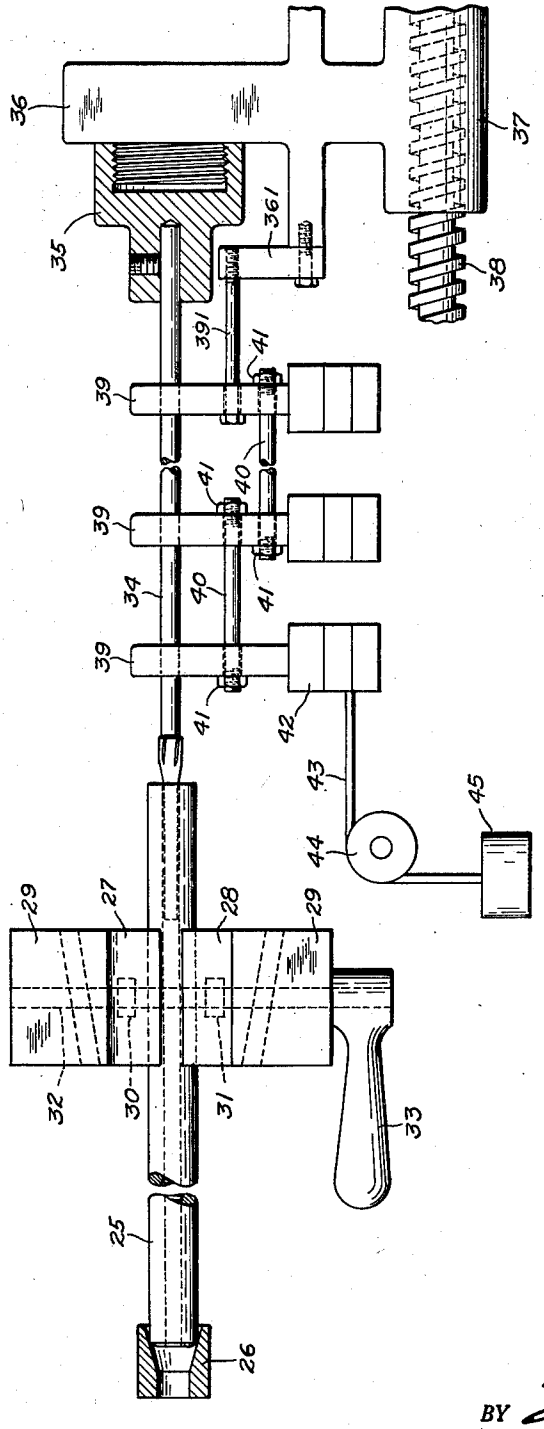


Fig. 5

INVENTOR.
MERLE H. WALKER
BY
D. Verner Smythe
ATTORNEYS

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2,383,356

UNITED STATES PATENT OFFICE

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FIREARM

Merle H. Walker, Ilion, N. Y., assignor to Remington Arms Company, Inc., Bridgeport, Conn., a corporation of Delaware

Application April 5, 1944, Serial No. 529,640

2 Claims. (Cl. 29—1.1)

This invention relates to the rifling of the barrels of firearms, particularly barrels of small caliber, and contemplates certain improvements and refinements in previous rifling practices especially intended to facilitate mass production.

The bores of the steel or alloy barrels of all modern firearms intended to discharge a single projectile on each firing comprise spiral grooves which are engaged by the softer metal of the projectile and impart to the projectile the rotary motion necessary for accurate sustained flight. The number of such grooves varies between wide limits. In ordinary practice, the barrel blank in the form of a bar or forging is drilled and reamed to form a bore of substantially the desired "land" diameter, the "lands" being the areas separating the grooves. Metal is then planed from the areas between the lands by passing through the bore a planing or rifling tool. For barrels of relatively large bore (not less than .3") it has been found feasible to use multiple bit tools (broaches) by which the rifling can be completed in a small number of passes, or even in a single pass, of the tool. However, in the confinement of the smaller bores of shoulder rifles broaching presents difficult problems of tool support, chip removal and lubrication.

The widely used single bit rifling tool is usually the full width of the desired groove, and removes .0002" of metal at each pass. Since the groove depth is about .004", about twenty (20) passes per groove are required, and the complete rifling of a barrel becomes a lengthy operation, and complex machines are required for spiraling the tool through the bore, returning the tool, and indexing the barrel between passes of the tool.

Some efforts have been made to rifle barrels by means of swaging. A tool which has been milled with spiral ribs corresponding to the rifling grooves is forced through the length of the barrel, forming therein by metal displacement spiral grooves which are the counterpart of the raised ribs on the tool. Prior to the present invention, the swaging of rifling in barrels less than .50 caliber has not been successful, on account of the excessive friction between the rifling tool and the bore surface and the excessive strains imposed on both the work and the tools.

The present invention contemplates certain new discoveries and refinements of process which have enabled the quantity rifling of the barrels of all shoulder rifles, including .22 caliber.

In the drawings:

Fig. 1 is an elevation of a rifling tool.

Fig. 2 is a section of the rifling tool of Fig. 1.

Fig. 3 is an elevation of a rifling tool blank.

Fig. 4 is a section of a die used in the making of the rifling tool.

Fig. 5 is a diagrammatic representation of a rifling machine adapted to the practice and processes of the invention.

The rifling tool illustrated in Fig. 1 comprises a somewhat elongated pilot 10, a tapered "lead" section 11, and a short cylindrical head 12 having thereon the inclined rifling ribs 13, the surfaces of which merge with the lead surface 11. It has been found that milled tools, if operable at all, are of comparatively short life, and the present invention contemplates the forming of the rifling ribs 13 by swaging. This is accomplished by the application of a swaging die, a typical form of which is illustrated in Fig. 4, to a blank of the form shown in Fig. 3. The die assembly includes a die holder 15 and the die proper 16, the die aperture comprising spiral lands 17 separated by grooves 18. To prepare the die assembly, a barrel made of tool steel is rifled in the conventional manner, and a section of the desired length cut therefrom and hardened to form die 16, which is then press fitted into holder 15. The die assemblies of Fig. 4 are made of a size convenient for machining and handling. The tool blank of Fig. 3, comprising pilot 100, taper 110 and elongated head 120, is turned from softened tool steel and is plated with a suitable friction reducing metal, such as copper, tin, lead, cadmium or zinc. The plated tool, being adequately lubricated with a semi-solid lubricant, is then forced into the die of Fig. 4 a distance sufficient to form a rifling head 12 of the desired length. For a .30 caliber barrel, a preferred length is about ⅜". The tool is then withdrawn from the die, the excess length of head 120 is removed and, after hardening, the tool is ready for use.

Barrels to be rifled in accordance with the present invention may be processed through the steps of drilling and reaming in the usual manner, except that the final reaming operation may be omitted, and the finished bore diameter is preferably about .001" under that of barrels to be rifled in the customary manner. The barrels of some rifles are tapered, the cross-sectional area adjacent the muzzle being substantially less than that adjacent the breech. Such barrels may be rifled by the process of this invention, after outside turning, with a resulting bore diameter within accepted manufacturing tolerances. However, if greater accuracy is desired, the rifling

should be performed before outside turning, so that during rifling the barrel is of substantially the same thickness from end to end. Swage rifling applies substantial stress to the barrel metal, with a tendency for greater bore enlargement at sections of reduced wall thickness. By swage rifling and stress relief annealing before outside turning, very high accuracy tapered barrels can be secured; and if the finished barrel is cylindrical high accuracy results are obtained without any special treatment. As heretofore stated, the variation in bore diameter, even in tapered barrels which are swage rifled according to the present invention after outside turning, is within accepted tolerances.

In preparation for swage rifling according to this invention, the bores of the drilled and reamed barrels, having been degreased and washed, are given a thin plating of copper, tin, lead, zinc, cadmium, or other anti-friction metal. Copper has been found to be particularly useful for this purpose, being applied by passing through the bore to be plated a suitable solution of copper sulphate or of one of the proprietary plating salt mixtures, such as "cuprodine." For this purpose, the barrels are preferably arranged in a vertical position and the plating solution introduced at the upper ends along with sufficient air to preclude the formation of air pockets which might interfere with uniform distribution of the solution. A solution of "cuprodine" prepared in accordance with the manufacturer's directions will satisfactorily plate bores in about one-and-one-half minutes.

An appropriate quantity of a suitable semi-solid lubricant is then introduced into one end of the bore; the rifling tool of Fig. 1 is inserted in the lubricant, pilot end first, and is then pushed through the bore. The pushing of a rifling tool through the bore can be accomplished in a very simple machine, as distinguished from the complex rifling machine. The tool is its own guide, the spiral rib thereon forming a counterpart spiral groove in the bore without forced rotation of either barrel or tool. The essentials of the machine are merely barrel holding means and adequately supported and guided tool pushing means.

Fig. 5 illustrates diagrammatically one form of such machine. One end of the barrel **25**, preferably the muzzle end is received in a suitably tapered aperture in a stationary supporting block **26**. Near its opposite end the barrel is clamped between suitable jaws **27** and **28** held in tapered ways in a fixed supporting block **29** and propelled into clamping position by their engagement with short arms **30** and **31** projecting from an arbor **32** provided with a manipulating handle **33**. The rifling tool is shown in place in the end of the barrel. In alignment with the barrel is a rifling tool push rod **34**, one end of which is received in a bushing **35** suitably held in a head stock **36** provided with a boss **37** which receives a feed screw **38** by which the head stock is moved along a fixed guideway. To prevent buckling of the long slender push rod **34**, said rod is passed through apertures in a plurality of guide plates **39** mounted for sliding movement on the machine way. The guide plate **39** adjacent the head stock is held for limited movement relative to the head stock by a headed bolt **39'** which passes freely through an aperture in plate **39**, and is threaded into a lug **36'** secured to or integral with the head stock **36**. The remaining guide plates are arranged for limited movement relative to each other, the construction being such that as the push rod **34** is advanced into the barrel the guide plates, which were originally appropriately spaced throughout the length of the push rod, move together adjacent the end of the barrel. For this purpose, each guide plate is provided with apertures which loosely receive the ends of connecting bolts **40**. Each bolt **40** passes freely through two adjacent guide plates and is retained therein by suitable end fastening means, such as nuts **41**. Each guide plate **39** comprises a sufficient number of apertures so located as to freely pass the nuts **41** when the guide plates are moved together. To the supporting base **42** of the guide plate adjacent the barrel there is secured a short cable **43** passing over a pulley **44** and supporting a weight **45** adequate to move each of the guide plates of the assembly into the position determined by bolts **40** and nuts **41**. Correct positioning of the guide plates when the push rod is retracted is thus insured.

It will be understood that the machine as described is only a representative means for practicing one part of the invention.

What is claimed is:

1. In the manufacture of rifled gun barrels, the method comprising the steps of forming a hole through the length of a barrel blank, said blank having a substantially uniform exterior diameter from end to end, plating said hole with an anti-friction metal, inserting into said hole a swaged forming tool of substantially the diameter of said hole and having raised spiral surfaces, pushing said tool through said plated barrel to form grooves in the walls of said barrel hole by plastic deformation of the barrel metal, relief annealing said blank after said plastic deformation to relieve expansion stresses set up by said plastic deformation, and subsequently exteriorly tapering said blank to the desired finished barrel configuration.

2. In the manufacture of rifled gun barrels, the method comprising the steps of forming a hole through the length of a barrel blank, said blank having a substantially uniform exterior diameter from end to end, plating said hole with copper, inserting into said hole a swaged forming tool of substantially the diameter of said hole and having raised spiral surfaces, pushing said tool through said plated barrel to form grooves in the walls of said barrel hole by plastic deformation of the barrel metal, relief annealing said blank after said plastic deformation to relieve expansion stresses set up by said plastic deformation, and subsequently exteriorly tapering said blank to the desired finished barrel configuration.

MERLE H. WALKER.