

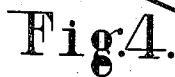
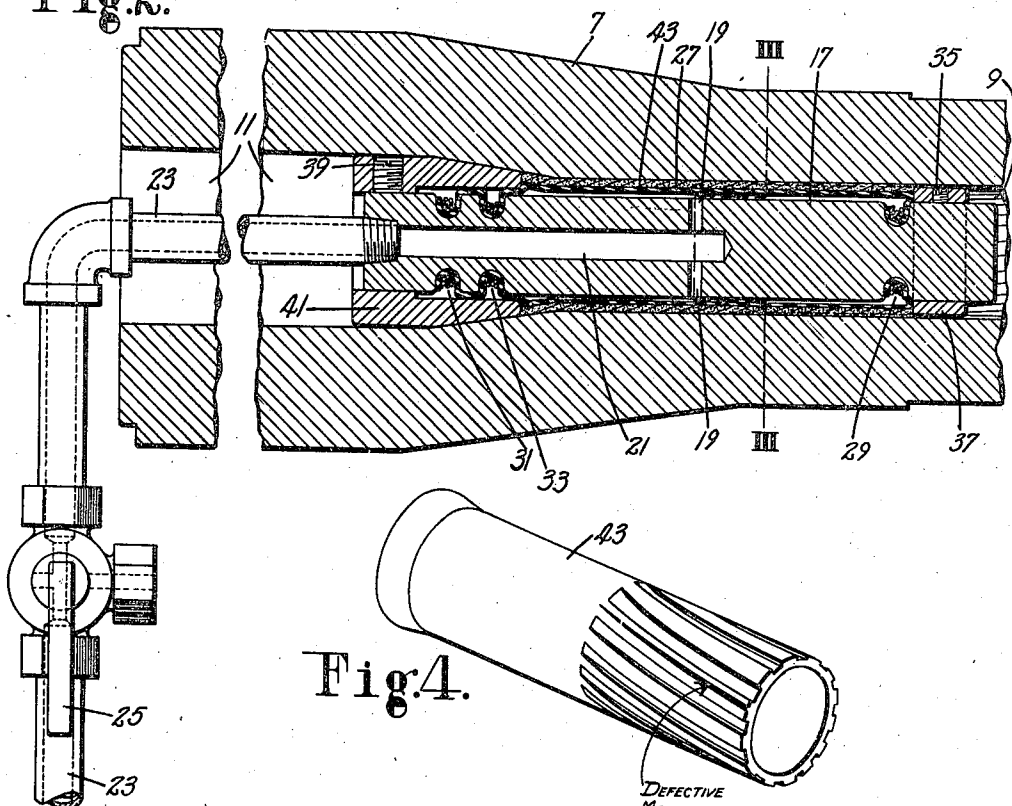
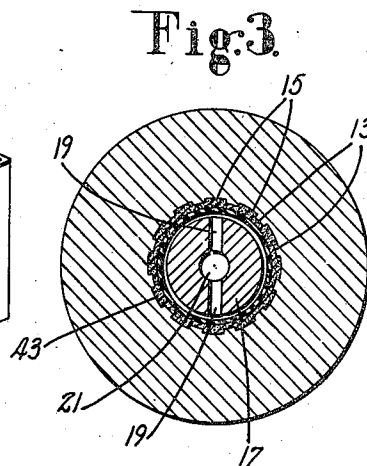
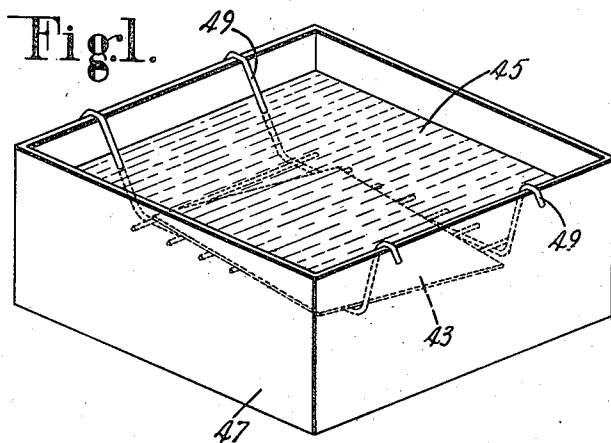
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EXAMINING THE INTERIORS OF GUN BARRELS

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DEFECTIVE MACHINING

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EXAMINING THE INTERIORS OF GUN
BARRELS

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This invention relates to examining the bore of a rifled gun barrel to learn the presence and nature of defects which may be present.

In the manufacture of gun barrels, for example those of anti-aircraft or anti-tank guns, it is customary to provide in a suitably shaped barrel of steel a smooth bore and a communicating shell chamber; and then by a rifling operation to provide in the bore a series of parallel spiral channels or grooves, such grooves forming the rifling and serving to impart rotation to the projectile when the finished gun is fired. It is very desirable that there should be no defects in the surfaces of the rifled barrel since such defects are liable to affect adversely the shooting qualities of the gun.

The present invention provides a method and a device for use in examining the interior of a gun barrel to find out whether there are any defects in its otherwise smooth surface, and if defects are present to learn their nature.

Referring to the accompanying drawing,

Fig. 1 is a perspective of a vessel containing a hot liquid, for example, water, in which a sheet of thermoplastic material of proper dimensions has been immersed to soften it preparatory to wrapping the heated sheet around a cylindrical holder.

Fig. 2 is a view in longitudinal median section of the breech end of a rifled gun barrel with the device of the present invention in place, the hollow cylinder of thermoplastic material having been expended to take an imprint of the interior of the gun barrel.

Fig. 3 is a cross section on the line III—III of Fig. 2; and

Fig. 4 is a perspective of the hollow cylinder after it has been removed from the gun barrel so that its exterior may readily be inspected.

In the rifling of a gun barrel the cuts of the rifling tool begin at a locality near the forward end of the shell chamber and continue to the muzzle, any defects in the rifling being more likely to occur during the first part of the travel of the tool. For this reason the illustrated device for detecting the presence and nature of defects in the surfaces of the bore is of comparatively short length and is adapted to detect defects only in a small extent at the breech end of the bore. It should be understood, however, that the length of the device will depend upon how much of the bore it is thought necessary or desirable to examine.

There is shown in Fig. 2 the rear portion of a gun barrel 7 having a bore 9 which extends from the forward tapered portion of the shell chamber 11 to the muzzle, not shown. The rifled portion of the bore begins a short distance from the forward end of the shell chamber and consists (Fig. 3) of lands 13 and spiral rifling grooves 15. Any slight defect in the surfaces of lands or those of

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the grooves is liable to affect disadvantageously the proper rotation of the projectile and/or its proper velocity, both of which are essential to the accurate flight and maximum striking power of the projectile.

The testing device has a generally cylindrical member 17 having two radial ports 19 which are in communication with the longitudinal central bore 21, the rear end of which is in communication with a pipe 23 for compressed air from any suitable source, the flow of which is controlled by a three-way valve 25. The forward intumed end of a hollow cylinder 27 of elastic material such as rubber is clamped tightly by means of a wire in an annular groove 29 formed in a member 17; and the rear end of the rubber cylinder is clamped tightly in two annular grooves 31, 33 formed in the same member. There is thus produced an elastic bag which is inflated when compressed air is admitted to the interior of the bag through the pipe 23. At the forward end of the cylindrical member 17 there is adjustably fastened by a set screw 35 a collar 37 which has a sliding fit on the surfaces of the lands 13; and on the rear end of the cylindrical member there is fastened by a set screw 39 a second collar 41 having a cylindrical portion to fit the cylindrical portion of the shell chamber and a tapered portion to fit the tapered portion of said chamber.

A sheet of heated thermoplastic material 43 (shown in its flat condition in Fig. 1) of the proper size is wrapped about the rubber bag between the projections or collars 37 and 41. The cylindrical member 17, with the hollow cylinder of softened thermoplastic material in place, is inserted in the breech end of the gun barrel; compressed air is admitted for a short interval through the pipe 23; and then the supply of air is cut off and the pipe exhausted. The hollow cylinder of thermoplastic material is first expanded and then cooled, after which the testing device is slid with a spiral motion out of the gun barrel and the cylinder removed. Its exterior, which has taken on the imprint of the lands and the rifling grooves, is then examined. Fig. 4 is a perspective of such a cylinder of thermoplastic material after it has been removed for inspection, there being shown a long scratch which indicates a defect in the bottom of one of the rifling grooves.

The time consumed in getting the heated cylinder of thermoplastic material into the gun barrel, expanding it, cooling it and removing it for inspection should be short. The thermoplastic material should therefore be a fairly tough one which is solid at room temperature; it should soften under a moderate degree of heat and should remain plastic and self-supporting over a considerable range of temperature. Solid waxes, which would otherwise be suitable, are compara-

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tively weak and remain plastic for only a short temperature range. In order to modify these characteristics such waxes may be combined with a resinous substance of higher molecular weight to add toughness and to increase the range of plasticity. Below are examples of suitable materials.

Example I

	Parts by weight
Ethyl cellulose.....	43.75
Opalwax #10.....	37.50
Castor oil.....	18.75

Example II

	Parts by weight
Ethyl cellulose.....	44.00
Opalwax #10.....	36.5
Stearic acid.....	19.5

Example III

	Parts by weight
Ethyl cellulose.....	50.00
Stearic acid.....	50.00

The ethyl cellulose is a product of the Hercules Powder Company of the type put out by that company as "B, granular, high viscosity, 100 C. P.," and any tough resinous substance of high molecular weight which is compatible with the particular wax chosen may be employed. Opalwax #10 is a product of the E. I. du Pont de Nemours Company. The ingredients are mixed for a few minutes at room temperature in a jacketed mixer, whereupon steam at about 80 pounds pressure is turned on and the mixing continued until the ethyl cellulose granules are dissolved and the mass is of the consistency of heavy molasses. The mass then cools slightly, is removed from the mixer while still plastic and rolled into sheets from which the small sheets of proper dimensions are cut.

The thermoplastic materials of the examples are plastic and self-supporting at 100° C., remaining so throughout a considerable range of temperature below 100° C., and at room temperature are tough solids. They are heated by placing them in boiling water, are expanded by an air pressure of about 80 pounds to the square inch, and may be withdrawn approximately one minute after they have been expanded. The sheet of thermoplastic material may conveniently be heated to soften it by suspending it by means of a support in boiling water contained in a receptacle.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of taking an impression of the rifled interior of a gun barrel to determine the condition of its surfaces, said method comprising, providing a thermoplastic material, heating the material to soften it, introducing into the cold gun barrel a heated, softened hollow cylinder of said material, and exerting fluid pressure upon the interior of the hollow cylinder to cause its outer surface to take an imprint of the interior of the gun barrel including the rifling grooves, whereupon the thermoplastic material sets without adhering to the interior of the gun barrel and may be withdrawn for inspection.

2. The method of taking an impression of the rifled interior of a gun barrel to determine the condition of its surfaces, said method comprising, providing a thermoplastic material consisting essentially of a solid wax and a resinous substance of high molecular weight, heating the material to soften it, introducing into the cold gun barrel

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a heated, softened hollow cylinder of said material, and exerting fluid pressure upon the interior of the hollow cylinder to cause its outer surface to take an imprint of the interior of the gun barrel including the rifling grooves, whereupon the thermoplastic material sets without adhering to the interior of the gun barrel and may be withdrawn for inspection.

3. A device for taking an impression of the interior of a gun barrel to determine the condition of its surfaces, said device comprising an elongated member having a port which leads to its periphery, an inflatable bag fastened to the member and having its interior in communication with the port, spaced projections on the member constructed and arranged to permit the member to be slid into the interior of the gun barrel and to prevent movement of the elongated member radially of said barrel, a hollow member of thermoplastic material located outside the bag, and means for causing a fluid under pressure to flow through the port to inflate the bag and thereby to make an imprint of the interior of the gun barrel upon the exterior of the thermoplastic member.

4. A device for taking an impression of the rifled interior of a gun barrel to determine the condition of its surfaces, said device comprising an elongated member having a port which leads to its periphery, an inflatable bag fastened to the holder and having its interior in communication with the port, spaced collars adjustably fastened to the member constructed and arranged to permit the member to be slid into the interior of the gun barrel and to prevent movement of the elongated member radially of said barrel, a member of thermoplastic sheet material outside the bag and located between the collars, and means for admitting a fluid under compression into the port for inflating the bag and thereby making an impression of the interior of the barrel on the outer surface of the thermoplastic member.

5. A device for taking an impression of the interior of a rifled gun barrel having a shell chamber in its breech and which is of larger diameter at its rear end than is the rifled bore and has at its forward end a tapered portion, said device comprising an elongated member having a port which leads to its periphery, spaced projections on said elongated member, the rear projection having a tapered portion to fit the tapered portion of the shell chamber and the forward projection being of a diameter to engage the lands of the rifled bore, an inflatable bag located on said elongated member, a hollow member of thermoplastic material located outside the inflatable bag, and means for causing a fluid under pressure to flow through the port to inflate the bag and thereby to make an imprint of the interior of the gun barrel upon the exterior of the thermoplastic member.

6. A device for taking an impression of the interior of a gun barrel to determine the condition of its surfaces, said device comprising an elongated member having a port which leads to its periphery and provided with means for centering it in the gun barrel, an inflatable bag fastened to said member and having its interior in communication with said port, a hollow member of thermoplastic material consisting essentially of a solid wax and a resinous substance of high molecular weight located on the outside of said bag, and means for causing fluid under pressure to flow through the port to inflate the bag.

ALEXIS E. USHAKOFF.