

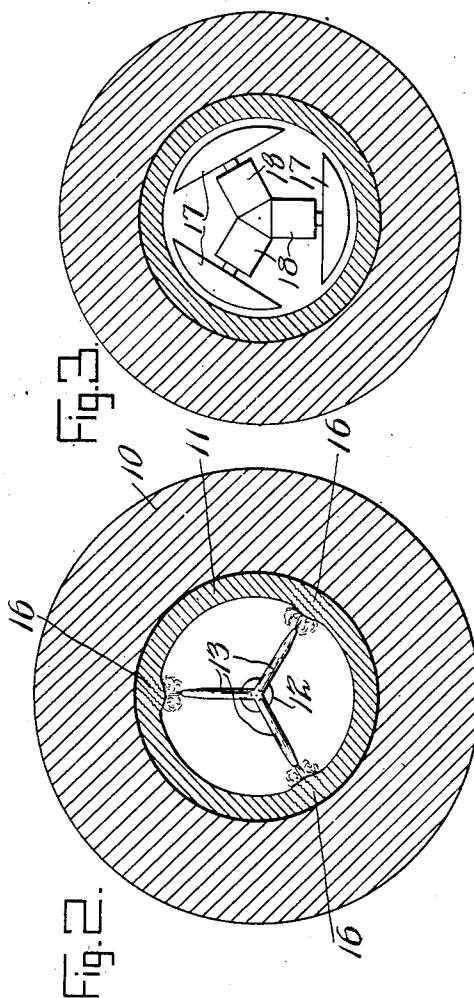
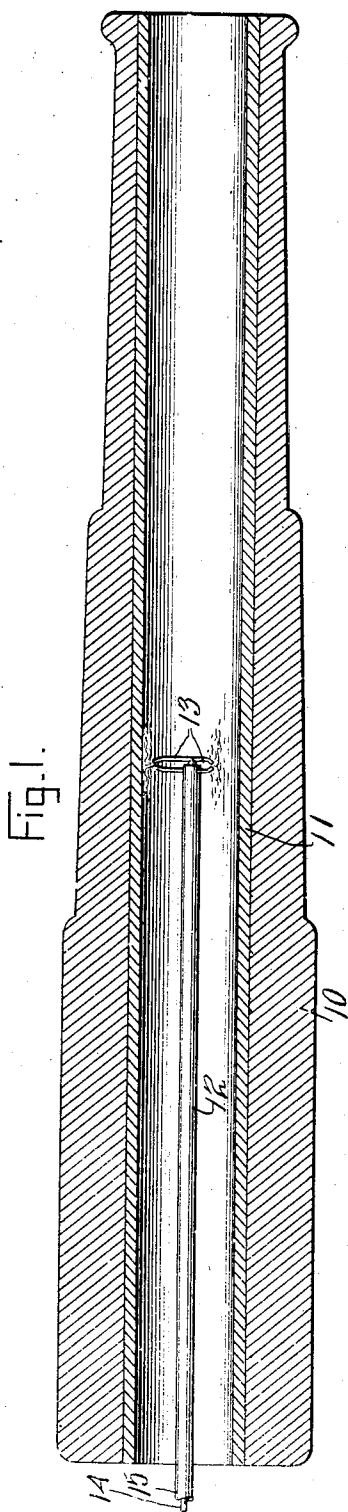
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W. R. WOOD

METHOD FOR REMOVING LINERS FROM CYLINDERS

Filed Sept. 8, 1922



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UNITED STATES PATENT OFFICE.

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METHOD FOR REMOVING LINERS FROM CYLINDERS.

Application filed September 8, 1922. Serial No. 587,018.

To all whom it may concern:

Be it known that I, WILLIAM R. WOOD, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Methods for Removing Liners from Cylinders, of which the following is a specification.

My said invention relates to an improved method for removing liners from shells in which they are fixed and it is an object of the invention to provide a cheaper and more expeditious process for removing such liners for example as are found in ordnance where the gun body is shrunk on the liner or such liners as are found in various other situations where the liner is forced by hydraulic pressure or the like into its seat.

Various methods have hitherto been practiced for securing this result, the usual method being to heat the jacket so as to expand the same and to cool the liner while the jacket is hot so as to procure a certain degree of separation between the jacket and the liner, the latter thereupon being pulled out by powerful jacks or like mechanisms. One detriment of this process has been that where the bore of the jacket is stepped the material in the liner is frequently forced out so as to form slight annular ridges and replace a portion of the material of the jacket. The separation between the liner and jacket can not be made great enough to take care of these ridges and therefore in the act of withdrawing the liner they are dragged over the inner surface of the jacket and form longitudinal grooves or scratches in the same. These grooves are afterward removed by reaming. The formation of such grooves is entirely avoided by my process.

In the practice of my invention the gun barrel or other cylinder is placed in convenient position and a heating instrumentality such as an oxyhydrogen flame or the like is passed from end to end thereof in such a manner as to heat the material of the jacket intensely along one or more narrow strips extending from end to end of the liner. The liner being in a condition of stress due to the inward pressure of the gun body will immediately exert a compressing action on the heated strips thereby crushing or upsetting the same from end to end of the liner. This gives the result that the

liner is separated from the jacket from end to end throughout its circumference after which it can be withdrawn in usual manner, either while still hot or after it has cooled.

Taking for example a cylinder in which the jacket has been shrunk on the liner with such a force as to produce a contraction of .05 of an inch, which liner is to be removed, it will be seen that heating two diametrically opposite strips of the liner may permit it to shrink just .05 of an inch so that its normal outer diameter will now correspond to the normal inner diameter of the jacket. If the liner has annular shoulders or ridges thereon such as hereinbefore referred to which will prevent its ready removal after the treatment indicated I may provide a heating apparatus for heating a larger number of strips through the length of the liner, as for example four or six strips. In this way a greater reduction in size will be provided. In some cases I may find it desirable to subject the entire interior surface of the liner to an intense heat thereby permitting the compressing effect of the jacket to be exerted over the entire area of the liner instead of being divided between a small number of longitudinal strips.

The theory of my invention, so far as understood, may be stated as follows: Intense heat is applied to a surface of a cylinder, usually the inner surface, to such a degree that the metal flows and becomes upset so that the thickness of the cylinder wall is permanently increased but the diameter of the cylinder, both internally and externally, is permanently decreased. As above explained the heat is ordinarily applied by means of one or more electrodes providing electric arcs whereby arcs along the cylinder wall can be heated rapidly throughout its thickness. At the same time it appears that the metal adjacent the electrode will heat more rapidly than that more remote and will break down and flow sooner to a sufficient extent to become thus upset. This is of importance especially when the cylinder is not under external compression. The action of the metal is as if there were a fulcrum at the extreme point of penetration of the heat with the heated metal prying or pulling laterally about said fulcrum. This would bend the metal about the ful-

crum if it were not for the softening and upsetting of the heated portion. While this explanation is the best I am able to give at this time it is not to be understood as limiting my invention in any way, the essence of the invention being the heating of a part (or in some cases the whole) of the circumferential or peripheral surface, either inner or outer, of a hollow cylinder or bushing in such a manner as to change the diameter of the same permanently.

Referring to the accompanying drawings which are made a part hereof and on which similar reference characters indicate similar parts,

Figure 1 is a longitudinal section illustrating the use of my invention,

Figure 2 a cross section of Figure 1, and

Figure 3, a cross section showing heating means of different character.

In the drawing reference character 10 indicates the outer jacket of a gun barrel having a liner 11. An oxy-acetylene burner 12 having two or more branches 13, an inner tube 14 for acetylene and an outer tube 15 for oxygen is inserted endwise into the barrel and is moved endwise of the same as indicated. The heat of the oxy-acetylene flame is applied directly to the inner periphery of the liner and as the burner moves from end to end of the barrel narrow sections of the liner, indicated at 16, will be heated to such an extent that the compression of the jacket acting on the liner will upset the metal in these narrow sections and cause these sections to become somewhat thicker and shorter in the direction of the circumference of the liner. After removal of the burner the liner and more particularly the upset sections will cool causing the liner to contract and spring away from the inner wall of the jacket leaving an annular space or crevice at 17 between the jacket and the liner. The liner may now be removed by any of the conventional means in a ready and expeditious manner. It will be obvious that I am not limited to any particular number of burners nor to movement in a straight line from end to end of the gun or other device. As already stated the movement may be along spiral lines or any other preferred lines. The heating of narrow annular zones for example, at spaced intervals through the length of the liner has been found very efficacious, it being deemed desirable to heat about 28 per cent or more of the surface of the liner. Furthermore such heating need not be done at one time the effect being the same whether the zones are all heated at once or successively with any desired interval of time between successive operations.

It will also be evident that I am not limited to any particular heating means, elec-

trical heating means being in many cases even better than the gas-heater shown in Figures 1 and 2. One reason for this is that the great accumulation of heat in a long tube interferes with the mixture of gases and is liable to cause the flames of the different burners to "pop" or be extinguished and relighted at intervals thereby heating the tube irregularly and leaving high and low places on the outside of the liner which score the jacket when the two are separated. In Figure 3 I have shown an electric heating device such as is not open to the objection stated. The heat may be very accurately controlled and may be gauged by means of pyrometers on the outside of the gun or other cylinder to insure against damage to the jacket by local overheating. The carbons 17 are arcuate in form and may be three in number, preferably covering a large part of the inner periphery of the liner. One wire is connected to the liner and a flaming arc is thus formed between each carbon and the liner, the heating devices being moved along the jacket at appropriate speed. The carbons are spring-pressed outwardly in sockets 18 and are retracted by a solenoid after the manner of those in the arc-lamp.

With either system if one operation does not afford sufficient clearance another set of strips may be heated between or overlapping the first, or the entire liner may be heated as preferred, the essential features being quick, localized heating with high temperature devices under low pressure in a manner not to change the character of the metal in the jacket.

As above indicated I do not limit myself to the application of this process for ordnance alone but may also use the same on hydraulic cylinders or other apparatus where liners are shrunk or pressed or otherwise forced very firmly into place so as to be difficult to remove.

Various other modifications of my invention will occur to those skilled in the art. For example it is not essential that the strips referred to shall extend precisely in straight lines from one end of the cylinder to the other but they may be somewhat curved or spiral if this is found desirable. Therefore I do not limit myself to the precise steps outlined above, but only as indicated in the appended claims.

As a slightly modified development of my invention I may mention that it serves excellently for shrinking cylinders or cylindrical bodies. In one example of such an operation I have subjected a rough cylinder of metal of substantial length and diameter to a general heat at its inner periphery and then suddenly cooled it from the outside by the application of water. It will be understood that various methods of heating and

cooling are available to those skilled in the art and that a comparatively low temperature for the general heat mentioned, as from 600 to 700 degrees, will suffice for my purpose in most instances.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent, is:

1. A process of permanently changing the diameter of a hollow metal cylinder by applying to one peripheral surface only heat sufficient to cause upsetting of the metal while keeping the other peripheral surface relatively cool, substantially as set forth.
2. A process of removal of a liner from a jacket holding the liner in compressed relation by the application to the inner surface of the liner of heat sufficient in degree to cause the metal of the liner to flow and be upset and thus cause a permanent contraction in the diameter of the liner, substantially as set forth.
3. A process for removal of a liner from a jacket holding the liner in compressed relation by the application at localized points on the inner surface of the liner of heat sufficient in degree to cause the metal of the liner to flow and be upset and thus cause a permanent contraction in the diameter of the liner, substantially as set forth.
4. A process for removal of a liner from a jacket holding the liner in compressed relation by the application to the inner surface of the liner along parallel strips of said surface of heat sufficient in degree to cause the metal of the liner to flow and be upset and thus cause a permanent contraction in the

diameter of the liner, substantially as set forth.

5. A process for removal of a liner from a jacket holding the liner in compressed relation by the application to the inner surface of the liner along one or more longitudinal strips of said surface of heat sufficient in degree to cause the metal of the liner to flow and be upset and thus cause a permanent contraction in the diameter of the liner, substantially as set forth.

6. A process of removal of a liner from a jacket holding the liner in compressed relation by the application to the inner surface of the liner along parallel longitudinal strips of said surface of heat sufficient in degree to cause the metal of the liner to flow and be upset and thus cause a permanent contraction in the diameter of the liner, substantially as set forth.

7. A process of removing liners from ordnance wherein such liners are held under compression by applying to the inner surface of a liner along one or more narrow strips thereof heat sufficient in degree to cause permanent contraction of the liner, allowing the liner to cool, and thereafter forcing the liner out of its jacket, substantially as set forth.

In witness whereof, I have hereunto set my hand and seal at Washington, District of Columbia, this 8th day of September, A. D. nineteen hundred and twenty-two.

WILLIAM R. WOOD. [L. s.]

Witnesses:

CHAS. E. RIORDON,
E. W. BRADFORD.