May 10, 1960 J. C. HARTLEY 2,935,912

EROSION-AND-CORROSION-RESISTANT GUN BARREL ADAPTED TO HOLD A COOLANT

Filed Oct. 11, 1950 3 Sheets-Sheet 1

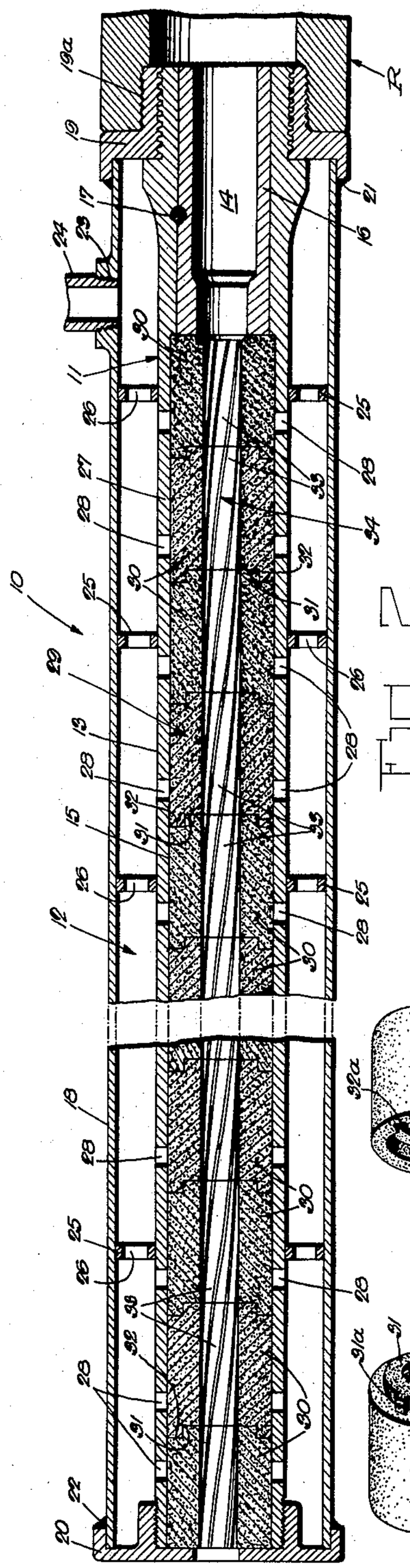

FIG - 2

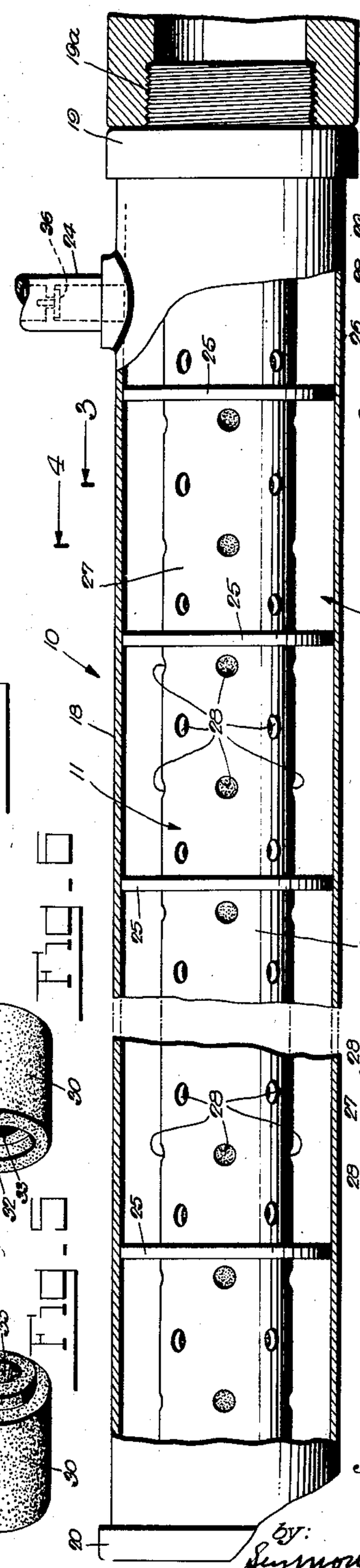

FIG - 6

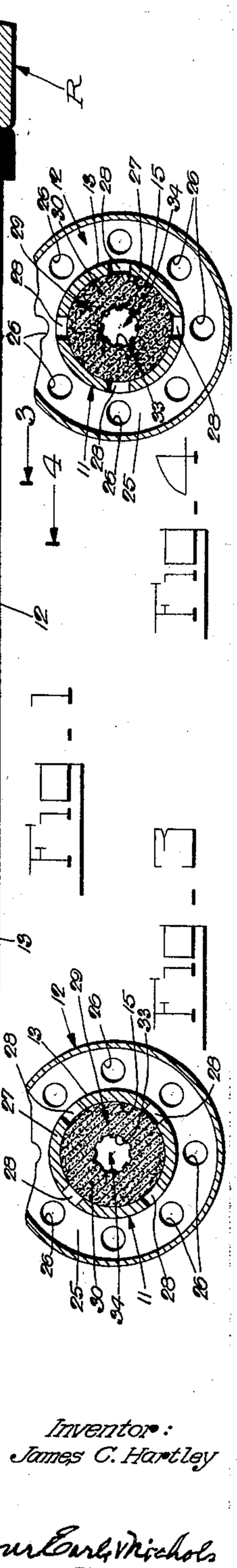

FIG - 4

FIG - 1

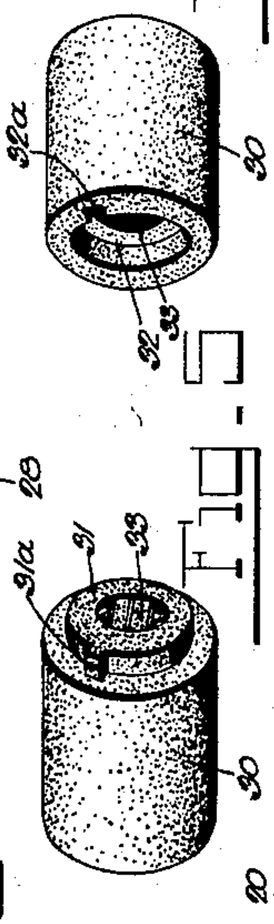

FIG - 5

FIG - 3

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May 10, 1960 J. C. HARTLEY 2,935,912

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Filed Oct. 11, 1950 3 Sheets-Sheet 2

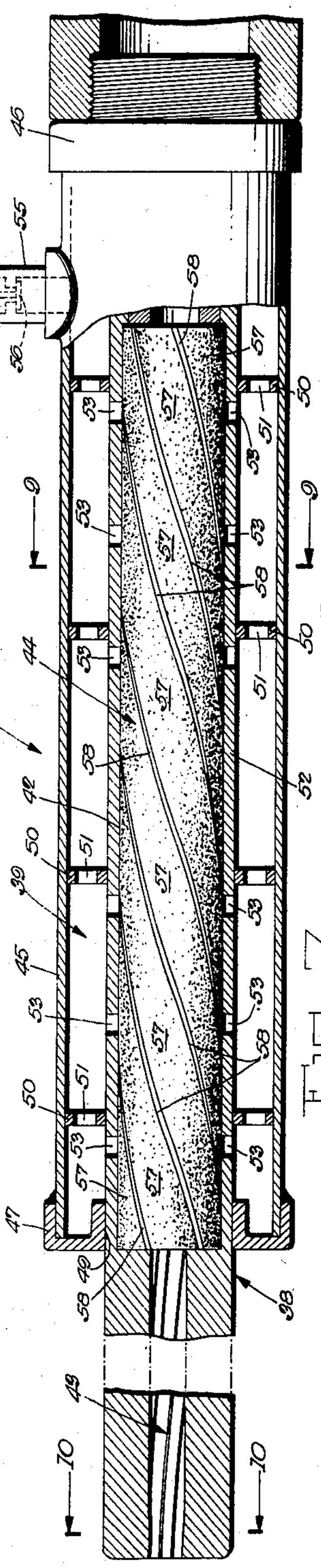

FIG. 7

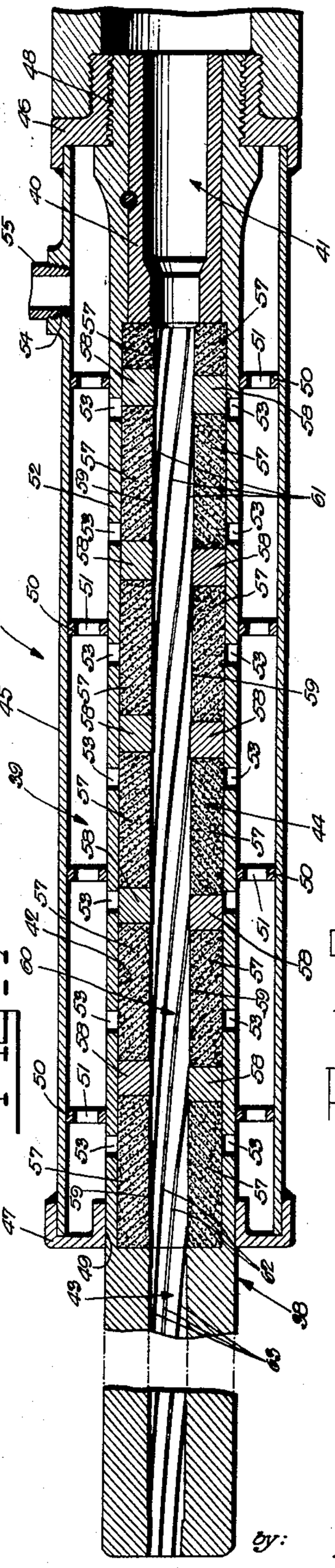

FIG. 8

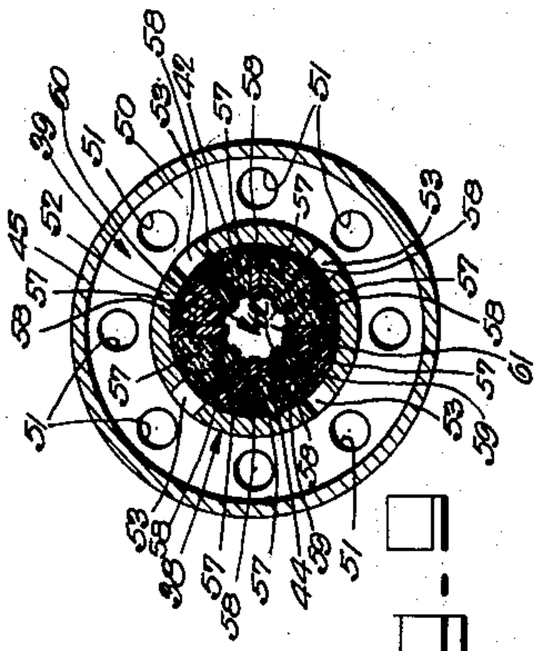

FIG. 9

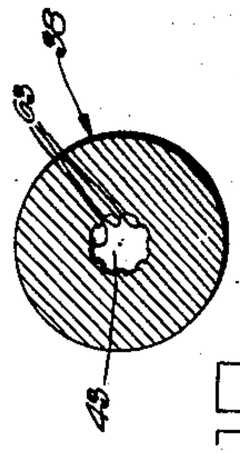

FIG. 10

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May 10, 1960 J. C. HARTLEY 2,935,912

EROSION-AND-CORROSION-RESISTANT GUN BARREL ADAPTED TO HOLD A COOLANT

Filed Oct. 11, 1950 3 Sheets-Sheet 3

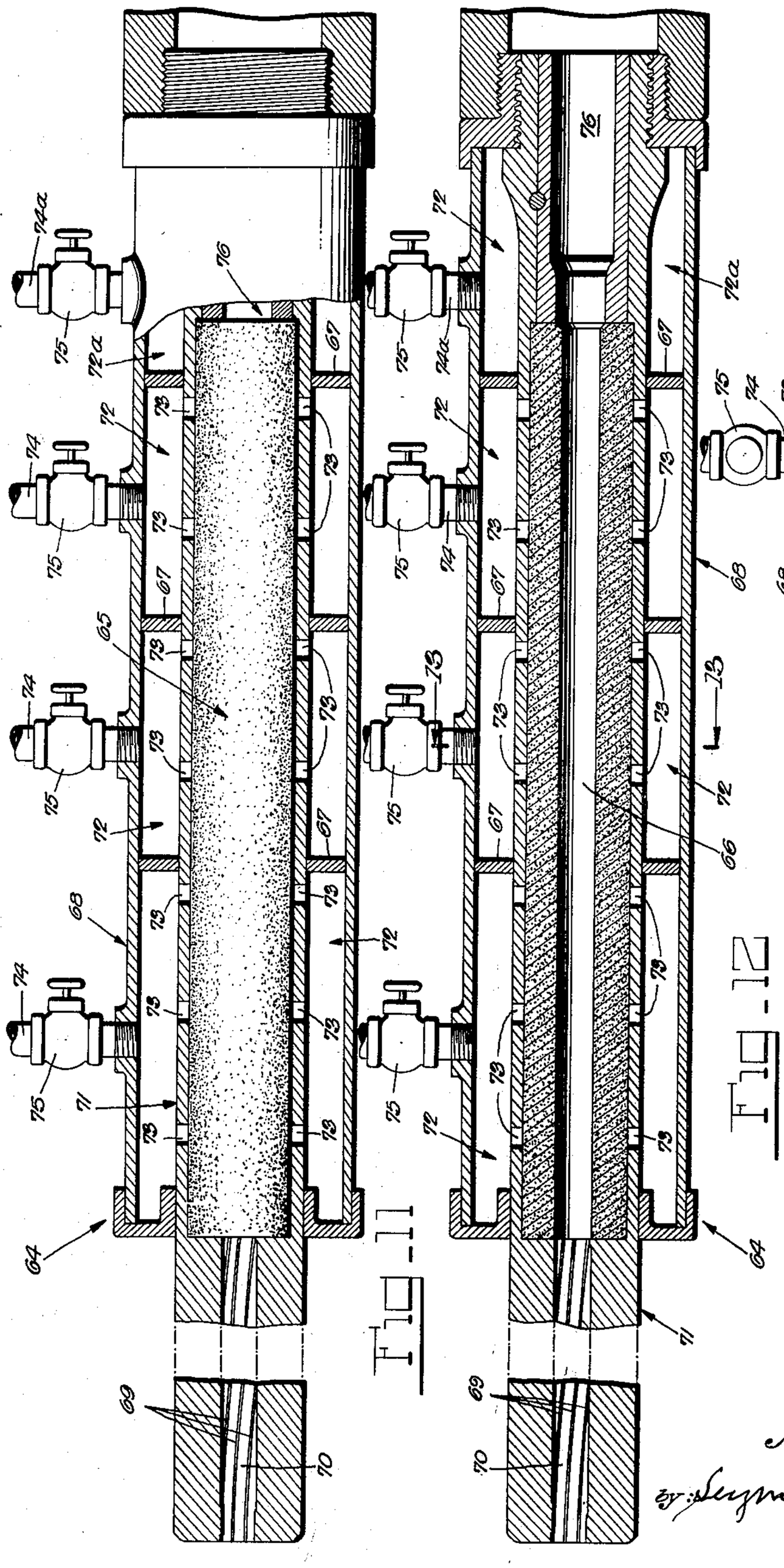

Fig. 11

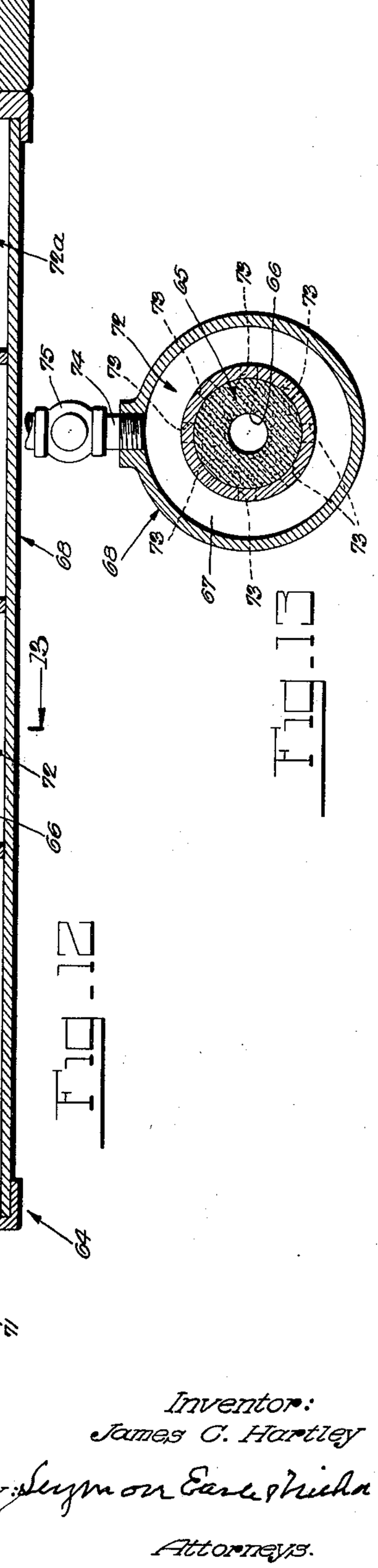

Fig. 12

Fig. 13

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United States Patent Office

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EROSION-AND-CORROSION-RESISTANT GUN BARREL ADAPTED TO HOLD A COOLANT

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Application October 11, 1950, Serial No. 189,643

30 Claims. (Cl. 89—14.1)

This invention relates to gun-barrels in general, and to gun-barrels for rapid-fire arms in particular.

It is one of the main objects of the present invention to provide a gun-barrel which has greater resistance to the erosive and thermal effects of firing than was heretofore attainable, thereby lending a longer useful life to the gun-barrel and rendering it suitable especially, though not exclusively, for use in weapons of high cyclic firing rates.

It is another object of the present invention to devise a method of, and make provisions for, cooling a gun-barrel more effectively and at a faster heat-exchange rate than heretofore, thereby to reduce the erosive and corrosive effects of firing on the gun-barrel to a minimum and permit effective firing, even at high cyclic rates, over a long period of time without overheating the barrel or entailing unduly rapid wear of the same.

A further object of the present invention is to bring a fluid-coolant into direct heat-exchange relation with a gun-barrel throughout the cross-sectional area of the latter, so that the gun-barrel is most effectively cooled even in its bore where it is directly subjected to the hot powder gases and the converted heat energy from the friction encountered by fired projectiles in the bore.

Another object of the present invention is to enhance the erosion-and-corrosion-resistance of a gun-barrel even further, by forcing controlled quantities of the aforementioned internal coolant in the gun-barrel into the bore thereof wherein the coolant will form a thin protective film or coat which effectively reduces heat-transmission into the barrel and substantially isolates a projectile therein from the bore thereof.

It is still a further object of the present invention to provide a gun-barrel which is especially suited for use in rapid-fire arms, such as machine guns and other ordnance of high cyclic firing rates, and which requires replacement much less frequently than previous gun-barrels in ordnance of this type.

It is also among the objects of the present invention to provide a superior erosion-and-corrosion-resistant gun-barrel of this type which, while exceedingly simple and sturdy in construction, is nevertheless highly accurate and reliable in its performance, and readily lends itself to efficient mass production at relatively low cost.

Other objects and advantages will appear to those skilled in the art from the following, considered in conjunction with the accompanying drawings.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a fragmentary side elevation, partly in section, of a gun-barrel embodying the present invention;

Fig. 2 is a fragmentary longitudinal section through the same gun-barrel;

Figs. 3 and 4 are fragmentary cross-sections through the gun-barrel as taken on the lines 3—3 and 4—4, respectively, of Fig. 1;

Figs. 5 and 6 perspectively illustrate a prominent detail

element of the instant gun-barrel, as viewed from different directions, respectively;

Fig. 7 is a fragmentary, longitudinal section, partly in elevation, of a gun-barrel embodying the present invention in a modified manner;

Fig. 8 is a fragmentary longitudinal section through the modified gun-barrel;

Figs. 9 and 10 are cross-sections through the modified gun-barrel, as taken on the lines 9—9 and 10—10, respectively, of Fig. 7;

Fig. 11 is a fragmentary longitudinal section, partly in elevation, of a gun-barrel embodying the present invention in a further modified manner;

Fig. 12 is a fragmentary longitudinal section through the modified gun-barrel of Fig. 11; and

Fig. 13 is a section taken on the line 13—13 of Fig. 12.

Referring to the drawings, and more particularly to Figs. 1 and 2 thereof, the reference numeral 10 designates a gun-barrel unit or assembly which comprises, in the present instance, a gun-barrel 11 and a jacket 12 which peripherally surrounds the latter and is adapted for holding a fluid-coolant. The gun-barrel 11 is in the form of a tubular member 13 which is provided at its rear end with a cartridge-chamber 14 and, in the present instance, also with a large longitudinal bore 15 that extends to the cartridge-chamber 14. In this instance, the cartridge-chamber 14 is provided in an insert 16 which may suitably be secured in the rear end of the barrel-member 13 as by a key-pin 17, for instance.

The jacket 12 is, in the present instance, formed by an outer tube 18, a breech-flange 19 and a muzzle-cap 20. The breech-flange 19 and the muzzle-cap 20 may conveniently be tightly screwed over the rear and front ends, respectively, of the barrel-member 13. The outer tube 18 is retained between the breech-flange 19 and the muzzle-cap 20, preferably in hermetically-sealed relation therewith by being, for instance, welded thereto as at 21 and 22, respectively. The tube 18 is provided with an inlet 23 to provide communication, through intermediation of a conduit 24, between the interior of the jacket 12 and a source of any suitable fluid-coolant under pressure. The jacket 12 may also be provided with spaced transverse partitions 25 which, in this instance, are in the form of rings that are suitably secured to the tube 18 and barrel-member 13. The partitions 25 in the jacket 12 are perforated at 26 (see also Figs. 3 and 4) to provide communication in the jacket throughout its longitudinal extent. The peripheral wall 27 of the barrel-member 13 is, within the longitudinal confines of the bore 15 therein, provided with a multitude of perforations or ducts 28 which provide communication between the barrel-bore 15 and the interior of the jacket 12. The breech-flange 19 is preferably externally threaded as at 19*a* for the assembly of the instant gun-barrel unit with a receiver R.

The bore 15 in the barrel-member 13 is, in accordance with the present invention, provided with a porous liner 29 which is preferably formed by a plurality of inserts 30 that are arranged end-to-end in the bore 15 of the barrel-member 13. The inserts 30 are held in accurate alignment with each other by being provided, for instance, with interfitting ends 31 and 32, respectively (Figs. 2, 5 and 6). The inserts 30 are also provided with longitudinal, preferably rifled bores 33, respectively, which collectively form the projectile-bore 34 of the gun-barrel 11. Any suitable provision may be made to hold the inserts 30 against rotation relative to each other. To this end, the inserts 30 are, in the present instance, provided with interfitting tongues and grooves 31*a* and 32*a*, respectively (Figs. 5 and 6).

It is the intended function of the porous liner 29 in the barrel-member 13 to conduct fluid-coolant under

pressure from the jacket 12 through the porous inserts 30 to the wall of the projectile-bore 34 for effectively cooling the same, and thereby greatly reducing the adverse erosive and corrosive effects from firing the gun on the gun-barrel 11. Thus, coolant under pressure will pass from the jacket 12 through the peripheral perforations 28 in the barrel-member 13 and will seep through the porous inserts 30 to the wall of the projectile-bore 33, accomplishing thereby the most effective direct heat-exchange between a coolant and the hottest part of a gun-barrel, i.e., the wall of its bore. In thus bringing the coolant into direct heat-exchange relation with the inserts 30 throughout their cross-sectional areas and, hence, also with the wall of the projectile-bore 34, the adverse erosive and corrosive effects on the instant gun-barrel are greatly reduced, so much so that the gun-barrel will safely withstand firing, even at high cyclic firing rates, for an unusually long period of time without becoming dangerously overheated or worn unduly rapidly. The instant gun-barrel unit 10 is, therefore, ideally suited for use in firearms having high cyclic firing rates, such as machine guns, sub-machine guns, or even larger rapid-fire ordnance.

The inserts 30, which make up the liner 29 in the barrel-member 13, may be made of any suitable porous material. For instance, the inserts 30 may be made from suitable powdered materials which in their compacted form are porous within the limits desired and best suited for the purpose in mind. Among the many materials suitable for this purpose, there may be mentioned "Stellite" alloys, such as "Vitallium," for instance, stainless steel, molybdenum, etc., also ceramals which are ceramic-metallic combinations, mainly borides of tantalum, chromium, etc.

Given only by way of example and by no means by way of limitation, the following is an analysis of an insert actually produced and found to possess satisfactory porosity and other desirable properties. Thus, an insert, such as the insert 30, was made from "Vitallium," comprising approximately 65% by weight of Co, 27% by weight of Cr, 6% by weight of Mo, all in powdered form, and smaller quantities, also in powdered form, of Si, C, Mn and Fe.

The above-mentioned "Vitallium" insert was compacted under a pressure of 40 tons per square inch, and then sintered for two hours at a temperature of 2100° F. The porosity of this insert was found to be approximately 32%.

The possible coolants employed in the instant gun-barrel unit 10 may be either gaseous or liquid. Among the many gaseous coolants that may be used, there may be mentioned, by way of example only, air, argon, helium, nitrogen, carbon dioxide, etc. Among the many liquid coolants useable for this purpose, there may be mentioned, also by way of example only, water, suitable petroleum derivatives, such as kerosene, etc.

As previously explained, coolant in the jacket 12, whether in gaseous or liquid form, will, by reason of being under pressure, penetrate the porous inserts 30 to the wall of the bore 34 therein, thereby not only cooling the entire inserts, including the wall of the bore 34 therein, most effectively, but also forming on the wall of the bore 34 a film or layer which prevents the hot powder gases from effectively contacting the wall of the bore 34, and also acts as a spacer between the latter and a traveling projectile therein, thereby reducing erosion of the wall of the projectile-bore 34 even further.

The high pressure in the projectile-bore 34, resulting from the firing of each cartridge, will displace, or tend to displace, the internal coolant in the inserts 30 nearest the cartridge-chamber 14, outwardly to a greater or lesser extent, depending on the permeability of the inserts, the viscosity of the coolant, and the peak-value of the pressure of the explosion of a firing charge. The high pressure in the projectile-bore 34, resulting from the explosion of a firing charge, lasts only momentarily, and there is sufficient time between shots, even when fired in rapid succession, to permit restoration of the pressure in the projectile-bore 34 to atmospheric or substantially atmospheric pressure. Thus, during approximately 75% of the time a rapid-fire arm is being fired at 1000 shots per minute, for instance, no explosions take place in the gun-barrel thereof. Hence, since the high pressure in the projectile-bore in consequence of firing a cartridge lasts only momentarily, and atmospheric, or substantially atmospheric pressure will be restored in the projectile-bore 34 soon after firing each cartridge, the internal coolant in the inserts 30 will, under its own pressure, reverse, or tend to reverse, its flow therein soon after firing a cartridge. Hence, the porous inserts 30, especially those nearest the cartridge-chamber 14, act much in the manner of a pulsating pump when the gun is in operation, with the coolant in the inserts effectively cleaning the latter and preventing their clogging with the waste products of the powder combustion. As an additional precautionary provision, the conduit 24 may be provided with a check-valve 36 (Fig. 1) which opens only for the admission of coolant under pressure into the jacket 12.

By reason of the high temperatures prevailing in the bore 34 in consequence of firing cartridges, a liquid-type coolant on the wall of the bore 34 and also in the inserts 30 near the bore-wall, will be vaporized and the requisite latent heat of vaporization will accordingly reduce the temperature on the wall of the bore 34, as will be readily understood. Hence, while a liquid-type coolant will remain in liquid form in more or less of the cross-sectional area of the inserts 30, the coolant film on the wall of the bore 34 will be in vaporized form and effectively isolate a projectile from the wall of the bore 34. Further, the pulsating liquid-type coolant in the porous inserts 30 acts as a check-valve which prevents the products of combustion in the bore 34 from passing through these inserts into the jacket 12, as will be readily understood.

Reference is now had to Figs. 7 and 8 which show a modified gun-barrel unit 37, having a gun-barrel 38 and a coolant-jacket 39 which, in this instance, surrounds only a length of the gun-barrel 38, including the rear end thereof. Provided in an insert 40 in the rear end of the barrel 38 is a cartridge-chamber 41 which is in coaxial alignment with an enlarged bore 42 in the barrel 38. The enlarged bore 42 extends, in the present instance, only over a part of the longitudinal extent of the barrel 38, and is continued to the front of the latter as a diametrically-reduced, preferably rifled part 43 of the projectile-bore in the instant gun-barrel. The enlarged bore 42 in the barrel 38 serves for the reception of a liner 44 to be described hereinafter.

The jacket 39 is formed by an outer tube 45, and end-flanges 46 and 47 which are suitably secured to the barrel 38 as at 48 and 49 respectively. Preferably, the jacket 39 is also provided with transverse partitions 50 which are perforated at 51 to provide communication in the jacket 39 throughout its longitudinal extent. The peripheral wall 52 of the barrel 38 is also provided with a multitude of perforations 53 which provide communication between the interior of the jacket 39 and the enlarged bore 42 in the barrel 38. The jacket 39 is also provided with an inlet 54 through which to admit coolant under pressure from any suitable source through intermediation of a conduit 55 which, as shown in Fig. 7, may be provided with a check-valve 56.

The liner 44 comprises a plurality of longitudinal porous inserts 57 and interposed spacer-ribs 58, respectively. The inserts 57, which may be made of similar materials and in a similar manner as the previously-described inserts 30, are cross-sectionally shaped like sectors (Fig. 9) which are truncated at 59 to form the remaining part 60 of the projectile-bore in the gun-barrel

38. The inserts 57 and spacer-ribs 58 extend longitudinally of the gun-barrel 38 in the spiral fashion shown in Figs. 7 and 8, and the spacer-ribs 58 extend radially inwardly of the part 60 of the projectile-bore sufficiently to form the rifling 61 therein. The rifling 61 is so arranged that its lands 62 are in alignment with the lands 63 of the rifling in the forward part 43 of the projectile-bore in the gun-barrel 38 (Fig. 8). The spacer-ribs 58 need not be porous, and are preferably of steel or other materials suitable for the purpose.

While the instant modified gun-barrel unit 37 has a porous liner 44 which extends only over a part of the longitudinal extent of the gun-barrel 38, it is fully within the purview of the instant invention to extend the porous liner 44 throughout the longitudinal extent of the gun-barrel 38, in accordance with the showing of the porous liner 29 in the earlier described gun-barrel unit 10. It is also fully within the purview of the instant invention to extend the liner 29 of the earlier described gun-barrel unit 10 over a part only of the longitudinal extent of the barrel-member 13 thereof in accordance with the showing of the modified porous liner 44 in the gun-barrel unit 37. It is further within the purview of the present invention to make each of the liners 29 and 44 in one piece. In that event, the ribs 58 are molded in the liner 44 when the same is formed, the ribs 58 preferably terminating short of the liner periphery so as to be embedded in the liner. Further, the inserts 30 may, for the formation of the rifling in the bore 34 thereof, be provided with molded-in steel ribs (not shown).

Figs. 11 and 12 show a further modified gun-barrel unit 64 which, with the exception of a single-piece porous liner 65 with a non-rifled bore 66 and nonperforated transverse partitions 67 in the jacket 68, may essentially be like the previously described gun-barrel unit 37. In the present instance, the requisite rifling 69 for spinning a discharged projectile is provided in the forward part 70 of the projectle-bore in the gun-barrel 71 of the unit. The nonperforated partitions 67 in the jacket 68 divide the latter into separate chambers or compartments 72, respectively, which are in individual communicating relation with the porous liner 65 through peripheral perforations or ducts 73 in the gun-barrel 71. Each of the chambers 72 is in individual communication with a suitable source of coolant under pressure through intermediation of conduits 74, respectively, and interposed in each conduit 74 is a valve 75 which may be controlled manually for admitting more or less coolant under pressure into the respective chamber 72. Each valve 75 may, if desired, be of the adjustable pressure-reduction type.

By dividing the jacket 68 into the separate chambers 72 and interposing the valves 75 in the respective conduits 74, coolant under different pressures and/or of different amounts may be admitted into the different chambers 72, thereby providing the mechanism for most efficient and economical use of the coolant. Thus, more coolant per time unit, preferably also under higher pressure, may be admitted into the chambers 72 nearest the cartridge-chamber 76 than into the chambers more remote from the latter, thereby to cool the hottest part of the projectile-bore more intensely than the remaining part thereof.

In lieu of the valves 75 and conduits 74, the jacket 68 may in its transverse partitions 67 be provided with check-type valves, respectively (not shown), which are spring-loaded to admit coolant from one chamber 72 into the chamber adjacent thereto only after the pressure of the coolant in the former chamber exceeds a predetermined maximum. In this event, only the chamber 72*a* nearest the cartridge-chamber 76 need be in communication with the source of coolant under pressure through the conduit 74*a*. By these provisions, the coolant in the chamber 72*a* may be under maximum pressure, while the coolant in the chambers 72 progressively more remote from the latter may be under progressively lower pressures.

The term "porous" as used hereinbefore and in the appended claims, is intended to denote fluid-permeability. Also, while the term "steel ribs" is used in the appended claims, this term is not to be interpreted in a limiting sense as to the word "steel," since the ribs 58 may well be made of a material other than steel without departing from the scope and spirit of the present invention.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. An erosion-and-corrosion-resistant gun-unit, comprising a gun-barrel having an outer circumference and a longitudinal projectile discharge bore and being, at least over a length thereof, porous from said outer circumference to said projectile discharge bore; and an outer jacket surrounding the porous circumference of said barrel-length and forming therewith a chamber adapted to hold coolant for penetration into said porous barrel-length to the projectile discharge bore thereof.

2. An erosion-and-corrosion-resistant gun-unit, comprising a gun-barrel having an outer circumference and a longitudinal projectile discharge bore and being, at least over a length thereof, porous from said outer circumference to said projectile discharge bore; and an outer jacket surrounding the porous circumference of said barrel-length and forming therewith a chamber, said jacket having an inlet for coolant under pressure for its forced penetration from said chamber into said porous barrel-length to the projectile discharge bore thereof.

3. An erosion-and-corrosion-resistant gun-unit, comprising a gun-barrel having a longitudinal projectile discharge bore and being, at least over a length thereof, porous substantially throughout its cross-sectional area; and an outer jacket surrounding said barrel-length and forming therewith a chamber adapted to hold coolant for penetration into said porous barrel-length to the projectile discharge bore thereof.

4. An erosion-and-corrosion-resistant gun-barrel unit, comprising a shell having a peripheral wall provided with perforations; a porous liner in said shell, said liner having a longitudinal projectile discharge bore; and an outer jacket surrounding the peripheral wall of said shell and adapted to hold coolant for passage through said perforations and penetration into said porous liner to the projectile discharge bore thereof.

5. An erosion-and-corrosion-resistant gun-barrel unit as set forth in claim 4, in which the projectile discharge bore of said porous liner is rifled.

6. An erosion-and-corrosion-resistant gun-barrel unit, comprising a shell having a peripheral wall provided with perforations; a porous liner in said shell, said liner having a longitudinal projectile discharge bore and being formed by a plurality of inserts in said shell; and an outer jacket surrounding the peripheral wall of said shell and adapted to hold coolant for passage through said perforations and penetration into said porous liner to the projectile discharge bore thereof.

7. An erosion-and-corrosion-resistant gun-barrel unit, comprising a shell having a peripheral wall provided with perforations; a porous liner in said shell, said liner being formed by a plurality of end-to-end arranged porous inserts in said shell having rifled bores, respectively, which form a continuous rifled projectile discharge bore in said liner; and an outer jacket surrounding the peripheral wall of said shell and adapted to hold coolant for passage through said perforations and penetration into said porous liner to the projectile discharge bore thereof.

8. An erosion-and-corrosion-resistant gun-barrel unit, comprising a shell having a peripheral wall provided with

perforations; a porous liner in said shell, said liner having a longitudinal projectile discharge bore and being formed by a plurality of end-to-end arranged porous inserts in said shell; and an outer jacket surrounding the peripheral wall of said shell and adapted to hold coolant for passage through said perforations and penetration into said porous liner to the projectile discharge bore thereof.

9. An erosion-and-corrosion-resistant gun-barrel unit, comprising a shell having a peripheral wall provided with perforations; a porous liner in said shell, said liner having a longitudinal projectile discharge bore and being formed by a plurality of end-to-end interfitted porous inserts in said shell; and an outer jacket surrounding the peripheral wall of said shell and adapted to hold coolant for passage through said perforations and penetration into said porous liner to the projectile discharge bore thereof.

10. An erosion-and-corrosion-resistant gun-barrel unit, comprising a shell having a cylindrical wall provided with perforations; a liner in said shell, said liner having a longitudinal projectile discharge bore and being formed by a plurality of complemental porous inserts of cross-sectional truncated sector shapes, respectively, and interposed spacers, respectively, in said shell; and an outer jacket surrounding the peripheral wall of said shell and adapted to hold coolant for passage through said perforations and penetration into said porous inserts to the projectile discharge bore in said liner.

11. An erosion-and-corrosion-resistant gun-barrel unit as set forth in claim 10, in which said inserts and spacers extend spirally in the longitudinal direction of said shell, and said spacers are of steel and extend inwardly slightly beyond the adjacent inserts, respectively, to form the rifling in said projectile discharge bore of the liner.

12. An erosion-and-corrosion-resistant gun-barrel unit, comprising a shell having a peripheral wall provided with perforations; a porous liner in said shell and having a longitudinal projectile discharge bore; and an outer jacket surrounding the peripheral wall of said shell and adapted to hold coolant for passage through said perforations and penetration into said porous liner to the projectile discharge bore thereof, said liner being formed by a plurality of porous inserts, including nonporous steel ribs, in said shell, of which said steel ribs extend radially into said projectile discharge bore and spirally longitudinally of the latter to form the rifling in said projectile discharge bore.

13. An erosion-and-corrosion-resistant gun-barrel unit, comprising a gun-barrel having a cartridge-chamber in its rear end and a cross-sectionally enlarged longitudinal bore extending to said cartridge-chamber, and being provided in its peripheral wall with perforations in communication with said bore; a porous liner in said barrel-bore, said liner having a longitudinal projectile discharge bore in line with said cartridge-chamber; and an outer jacket surrounding the peripheral wall of said gun-barrel and adapted to hold coolant for passage through said perforations and penetration into said porous liner to said projectile discharge bore therein.

14. An erosion-and-corrosion-resistant gun-barrel unit as set forth in claim 13, in which said porous liner is formed by a plurality of inserts in said barrel-bore.

15. An erosion-and-corrosion-resistant gun-barrel unit as set forth in claim 13, in which said porous liner is formed by a plurality of end-to-end arranged porous inserts in said barrel-bore.

16. An erosion-and-corrosion-resistant gun-barrel unit as set forth in claim 13, in which said liner is formed by a plurality of porous inserts, including nonporous steel ribs in said barrel-bore, of which said steel ribs extend radially into said projectile discharge bore and spirally longitudinally of the latter to form the rifling in said projectile discharge bore.

17. An erosion-and-corrosion-resistant gun-barrel unit, comprising a gun-barrel having a cartridge-chamber in its rear end and a longitudinal bore of which an end-length at the front of said barrel forms a part of the projectile discharge bore of the latter and the remaining length extends to said cartridge-chamber and is cross-sectionally enlarged, said gun-barrel having a peripheral wall provided with perforations in communication with said enlarged bore-length; a porous liner in said enlarged bore-length in said barrel, said liner having a longitudinal bore in line with said cartridge-chamber and with said end-length of said barrel-bore and constituting the remaining part of the projectile discharge bore in said gun-barrel; and an outer jacket surrounding the peripheral wall of said gun-barrel and adapted to hold coolant for passage through said perforations and penetration into said porous liner to said bore therein.

18. An erosion-and-corrosion-resistant gun-barrel unit as set forth in claim 17, in which said porous liner is formed by a plurality of inserts in said enlarged bore-length in said gun-barrel.

19. An erosion-and-corrosion-resistant gun-barrel unit as set forth in claim 17, in which said end-length of the bore in said barrel is rifled.

20. An erosion-and-corrosion-resistant gun-barrel unit as set forth in claim 17, in which said end-length of the bore in said barrel is rifled, and said liner is formed by a plurality of porous inserts, including nonporous steels ribs, in said enlarged bore-length in said gun-barrel, of which said steel ribs extend radially into said liner-bore and spirally longitudinally of the latter to form the rifling in said liner-bore in continuation of the rifling in said end-length of said barrel-bore.

21. An erosion-and-corrosion-resistant gun-barrel unit, comprising a shell having a peripheral wall provided with perforations; a porous liner in said shell, said liner having a longitudinal projectile discharge bore and nonporous steel ribs extending radially into said projectile discharge bore and spirally longitudinally of the latter to form the rifling in said projectile discharge bore; and an outer jacket surrounding the peripheral wall of said shell and adapted to hold coolant for passage through said perforations and penetration into said porous liner to the projectile discharge bore thereof.

22. An erosion-and-corrosion-resistant gun-barrel unit, comprising a shell having a peripheral wall; and a porous liner in said shell, said liner having a longitudinal projectile discharge bore and said peripheral shell-wall being apertured for the passage of coolant to said porous liner and penetration of the coolant into the latter to the projectile discharge bore thereof.

23. An erosion-and-corrosion resistant gun-barrel unit as set forth in claim 22, in which said porous liner is formed by a plurality of inserts in said shell.

24. An erosion-and-corrosion-resistant gun-barrel unit as set forth in claim 22, in which said liner has nonporous steel ribs extending radially into said projectile discharge bore and spirally longitudinally of the latter to form the rifling in said projectile discharge bore.

25. An erosion-and-corrosion-resistant gun-barrel unit, comprising a shell having a peripheral wall; and a porous liner in said shell, said liner being formed by a plurality of end-to-end arranged porous inserts in said shell having rifled bores, respectively, which form a continuous rifled projectile discharge bore in said liner, and said peripheral shell-wall being apertured for the passage of coolant to said porous liner and penetration of the coolant into the latter to said projectile discharge bore thereof.

26. An erosion-and-corrosion-resistant gun-barrel unit, comprising a gun-barrel having a cartridge-chamber in its rear end and a cross-sectionally enlarged longitudinal bore extending to said cartridge-chamber; and a porous liner in said barrel-bore, said liner having a longitudinal projectile discharge bore in line with said cartridge-chamber, and said gun-barrel having a peripheral wall which is apertured for the passage of coolant to said porous liner and penetration of the coolant into the latter to said projectile discharge bore thereof.

27. An erosion-and-corrosion-resistant gun-barrel unit, comprising a gun-barrel having a cartridge-chamber in its rear end and a longitudinal bore of which an end-length at the front of said barrel forms a part of the projectile discharge bore of the latter and the remaining length extends to said cartridge-chamber and is cross-sectionally enlarged, said gun-barrel having a peripheral wall provided with an aperture in communication with said enlarged bore-length; and a porous liner in said enlarged bore-length in said barrel, said liner having a longitudinal bore in line with said cartridge-chamber and with said end-length of said barrel-bore and constituting the remaining part of the projectile discharge bore in said gun-barrel, and said aperture in said peripheral barrel-wall serving for the passage of coolant to said porous liner and penetration of the coolant into the latter to said bore therein.

28. An erosion-and-corrosion-resistant gun-unit, comprising a gun-barrel having an outer circumference and a longitudinal projectile discharge bore and being, at least over a length thereof, porous from said outer circumference to said bore; and an outer jacket surrounding the porous circumference of said barrel-length and forming therewith a chamber, said jacket having transverse partitions spaced longitudinally of said barrel-length and dividing said chamber into separate compartments which are in individual communicating relation with the porous circumference of said barrel-length, and each of said compartments having an inlet for a coolant for its penetration into said porous barrel-length to the projectile discharge bore thereof.

29. An erosion-and-corrosion-resistant gun-barrel unit, comprising a shell having a peripheral wall provided with perforations; a porous liner in said shell, said liner having a longitudinal projectile discharge bore; and an outer jacket surrounding the peripheral wall of said shell, said jacket having transverse partitions dividing the same longitudinally of said shell into separate chambers which are in individual communicating relation with said liner through said wall-perforations, and each of said chambers having an inlet for a coolant for its passage through said perforations and penetration into said liner to the projectile discharge bore thereof.

30. An erosion-and-corrosion-resistant gun-barrel unit as set forth in claim 29, further comprising valves in said inlets, respectively, for the admission of variable amounts of coolant into the respective chambers.

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