April 24, 1928. 1,666,887

J. M. BROWNING

BARREL COOLING DEVICE FOR FIREARMS

Filed Oct. 15, 1925 2 Sheets-Sheet 1

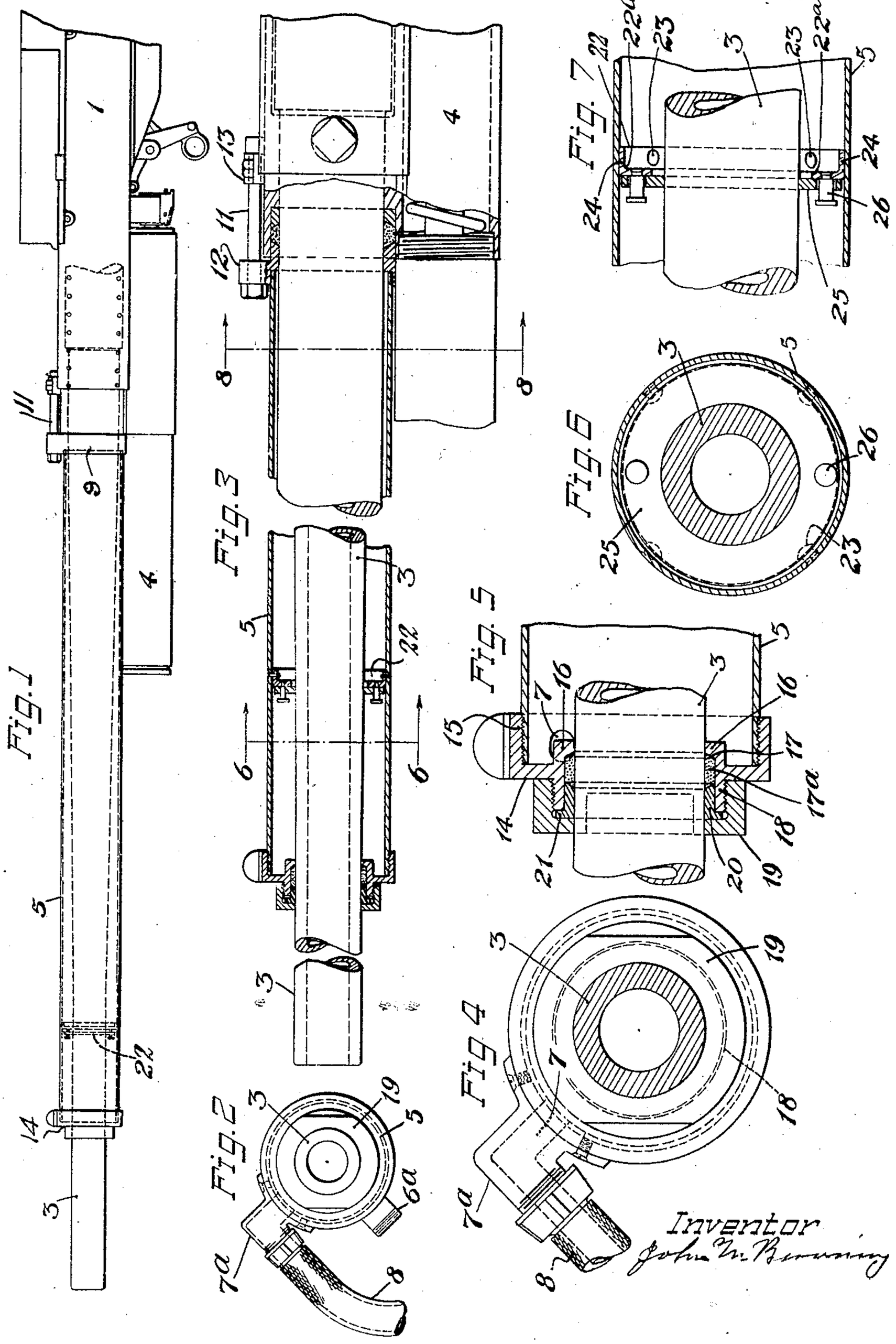

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Fig. 9

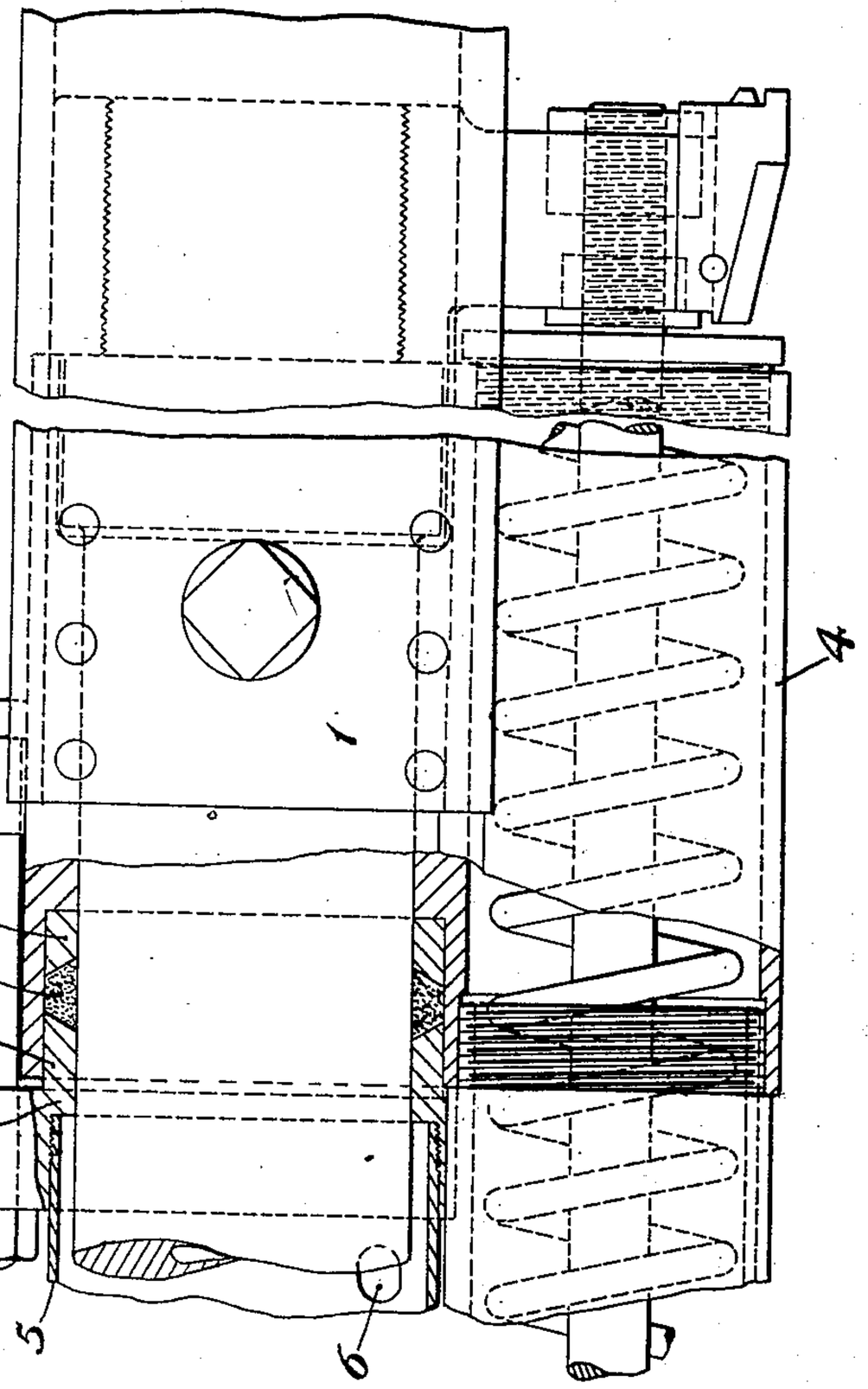
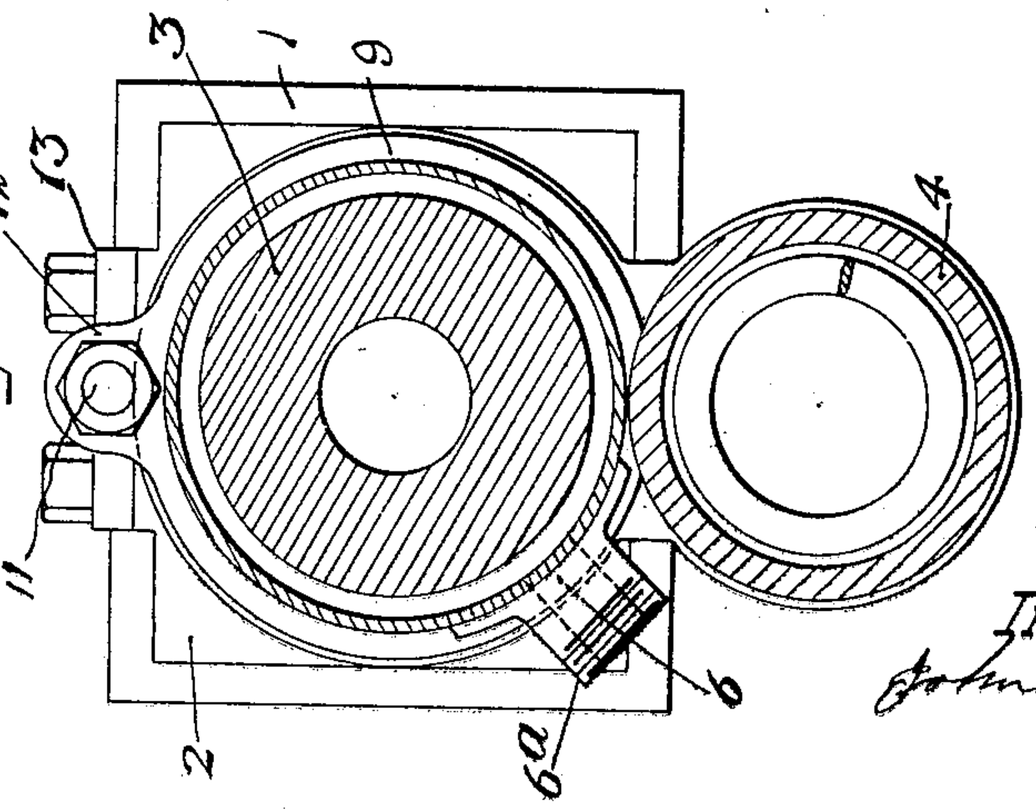


Fig. 8



Inventor
John M. Browning

Patented Apr. 24, 1928. 1,666,887

UNITED STATES PATENT OFFICE.

JOHN M. BROWNING, OF OGDEN, UTAH; JOHN BROWNING ADMINISTRATOR OF SAID JOHN M. BROWNING, DECEASED.

BARREL-COOLING DEVICE FOR FIREARMS.

Application filed October 15, 1925. Serial No. 62,672.

The invention relates to a barrel cooling device for automatic machine guns having a recoiling barrel, and more particularly to a device of this kind in which water is used as the cooling medium.

In machine guns of this class a tubular water cooling jacket surrounds the barrel and is suitably connected at its rear end to the breech casing of the gun. At the front, the jacket is provided with a closing cap having a bore within which the barrel slides. To prevent leakage of water along the barrel suitable stuffing boxes are provided at the rear end and at the front closing cap of the jacket.

After using such a gun, the water must be drained from the jacket and the barrel cleaned and greased to prevent its rusting. Failure to effect this cleaning operation may result in the subsequent malfunctioning of the gun due to the rusted condition of the barrel which particularly interferes with the smooth movement of the barrel and tends to tear the packing in the front and rear stuffing boxes with a resultant leakage of the water from the casing. Heretofore it has been necessary, in order to effect this necessary cleaning and treatment of the barrel, to open the rear end of the breech casing, remove the mechanism in rear of the barrel and to finally withdraw the barrel from the water jacket and breech casing in rearward direction.

It is an object of my invention to provide a construction whereby ready access can be had to the barrel for this purpose without the necessity of handling the barrel by dismounting it from the gun. Such a construction is particularly desirable in guns of relatively large caliber (say 37m/m or over) because of the weight of the barrel. This object is attained by providing a water cooling casing which can be easily attached to and detached from the breech casing and slid forwardly off the barrel, after which the barrel can be cleaned in situ.

A further object of the invention resides in the provision of means whereby the used packing in the stuffing boxes can also be readily removed and new packing inserted.

In automatic machine guns of this class, it has also been found that the extreme forward portion of the barrel, which necessarily projects forwardly beyond the front closing cap of the water jacket a distance substantially equal to the length of the recoil of the barrel, is not as effectively cooled as may be, because not immersed in the water of the jacket for a sufficient length of time, if at all. This is particularly true, when the barrel is tapered and when the gun is fired at a high angle of elevation, as at an aerial target, because the level of the water in the casing then drops an appreciable extent at each recoil of the barrel due to the decreased displacement of the barrel when in the recoiled position.

It is, therefore, a further object of the invention to provide for the more effective cooling of the barrel at its forward portion, and this object is attained by providing means for preventing the drop of the level of the water in the forward portion of the jacket when the gun is at a high elevation, and during the recoil and return movements of the barrel, thereby insuring that the forward portion of the barrel is sufficiently subjected to the cooling action of the water.

In the accompanying drawings there is shown a preferred embodiment of the invention as applied to an automatic gun of large caliber, such as is shown and described, for example, in my prior Patent, No. 1,525,065 dated February 3, 1925, for an automatic firearm, but it will be obvious that it is equally applicable to other guns and to guns of smaller caliber.

In the drawings:

Fig. 1 is the partial left side elevation of the gun having mounted thereon a cooling device embodying the invention;

Fig. 2 is a front elevation of the forward portion of the gun and cooling device mounted thereon;

Fig. 3 is a vertical longitudinal section of the forward portion of the gun with parts broken away;

Fig. 4 is an enlarged front elevation of the front stuffing box and the hose connection therefor, the barrel being shown in section;

Fig. 5 is an enlarged central longitudinal vertical section through the front stuffing box;

Fig. 6 is an enlarged vertical transverse section taken on the line 6—6 of Fig. 3, showing the novel check valve for holding the water in the extreme forward portion of the casing when gun is elevated to high angles;

Fig. 7 is an enlarged central vertical longitudinal section through water jacket and valve;

Fig. 8 is an enlarged vertical transverse section taken on the line 8—8 of Fig. 3 showing the positions of rear hose connection and rear stuffing box; and

Fig. 9 is an enlarged partial vertical longitudinal section and elevation of the gun showing the rear stuffing box, recoil spring, and means for readily releasing the water jacket from the gun casing.

The following main parts of the gun shown and described in Patent No. 1,525,065 are shown in the drawings; the breech casing 1, trunnion block 2, barrel 3 and recuperator 4.

In the gun to which the invention is shown applied, the rear portion of the long slidable barrel 3 is supported and guided in a seat in the trunnion block 2 closing the front end of the breech casing 1. The barrel 3 is preferably tapered in accordance with the customary practice.

As clearly shown in the drawings, there is provided a water jacket 5 which surrounds the barrel 3. Preferably the internal diameter of the tubular jacket 5 is but slightly larger than the external diameter of the rear portion of the barrel and surrounds the same from the breech casing forward to a point some distance rearward of the muzzle of the barrel. This small diameter of the cooling jacket is desirable to avoid unnecessarily increasing the weight of the gun and the water is conveniently supplied to the jacket through a port 6 at the rear end of the tubular casing and leaves the jacket through a similar port 7 at the top of the forward portion of the jacket, the said ports being respectively provided with suitable fixtures 6^a and 7^a. The continuous or substantially continuous supply of cold water to the jacket is assured by the provision of an external reservoir (not shown) from which the water is pumped through a conduit to the jacket and, if desired, the warmer water leaving the jacket may again be led back to the reservoir through a flexible conduit 8. Obviously, other suitable means for circulating the cooling water through the jacket bringing it into contact with the barrel might be used, the manner in which the circulation of the water is effected forming no part of the present invention.

To provide a readily detachable connection for the water jacket to the breech casing of the gun so as to permit its convenient removal I provide a suitable connecting means which is operative while the casing is held against rotative movement, the said means serving to draw the casing rearward into its proper relationship with the breech casing. It will be obvious that the avoidance of rotary movement is highly important as otherwise the hose connections would have to be removed before the jacket would be detached.

A suitable means such as a stuffing box is provided for preventing the leakage of water from the water jacket into the breech casing and preferably this stuffing box is so arranged that it can be adjusted while the jacket is secured to the casing as already stated.

Preferably and as shown the trunnion block 2 forming a part of the breech casing is formed with an annular recess surrounding the barrel and the water jacket is provided with a bushing adapted to enter the said recess and to serve as the bushing of a stuffing box or gland. Preferably there is an annular flange into which the rear end of the tubular portion of the jacket is threaded and the aforesaid gland bushing 9^a is formed as an integral part of the flange 9. An annular packing 10 is located in the said recess and preferably a second bushing 9^b is provided in the recess for forming a rear abutment for holding the packing 10. When the water jacket 5 is moved rearward by the attaching means the said packing 10 is compressed between the bushing 9^a and the rear abutment, which has already been stated, may be a second bushing 9^b. Preferably the rear face of the bushing 9^a is inclined rearward and outward and the front face of the bushing 9^b is inclined forward and outward, the result being that there is a tendency to force the packing 10 inward and into firmer contact with the barrel 1.

The means for drawing the water jacket rearward and for holding it in the assembled position is preferably located entirely at one side of the jacket, preferably at the top thereof, so as to be more conveniently accessible. The attaching means may comprise a single bolt 11 arranged conveniently at the top of the gun and passing as shown through an opening in an upwardly projecting lug 12 on the flange 9 and through a similar lug 13 secured to the top of the trunnion block of the breech casing, as shown in Fig. 8. Since the water jacket 5 is centered on the barrel at the front, by means to be described, and at the rear by the bushing 9^a, it will be evident that this connection is sufficient and provides means whereby the water jacket can be readily detached and slid off the barrel in forward direction, after which the rear packing is free to be removed and replaced. It will be observed that the bolt 11 serves as a common means for detachably holding the water jacket in place and for adjusting the stuffing box, that is, for compressing the packing 10.

At its forward reduced portion the water jacket is centered and guided on the barrel by an end cap 14, (see Fig. 5) having a

rearwardly projecting internally threaded flange 15 screwing over the forward end of the tubular portion of the jacket. This end cap carries a stuffing box to prevent leakage of water and the construction of this stuffing box is such that the removal and replacing of the packing is facilitated.

To form the stuffing box the end cap 14 has an internal rearward flange 16 the rear end of which is extended inwardly to fit the barrel and this inwardly extended portion has a rearwardly and inwardly inclined forward face 17 against which the packing 17ª is adapted to be forced. The end cap has also a forwardly extending flange 18, the outside of which is screw threaded to receive a cap nut 19, this cap nut being operative to force a sliding gland-bushing 20 having a rearwardly and outwardly inclined surface against the packing 17ª, thereby forming a water tight joint around the barrel. The gland-bushing may have, as shown, a flange 21 at its outer end, which, if the cap nut is screwed home, will be clamped between the nut and the outer end of the forwardly extending flange on the end cap of the water jacket.

By this construction it will be evident that the packing can be readily removed and replaced with fresh packing by unscrewing the cap nut and sliding the gland-bushing forwardly, thereby exposing the packing. An advantage of this arrangement resides in the fact that no internal screw threads hinder the insertion or removal of the packing as in stuffing boxes having a screw threaded gland fitting such internal threads.

To effectively cool the forward end of the barrel, particularly when the gun is being fired while pointed upward, I provide means surrounding the barrel and forming two water compartments, one of which is in front of the other and adjacent the front end of the barrel. The front compartment serves to retain the water and to prevent it from flowing backward toward the rear as might happen if only one long compartment were provided. Preferably when a single water jacket such as 5 is provided, the two compartments are formed by means of a transverse partition 22 (see Figs. 6 and 7) positioned some distance to the rear of the forward end of the water jacket. Preferably there is associated with the partition 22 a check valve which is so constructed as to prevent the flow of water from the forward compartment to the rear compartment, on the recoil of the barrel, but to otherwise permit free passage of the water in the opposite direction.

In the embodiment of the invention shown this partition comprises an annular member 22ª secured to the tubular portion of the water jacket as by rivets 23 passing through a flange 24 extending at right angles to the main body of said member and parallel with the tubular portion of the jacket. This annular member has its inner periphery spaced some distance from the barrel thereby, when the valve is open, leaving a free passage for the water and forming a valve seat. The movable member of the valve comprises a second annular member 25 fitting the barrel but of smaller external diameter than the internal diameter of the jacket. This movable valve member 25 is located forward of the fixed member 22ª and has limited longitudinal movement to open and close the passage between the fixed member and the barrel. Suitable means are provided to guide and support said movable member in its movements, and such means may comprise, as shown, studs 26, say two in number, projecting forwardly from the fixed member through holes in the movable member, the forward ends of the studs being headed or otherwise provided with means for limiting the forward movement of said member.

It will be understood that without the partition 22 and the associated check valve the level of the water in the water jacket would be lowered upon each recoil movement of the barrel, this being due to the fact that the barrel is tapered as shown. With the described construction, however, it will be evident that at the beginning of recoil of the barrel after firing a shot, the movable member 25 will seat against the fixed member 22ª and thereby prevent the passage of the water in the forward compartment to the rear. This insures that the forward end of the barrel will be subjected to the cooling action of the water by being immersed in it for an appreciable period of time while the barrel is in the recoiled position and during its less rapid return to battery.

On return of the barrel to battery the movable valve member 25 is carried to its forward position, opening the valve and again permitting the normal circulation of the water.

While I have herein shown and described a preferred embodiment of the invention, it will be understood that various changes may be made without departing from the spirit of the invention as covered by the following claims.

I claim:

1. In an automatic gun having a recoiling barrel, a frame, a jacket for maintaining a cooling fluid surrounding the barrel, a readily detachable connection securing said jacket to said frame, packing for preventing leakage of said cooling fluid, and means located outside of the frame and the jacket for compressing said packing, the said means being adjustable when said jacket is secured to said frame.

2. In an automatic gun having a recoiling barrel, a frame supporting the barrel, a cooling jacket surrounding said barrel and slidable off the barrel in a forward direction, and a readily detachable connection between said jacket and said frame, the said connection being operative while the jacket is held against rotative movement.

3. In an automatic gun having a recoiling barrel, a frame supporting the barrel, a cooling jacket surrounding said barrel and slidable off the barrel in forward direction, and a readily detachable connection between said jacket and said frame, the said connection being located entirely at one side of the said jacket and frame.

4. In an automatic gun, having a recoiling barrel, a frame supporting the barrel, a cooling jacket surrounding said barrel and slidable off the barrel in a forward direction, and a readily detachable connection between said jacket and said frame, the said connection comprising lugs on the jacket and the frame respectively, and a bolt extending through holes in the said lugs.

5. In an automatic firearm having a recoiling barrel, a frame supporting the barrel, a cooling jacket surrounding said barrel and slidable off the barrel in a forward direction, a readily detachable connection between said jacket and said frame, the said connection being operative while the casing is held against rotative movement, and a stuffing box surrounding said barrel and forming a fluid tight joint between said jacket and said barrel.

6. In an automatic firearm having a recoiling barrel, a frame, a cooling jacket surrounding said barrel and slidable off the barrel in a forward direction, a stuffing box surrounding said barrel and adapted to form a fluid tight joint between said jacket and said barrel, and a common means for detachably connecting the jacket to the frame and for adjusting the said stuffing box.

7. In an automatic firearm having a recoiling barrel, a frame, a cooling jacket supported by said frame and said barrel, the rear wall of said jacket forming a bearing bushing for the barrel, an abutment in the rear of said bushing in fixed relation to the frame, a packing between said abutment and the rear wall of the jacket, and means for moving the said jacket to compress said packing between the rear wall of said casing and said abutment.

8. In an automatic gun having a recoiling barrel, a frame supporting and guiding said barrel, a cooling jacket surrounding said barrel forwardly of said frame, a bushing surrounding said barrel adjacent to the rear wall of said jacket, a packing between said bushing and the front wall of said frame, means for securing said jacket to said frame, the actuation of said securing means compressing said packing to form a fluid-tight joint.

9. In an automatic gun having a recoiling barrel, a breech casing, the forward wall of which is provided with an annular recess surrounding the barrel, a cooling jacket supported on said barrel at the front and at the rear, a packing in the recess, means on the rear wall of the jacket for compressing said packing when the jacket is attached to the breech casing, and a readily detachable means for attaching said cooling jacket to said breech casing.

10. In an automatic firearm having a recoiling barrel, a breech casing, a cooling jacket supported by said breech casing and said barrel, the rear wall of said jacket forming a bushing, an annular abutment at the rear of the said bushing, a packing between the bushing and the abutment, and a readily detachable connection between the said jacket and the said breech casing, the said connection being operative while the casing is held against rotative movement and serving not only to hold the jacket but also to compress said packing to form a fluid-tight joint.

11. In an automatic firearm having a recoiling barrel, a breech casing, a cooling jacket supported by said breech casing and said barrel, the rear wall of said jacket forming a bushing, an annular abutment at the rear of the said bushing, a packing between the bushing and the abutment, and a readily detachable connection between the said jacket and the said breech casing, the said connection comprising lugs on the jacket and the frame respectively and a bolt extending through holes in the said lugs and the said connection serving not only to hold the jacket but also to compress the said packing to form a fluid-tight joint.

12. In an automatic gun having a recoiling barrel, a frame, a cooling jacket detachably secured to said frame and surrounding said barrel, a front wall on said jacket, a bushing surrounding said barrel adjacent to said front wall, packing in said bushing, an annular member detachably secured to the front portion of said jacket by longitudinal movement of said member, and a gland-bushing supplemental to the said member whereby said packing is compressed to form a water-tight joint when said member is secured to said jacket.

13. In an automatic gun having a recoiling barrel, a cooling jacket surrounding the barrel having a front wall adjacent the forward end of the barrel, an annulus surrounding the barrel adjacent the front wall and secured thereto, external screw threads on said front wall portion of the jacket, a cap with internal threads engaging said external threads, packing forwardly of said annulus, and a gland-bushing between said packing

and said cap whereby when said cap is secured to said front wall portion the gland-bushing will compress the packing against the annulus forming a fluid-tight joint.

14. In an automatic firearm having a barrel adapted to recoil upon the firing of a shot, of a single tubular jacket surrounding the barrel and adapted for holding cooling water, and a one-way valve associated with the partition for permitting free flow of the water from the rear compartment to the front compartment and for preventing free flow from the front compartment to the rear compartment.

15. In an automatic firearm having a barrel adapted to recoil upon the firing of a shot and being of larger diameter at its rear portion than at its forward portion, a tubular water-cooling jacket surrounding the barrel, and means for retaining the water in the front portion of the jacket upon the recoil when the arm is fired at angles of elevation.

16. In an automatic firearm adapted to be fired at angles of elevation and having a recoiling barrel of larger diameter at its rear portion than at its forward portion, a cooling jacket surrounding the barrel, a one-way valve forming a partition some distance in rear of the forward wall of said jacket to prevent the drop of the water level in the forward portion of the casing when the barrel recoils while being fired at angles of elevation.

17. In an automatic firearm having a barrel adapted to recoil upon the firing of a shot and being of larger diameter at its rear portion than at its forward portion, a tubular water-cooling jacket surrounding the barrel, and means for preventing the drop of the water level in the front portion of the jacket upon the recoil of the barrel when fired at angles of elevation, said means comprising an annular member secured to the inside of the jacket and extending inward toward the barrel, but leaving a passage between it and the barrel for the free passage of water past said member, and a second annular member forward of the first member and adapted to have limited longitudinal movement to open and close said passage, whereby in the recoil of the barrel said passage is closed and the water retained in the forward portion of the jacket to effectively subject the forward end of the barrel to its cooling action.

18. In an automatic firearm having a barrel adapted to recoil upon the firing of a shot and being of larger diameter at its rear portion than at its forward portion, a tubular water-cooling jacket surrounding the barrel, and means for retaining the water in the front portion of the jacket upon the recoil and return of the barrel when the arm is fired at angles of elevation, said means comprising a fixed annulus secured to the wall of the jacket, and a movable annulus forward of said fixed annulus and movable to open and close an annular passage for the water between the fixed annulus and the barrel, and means on the fixed annulus for guiding the movable annulus in its movement and for limiting such movement.

This specification signed and witnessed this 30th day of September A. D. 1925.

JOHN M. BROWNING.

CERTIFICATE OF CORRECTION.

Patent No. 1,666,887. Granted April 24, 1928, to

JOHN M. BROWNING.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, lines 89 and 90, for the article "the" read "a"; page 2, line 52, for the word "bringing" read "to bring"; page 4, line 55, claim 7, and page 5, line 32, claim 16, for the word "casing" read "jacket"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of July, A. D. 1928.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.