B. B. KAHN.

FUEL TANK.

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1,309,526.

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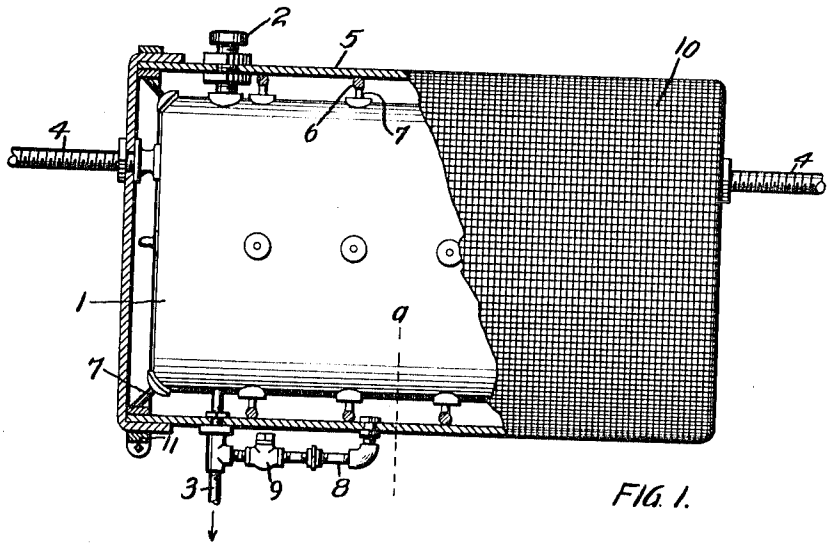



FIG. 1.

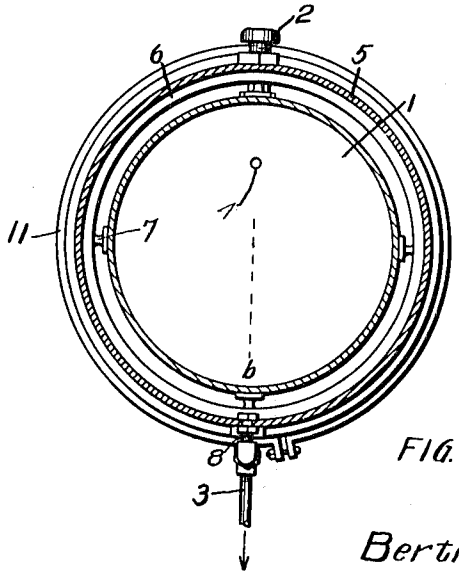



FIG. 2.

Witness:

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# UNITED STATES PATENT OFFICE.

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## FUEL-TANK.

1,309,526. Specification of Letters Patent. Patented July 8, 1919.

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*To all whom it may concern:*

Be it known that I, BERTRAND B. KAHN, a citizen of the United States, residing at Cincinnati, Hamilton county, Ohio, have invented certain new and useful Improvements in Fuel-Tanks, of which the following is a specification.

The present invention has particular reference to fuel tanks employed as containers for liquid fuel under conditions exposing them to penetration by projectiles, a gasolene tank in an aeroplane for instance, and the improvements relate to means for lessening the damage which may result from such penetration.

In the present invention a metallic tank contains the liquid fuel and this tank is surrounded by an elastic jacket, as of rubber, the jacket being spaced apart from the tank such a distance that if a bullet is shot entirely through the structure it will not, in leaving the tank wall on the outgoing side, so rag out the metal of the tank-wall as to prevent the self closure of the wound in the rubber jacket. The fuel is led from the tank by an outlet pipe, and a secondary outlet pipe is connected with the space between the tank and the jacket to convey to the motor the liquid fuel which escapes into the intervening space when the tank is punctured. The secondary outlet pipe connects with the outlet pipe from the tank and a check valve is arranged between the two pipes to prevent the ordinary outflow from the outlet pipe going to the space within the jacket.

My invention will be readily understood from the following description taken in connection with the accompanying drawing in which:—

Figure 1 is a side elevation of a fuel tank embodying an exemplification of my invention, a portion of this figure appearing in vertical section in the plane of line *b* of Fig. 2, while Fig. 2 is a transverse section in the plane of line *a* of Fig. 1:

In the drawing:—

1, indicates a fuel tank, which in the present exemplification is illustrated as being cylindrical in form, and which may be assumed as being formed of metal:

2, the filling-plug:

3, the outlet-pipe:

4, studs projecting from the tank for its support:

5, a casing of resilient material, soft rubber for instance, completely inclosing the tank but spaced away from it:

6, hoops surrounding the tank at the interior of the casing:

7, struts connecting these hoops with the tank and maintaining the spacing between the tank and the casing:

8, a branch outlet pipe leading from the base of the interior of the casing:

9, a check-valve in this branch pipe, closing toward the casing: and

10, a netting tightly surrounding the casing.

The studs 4, which are to serve as sustaining elements in connection with the tank, are to have their exterior portions formed in any appropriate manner suitable for their attachment to whatever is to support the tank, the stanchions of an aeroplane for instance. Where studs pass through the casing, and also where the filling plug and the outlet pipe pass through the casing, suitable packing devices, such as the flanges and nuts illustrated, are to be employed, the object being to insure that the casing will be liquid tight. The hoops within the casing serve to preserve its exterior form. The casing may, if desired, be formed with a removable head forming a tight closure, and removably secured in place, as by means of the drawband illustrated. All portions of the casing should be formed of resilient material, as rubber for instance, and, for reasons hereinafter given, all of the parts connecting the casing and the tank should be as small as is consistent with their duties.

If a projectile, such as a rifle bullet, strike the structure, it may be presumed as penetrating the casing and penetrating the nearer wall of the tank, and passing through the liquid and penetrating the wall of the tank and the casing at the farther side. If the structure were entirely of metal then such penetration, if occurring at the base portion of the tank, would permit the liquid to leave the tank very quickly, and this happening might be very serious by reason of the loss of liquid and by reason of the danger of inflammability of the escaping liquid. It is the purpose of the casing to prevent or, in a considerable degree, retard the escape of the liquid.

It is found in practice that if a bullet penetrate the resilient casing, it will, for the instant, produce a hole therein, which, by reason of the resilient nature of the ma-

terial of the casing, will generally immediately close up and retard the outflow of liquid to such degree as to conserve the liquid for use, and prevent inflammability.

The netting surrounding the casing endows it with strength tending to enhance its natural self-healing or self-restoring qualities. When liquid leaks from the penetrated tank into the casing, and produces a hydrostatic head in the casing, tending to urge outwardly the parts of the casing surrounding the wound, the netting serves in meeting this outward pressure of the casing material.

When the tank is penetrated, then the liquid becomes intercepted in the casing, the wound in the casing having fairly closed up, and the outlet pipe from the tank may become ineffective, but the branch outlet pipe becomes at once automatically available.

It is to be understood that if a projectile tending to penetrate the structure, strikes the filling-plug or a pipe or a stud or a strut, the damage to the tank, and possibly to the casing, might be very serious, but it will be at once recognized that the proportion of tank area thus capable of being thus attacked is small compared with the total area of the tank.

A bullet penetrating the tank on its nearer side will not only make a hole in the tank but will cause the ragged edges of the hole to protrude inwardly, which, of itself, cannot add to the harm. But when the bullet penetrates the farther wall of the tank, and produces ragged edges there, such ragged edges might, if the casing were near enough, produce such a serious wound in the casing as to prevent any satisfactory healing. The distance between the tank and the casing should therefore be such that such ragging will not additionally damage the casing by increasing the wound therein or by interfering with the closing up of the wound. I have found that a minimum distance of one and three-quarters inches between the tank and the casing will adequately guard this matter when any usual thickness of tank material is employed.

I claim:—

1. A fuel tank comprising, a metallic tank for containing liquid fuel, an enveloping casing formed of rubber, and means for spacing the casing away from the tank such distance as to prevent the outward ragging of the wall of the tank from reaching the casing, combined substantially as set forth.

2. A fuel tank comprising, a metallic tank for containing liquid fuel, an enveloping casing formed of rubber, means for spacing the casing away from the tank such distance as to prevent the outward ragging of the wall of the tank from reaching the casing, an outlet from the tank through the casing, and an outlet from the space between the casing and the tank connected with the first-mentioned outlet, combined substantially as set forth.

3. A fuel tank comprising, a metallic tank for containing liquid fuel, an enveloping casing formed of rubber, means for spacing the casing away from the tank such distance as to prevent the outward ragging of the wall of the tank from reaching the casing, an outlet from the tank through the casing, an outlet from the space between the tank and casing and connected with the first-mentioned outlet, and a check-valve disposed between the two outlets to prevent the flow of liquid from the tank to the space between the tank and casing, combined substantially as set forth.

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Witnesses:
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