Aug. 15, 1950 A. N. BENSON ET AL 2,518,446

PROCESS OF AND METHOD FOR CATCHING MACHINE GUN BULLETS

Filed Oct. 29, 1948 3 Sheets-Sheet 1

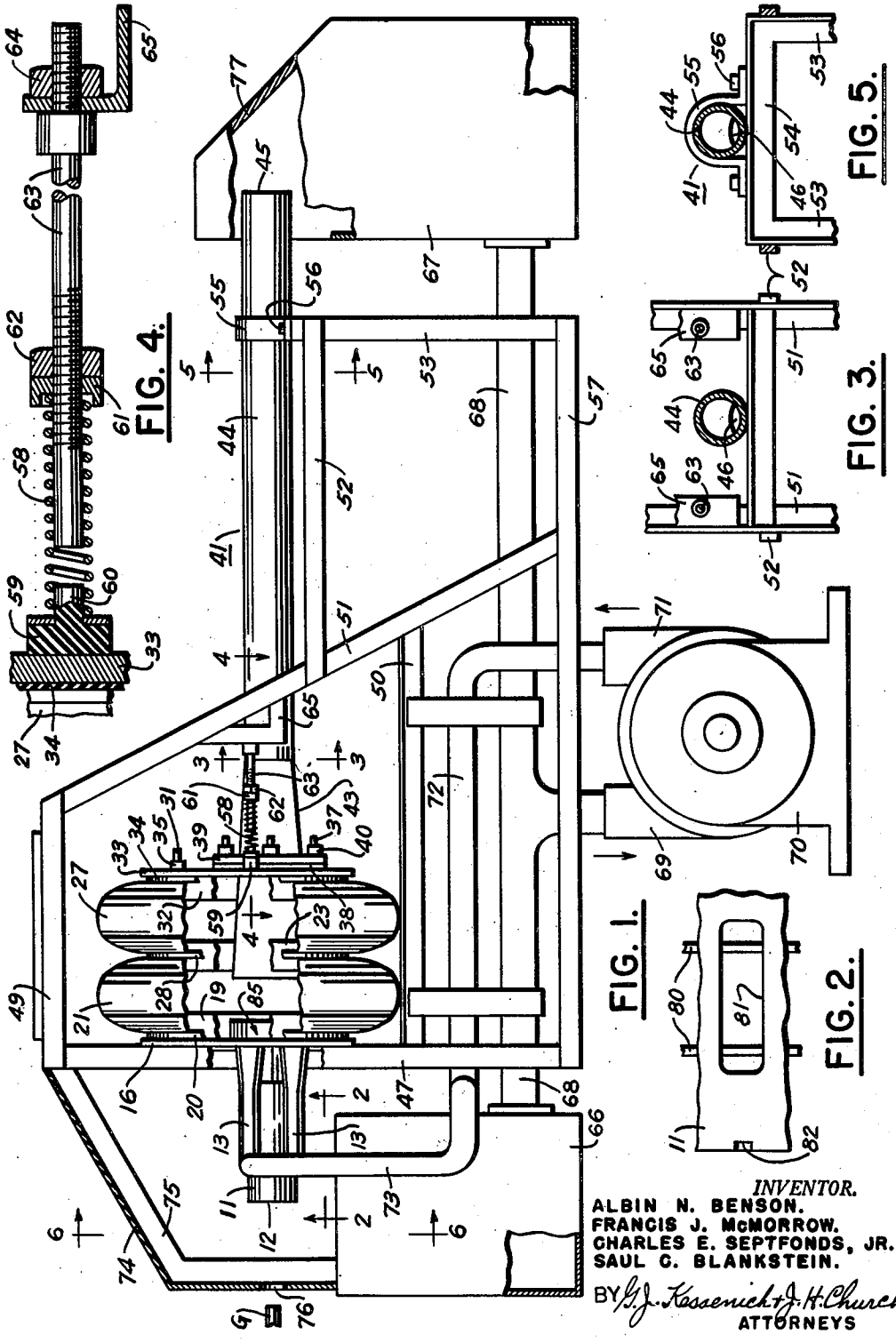


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 5.

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Filed Oct. 29, 1948 3 Sheets-Sheet 2

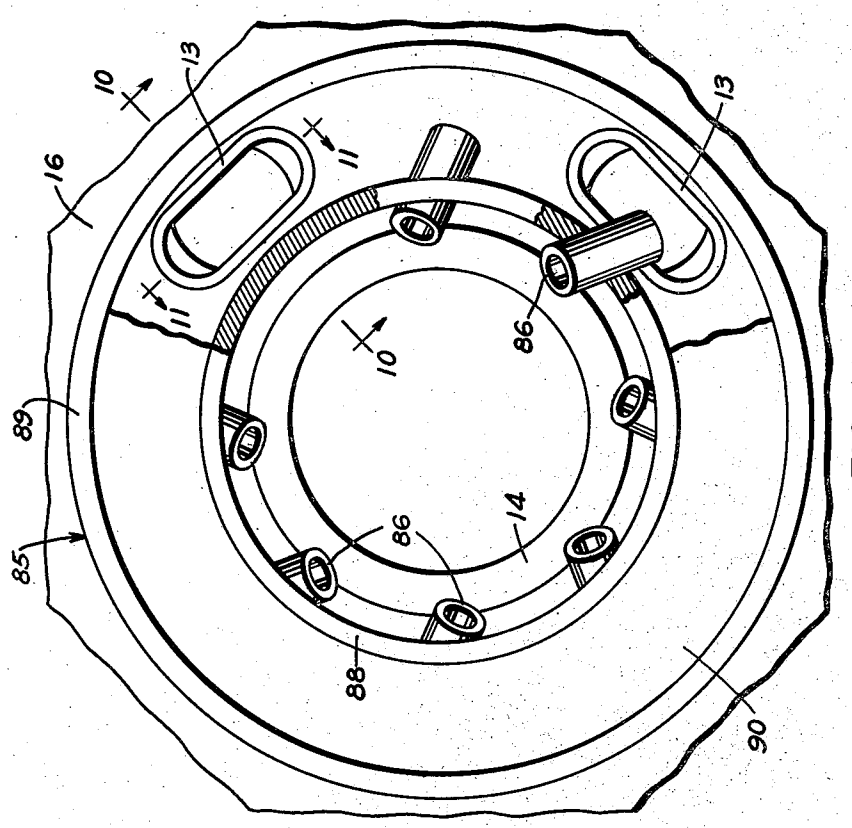


FIG. 9.

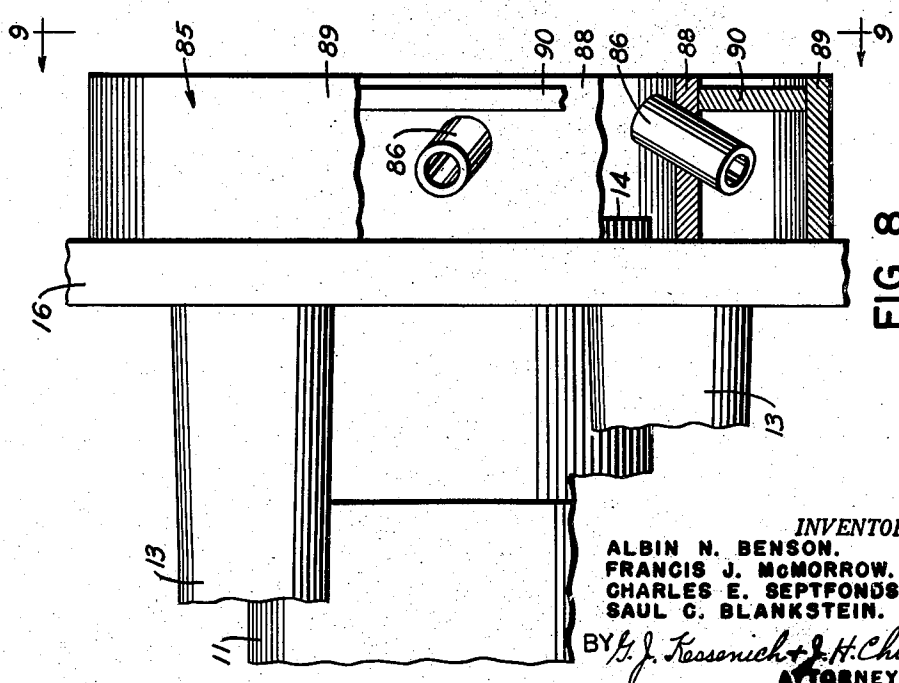


FIG. 8.

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PROCESS OF AND METHOD FOR CATCHING MACHINE GUN BULLETS

Filed Oct. 29, 1948 3 Sheets-Sheet 3

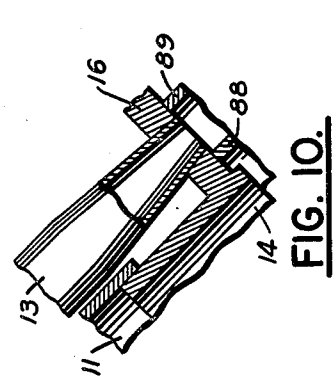


FIG. 10.

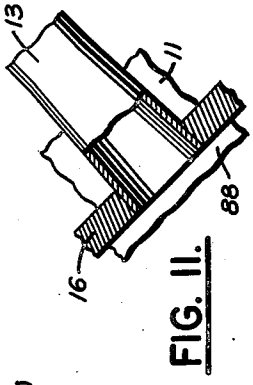


FIG. 11.

FIG. 6.

FIG. 7.

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Patented Aug. 15, 1950 2,518,446

UNITED STATES PATENT OFFICE

2,518,446

PROCESS OF AND METHOD FOR CATCHING MACHINE GUN BULLETS

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Application October 29, 1948, Serial No. 57,282

7 Claims. (Cl. 73—167)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described in the following specification and claims may be manufactured and used by or for the Government for governmental purposes without the payment to us of any royalty thereon.

This application is for improvements made in an invention first disclosed by the co-pending application of Albin N. Benson, Serial No. 756,535, which was filed on June 23, 1947, for "Process of and Apparatus for Catching Machine Gun Bullets." In that co-pending application it was stated that the objects of the invention there described included the provision of "an apparatus for and a process of catching or stopping machine gun bullets of all types including armor piercing, incendiary, and tracing, which apparatus is for and which process comprises: firing a burst or series of machine gun bullets into a flowing stream of water; absorbing by means of an elastic, resilient, renitent structure the initial shock wave resulting from the impact of each bullet against the flowing stream; absorbing the kinetic energy of each bullet by transforming it into kinetic energy of flowing water; and allowing the bullets to settle by gravity from the water."

The above described objects are likewise objects of the present invention. In addition thereto it is an object of the present invention to provide a catcher or stop for machine gun bullets, which catcher or stop comprises: (*a*) an inlet tube having an open end; (*b*) a shock absorption tube consisting of a cylindrical continuation of the inlet tube having an increased cross section and being formed of resilient, flexible, elastic material; (*c*) nozzles each mounted so as to penetrate directly into and at a compound angle to the longitudinal axis of the shock absorption tube, and connected so that each nozzle supplies a jet of water which contributes to the maintenance of a head of water in the shock absorption tube; (*d*) an energy absorption tube, forming a continuation of the shock absorption tube, through which the water flows and where it has increased kinetic energy imparted to it as a result of the pressure built up by the bullets in the resilient shock absorption section; and (*e*) an outlet basin into which the water pours from the energy absorption section and in which each bullet settles out of the standing water.

A further object of the present invention is to make more uniform the head of water which is disclosed in the said co-pending application as being maintained within a large rubber tire, whereby rapidly to reduce the speed and travel

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of bullets fired therethrough, thus to diminish the scattering of the bullets in their travel to the exit portion of the apparatus.

An additional object is to maintain an increased head of water over that made possible by the device of the said co-pending application, thereby lessening the amount of water that is required and permitting the shortening of the apparatus' energy absorption tube, or conversely to permit the firing of higher energy bullets without requiring an increase in size of the apparatus or the amount of water used.

A still further object of the present invention is to provide means whereby the water splashing back towards the apparatus' bullet inlet is prevented from reaching the muzzle of the gun.

Our improved apparatus may better be appreciated from the drawings wherein:

Fig. 1 is a view in side elevation of our novel device;

Fig. 2 is a view taken from line **2—2** of Fig. 1 to show the mounting of baffle plates which reduce the splash-back effect of the water, and further to show the opening through which the water is permitted to escape from the inlet portion of the apparatus;

Fig. 3 is a vertical transverse section taken from line **3—3** of Fig. 1;

Fig. 4 is a horizontal longitudinal cross section on an enlarged scale taken from line **4—4** of Fig. 1;

Fig. 5 is a vertical transverse cross section on line **5—5** of Fig. 1;

Fig. 6 is an end elevation on line **6—6** of Fig. 1, two of the water inlet pipes having been removed so as to indicate the manner of their connection or passage through the front plate of the shock absorption section;

Fig. 7 is a vertical longitudinal cross section of the tube through which the bullets are fired, of the tires which absorb the shock wave caused by the impact of the bullets against the flowing stream of water, and of the energy absorption tube, this view being much enlarged over the showing of Fig. 1, with parts broken away transversely to shorten the length of the view;

Fig. 8 is a side elevation showing a portion of the main water inlet pipes which enter through the front plate to feed the novel, circularly disposed nozzles which set up the swirling stream of water that features our present invention, portions of the illustrated parts having been broken away to show the structure and positioning of the circularly disposed nozzles;

Fig. 9 is a view taken from line **9—9** of Fig. 8

further to show the relative positioning of the circularly disposed nozzles, a portion of the plate in which the nozzles are housed having been broken away to show the manner in which the nozzles are secured thereto;

Fig. 10 is a view taken from line 10—10 of Fig. 9 to show further constructional details of one of the water inlet pipes; and

Fig. 11 is a similar detailed view taken from line 11—11 of Fig. 9.

One selected embodiment of the apparatus of this invention is as follows: the muzzle of the machine gun undergoing test is represented at G in the left-hand side of Fig. 1. This machine gun may typically be of caliber .50 size which, when fired at a high cyclic rate, shoots bullets delivering energy at a rate equal to 450 H. P.

Referring to Fig. 7, the trapping or catching device for stopping these bullets and absorbing the energy therein comprises an inlet end consisting of an inlet tube 11 having an open inlet end 12 and a series of ring-shaped baffle plates 80, an opening 81 through the bottom of the tube and another opening 82 through the first baffle plate, the baffles and the openings serving to prevent water from splashing back through the tube inlet end 12 onto the muzzle of gun G. The inlet tube 11 has an open outlet end 14 which extends through a steel plate 16 that forms a lateral extension of the inlet tube 11 and is attached thereto as by welding. Somewhat near the periphery of plate 16 there are a plurality of perforations therethrough arranged in a ring. Through each of these perforations passes a bolt 17 having at its inner end a clamp 18. A short cylindrical section 19 is welded or otherwise fastened to plate 16 so that it projects inwardly therefrom. A flat ring 20 of rubber or like material forms a gasket between the interface of plate 16 and a portion of the side wall of a heavy-duty truck tire 21, which is mounted, at one side, on the cylinder 19 and held in position thereon by bolts 17 and clamps 18. Nuts 22 are provided on bolts 17 for this purpose. The opposite inside edge of truck tire 21 contacts a second short cylindrical section 23 and is secured thereto by means of a series of clamps 24 which form the ends or heads of a series of bolts 25. On each of bolts 25 is slidably mounted a movable clamp 26 adapted to engage a portion of the inlet side of a second heavy-duty truck tire 27 and to clamp tire 27 against tire 21, the junction between them being sealed by a second flat ring 28 serving as a gasket. Nuts 29 press clamps 24 and 26 towards each other so as to grasp portions of tires 21 and 27 between them. The rearward edge of tire 27 is supported and sealed in a similar manner. A series of clamps 30 forming the heads of bolts 31 are pressed against portions of the inner side wall of tire 27 and hold it upon the outer edge of a third cylinder 32 which is welded or otherwise secured to a flat plate 33 having a series of perforations in it through which the bolts 31 pass. A third flat ring 34, serving as a gasket, is interposed between the outer face of tire 27 and the opposite face of plate 33. A number of nuts 35 are each mounted on one of the bolts 31 and permit pressure to be applied to clamp 30.

The plate 33 has a hole 36 therethrough, and surrounding this hole are a series of projecting studs 37. Studs 37 pass through perforations arranged in a ring adjacent the edge of a gasket 38 and through perforations arranged in a ring adjacent the edge of plate 39. Each of studs 37 carries a nut 40 on it which serves to tighten

the plate 39 and the gasket 38 against plate 33 and thereby form a tightly sealed wall.

An energy absorption or outlet tube 41 of square cross section is mounted on plate 39 by welding or other means. Outlet tube 41 has an open inlet end 42 opposite the outlet end 14 of the inlet tube 11. The walls 43 of outlet tube 41 adjacent the inlet end 42 slope in the form of a frustum of a hollow pyramid having its larger base or flat surface forming the inlet end 42. The walls 43 are approximately one inch thick and are made of homogeneous hardened armor plate. These walls 43 continue for a considerable distance and merge into a cylindrical wall 44 which continues to the outlet end of the outlet tube 41, which outlet end is closed at its upper part by wall 45 and is open at its lower part, as shown at 46.

Referring now to Figs. 1, 6, 7 and 8, there will be seen water inlet pipes 13 (four are illustrated in the drawings although, of course, more or less may be employed) which pass through plate 16 so that a supply of water or other fluid issuing from each of said pipes is delivered to a cylindrical, ring-shaped tank 85 maintained within cylinder 19. This tank 85 may consist of a ring-shaped tubular structure whose inwardly facing surface is perforated by a series of holes each passing on a compound angle through the tube wall for the accommodation of a series of nozzles 86, as will later be described. One simple method for making the ring-shaped tank 85 would be to use a tubular ring and drill holes through the wall facing inwardly towards the ring's center. However, another and possibly preferable method is first to form a flat strip of steel in the form of a ring 88 and by means such as welding secure it to plate 16. Prior to thus securing this ring 88 it would be best to make the necessary series of holes therethrough which are later to accommodate nozzles 86. Then the nozzles 86 can be placed through these holes in the position shown in Figs. 8 and 9, and secured therein by welding or other convenient means. It will be noticed that nozzles 86 are so fixed that the jets of water which will issue therefrom will take a spiral path, all the streams being tangent to a common imaginary circle, and merging into one circularly moving body of water. The next step in fabricating tank 85 would be to form an outer ring 89 from another strip of steel and weld it to plate 16 as shown in Fig. 8. Then the flat, ring-shaped cap 90 can be welded into place (see Figs. 8–9) thereby completing the ring-shaped tank 85.

It is worthy to note at this point that the tank 85, and more particularly the nozzles 86, do not have to be positioned at the entrance to tire 21 as illustrated in the drawings. Instead, the tank and nozzles could be mounted at any point within the tires in order to produce a whirling motion and to maintain a head of water in the tires.

Referring now to Fig. 1, it will be seen that the parts already referred to are mounted in a frame consisting of vertical brackets 47 connected at their upper ends by a top (not shown). From the junctions of brackets 47 and the connecting top (not shown) project top sides 49. Parallel and beneath top sides 49 projects a lower support 50. The ends of these sides 49 are connected to diagonal brace 51 from which project horizontal forward sides 52 connected at their ends to front supports 53 which are joined together by a front top 54 (see Fig. 5) on which the cylindrical portion 44 of tube 41 is mounted slidably by means of an inverted U-shaped guide 55 held in position

by stud bolts 56. Bottom sides 57 connect the lower ends of brackets 47, of diagonal braces 51, and of front supports 53.

Figs. 1, 4 and 7 each show one of a pair of duplicate springs 58, a description of one of which will suffice since they are alike. Springs 58 are disposed in the same cylindrical plane on opposite sides of a vertical plane passing through the axis of outlet tube 41 and yieldingly stress plate 33. Fig. 4 shows tire 27, gasket 34 and plate 33 against which presses a plug 59 of rubber or the like, having a portion 60 of reduced diameter which enters within the end of the coils of spring 58. The opposite end of spring 58 is located in the projecting flange of a nut 61 which is pushed by a lock nut 62 on a screw threaded rod 63 whose opposite end is secured by a nut 64 to an angle iron 65 fastened at its ends to the diagonal brace 51.

A supply of water is provided by means of a front reservoir 66 and a rear reservoir 67 which are connected by inlet pipe 68 to the inlet 69 of a pump 70 driven by a suitable motor (not shown). The outlet 71 from pump 70 connects with an outlet pipe 72 which branches and connects with headers 73 which in turn connect with the inlet pipes 13, as shown in Figs. 1 and 6.

A splash plate 74 having depending flanges 75 and a front perforation 76 is located on top of front reservoir 66. A rear splash plate 77 of armor plate similarly is secured on top of rear reservoir 67 opposite the outlet 46 in the end of outlet tube 41.

The operation of the bullet trap or catcher of the present invention is as follows. A suitable supply of water or other fluid, such as brine or low freezing point mixture, is provided in reservoirs 66 and 67. Pump 70 is started so that the water is circulated from the reservoirs 66 and 67 through inlet pipe 68, pump 70, outlet pipe 72, headers 73, and inlet pipes 13 from whence the water courses through tank 85 and issues through the circularly disposed nozzles 86 with sufficient velocity to maintain a head of water in the shock absorption section of the apparatus. The number and bore size of nozzles 86 are so selected that for a given pressure which circulates the water in the system, the water will issue from nozzles 86 with the required velocity.

In the aforesaid co-pending application of A. N. Benson, Serial No. 756,535, the water being admitted into the system is made to pass through the bullet inlet tube prior to reaching the shock absorbing tires. We have found that our invention, by which the water is admitted directly to the tires and is not subject to interference by the air stream or bullet stream that passes through the inlet tube, makes it possible to get a more uniform head of water in tires 21—27, thereby resulting in a diminution of bullet scattering in travel through tube 41. Further enhancing this improvement is the fact that we have provided a great many more water inlet nozzles 86 than were employed in the apparatus shown by the said co-pending application. In addition, since these nozzles enter directly into tire 21, advantage can be taken of the means illustrated and above described for effecting a swirling motion on the water (see Fig. 9) which further serves to make the head of water greater and more uniform than could the predecessor device which we have improved. Still further facilitating this objective, we have provided a vent hole 91 through plate 16 (see Fig. 7). This vent hole 91 permits some of the air entrapped in tire 21 to escape therethrough, thereby permitting the height of the water therein to rise higher than was possible in the device of the co-pending Benson application. The advantages of this increased head of water are: the use of less water, as the desired cushioning effect can be achieved with a lower gallons-per-minute flow of water than was required in the earlier device which had a lower water head and therefore a less effective cushioning action; shortening of tube 41 is made possible, as the increased cushioning effect of the greater water head reduces the need for the lengthy passageway required in the earlier Benson device to carry off the spent bullets; and, as a converse choice over the two advantages just named, by utilizing the same amount of water and the same length of tube 41, it is possible to fire higher energy bullets through the apparatus than could have been fired through the device disclosed in the aforesaid co-pending application.

Continuing the explanation of the operation of the present invention, it will be understood that the water substantially fills the interior of tires 21 and 27 except for the space above the level of vent hole 91. Some of the water escapes through the outlet 14 of inlet tube 11, although our improved baffles 80 and the openings 81 and 82 provided in inlet tube 11 considerably reduce the amount escaping through the inlet end 12 in comparison with the condition which existed in the earlier Benson device. Still other portions of the water run through tube 41 emptying therefrom through an opening 46. Some water is emitted through vent hole 91, but not enough to be of and consequence. Of course, all the water which escapes from tires 21 and 27 falls into the reservoirs 66 and 67 at opposite ends of the apparatus.

With the apparatus in the condition just described the machine gun G is then brought into position so that its axis is aligned with the axes of front perforation 76 in splash plate 74, the inlet tube 11 and the outlet tube 41. A burst or rapid succession of bullets is then fired in series into the standing body of water in the interior of the tires 21 and 27. In a typical example, each bullet leaves the muzzle of machine gun G with an energy of about 1200 foot pounds. When a burst of such bullets is fired at high rate the energy is delivered to the water at a rate of 450 H. P. Most of this energy is transformed into kinetic energy of the water. Each bullet, as it strikes the water, sends out a sharp shock wave. These shock waves are absorbed by the resiliency of the heavy duty truck tires 21 and 27 and flexion of the springs 58. These bullets tend to build up pressure in the interior of the tires 21 and 27 and increase the velocity of the flow of water through the outlet tube 41. The length of the outlet tube 41 is sufficient so that the speed of the bullets and the speed of the water have substantially equalized before the outlet end of the outlet tube 41 is reached. The bullets, therefore, drop through the outlet 46 into the rear reservoir 67 whence they settle out of the water and can readily be removed after a test or series of tests have been run.

Summary

It will be evident from the foregoing that the present invention provides a process of and apparatus for testing heavy caliber ammunition and machine guns using same by firing bullets

from such weapons at their normal high cyclic rates of fire, and that the said process and apparatus are even superior to the basic disclosure first made in the co-pending Benson application Serial No. 756,535. These bullets are stopped or trapped in a minimum space and in good condition by the use of water contained in a tube, a portion of whose walls are of a material which is sufficiently elastic, flexible, and renitent to absorb the shock waves caused by the impact of each bullet in succession without damage to the apparatus or its surroundings.

We claim:

1. A process of stopping machine gun bullets that have been fired in rapid succession, which process includes firing the bullets into a chamber in which is maintained a circularly fed and moving stream of liquid in an amount sufficient to form a bank which will absorb at least a major portion of the bullets' kinetic energy.

2. The method of decelerating a projectile which comprises providing a chamber having opposed inlet and outlet tubes open to the atmosphere and continuous therewith an intermediate section consisting of a much enlarged resilient and renitent portion, introducing liquid directly into said intermediate section adjacent said inlet tube in such manner as to produce a head of constantly flowing liquid which completely blocks the passage from the inlet to the outlet tubes, projecting a projectile to be trapped into the inlet tube and towards the outlet tube at an initial velocity greatly exceeding that of the flowing head of liquid, and absorbing at least a major portion of the kinetic energy of said projectile in said liquid, whereby the projectile emerges from the outlet tube at a speed considerably less than its initial velocity.

3. The method of decelerating a projectile which comprises providing a chamber having opposed inlet and outlet tubes open to the atmosphere and continuous therewith an intermediate section consisting of a much enlarged resilient and renitent portion, introducing liquid directly into said intermediate section in such manner as to produce a circularly moving stream which will produce a head of constantly flowing liquid that completely blocks the passage from the inlet to the outlet tubes, projecting a projectile to be trapped into the inlet tube and towards the outlet tube at an initial velocity greatly exceeding that of the liquid stream, whereby to absorb the initial shock of the projectile striking the liquid by the resilient intermediate section and to absorb at least a major portion of the kinetic energy of said projectile in said liquid so that the projectile emerges from the outlet tube at a speed considerably less than its initial velocity.

4. A stop for a series of machine gun bullets including, a tubular inlet section, a tubular shock-absorption section of increased cross sectional diameter forming the outlet from said inlet section and receiving said stream therein, at least a portion of the walls of said shock-absorption section being formed of flexible elastic renitent material suitable for absorbing from said stream the impact-shock of each of said bullets, a plurality of inlet nozzles leading into said shock-absorption section each having its axis arranged at an angle to the axis of that section so that jets of liquid issuing from said nozzles mix together to form a stream of liquid therein, an elongated tubular energy absorption section forming the outlet from said shock-absorption section and receiving said stream and the bullets in such a way as to cause said bullets and said stream to travel together through said energy-absorption section thereby decreasing the speed of said bullets and increasing the speed of said stream, and an outlet reservoir communicating with said energy-absorption section and receiving said stream and said bullets therein in such a way that the bullets separate out of said stream.

5. A tubular elongated stop for machine gun bullets including, an inlet section, a chamber formed of a band of flexible resilient elastic renitent material adjacent to and continuous with said inlet section, a container for liquids mounted in said chamber, a plurality of ducts leading into said container, a plurality of nozzles protruding from said container into the surrounding chamber at an angle to the chamber axis so that jets of liquid which issue therefrom attain sufficient velocity to maintain a bank or head of the liquid in said chamber through which the bullets must pass, an outlet section adjacent to and continuous with said chamber and extending therefrom for a considerable distance sufficient for the speed of each of said bullets and the speed of the surrounding liquid to equalize during the co-passage through said outlet section, and a reservoir into which the stream and bullets in it flow from said outlet section and in which the bullets separate by gravity from the stream.

6. A machine for catching a series of machine gun bullets fired in quick succession in a burst, said machine including, a tube having a hollow end forming an inlet for bullets, a renitent rubber tire of greater diameter than said tube connected to the outlet from said tube, a plurality of nozzles projecting into said tire, a supply of water under pressure connected to said nozzles so that jets of water issue from said nozzles with sufficient velocity to maintain a bank or head of water in said tire through which the fired bullets must pass, a frusto-conical outlet tube of homogeneous armor plate having its larger inlet located within said tire and having its walls sealed to said tire so that said stream and the bullets therein travel through said outlet tube for a distance sufficient to allow the speed of each of said bullets to reduce greatly and the speed of said stream to increase, and a hollow vessel communicating with the outlet end of said outlet tube and receiving said stream and said bullets and in which said bullets fall to the lower part and separate themselves from said stream.

7. A device for stopping machine gun bullets fired in rapid succession including, a pump arranged to circulate a flow of liquid, an inlet tube having an open end forming an inlet for bullets, a ring-shaped intermediate section made of springy shock-absorbing material sealed to the outlet end of said inlet tube, a plurality of nozzles arranged in a ring and emptying into the center of said intermediate section so that jets of liquid can be forced by the pump through the nozzles directly into the intermediate section to maintain a bank or head of liquid therein through which the bullets must pass, and an outlet tube having an enlarged inlet end sealed to and communicating with said ring-shaped section so as to receive said liquid therefrom and to conduct said liquid for a sufficient distance to allow the resistance of said liquid to retard the speed of said bullets and thereby absorb the kinetic energy of said bullets and further to conduct said liquid and said bullets to an outlet, and a settling basin communicating with the outlet from said outlet tube to receive said liquid and said bullets

in said settling basin, said bullets falling by gravity into the lower portion of said settling basin so as readily to be separated from said liquid.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,356,992	Gilson	Aug. 29, 1944

Certificate of Correction

Patent No. 2,518,446 August 15, 1950

ALBIN N. BENSON ET AL.

It is hereby certified that error appears in the above numbered patent requiring correction as follows:

In the grant, line 7, title of invention, for "METHODS" read *APPARATUS*; in the heading to the drawings, line 2, Sheets 1 to 3, inclusive, and in the heading to the printed specification, line 2, for "METHOD" read *APPARATUS*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of December, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.