A. G. BERGMAN.

ILLUMINATING PROJECTILE.

APPLICATION FILED FEB. 17, 1917.

1,305,186.

Patented May 27, 1919.

2 SHEETS—SHEET 1.

Fig. 1.

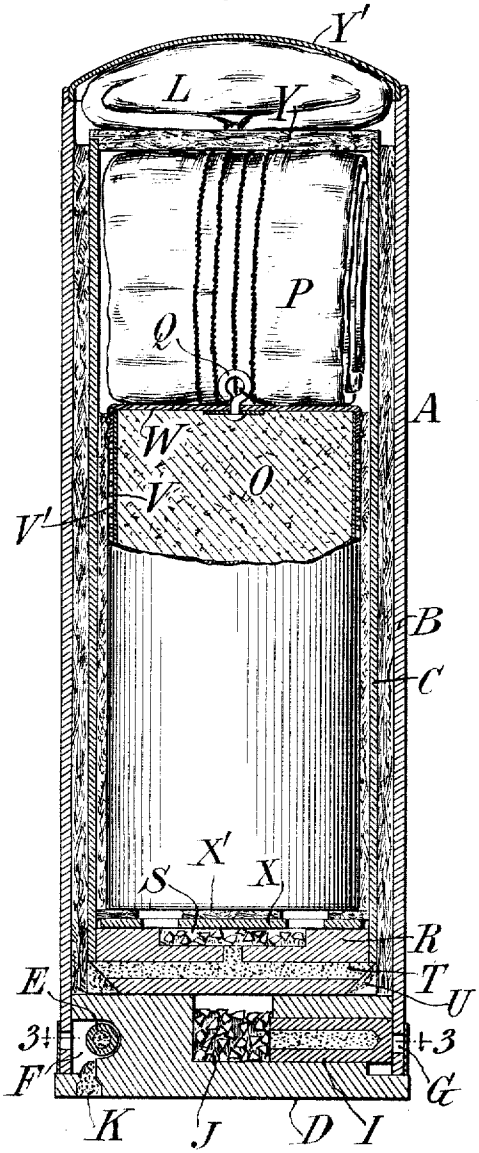


Fig. 2.

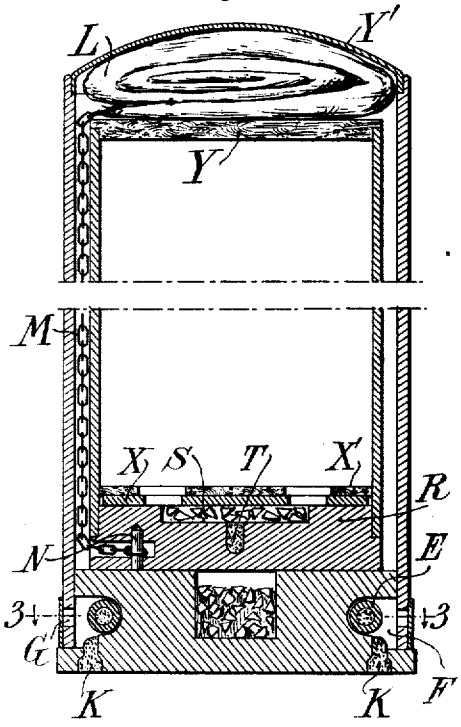
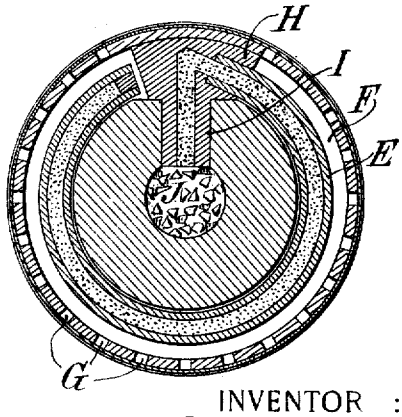


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

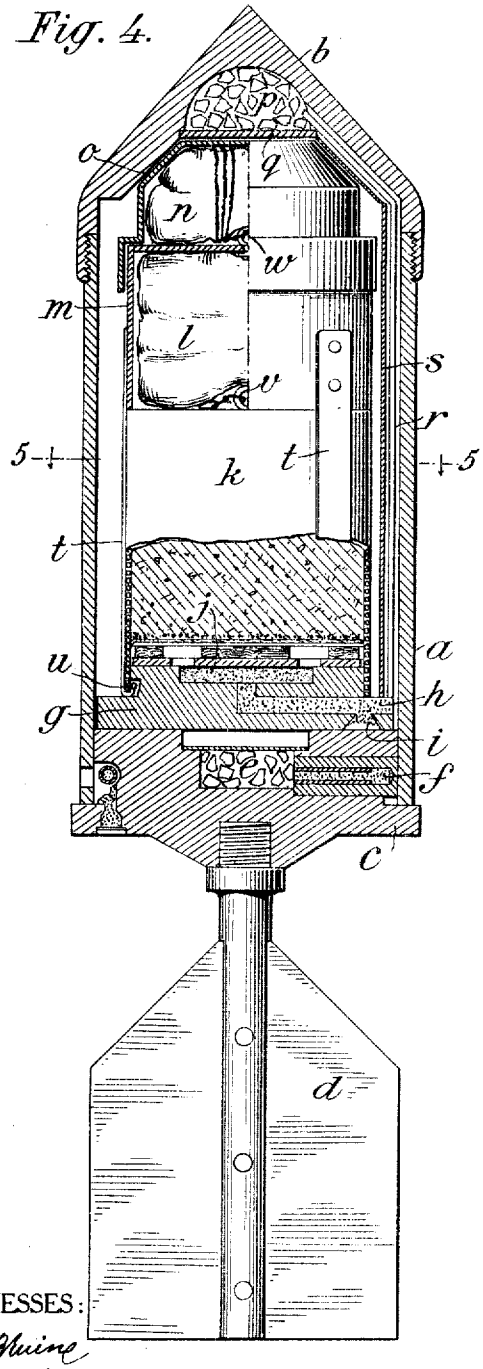
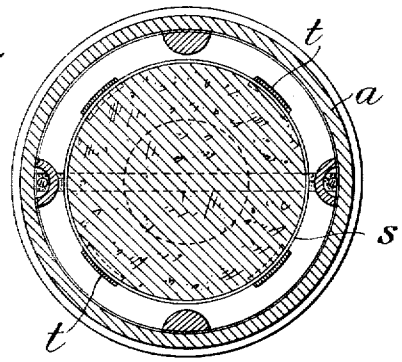


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ILLUMINATING-PROJECTILE.

1,305,186. Specification of Letters Patent. Patented May 27, 1919.

Application filed February 17, 1917. Serial No. 149,260.

To all whom it may concern:

Be it known that I, AXEL G. BERGMAN, a subject of the King of Sweden, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Illuminating-Projectiles, of which the following is a specification.

This invention relates to illuminating projectiles and aims to provide certain improvements therein. Projectiles of this type are designed for illuminating an object or field in the distance and usually comprise a casing having a mass of illuminating material which is discharged from the casing at a definite point in the flight of the projectile, being at the same time ignited. The illuminating material is usually sustained in mid-air by a parachute or equivalent device which retards the fall thereof for a sufficient length of time to enable the illuminating material to expend itself. In my application No. 119,396, I have illustrated a construction of such shell.

The present invention relates to a construction of such devices which will better fit the shell for use in connection with higher powered guns than it has been hitherto possible to use effectively for such purposes. In the ordinary use of such projectiles it is found that if the speed of the projectile at the moment of expulsion of the illuminant and its parachute be in excess of a certain low rate, the parachute, whose real function it is to sustain the illuminant, is immediately slatted or torn to pieces with the result that the illuminant drops to the ground. Hence where the field of illumination is some distance away so that a gun of high power has to be used to obtain the distance, it is found impracticable to release the illuminant and its parachute except at or about the summit of the trajectory, at which point the shell is traveling at its lowest speed. This seriously interferes with the usefulness of the shell, as it practically prevents its use at shorter ranges.

The principal object of the present invention is to provide an illuminating shell from which the illuminant can be discharged at any point in the trajectory, practically irrespective of the speed of the projectile at the time of discharge. To this end the invention comprises a means for checking or stopping the illuminant in its forward flight in such manner as to avoid slatting of the sustaining parachute or other device. In the preferred form of the invention I make use of a retarding parachute which is so much smaller and so much stronger than the sustaining parachute that it can successfully resist the atmospheric pressure and check or retard the flight of the illuminant without danger of being destroyed. In carrying out the invention I may employ two casings, the inner of which contains the illuminant and its sustaining parachute, and the outer of which contains the inner casing and an attached retarding parachute. A timing element such as a time fuse is used in connection with the device, which effects the discharge of the inner casing at the appropriate point in the flight of the projectile, the outer casing continuing its flight and the inner casing being retarded at the proper point for the field to be illuminated. Preferably also the inner casing contains some timing element (which may be fixed) adapted to delay the expulsion charge for the illuminant until the speed of the inner casing is well checked, whereupon the illuminant and its sustaining parachute are projected and the illuminant ignited. The invention also includes certain other improvements which will be hereinafter more fully described.

Referring to the drawings which illustrate the preferred form of the invention,—

Figure 1 is a diametrical section of the complete projectile;

Fig. 2 is a similar view taken at an angle to Fig. 1;

Fig. 3 is a cross-section taken on the lines 3—3 in Figs. 1 and 2.

Fig. 4 is a longitudinal section of another form of illuminating shell, and

Fig. 5 is a cross-section on the line 5—5 in Fig. 4.

Referring to the drawings, let A indicate the projectile as a whole which is shown as comprising an outer casing B and an inner casing C. The outer casing is preferably provided with a timing element such as a time fuse, the latter being shown as mounted in the base D and comprising a puncturable tube E arranged within a circular chamber F. The lower end of the casing B is formed with a series of apertures G

through which an instrument can be forced to penetrate the casing E. The casing E contains a powder or other charge having a definite rate of burning, and by puncturing the latter at the appropriate point, the length of time required to ignite the expelling charge is predetermined. Preferably the tube E is fitted in a block H which has an extension I leading to the chamber J which contains the expelling charge. Openings such as K permit the fire gases from the propelling charge to ignite the fuse through the punctured hole. This construction is in the main set forth in my prior application above alluded to.

The casing B also contains the retarding parachute L which is best packed above the casing C and is preferably attached to the latter casing by a chain M, the end of which is fastened to the casing C by a pin or the like N.

The casing C contains the illuminating body O, and above it the sustaining parachute P fastened to the body O by a cord connected with an eye Q, or in any other suitable manner. The casing C is preferably provided with a base R, the center part of which is formed with a chamber S adapted to contain an expelling charge for the illuminant. In the construction shown the base is also bored to receive a fuse such as T, the base at the ends of the bore being cut away as shown at U in order to permit the flames from the main expelling charge in the chamber J to easily reach the fuse. In the construction indicated the fuse T is adapted to burn about two seconds after the casing C is expelled, and before the expelling charge in the chamber S is ignited, this delay being desirable in order that time may be provided for the speed of the casing C to be checked or retarded before the illuminant body is expelled from the latter casing.

In illuminating shells, and particularly those for use in high power guns, the illuminant body is very apt to become shattered or crumbled by the force of the propelling charge in the gun. This force is communicated to the casing before the inertia of the shell can be transferred to the illuminant, and the latter becomes disintegrated or crushed. I find in practice, however, that if the illuminant be packed in a metallic or other stiff container which is adapted to burn or melt at about the same speed as the illuminant, the latter will be maintained intact, and this is particularly true if the container be wound with wire so as to strengthen the container. I have found in practice that sheet-zinc is quite appropriate for the container (which is shown at V). A common iron wire of light gage is suitable for winding it. The latter is indicated at V'. At the top of the container I prefer to employ a fiber disk W to which the eye Q is attached.

Between the bottom of the illuminant and the base I preferably employ a metal disk X which is suitably perforated to permit the gases from the chamber S to ignite the illuminant; and I also preferably impose between the disk X and the bottom of the illuminant a fiber disk X' which eases the shock on the illuminant when the projectile is fired.

Difficulty has also been encountered in the provision of a suitable cover for the casing C, which must be sufficiently easily forced out of place to permit the illuminant to leave the shell and which at the same time is capable of preventing ingress of fire gases to the illuminant while the latter is in the gun. I have found that a fiber disk such as Y forced into the end of the casing serves these purposes admirably. A similar construction is adapted in the end of the casing B as indicated at Y'.

In all prior illuminating shells with which I am acquainted, difficulty has been encountered in the unfolding of the parachute element in flight. Great care has been used in packing the parachute to avoid any twists or turns in the cords leading from the periphery of the parachute to the main or central cord, the latter device being folded or looped with the idea that by so doing the parachute would be enabled to become immediately expanded by the atmospheric pressure. The result has been, however, that frequent entanglement of the cords takes place so that a large percentage of the illuminants fall to the ground without the parachute filling. Efforts have been made to overcome this without success.

I have found, contrary to expectation, that if the numerous cords be well wound around and around the parachute body, the latter will fill quite as quickly, and practically all risk of entanglement of the cords is eliminated.

The operation of the invention will be apparent. If a gun has the possible range of three miles and it is desired to illuminate a field one-half mile distant, the time fuse is appropriately punctured to expel the inner casing just before the field is reached, whereupon the retarding parachute comes into effect and checks the inner casing for a determined period until its speed is overcome sufficiently to enable the sustaining parachute to act with safety, whereupon the illuminating charge and sustaining parachute are ejected and the charge ignited.

In Figs. 4 and 5 I have shown another form of shell in which a single casing is used. In these figures the casing *a* is provided with a nose *b* and a base *c*. Fixed to the base is a set of wings *d* which are adapted to cause the projectile to fly straight

without tumbling, the nose *b* being preferably pointed to assist in such flight. If desired, the wings *d* can be slightly bent to impart a rotative movement to the shell.

The base *c* is provided with an expelling charge *e* which is controlled by a time fuse *f* and which is adapted to blow out the base at the proper time in the flight of the projectile. Above the base is located a plug *g* which contains a fuse *h* designed to be ignited by the charge *e* through passage *i*. The fuse *h* corresponds to the fuse T in Figs. 1 to 3, and leads to a charge *j*, the function of which is to blow out the plug *g*. *k* is the illuminant having mounted above it and fastened thereto the sustaining parachute *l* which is contained in a light metal cup *m* while above the cup *m* is located the retarding parachute *n* which is also contained in a light cup *o*. Above the cup *o* is an expelling charge *p*, a metal disk *q* being interposed between the two. To ignite the charge *p*, I provide a quick-match *r* preferably contained in a semi-circular casing *s* made of half tubing or other suitable material. Preferably two quick-matches are provided, as shown in Fig. 5. The cup *m* is connected to the plug *g* preferably by metal strips *t* which are bent or hooked under a lip formed on the plug, as shown at *u* (Fig. 4). The parachute *l* is connected to the illuminant *k* by an eye *v* and the parachute *n* is connected to the cup *m* by an eye *w*.

The operation of the device shown in Figs. 4 and 5 is somewhat different from that shown in Figs. 1 to 3. The time fuse *f* being properly punctured and the projectile fired, at the proper time in the flight the expelling charge *e* is fired and the base *c* blown out. Simultaneously a portion of the fuse *h* is ignited and almost immediately thereafter the quick-matches *r* are ignited. Following closely on this the expelling charge *p* is fired, throwing the illuminant with its plug G, cup *m*, cup *o*, and the two parachutes out of the casing *a*, the latter continuing its flight. As soon as these parts have left the casing *a*, the cup *o* drops off (in which it may be assisted by a spring, if desired), and the retarding parachute *n* is filled. This shortly brings the illuminant down to a comparatively low speed. During this time the fuse *h* has been burning and the expelling charge *j* is then fired, forcing off the plug *g*. The illuminant and its sustaining parachute *l* are then free to separate from the cup *m*, whereupon the sustaining parachute unfurls. The firing of the expelling charge *j* ignites the illuminant as before.

The construction shown in Figs. 4 and 5 has the advantage that but one casing is required and also introduces the novel feature of a projectile having an expelling charge which throws the illuminant backward, thereby to a very considerable extent neutralizing the forward speed of the illuminant and lessening the burden of the retarding parachute. In some cases where very high speeds are not required, the retarding parachute may be omitted in this construction, the speed being reduced sufficiently so that the sustaining parachute is not taxed beyond its capacity.

While I have shown and described several forms of the invention it will be understood that I do not wish to be limited thereto, since various changes may be made therein without departing from the spirit of the invention.

I believe myself the first to provide an illuminating projectile which is adapted for use at long ranges, and in which the illuminant can be adequately checked and properly sustained at substantially any point in the trajectory of the projectile. In the preferred form of the invention I accomplish this by the combination of two elements (herein shown as separately formed), the retarding element taking the principal checking strain and the sustaining element performing the principal sustaining function.

The specific construction of Figs. 1 to 3 inclusive, disclosed but not claimed in this application, constitutes the subject-matter of my pending application, filed April 2, 1919, Serial No. 287,002.

What I claim is:—

1. A projectile having an illuminant, a sustaining device therefor and means adapted to check the speed of the illuminant at high velocities previously to the operation of the sustaining device.

2. A projectile having an illuminant, a sustaining device therefor, and a parachute adapted to check the speed at high velocities previously to the operation of the sustaining device.

3. An illuminating shell having a sustaining device and a retarding device for a portion of its contents operating previously to the sustaining device.

4. An illuminating shell having a sustaining parachute and a retarding parachute operating previously to the sustaining parachute.

5. An illuminating shell having a retarding device adapted to check the speed of a portion of its contents at high velocities, a timing device adapted to set in operation said retarding device, and a sustaining device which acts after the retarding device.

6. An illuminating shell having a retarding parachute, means for bringing said parachute into operation, an illuminant, and a sustaining parachute for said illuminant acting after the operation of the retarding parachute.

7. An illuminating projectile having a time fuse comprising a circular-like punc-

turable tube with its ends terminating in spaced relation with one another, and a block located between said ends and surrounding one of the ends of the tube, said block having a bore which forms a continuation of the passage through the tube, and the block and bore extending inwardly and terminating at the center of the projectile.

8. A shell having an illuminating charge, means for expelling the illuminating charge out of the shell in a direction opposite to its line of flight, and means for sustaining the illuminating charge after expulsion.

9. A shell having an illuminating charge and a sustaining parachute, means for expelling the charge and parachute out of the shell in a direction opposite to its line of flight, and means for retaining the illuminating charge in fixed position within the shell previously to its expulsion.

10. A shell having an illuminating charge and sustaining means therefor, means for expelling the charge and sustaining means out of the shell in a direction opposite to its line of flight, and means for retaining the illuminating charge fixedly within the shell previously to its expulsion therefrom.

11. An illuminating shell having a portion of its contents designed to be expelled therefrom, means for expelling said contents from the shell in a direction opposite to its line of flight, and devices acting to retain said contents in fixed position within the shell previously to its expulsion therefrom.

12. An illuminating shell having wings fixed thereon adapted to prevent tumbling, and an automatically detachable part carrying such wings.

13. An illuminating shell having wings fixed thereon adapted to prevent tumbling, a detachable part carrying said wings, and means for automatically detaching such part.

14. An illuminating shell having wings fixed thereon adapted to prevent tumbling, a detachable part carrying said wings, and an expelling charge adapted to detach such part.

15. The combination of a projectile comprising an illuminating body, said projectile having means for sustaining the weight of the illuminating body which is of such fragility as to be incapable of overcoming the momentum of said body at high service speeds, and said projectile having means for overcoming such momentum of said body sufficiently to bring the latter within the capacity of said sustaining means.

16. A high speed illuminating projectile for long range guns adapted to operate and ignite the illuminant at any one of a number of different points in the trajectory of the projectile as predetermined by the user, and means for retarding and subsequently sustaining the illuminant at any such predetermined point, the retarding element being adapted to relieve the sustaining element of excess strain.

17. A high speed illuminating projectile for long range guns containing an illuminant, and timing means for igniting the illuminant, said timing means adapted to operate at any one of a number of different points in the trajectory of the projectile, and means for retarding and subsequently sustaining the illuminant at any such predetermined point, the retarding element being adapted to relieve the sustaining element of excess strain.

18. A high speed illuminating projectile for long range guns adapted to operate and ignite the illuminant at any one of a number of differeat points in the trajectory of the projectile as predetermined by the user, including means for preventing tumbling of the shell, means acting to eject the illuminant out of the shell in a direction opposite to its line of flight, and means for sustaining the illuminant at any such predetermined point.

In witness whereof, I have hereunto signed my name.

AXEL G. BERGMAN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."