K. DOUGAN.

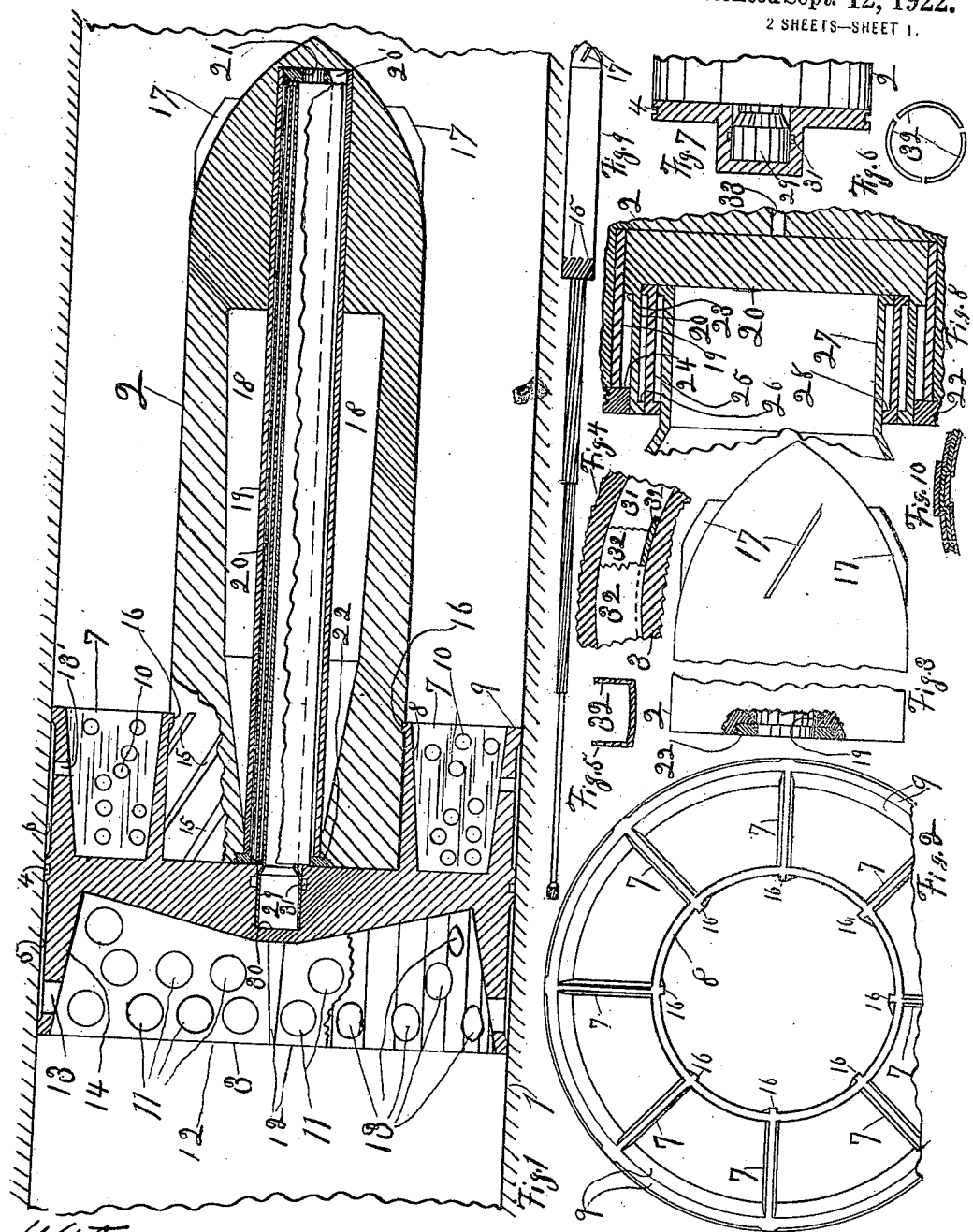
PROJECTILE.

APPLICATION FILED AUG. 1, 1918.

1,428,683.

Patented Sept. 12, 1922.

2 SHEETS—SHEET 1.



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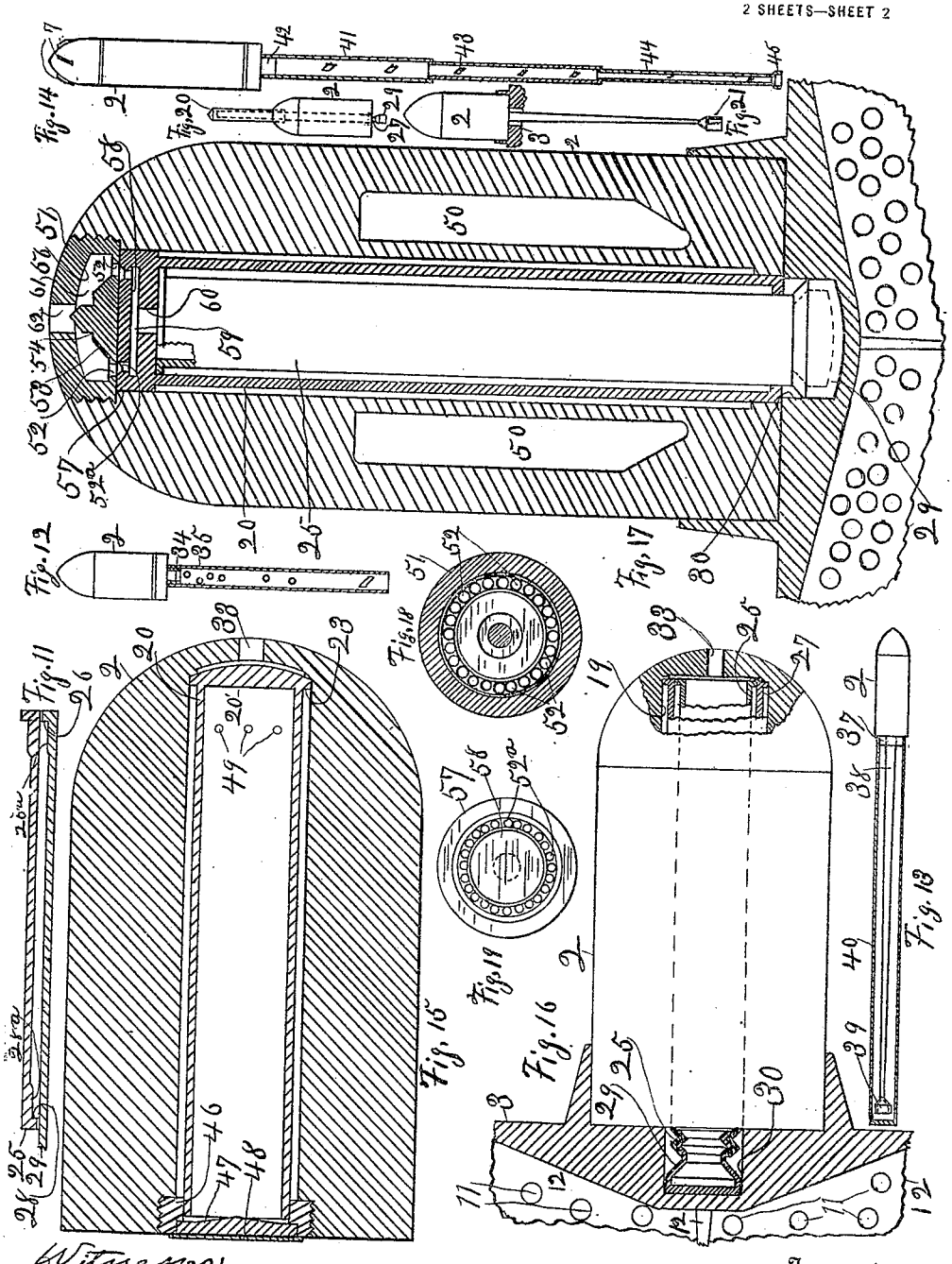

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UNITED STATES PATENT OFFICE.

KENNEDY DOUGAN, OF MINNEAPOLIS, MINNESOTA.

PROJECTILE.

Application filed August 1, 1918. Serial No. 247,860.

To all whom it may concern:

Be it known that I, KENNEDY DOUGAN, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvments in Projectiles, of which the following is a specification.

My invention relates to steering the projectile, and the object is to provide a projectile that will travel point foremost when fired from a smooth bore gun, or from one which gives but slight angular velocity to the projectile as compared to that of a conventional projectile.

My invention consists, first, in placing in the center of the projectile and in alignment with its horizontal axis, a plurality of telescoping cylinders, which when the projectile leaves the gun, slide back one upon the other and in the projectile, forming a long light cylinder extending back from the base of the projectile and in alignment with its horizontal axis; second, in means for moving the telescoping cylinder backward into active or steering position, and, third, means for firing the projectile from a gun having a bore of the same diameter as the projectile, or from a gun having a bore larger than the projectile.

Referring to the drawings:

Fig. 1 is a central longitudinal section through a fragment of the gun, projectile, head, and telescoping cylinders, a small portion of the projectile being shown in full lines.

Fig. 2 is a view of the head looking toward the left.

Fig. 3 is an exterior view of the projectile with some of the parts shown in section.

Fig. 4 shows fragmentally an enlarged view of an annular groove in head 3 and a spring in said groove, a cross-section of said spring being shown by Fig. 5, and a view at right angles to Fig. 5 by Fig. 6.

Fig. 7 shows a form of head adapted for use when the projectile is to be thrown from a gun having a bore the same diameter as that of the projectile.

Fig. 8 shows a central longitudinal section through a fragment of the projectile and through the telescoping cylinders. In this view the proportion of length to diameter is disregarded.

Fig. 9 is a view of the projectile as it would appear in flight.

Fig. 10 is a fragmental cross-section of a modified form of the telescoping tubes.

Fig. 11 is a fragmental view of a portion of cylinders 25 and 27.

Fig. 12 shows a conventional projectile adapted to be fired from a conventional gun, and having a single perforate hollow cylinder rigidly secured to its base.

Fig. 13 shows a similar projectile having a solid tapering extension rigidly secured in its base and provided with an enlargement on its small end.

Fig. 14 shows a similar projectile having a hollow perforate extension rigidly secured to its base.

Fig. 15 shows a similar projectile provided with a single telescoping cylinder having a head upon which the air acts to drive said cylinder into active position.

Fig. 16 shows a projectile, and a portion of a head adapted to drive it from a gun having a bore of greater diameter than that of the projectile, the gun being rifled to give a comparatively slight rotary motion to the projectile, Fig. 17 being a modified form of a similar projectile, Fig. 18 being a detached view of a part in the head, and Fig. 19 a front end view of the telescoping cylinder.

Fig. 20 shows a modified form of a sub-caliber projectile in which the front end of the outer telescoping cylinder extends forward beyond the front end of the projectile.

Fig. 21 shows a different combination of projectile and head in which the steering element extends back through the detachable head and is rigidly secured to the projectile.

Referring to Fig. 1:

1 is a fragment of the gun; 2 is the projectile which is carried by head 3 in the manner shown; said head 3 fills the bore of the gun and is provided with an exterior annular groove 4 to receive a conventional copper ring, not shown.

The exterior of a portion of head 3 is

recessed as shown, forming two annular spaces 5 and 6 between said head and said gun barrel. 7 are webs connecting annulus 8 with annulus 9 and are formed integral therewith. 10 are a series of circular openings formed in webs 7 with the object of reducing their weight and permitting the free flow of the gases therethrough in order to equalize the pressure. 11 are similar openings for a similar purpose in webs 12. 13 are circular openings through the annular portion 14 of head 3, and lead into annular space 5, the object of course being to equalize the gas pressure on both sides of annulus 14. 13′ are similar openings in annulus 9.

For the purpose of rotating the projectile after it will have left the gun and before it will have been given rotary motion by the other means provided, there are formed therein a plurality of spiral grooves 15 into which extend projections 16 formed integral with annulus 8. When the gun is fired the greater air pressure on head 3 after leaving the gun, in proportion to weight, will cause it to slow up faster than the projectile which will cause said head to rotate in one direction and the projectile in the opposite direction. After the separation of projectile from head the action of the air on one of the radial sides of each groove 15, will tend to rotate the projectile, and in order that the horizontal axis of the projectile may not be thrown out of alignment with its true course its front end is provided with wings 17 of such dimensions and set at such angle as to keep the projectile in its true course. The required angle and dimensions of wings 17 can only be determined by experiment. 18 is a chamber for carrying the explosive charge; 19 is a metal cylinder fitting tightly in the front and rear portion of the projectile. 20 is a cylinder formed of thin properly tempered steel, just thick enough to safely withstand atmospheric pressure, as when in flight there will be a vacuum in said tube. 20^1 is a head formed integral with cylinder 20 and has formed therein an opening 21, the function of which is to prevent the formation of a vacuum between said head and the front end of the projectile when said cylinder 20 is drawn out. 22 is an annulus which screws into the base of projectile 2 as clearly shown in Fig. 8.

When cylinder 20 is caused to move rearwardly, the outwardly extending portion 23 on said cylinder is stopped and held by the inwardly extending portion 24 of annulus 22. In like manner cylinder 25 is held by the inwardly extending portion 26 of cylinder 20, and cylinder 27 by the inwardly extending portion 28 of cylinder 25.

For the purpose of drawing cylinders 20, 25 and 27 out into steering position, cylinder 27 extends out beyond the base of the projection and has formed thereon and integral therewith an enlarged cylindrical shaped open ended head 29 which fits snugly into a cylinder 30 formed in head 3. 31 is an annular groove formed in head 3, and is provided with a spring 32 of the form shown in Figs. 4, 5 and 6. This spring is made in sections in order to get it into groove 31 and its inner side is formed slightly convex as shown in Fig. 5. This ring grips end 29 of cylinder 27 with sufficient force to draw cylinders 20, 25 and 27 into their extreme outward position but not with sufficient force to prevent head 3 from sliding from head 29 when sufficient force is applied.

When the form of head shown in Fig. 7 is used, it is obvious that the air pressure would not draw the cylinders 20, 25 and 27 out into position. For the purpose of forcing cylinder 20 into its extreme outward position there is formed in the front end of the projectile an air conduit 33, and head 20^1 is imperforate. Air entering through conduit 33 acts on head 20^1 and drives cylinder 20 to its outer position; air then acts on head 4 and draws cylinders 25 and 27 out into place, and when their further outward movement is checked by the means shown and described, head 4 is forced off of enlargement 29 by the pressure of the air. There is no special provision made for the escape of air from the annular spaces formed between the various cylinders 19, 20, 25 and 27, as they will be an easy sliding fit one upon the other admitting the escape of air so as to prevent objectionable air pressure in the annular spaces formed between them, but in order that said cylinders may not be checked too abruptly, the external diameter of the last mentioned three cylinders is enlarged near their front ends and the internal diameter of two of them reduced near their rear ends so as to make them a snug sliding fit and thus form an air cushion adapted to check them slowly; this is shown in Fig. 11 on a magnified scale, 28^a being an internal enlargement and 26^a an external enlargement.

The pressure of the air upon the beveled portion of head 29 together with the friction of the air upon cylinders 20, 25 and 27 will keep a continuous pull on the rear end of the projectile and help to prevent tumbling. Reliance, however, is placed mainly upon the relative air resistance in proportion to weight between the projectile and cylinders. It would appear that could the cylinders be made strong enough and light enough to stand the strain, that were the projectile, with the cylinders extended, fired with its longitudinal axis at right angles to the line of flight, it would instantly assume a position with its longitudinal axis in alignment with the line of flight.

Referring to Fig. 11:

When in the outer movement of cylinder 27, flange 26 reaches the portion 28ª of cylinder 25, and the enlarged portion 26ª of said cylinder 27 enters flange 28 of cylinder 25 the entrapped air forms a cushion, stopping cylinder 27 gradually.

Referring to Fig. 12:

34 is a short cylinder formed on the rear of projectile 2. 35 is a hollow perforate cylinder rigidly secured to said cylinder 34. The perforations in said cylinder 35 near the projectile may be of any desired form, the object of said perforations being to admit of the passage of the gases to prevent excessive pressure on said cylinder 35 when the gun is fired. The perforations near the rear end of said cylinder 35 may be shaped so as to impart rotary motion to said cylinder.

Fig. 13 shows a form of the invention more especially adapted to guns using fixed ammunition. 37 is a short cylinder formed on the rear end of the projectile. 38 is a tapering rod, circular in its cross section, rigidly secured in the rear end of the projectile; 39 is an enlarged hollow head rigidly secured to said rod 38 or formed integral therewith. 40 is a powder-carrying cylinder of the same external diameter as the projectile and secured to cylinder 37 in the usual way. This is of course not a sub-caliber projectile.

Fig. 14 shows a slightly different form of the invention in which a hollow perforate cylinder 41 is rigidly secured to a short cylinder 42 formed on the base of the projectile. 43 is a cylinder rigidly secured in cylinder 41 and 44 a smaller cylinder secured rigidly in cylinder 43. 45 is an enlargement on the end of cylinder 44.

Referring to Fig. 15:

46 is an annulus which is screwed into the rear end of the projectile; 47 is a head fitting snugly into annulus 46; 48 a thin disk of some frangible material which is secured to annulus 46 by paste or glue; 49 are a series of openings through cylinder 20; when the projectile is fired, air passes through opening 33 and acting on head 20′ of cylinder 20, drives said cylinder against head 47 with such force as to break disk 48, allowing said cylinder 20 to move out until flange 23 thereon strikes annulus 46. When cylinder 20 is moving outward the air in the annular space between said cylinder and projectile passes into the interior of said cylinder 20 through openings 49, but when said openings have passed beyond the inner end of annulus 46 the remaining air is trapped between flange 23 and said annulus 46, checking the motion of cylinder 20 gradually. This is not a sub-caliber projectile. The object of head 47 is to prevent gases from entering cylinder 20 and bursting it. Annulus 46 is necessary to assembling. The object of cylinder 20 is to reduce the amount of angular velocity necessary to prevent the tumbling of the projectile.

Referring to Fig. 16:

In this form of the invention there are no projections extending into grooves in the projectile as shown in Figs. 1 and 2. Head 3 is provided with a copper ring, not shown, and is to be fired from a rifled gun, the rifles having but slight twist as compared with those of conventional guns. When the gun is fired the pressure between head 3 and the base of the projectile will prevent slip between said head and projectile when the rifles have the proper twist and this will impart the same rotary motion to both head and projectile; the telescoping cylinders may be either perforate or imperforate. Head 29 is screwed into cylinder 25 as shown, and there is no friction ring holding said head in cylinder 30. Air entering through conduit 33 presses on head 29 forcing the cylinders 25 and 27 out into steering position. The exterior of the projectile may have formed therein or secured thereto any of the rotary devices hereinbefore described or described in any of my former applications.

Fig. 17 shows a form of the projectile in which the openings in both ends of the projectile are closed by the initial explosion of the bursting charge carried in annular space 50. 51 is a head of the form shown, screwed into the nose of the projectile. In the inner portion of this head are formed a series of air passages 52. (See Fig. 18.) When the explosion occurs portion 53 of said head is driven outwardly making a hermetically sealed joint between shoulder 54 and surface 56 of head 51. The passages 52 so weaken the support of portion 53 that only a slight pressure is required to break said support. Head 57 of cylinder 20 will of course be at the base of the projectile when the explosion of the bursting charge takes place. The explosion will break the support of head 58 and forcing it against head 57 close conduit 59 thus preventing the escape of gas. 52 are air passages formed in portion 58 of head 57 and register with air passages 52ª. When the projectile leaves the gun, air at high pressure enters space 61 through conduit 62 and passing through passages 52 and 52ª, and space 59, pass through conduit 60 and enter cylinder 25 filling it with air at nearly the pressure of the entering air. The object of having air pressure in cylinder 25 is to prevent its collapsing from exterior pressure that would arise through leakage into the annular space surrounding said cylinder. Cylinders 20 and 25 may be perforate or imperforate. This projectile

is given rotary motion in a manner similar to that described in Fig. 16.

Fig. 20 shows a form of the invention differing slightly from that shown in Fig. 1. The only difference being that cylinder 20 extends out through the front end of the projectile though head 3 is not shown. This form gives a longer extension with the same number of cylinders. When the cylinders are back in steering position the front end of cylinder 20 forms, in combination with the front end of the projectile, a symmetrical head on said projectile.

The operation has been explained in connection with the description. It appears obvious that any of the extensions shown and described will assist in preventing tumbling of the projectile and will permit its being fired with very much less rotary motion that the conventional projectile, and this will insure longer life for the gun and increased range. It also appears obvious that the gyroscopic effect will not be great enough to prevent the projectile from travelling head on.

I claim:

1. A projectile, provided with a plurality of spiral grooves in its periphery extending from the base of said projectile forward, a head of larger diameter than said projectile detachably secured thereto and separable therefrom by the greater respective air pressure exerted thereon in proportion to their weights when travelling through the air, said head being provided with projections adapted to move in said spiral grooves, a cylinder formed axially in said projectile having its rear end open, a cylinder telescopically mounted in said first named cylinder, means for moving said second named cylinder rearwardly out of said first named cylinder, and means for limiting the outward movement of said second named cylinder.

2. A projectile, a circular head of larger diameter than said projectile detachably secured thereto and separable therefrom by the greater respective air pressure exerted thereon in proportion to their weights when travelling rapidly through the air, a cylinder formed axially in said projectile having its rear end open, a cylinder telescopically mounted in said first named cylinder, means for moving said second named cylinder rearwardly out of said first named cylinder, and means for limiting the outward movement of said second named cylinder.

3. A projectile, a circular head of larger diameter than that of said projectile detachably secured to said projectile and separable therefrom by the greater respective air pressure exerted thereon in proportion to their weights when travelling rapidly through the air, a cylinder formed axially in said projectile having its rear end open, a plurality of cylinders telescopically mounted in said first mentioned cylinder, means for moving said second named cylinders rearwardly out of said first named cylinder and out of each other, and means for limiting the outward movements of said second named cylinder.

4. A projectile, a circular head of larger diameter than said projectile detachably secured thereto and separable therefrom by the greater respective air pressure exerted thereon in proportion to their weights when travelling rapidly through the air, a cylinder formed axially in said projectile having its rear end open, a cylinder telescopically mounted in said first named cylinder, means for limiting the outward movement of said second named cylinder, a head of greater diameter than that of said second named cylinder rigidly secured to or formed integral with the rear end of said cylinder, a cylinder formed in the front side of the aforementioned first named head, having its front end open and adapted to receive said second mentioned head, and means for flexibly holding said second mentioned head in said cylinder in said first mentioned head, said means being adapted to draw said second mentioned cylinder rearwardly out of said first mentioned cylinder when projectile and said head separate, and to release said second named head when sufficient force is applied.

5. A projectile, a circular head of larger diameter than said projectile detachably secured thereto and separable therefrom by the greater respective air pressure exerted thereon in proportion to their weights when travelling rapidly through the air, a cylinder formed axially in said projectile having its rear end open, a plurality of cylinders telescopically mounted in said first named cylinder, means for limiting the outward movement of said second named cylinders, a head having greater diameter than that of the smallest of said plurality of cylinders rigidly secured to or formed integral with the rear end of said smallest cylinder, a cylinder formed in the front side of the aforementioned first named head having its front end open and adapted to receive said second named head, and means for flexibly holding said second mentioned head in said cylinder in said first mentioned head, said means being adapted to draw said plurality of cylinders out of said first mentioned cylinder when said head moves slower than said projectile.

6. A projectile, a circular head of larger diameter than that of said projectile detachably secured to said projectile and separable therefrom by the greater respective air pressure exerted thereon in proportion to their weights when travelling rapidly through the air, a cylinder formed axially in said projectile having its rear end open,

a plurality of cylinders telescopically mounted in said first mentioned cylinder, means for moving said second named cylinders rearwardly out of said first named cylinder and out of each other, means for limiting the outward movements of said second named cylinder, and means for closing both ends of said first named cylinder by the initial explosion in said projectile.

August 1, 1918.

In testimony whereof I hereby affix my signature.

KENNEDY DOUGAN.