(No Model.) 3 Sheets—Sheet 1.

J. G. JUSTIN.

SHELL FOR HIGH EXPLOSIVES.

No. 572,261 Patented Dec. 1, 1896.

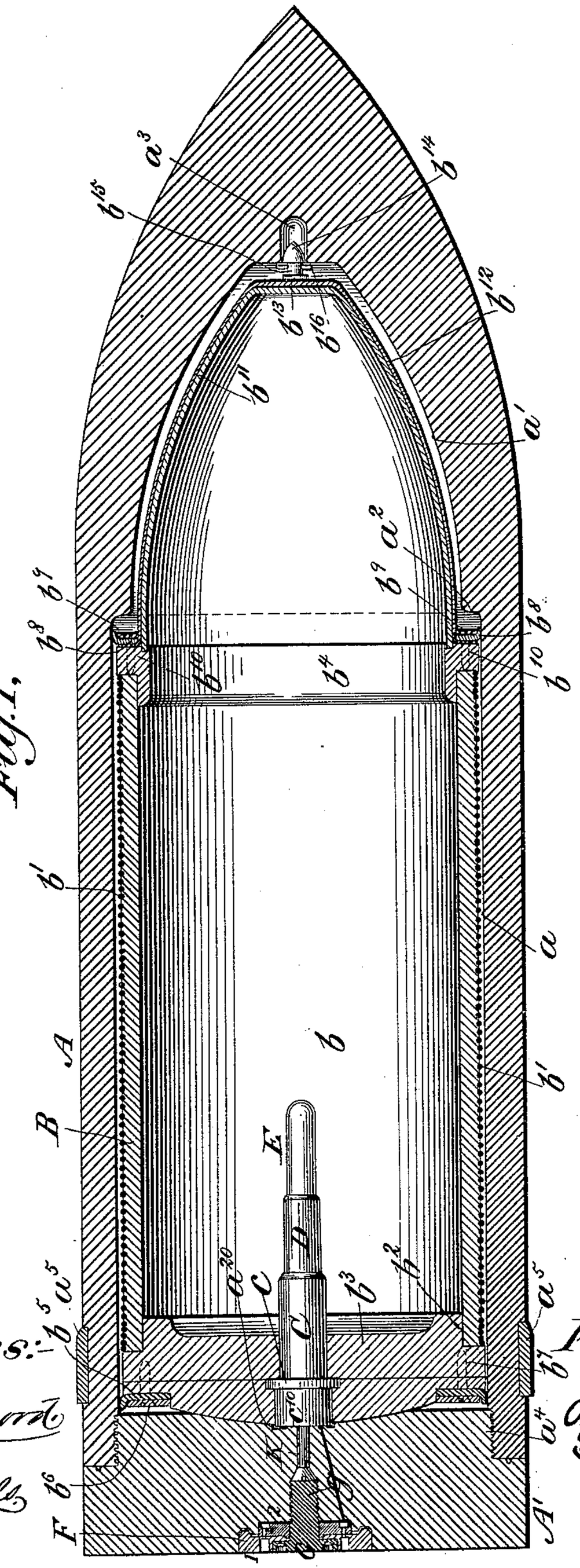

Fig. 1.

Witnesses:-
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Pierson L. Wells

Inventor:-
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by his attorney
Edwin H. Brown

(No Model.) 3 Sheets—Sheet 2.

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Fig. 4.

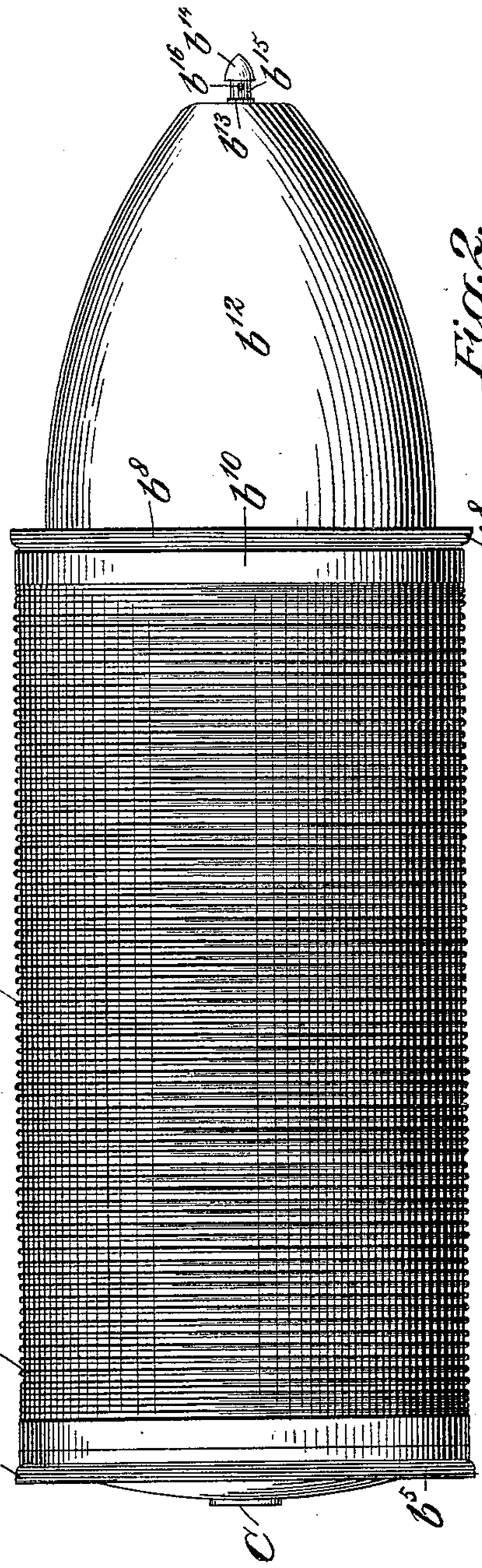

Fig. 2.

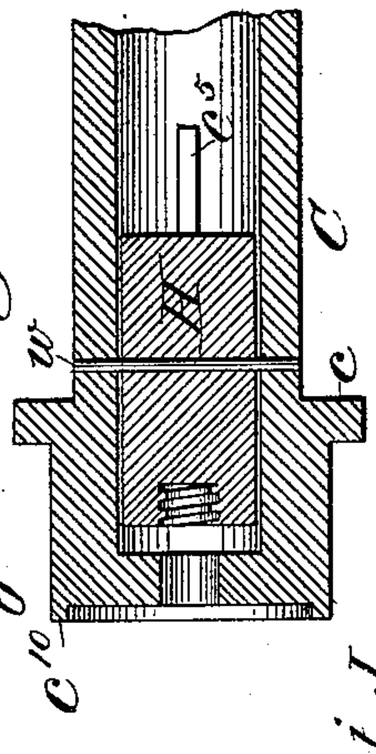

Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

J. G. JUSTIN.

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Fig. 1.

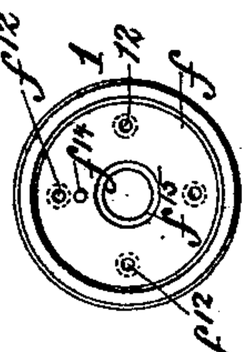


Fig. 8.

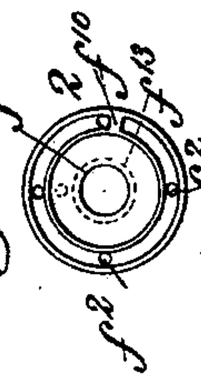


Fig. 11.

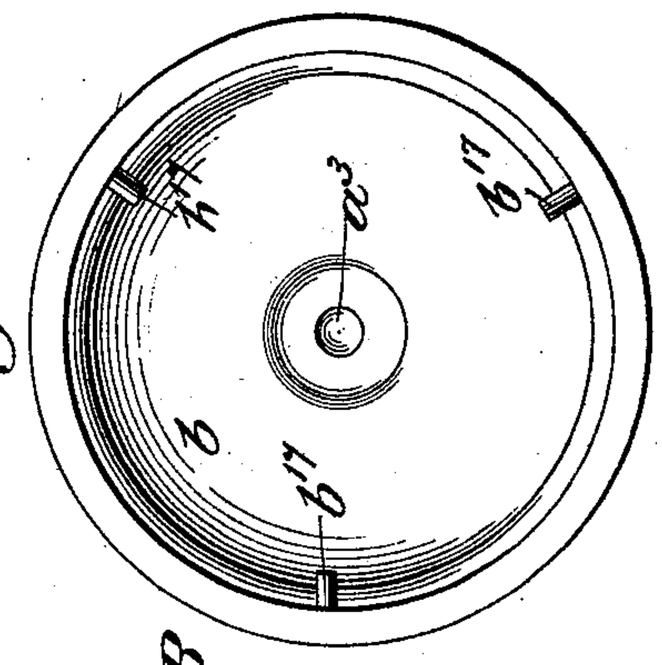


Fig. 6.

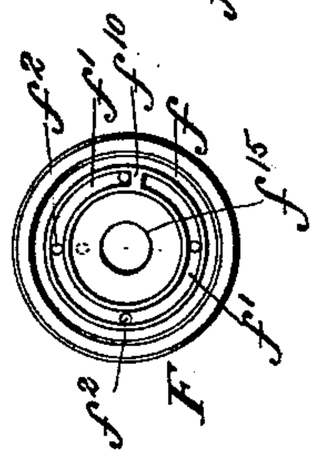


Fig. 10.

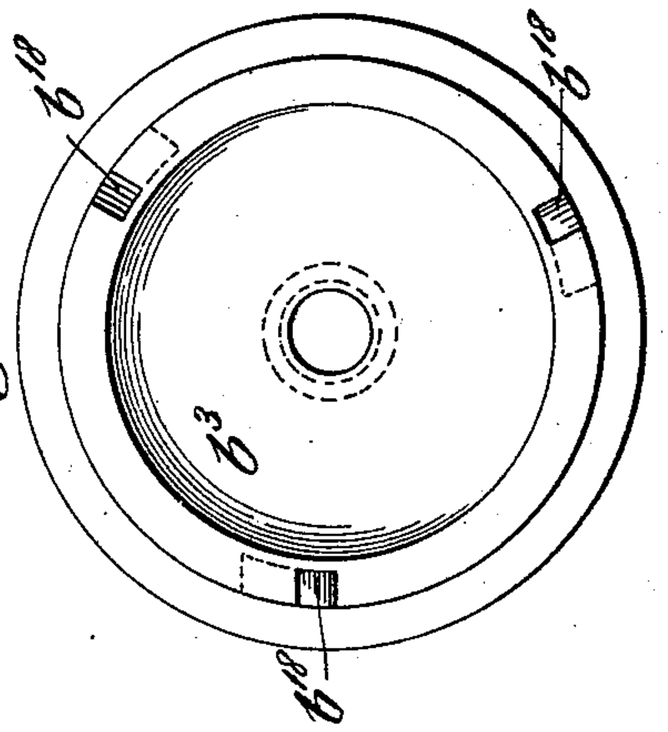


Fig. 5.

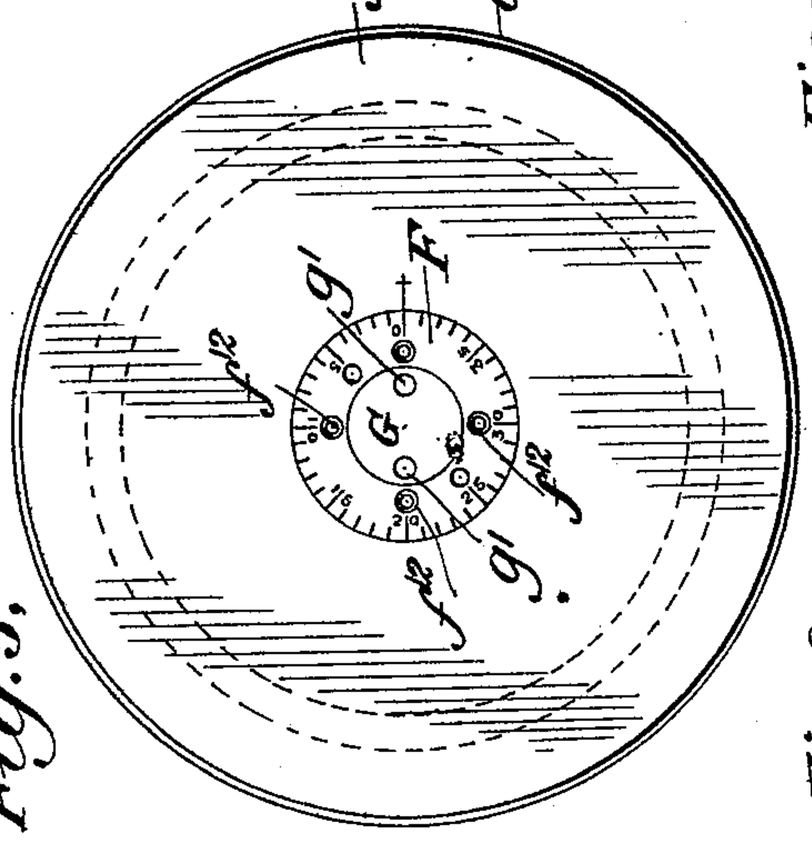
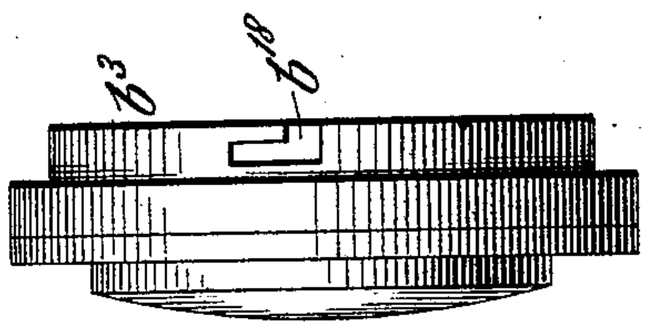


Fig. 9.



Witnesses:-

O. H. Hayward

Pierson & Wells

Inventor:-

Joel G. Justin,

by his attorney

Edwin H. Brown

UNITED STATES PATENT OFFICE.

JOEL G. JUSTIN, OF SYRACUSE, NEW YORK, ASSIGNOR TO THE JUSTIN PROJECTILE COMPANY OF WEST VIRGINIA, OF SAME PLACE.

SHELL FOR HIGH EXPLOSIVES.

SPECIFICATION forming part of Letters Patent No. 572,261, dated December 1, 1896.

Application filed October 5, 1894. Serial No. 524,998. (No model.)

To all whom it may concern:

Be it known that I, JOEL G. JUSTIN, of Syracuse, in the county of Onondaga and State of New York, have invented a certain new and useful Improvement in Shells for High Explosives, of which the following is a specification.

This invention relates to shells or projectiles arranged to carry an explosive charge, and embodies a construction for the same comprising a shell-casing and a relatively-movable charge-carrier for the explosive material, which latter is designed to be exploded either on impact with a body or upon the expiration of a definite period after the shell has left the gun.

I will describe a shell embodying my improvement, and then point out the novel features in the claims.

In the accompanying drawings, Figure 1 is a central longitudinal section of a shell embodying my improvement, there being no charge represented. Fig. 2 is a longitudinal section of certain parts. Fig. 3 is a similar section, on an enlarged scale, of certain parts in the rear portion of the shell. Fig. 4 is a side view of the carrier or chamber containing the explosive charge. Fig. 5 is a rear view of the rear end of the shell. Fig. 6 is a view of the front side of a fuse-plate comprised in the shell. Fig. 7 is a front view of the main section of the fuse-plate. Fig. 8 is a front view of the other section of the fuse-plate. Fig. 9 is a side view of the base or base-block of the carrier for the explosive charge. Fig. 10 is a front view of the latter. Fig. 11 is a rear view of the main or body section of the explosive-carrier.

Similar letters of reference designate corresponding parts in all the figures.

A designates the casing of the shell. It is mainly of cylindrical form, but the forward end is pointed. Interiorly it has a cylindric cavity a and in advance of this a conoidal cavity a', the latter being at its greatest diameter smaller than the cylindric portion a, so as to form a shoulder a^2. In the forward extremity of the conoidal portion a' is a recess a^3, which may be of cylindric form with a rounded inner end. At the rear end it is provided with a removable base-block or plug A', which, as here shown, is provided on the forward side with a screw-threaded boss a^4 for engaging with a screw-thread formed interiorly in the rear end of the casing A. A gas-tight joint may be advantageously produced by forming a circular groove in the forward side of the flanged or main portion of the base-block A' and introducing therein a copper wire of such size that, when seated, it will project slightly beyond the face. The fitting of the base-block into place will compress the wire, so as to make a tight joint. The shell and base-block will preferably be made of steel. I may furnish the casing with any suitable soft-metal ring a^5 for taking the lands of the rifling.

B designates a chamber or carrier for the explosive charge. In the present instance its body is shown as comprising a hollow cylindrical section b, made of wood or other light material, and wound with wire b'. White wood may advantageously be used for the body, and the wire may be of steel. At the rear end this section fits in a rabbet b^2, formed exteriorly of the forward end of a base-block or plug b^3, which may advantageously be made of hard maple wood. At the forward end it is similarly fitted in an exterior rabbet formed in a ring b^4, which may advantageously be made of hard maple wood.

A convenient way of securing the section b to the base b^3 is by means of a bayonet-joint. I have therefore shown the section b as provided with a number of inwardly-extending radial pins b^{17}, and the rabbet of the base as provided with L-shaped grooves b^{18}, as may be seen by reference to Figs. 9, 10, and 11.

The forward end of the section b of the carrier may conveniently be secured to the ring b^4 by radially-extending dowel-pins and glue.

The base-block b^3, as here shown, is provided with a flexible packing-ring b^5, of leather or like material, fitted at the inner edge within a rabbet formed exteriorly in the rear portion of the base-block and secured there by a metal ring b^6, the latter being fastened by screws b^7. The outer edge of the ring b^5 is projected against the interior of the cavity a in the casing A.

The ring b^4 has attached to its forward side a packing-ring b^8, which may be made of leather

or like material, whose edges project outwardly against the interior of the cavity a in the casing A. This ring b^8 is secured in place by a ring b^9, which may be made of metal and may be fastened by screws b^{10}.

In the forward side of the ring b^4, and near its interior surface, is a rabbet in which fits the rear edge of a conoidal shell or dome b^{11}, which may be made of wood or other light material. When made of wood, there will preferably be outside of it a shell of metal b^{12}, such, for instance, as copper. This shell may be secured in place by having its rear edge turned outwardly like a flange and extended between the packing-ring b^8 and the ring b^4. Then the screws b^{10} will retain it in place.

To the forward end of the dome or shell b^{11} is secured a shaft or rod b^{13}, having at the forward extremity an enlarged head b^{14}, which may be of conoidal form. Rearward of this is a neck portion b^{15}, and in this neck portion is a transverse pin b^{16}. The purpose of this shaft b^{13} and its appurtenances is to coact with the recess a^3 of the casing A.

Before going further, it may conduce to a clear understanding of my improvement for me to explain that in the present example of my invention the carrier B is to remain in contact with the base A′ of the casing A until the shell is arrested in its flight, and that then the carrier is intended to move forwardly within the casing. The pin b^{16} will prevent the carrier from any considerable movement away from the base A′ of the casing A until the flight of the shell is arrested. This feature may be entirely omitted with my present improvement, if desired.

I may add that when the shell begins its flight it is desirable that the rotary motion of the casing derived from the rifling of a gun from which the shell is projected shall not too suddenly be transmitted to the carrier, and hence that the carrier is fitted within the casing so as to provide for a relative rotary motion of the casing around it. To facilitate this relative rotary movement the base of the carrier is adapted to act as a pivot. As here shown, it is convexed and the forward end of the base A′ of the casing A is concaved to form a seat for it. The reverse of this construction, or, indeed, any other suitable construction, might be adopted.

C designates a chamber attached to the base-block b^3 of the carrier B. It is internally cylindric and is closed at the rear end, but open at the forward end. It is also in the present instance cylindric externally. I have shown it as provided with a flange c, whereby it is secured in position in the base-block b^3 of the carrier B, this base-block being made in two sections so as to permit the introduction of the chamber with its flange in place. The two sections, when made of wood, may have the grain of the wood reversed and may be glued together. The chamber C will be secured in the base-block while the latter is being constructed, and it will be retained by the screws which secure the packing-ring b^5 in place, because these screws serve to fasten together the two sections of the base-block.

Extending through the wall of the chamber C from end to end is a passage c', and this communicates with an annular passage a^{10} in the forward side of the base-block A′ of the casing A. This annular passage a^{10} is in communication with a passage a^{11}, extending to it through the base-block A′ of the casing A. At the rear this chamber C has a rearwardly-extending circular rib c^{10}, which extends into a similarly-shaped groove a^{20}, formed in the forward side of the base-block A′; but this groove may be so much larger than the rib that the latter does not touch it at any point. This combination of rib and groove lessens the passage of gases from the annular passage a^{10}.

To the forward end of the chamber C is secured a gun-barrel D, the connection being, as here shown, by means of an externally-screw-threaded boss on the latter engaging with a screw-thread in the former. This gun-barrel contains a chamber d for gun-powder and a chamber d' for a ball which is to be projected from the gun-barrel upon the explosion of the gun-powder. Beyond the gun-barrel D is a chamber E for high-explosive material. This may be cylindrical in form and is closed at the outer end. A convenient way of connecting this chamber E with the gun-barrel is to form an externally-screw-threaded boss on the latter and engage this with a screw-thread in the former.

With the passage c' of the chamber C communicates a passage or channel d^2, formed in the gun-barrel D, said passage or channel d^2 being formed to communicate with the powder-chamber d of the gun-barrel.

In the rear of the base A′ of the casing A is a fuse-plate F, (shown as composed of two sections 1 and 2.) Both sections are circular in form. The rear or main section, 1, consists, essentially, of a flat disk with a rim at the circumference on the forward side, and a number of holes f^{12}, extending through it from front to rear. The other section, 2, consists of a disk-shaped plate, which is provided with a rearwardly-projecting rim or circular flange f^{13}, that extends into a recess formed in the front of the main section 1 of the plate. Rotary motion of the section 2 is prevented by means of a pin f^{14}, extending from the main section 1 into a hole in the rear of the section 2. This fuse-plate fits in a recess formed in the rear of the base A′ of the casing A. In the forward side of the section 2 of the plate is an annular groove f, that engages with an annular rib b^{20}, formed on said base A′. This groove is bounded by the rim f^{13} of the main section of the plate F and the circumference of the section 2 of such plate. The plate F has a central hole f^{15} through both its sections and a circular recess f^{16} rearward of said hole. In this circular recess f^{16} fits a

plate G, and from this plate extends a screw-bolt g through the hole f^{15} of both sections of the plate F and into a tapped hole in the base-block A′ of the casing A. The engagement of the bolt with the base-block of the casing secures the plate G in place, and the latter secures in place both sections of the plate F. The bolt G may be screwed into place by means of a forked screw-driver inserted in recesses g'.

To make the joint between the plate F and the base-block A′ of the casing A gas-tight, I may use any suitable packing in the joint, as, for instance, a mixture of powdered asbestos and tallow, and this packing will be arranged between the rib b^{20} and the annular groove f, as well as around the ring f^{13} at the outside of the groove. Between the central or main portion of the plate F and the opposite portion of the base-block A′, I preferably introduce a packing material, such, for instance, as a sheet of paper f^{11}. This has a hole through the center for the passage of the bolt g, and another hole near the circumference corresponding to the passage a^{11} in the base-block A′. The purpose of this packing is to form a tight joint precluding the passage of gases. Its yielding character compensates for the expansion of the metal parts, due to heating. In the forward side of the section 2 of the plate F is an annular groove f', which communicates at one point with the passage a^{11} in the base A′ of the casing A, and hence communicates indirectly with the powder-chamber d of the gun-barrel D. This groove f' is not a complete annulus, but will be crossed by a bridge or partition f^{10}, so that the composition contained in it will not burn both ways. Moreover, this bridge renders it possible to cut off the passage a^{11} by turning the plate F so that the bridge will be opposite said passage. Thus it would be possible to render the shell incapable of being exploded by means of the passages a^{11}, a^{10}, c', and d^2.

The exterior of the plate F is shown as marked with a scale, and in the present instance the scale is so arranged that the zero-mark of this scale is adjacent to the bridge f^{10}, so that the operator, by adjusting the plate rotarily so that the zero-mark will occupy a certain relation to a fixed mark on the base-block A′, may adjust the bridge f^{10} so that it will close the passage a^{11}. Holes f^2 are formed in the section 2 of the plate F. They extend from the rear to the annular groove f', and correspond in number and spacing with the holes f^{12} in the main section 1 of said plate, so that when the two sections of the plate are locked together these holes f^2 of the section 2 of the plate will be in line with the holes f^{12} of the section 1 of the said plate. By these two sets of holes f^2 f^{12} communication is established between the annular groove f' and the rear of the plate F.

The object of making the plate F in two sections is so that the holes of the two sections may be separately filled. All of the holes f^2 of the section 2 of the plate F, excepting only one, are sealed by disks of paraffin, and this one which is left unsealed is the one near the partition f^{10}, and hence near the zero-mark of the scale. Any suitable fuse composition is placed in the annular groove f'.

The holes f^{12} of the main section 1 of the plate F, excepting the one near the zero-mark of the scale, are filled with any suitable fuse composition.

On the firing of the gun containing the shell fire will pass through the empty hole f^{12} in the main section 1 of the plate F near the zero-mark of the scale and through the corresponding hole f^2 in the other section 2 of the plate F to the fuse composition in the annular groove f'. The fuse composition in the other holes f^{12} will be ignited, and will burn through to the paraffin in the opposite holes f^2 and go out. When the fuse composition in the annular groove f' reaches the holes f^2 which were filled with paraffin, it will melt the paraffin, and in this way clear a vent for the escape of gases. In due time a flame will pass from it through the passage a^{11} to the annular passage a^{10}. By rotating the plate F and securing it in different positions after rotation the empty hole f^{12}, near the zero-mark of the scale, may be moved different distances from the passage a^{11}, so as to give a different timing for the discharge of the shell. Of course this may be changed for one timing, and if the artillerist changes his mind as to the best time for discharging the shell the plate can be changed to a new position without detriment to any of the parts of the shell.

The annular passage a^{10} is provided because of the rotary motion between the casing and the carrier. Preferably there will be a priming charge in this passage, so as to provide a circular sheet of flame, some part of which will enter the passage c'. The latter, near the annular passage a^{10}, will preferably be primed. A flame from the priming will pass through the passages c' d^2 to the powder-chamber d of the gun-barrel D. Thus the charge in the gun-barrel will be discharged, and the ball will be projected from the gun-barrel into the charge of high explosive in chamber E. The latter will be exploded and the main charge in the carrier B will be exploded.

I not only afford provision for the firing of the explosion of the shell by a time-fuse in the manner described, but I also provide for exploding it on the impact of the shell against any object. The means for producing this operation I will now describe.

In the chamber C is a hammer H, which preferably will be of such shape and size as to leave spaces between it and said chamber, in order that the air shall not interfere with its movement. It may be mainly of cylindrical form, with flattened portions, to afford these spaces. It is longitudinally grooved on

one side to fit a rib c^5, extending lengthwise of the interior of the chamber C. During the loading of the shell the hammer is held in a position wherein its rear end will be a short distance forward of the rear end of the chamber C. The means shown for holding it in this position consist of a soft copper wire *w*, passing transversely through it and through the walls of the chamber C.

The hammer is intended, upon the impact of the shell against any object, to move forward and discharge the powder in the powder-chamber *d* of the gun-barrel D. As here shown, the hammer will strike a pin I, working in a fulminate-chamber I′. Normally this pin I is held in position by a small wire i^{10}, extending transversely through the pin I and through the wall of the chamber I′. When the hammer H strikes the pin I, the wire i^{10} will be sheared off, so as to permit of the forward movement of the pin I. The fulminate-chamber opens into a second chamber J, which may contain a delay-action composition. A passage d^5 extends from the chamber J into the powder-chamber *d* of the gun-barrel D.

As here shown, the chamber J is of cylindrical form and externally threaded to fit into and engage with a recess in the rear of the gun-barrel, and the chamber I is provided at the forward end with an externally-screw-threaded boss that engages with the interior of the rear part of the chamber J.

It will be seen that rearward of the gun-barrel the chamber J is provided with transverse passages *j*, whence the gases will pass into the chamber C, the purpose of these passages *j* being merely that of vents.

K designates a screw which is fitted into a recess in the base-block A′ of the casing A and extends through the rear of the chamber C. This screw is held against turning by the bolt *g*, which clamps it within its recess in the base A′ of the casing A. Any other mode of providing the base-block A′ with a screw will suffice. This screw has a thread reverse in pitch from the pitch of the rifling. In the present instance it has a square thread of the kind known as a "left-hand" thread. During the assembling of the parts of the shell the screw K is turned so as to engage a screw-thread formed in a recess in the rear portion of the hammer H. The turning of the screw, after it has engaged with the hammer, will draw the hammer rearward into contact with the rear of the chamber C. Thus it will shear off the wire *w*. Then the only means for holding the hammer will be the screw K.

When the shell is fired, the rotary motion imparted by the rifling to the casing will turn the screw K relatively to the hammer H, the latter being locked by the rib c^5 against rotation independently of the carrier B, and the latter being prevented by inertia from beginning its rotation as soon as that of the casing commences. This rotation of the screw K disengages the hammer H, for the latter is free to move forward in the chamber C as the screw rotates. In the present instance about two rotations of the casing will release the hammer. The hammer H being thus freed it can move forward and fulfil its function on the impact of the shell with any object.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a shell the combination of a casing constituting the body of the shell, a carrier for an explosive charge fitted to the casing so as to provide for relative rotary motion between the two parts, a detonator arranged in said carrier, and a hammer, which will normally be inoperative, for exploding the detonator, but which will be rendered operative by rotary motion caused by the rifling of a gun.

2. In a shell the combination of a casing, a carrier for an explosive charge fitted to the casing so as to provide for relative rotary motion between the two parts, a detonator arranged in said carrier, a hammer fitted to the carrier for exploding the detonator, and means appurtenant to the casing, which will normally hold the hammer in a position in which it will be incapable of exploding the detonator, but which will release the hammer when the relative rotary motion between the shell and carrier begins.

3. In a shell the combination of a casing, a carrier for an explosive charge fitted to the casing, so as to provide for relative rotary motion between the two parts, a detonator arranged in the said carrier, a hammer fitted to the carrier for exploding the detonator, and a screw-thread forming an appurtenance of the casing, engaging with the hammer and having a pitch the reverse of that of the rifling of the gun in which the shell is to be used.

4. In a shell the combination of a casing, a carrier for an explosive charge, fitted to the casing, so as to provide for relative rotary motion between the two parts, a detonator arranged in said carrier, a hammer fitted to the carrier for exploding the detonator, and a screw fastened to the base of the casing and extending into a screw-threaded recess in the hammer, said screw having a pitch the reverse of the rifling of the gun from which the shell is to be fired.

5. In a shell the combination with a casing having a base-block provided with a screw K and a screw *g* for holding said screw K in place; of an explosive-carrier fitted to the casing so as to provide for relative rotation between the two, and having a hammer H for engaging with the said screw K.

6. In a shell the combination of a casing, a carrier for an explosive charge fitted to the casing so as to provide for relative rotary motion between the two parts, a base-block, a recess in the rear side of said base-block, and a fuse-plate fitting such recess, the said fuse-plate and the said recess being constructed so that the one shall have a tongue and the other a groove for packing, which will be located intermediately of it and the tongue.

7. A fuse-plate for a shell made in two parts, one part having a firing-hole and independent vent-holes, and the other part having holes which communicate with the holes in the first-mentioned part, one of said parts being revoluble relatively to the other, substantially as specified.

8. In a shell the combination of a base-block having a recess and a two-part fuse-plate fitting in said recess, and having an annular groove or recess in the forward side and a number of holes leading from said groove or recess to the rear of said fuse-plate.

9. The combination with a shell having a single passage a^{11}, of a two-part fuse-plate having in its forward side an annular groove or recess communicating with the said passage a^{11} and a bridge or partition crossing said annular groove or recess, one part of said fuse-plate being rotarily adjustable relatively to the shell, so as to locate its bridge or partition at different distances from said passage.

10. The combination with a shell having a single passage a^{11}, of a two-part fuse-plate having in its forward side an annular groove or recess adapted to communicate with the said passage a^{11} and a bridge or partition crossing said annular groove or recess and made of such size as to be capable of closing said passage a^{11}, one part of said fuse-plate being rotarily adjustable relatively to the shell, so that its bridge or partition may be brought behind or to one side of the said passage a^{11}.

11. In a shell the combination with a casing having a base-block provided with a passage a^{11} and an annular passage a^{10}, of an explosive-carrier fitted to said casing, to provide for relative rotary movement between said parts, and having a passage c' communicating opposite the passage a^{10} of the casing.

12. In a shell the combination of a casing having an annular groove a^{20} and a relatively movable carrier for an explosive charge, having a circular rib c^{10} extending into said annular groove a^{20}.

13. In a shell the combination with a casing and an explosive-carrier having a base-block made in two parts, a detonator having a chamber C provided with a flange c which fits between the two parts of the base-block in said carrier.

14. In a shell the combination of a chamber, a hammer, a wire for temporarily holding the hammer in position and a screw for engaging the hammer and detaching it from the wire.

15. In combination with a shell a firing device consisting of a chamber J provided with vents, a chamber I′ engaging with said chamber J, a firing-pin I and a wire for temporarily holding the firing-pin.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOEL G. JUSTIN.

Witnesses:
ANTHONY GREF,
WALTER A. PAULING.