No. 811,910. PATENTED FEB. 6, 1906.

A. H. EMERY.

CARTRIDGE.

APPLICATION FILED MAR. 12, 1903.

3 SHEETS—SHEET 1.

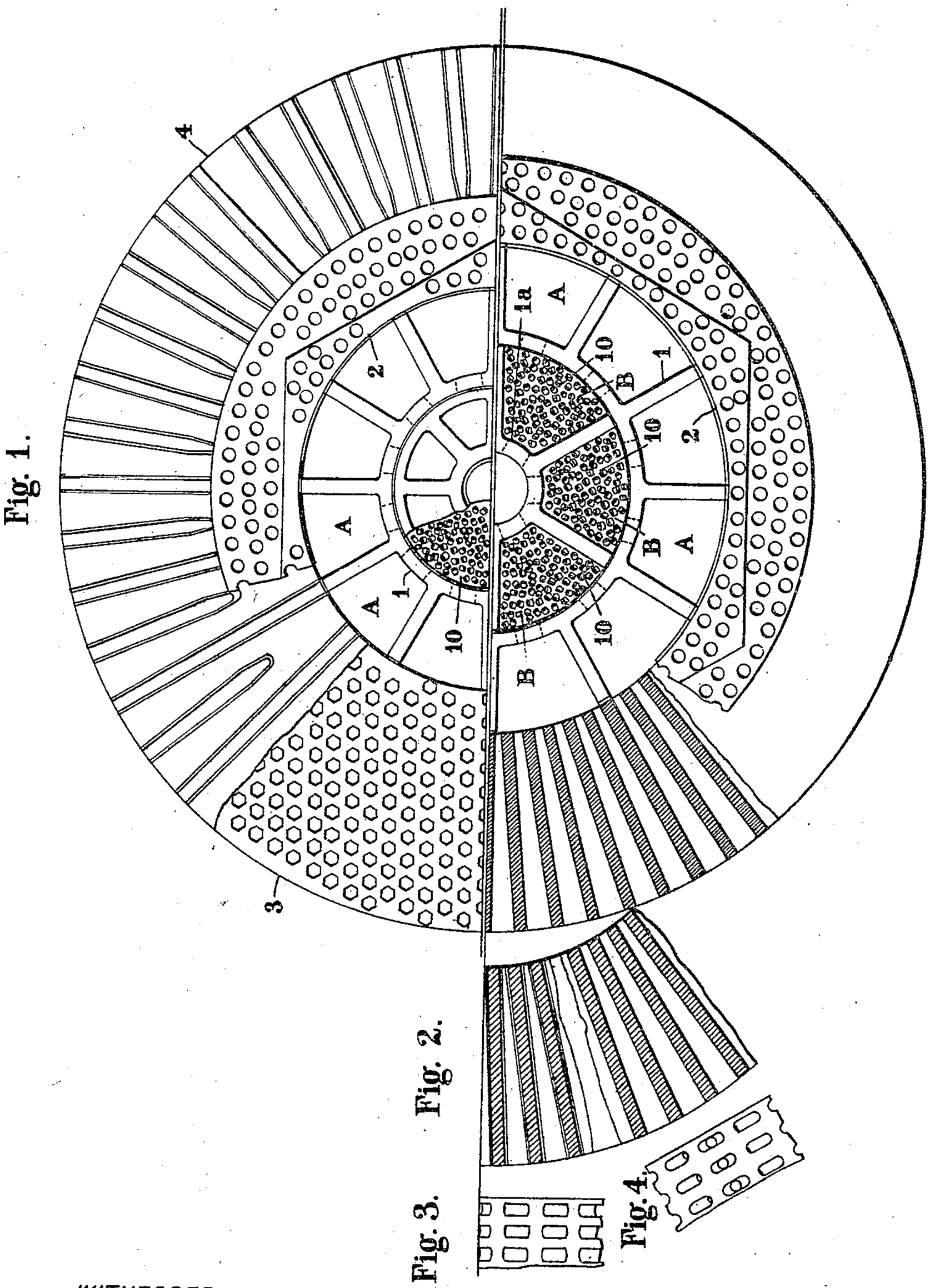

Fig. 1.

Fig. 1a.

Fig. 2.

Fig. 3.

Fig. 4.

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3 SHEETS—SHEET 2.

Fig. 5.

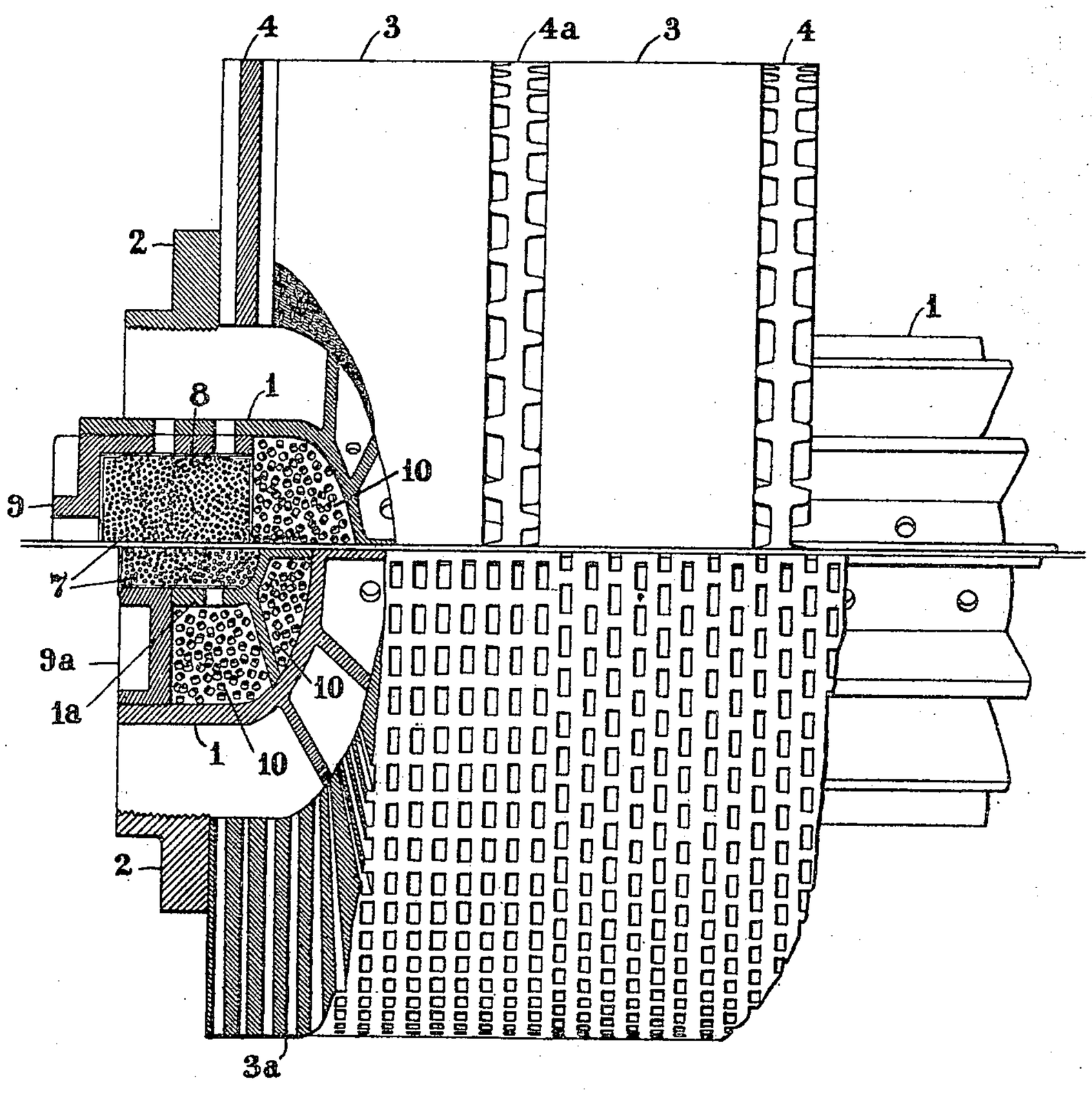

Fig. 5a.

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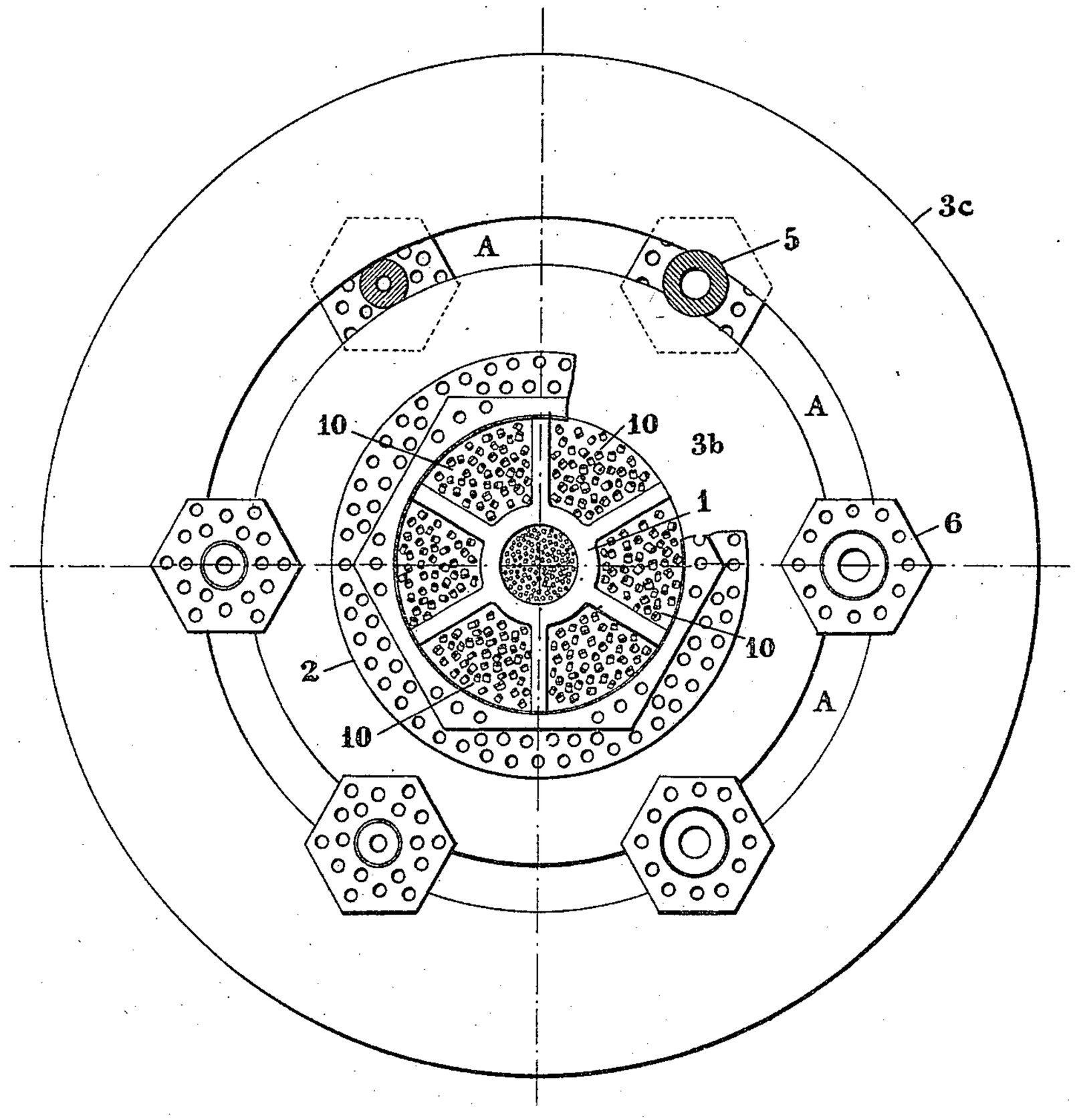
3 SHEETS—SHEET 3.

Fig. 6.



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ALBERT H. EMERY, OF STAMFORD, CONNECTICUT.

CARTRIDGE.

No. 811,910. Specification of Letters Patent. Patented Feb. 6, 1906.

Application filed March 12, 1903. Serial No. 147,543.

To all whom it may concern:

Be it known that I, ALBERT H. EMERY, a citizen of the United States, residing at Stamford, in the county of Fairfield, State of Connecticut, have invented new and useful Improvements in Cartridges, of which the following is a specification.

Heretofore cartridges have been made of loose grains of brown and black powder and of loose grains or sticks of smokeless powder. It has also been proposed to make large perforated cakes of the latter. Those which have been made of loose grains of either brown, black, or smokeless powder or sticks of smokeless powder have usually in the case of cartridges for large guns been formed by placing the loose grains in one or more bags, which are placed in the chamber of the gun, which is usually larger than the bore. In this case there is great danger, especially in the case of smokeless powder, of a large portion of the cartridge when lighted suddenly moving forward into the bore of the gun and choking or damming at the front of the chamber, where it reduces to the diameter of the bore. A stoppage of the powder at this place results in an increase of the pressure of the gases of combustion, and this increase of pressure causes greater rapidity of burning, still further increasing the pressures, resulting in dangerous strains or even in the bursting of the gun. Some guns have doubtless been burst in this manner, the accident being laid to the uncertainty and irregularity of the powder, when it was really wholly due to this choking, as explained.

I have endeavored to make a cartridge of such form that it will not break up and wedge or choke by passing from the chamber into the bore of the gun, also to so construct the cartridge that it may be wholly or mostly consumed in the chamber without breaking up or so constructing it that part of it will be so consumed and the other part move freely into the bore without wedging, providing such venting of the cartridge that the products of combustion easily move forward and such air-spacing with such proportion of kinds and forms of powder having such an extent of surface and such rates of decrease and increase of surface as burning of the whole cartridge progresses that the pressure will quickly reach nearly or quite the maximum before the shot has moved far, after which with an increasing surface of combustion it keeps the pressure as high as, but not greater than, the gun is well fitted to carry as the projectile moves forward, until the projectile leaves the bore, when all the powder should be consumed. The methods of accomplishing these results are illustrated in three sheets of drawings, in which—

Figures 1 and 1ª show end elevations of two forms of these cartridges, one-half only of a cartridge being shown in each figure and portions of each being broken away to illustrate some details of their construction. Figs. 2, 3, and 4 show details of forms of perforations of the powder. Figs. 5 and 5ª show side elevations of portions of the cartridges shown in Figs. 1 and 1ª. Fig. 6 shows an end elevation of another form of these cartridges.

In the figures, 1 is a central ribbed tube, preferably made of explosive material, with uniform thickness of thin walls, around which the main body of the cartridge is assembled and secured by nuts 2. In Fig. 1 the cartridge consists of a longitudinal series of cellular sections 3, separated by ribbed lighting and venting plates 4, as shown in Fig. 5. Fig. 1 shows also one of these ribbed plates partly broken away, exposing the cellular structure of the sections 3, which are perforated with a large number of longitudinal holes of any desired form, best hexagonal and equidistant from each other. Fig. 5 shows one of the ribbed plates 4 with the ribs on one face symmetrical with and opposite those on the other face and a plate 4ª with symmetrical ribs on its two faces, but with the ribs on one face opposite the spaces on the other face. The general form and use of these parts has been fully described and claimed in my application of March 11, 1903, Serial No. 147,346. In Figs. 1ª and 5ª a cartridge is shown of somewhat similar construction, where the lighting and venting plates 4 are omitted and the parts 3 are replaced by one or more sections 3ª, secured around the central stem 1 by the nut 2; but in this case the perforations of the section 3ª are not longitudinal but radial, with walls of uniform thickness between them, the diameter of the hole increasing in one direction only and forming of themselves lighting and venting passages. In Figs. 1ª and 5ª the sections of these radial perforations are shown rectangular with uniform thickness of walls between them. In Figs. 2 and 3 the radial walls of the perfora-

tions are slightly curved, while the transverse walls are parallel, and in Figs. 2 and 4 the radial walls are still more curved. The perforations shown in Figs. 1[a] and 5[a] have a uniform thickness longitudinally of the cartridge, but a width rapidly increasing from the interior to the exterior, giving uniform thickness to the walls between them, while in Figs. 2 and 3 and 2 and 4 the transverse walls between these cells are of uniform thickness, and the cells or perforations themselves are of uniform longitudinal thickness or length, with the width rapidly increasing from the interior to the exterior; but the radial walls between them instead of having plain parallel faces have curved faces. The perforations may be tapered slightly in the other direction also, if desired, to allow the perforating-tool to be extracted more rapidly.

Fig. 6 shows two concentric annular bodies of explosive material 3[b] and 3[c], separated and held together by rods 5 and nuts 6, best made of explosive material. The annular spaces A between these form air-spaces and large venting-passages, through which the products of combustion pass to the front of the cartridge. These two annular bodies 3[b] and 3[c] may be either or both built up, as shown in Figs. 1 and 5 or as shown in Figs. 1[a] and 5[a]. The tubular rods 5 should, if of large diameter, be ribbed to cause quick combustion, as shown in my application of even date herewith, hereinbefore referred to.

When the cartridge is made as shown in Figs. 1 and 5 or as shown in Figs. 1[a] and 5[a], if the diameter is equal to that of the chamber, or nearly so, it is held centrally in the chamber, and the air-passage A between the ribs of the central stem should be large to provide sufficient venting to prevent the cartridge from blowing to pieces. For this reason the central hole in these sections is made very large. The threads on the stem 1 and nuts 2 when the cartridge is ignited quickly burn sufficiently to allow the whole central stem to pass on with the flow of the gases out of the chamber. The unburned part of the main body of the cartridge remains within the chamber until it is nearly or wholly consumed. In Fig. 6 the outer body 3[c] has nearly or quite the diameter of the chamber and remains therein until nearly or wholly consumed, while the inner body 3[b], the outer diameter of which is less than that of the bore of the gun, will under the action of the flowing gases begin to move forward out of the chamber as soon as the threads on rods 5 and nuts 6 are burned sufficiently to allow of this movement. If the outer diameter of these cartridges is not nearly or quite as great as the diameter of the chamber, they should be carefully centered therein by lugs, legs, or ribs, as I have shown in my other application of even date herewith hereinbefore referred to.

In the central stem 1 (shown in Fig. 1 and in Fig. 6) there is a longitudinal central hole running the whole length, in the rear end of which should be placed a lighting charge of quick-burning powder, which may be lighted by electricity or by the primer in the usual way. This lighting charge 7 is shown in Fig. 5 contained in a light case 8, of paper or explosive material, which is secured in the screw-cap 9 of explosive material. In Fig. 5 this stem 1 contains in front of this firing charge 7 a charge of rapid-pressure-developing powder 10 of such quantity and form of grains as to greatly increase the entire burning-surface of the cartridge. The tube 1 is perforated with lateral holes at suitable distances, and the flame from the firing charge 7 will light the powder 10 and simultaneously blow through these holes into the igniting-passages in the external part, and so light the whole cartridge. In Figs. 1[a] and 5[a] the stem 1 has a similar inner stem 1[a], in the rear of the central tube of which is put the igniting charge, while in the pockets B, formed by the ribs of these tubes, is placed the "rapid-pressure-developing" charge 10, secured by cap-nuts 9[a]. In the cartridge shown in Fig. 6 the stem 1 is used in exactly the same manner as is the stem 1[a] just described. Similar nuts to 9[a] (not shown) are used here also. This rapid-pressure-developing powder should have in the aggregate a large burning-surface and a large surface per pound, with thin walls which will be nearly or wholly consumed by the time the maximum pressure is reached. Usually the slow-burning powder which constitutes the larger portion of the cartridge will have a large and an increasing surface of combustion as burning proceeds. The large surface of combustion of this and the rapid pressure-developing charge together should develop nearly or quite the maximum pressure desired before the shot has moved far, at which time the consumption of the rapid-pressure-developing charge will have temporarily decreased the burning-surface of the entire charge, which surface, however, will be rapidly increased thereafter by reason of the cellular construction of a large portion of the slow-burning powder, which is necessary to keep up the pressure to the extent desired under the rapidly-increasing velocity of the projectile; but the cells should be so proportioned in the slow-burning powder that this increase will not be so rapid as to cause the pressure to exceed that desired in the chase of the gun. The increase of the burning-surface of the slow-burning powder may be checked or reduced at any position of the shot by so proportioning the diameter of the cells and the thickness of walls in a part of the cartridge that the walls of these cells are burned through when the shot reaches that position. The constructions shown greatly facilitate the manufacture of a cartridge which will have these properties.

In making this cartridge in many cases the

form shown in Fig. 6 is preferred, with such size and proportions that the outer body fills the chamber of the gun diametrically and extends usually from the breech-block well into the conical part of the chamber, while the inner part of the cartridge has a diameter somewhat smaller than the bore of the gun. The thickness of the outer body at the front end when thus made is so small that the construction shown in Figs. 1 and 5 is undesirable for that part of the cartridge. Moreover, should the remainder of this outer body be made up as shown in Figs. 1 and 5 there would be tendency for the sections to separate, and those in the conical part of the chamber would in moving forward be reduced in diameter and crushed together, endangering or disturbing the proper action of the cartridge, which should be that the outer body remains in the chamber until it is consumed, while the inner portion moves freely into the bore of the gun, and the best action is had when the inner part of the cartridge moves freely forward into the bore and becomes largely separated and spread out while burning in the space between the chamber and the projectile. This last condition is more readily brought about by the construction shown in Figs. 1 and 5 than it would be by those constructions shown in Figs. 1^a and 5^a, while by making the outer part of the cartridge as shown in Figs. 1 and 5^a such part is readily made to retain its position in the chamber until consumed. The relative diameters of the exterior and interior of this part of the cartridge are such that the perforations may be made of the desired form and number very readily, whereas the exterior and interior diameters of the inner part of the cartridge are such relatively that the radial perforations with uniform thickness of walls have undesirable proportions, being very large at the exterior and very small at the interior. The construction shown in Figs. 1 and 5 readily lends itself to a proper thickness of walls, perforations, and vents and permits the desired distribution of this part of the cartridge in the bore while burning.

Having thus described the invention, the following is what I claim as new therein:

1. A plate of explosive material for cartridges constructed with raised ribs upon its opposite faces, the ribs on one face being opposite the spaces on the other and extending from the exterior toward the interior of the plate.

2. A cartridge constructed with a longitudinal series of transverse sections or plates of explosive material, each having a large central opening, said plates or sections being separated from each other at suitable intervals by ribbed plates which form lighting-passages, the whole cartridge being suitably secured together, to form a cartridge with a large central orifice through which the gases of combustion can pass to the front of the cartridge.

3. A cartridge constructed with a longitudinal series of short transverse sections or plates of explosive material, each section being formed with or having a large central orifice coaxial with the cartridge, open to permit the free passage of the gases of combustion to the front of the cartridge, and secured together by a rod or rods of explosive material, said plates or sections being separated from each other at suitable intervals by ribbed plates which form lighting and venting passages.

4. A cartridge constructed with short transverse sections of explosive material, each section having a large number of longitudinal holes forming a burning-surface which increases as combustion progresses, and separating ribbed plates interposed between said sections at suitable intervals, said plates having igniting and venting passages, each of the said sections and plates having a large central orifice, coaxial with the cartridge, through which the gases of combustion can pass to the front of the cartridge.

5. A cartridge constructed with short transverse sections of explosive material, each section having a large number of longitudinal holes forming a burning-surface which increases as combustion progresses, and separating ribbed plates interposed between said sections at suitable intervals, said plates having igniting and venting passages, said sections and plates being suitably secured together, and each of the said sections and plates having a large central orifice, coaxial with the cartridge, through which the gases of combustion can pass to the front of the cartridge.

6. A cartridge constructed with short transverse sections of explosive material, each section having a large number of longitudinal holes minutely dividing the body of the sections into thin walls, and transmitting flame uniformly to all parts of the interior of the sections; said holes being hexagonal and disposed so as to give equal thicknesses of walls between them and insure substantial completion of combustion of most of the entire mass at the time the walls are burned through; and separating ribbed plates interposed between said sections at suitable intervals, said plates having igniting and venting passages, each of the said sections and plates having a large central orifice, coaxial with the cartridge, through which the gases of combustion can pass to the front of the cartridge.

7. In a cartridge, the central tube of explosive around which a large part of the cartridge is secured, said tube being constructed with a series of longitudinal ribs on its exterior which, with the surrounding cartridge,

form longitudinal cells and longitudinal lighting and venting passages for the surrounding cartridge.

8. In a cartridge, the central tube of explosive around which a large part of the cartridge is secured, said tube being constructed with a series of longitudinal ribs on its exterior which, with the surrounding cartridge, form longitudinal cells and longitudinal lighting and venting passages for the surrounding cartridge, and having powder in these longitudinal cells.

9. In a cartridge, a central tube of explosive material, around which a large part of the cartridge is assembled, this tube having a series of cells or pockets, in which is placed explosive material, and caps or nuts to aid in securing powder placed in said pockets or cells.

10. A cartridge constructed with an exterior annular body of slow-burning powder, containing a longitudinal tube of explosive material interior thereto, through which the charge is ignited, having external radial ribs centering it within the body of slow-burning powder and forming pockets, and a rapid-pressure-developing powder contained within said pockets.

11. A cartridge constructed with an exterior annular body of slow-burning powder, containing a quick-burning charge of rapid-pressure-developing powder, a longitudinal tube containing the quick-burning powder and centering it within the exterior annular body, said containing-tube having a series of longitudinal external ribs forming large passages through which the gases from the slow-burning powder when developed can pass through to the front of the cartridge.

12. A cartridge consisting of separate concentric annular bodies of explosive material, perforated to increase their surface of combustion, and projections, ribs or rods, separating and holding said bodies concentric, and leaving large longitudinal air-spacing between them, through which the gases from combustion pass to the front of the cartridge.

13. A cartridge consisting of separate concentric annular bodies of explosive material perforated to increase their surface of combustion, and projections, ribs or rods, separating and holding said bodies concentric, and leaving large longitudinal air-spacing between them through which the gases from combustion pass to the front of the cartridge, the exterior diameter of the inner annular body being smaller than the bore of the gun in which it is to be fired.

14. A cartridge consisting of separate concentric annular bodies of explosive material perforated to increase their surface of combustion, and projections, ribs or rods, separating and holding said bodies concentric, and leaving large longitudinal air-spacing between them through which the gases from combustion pass to the front of the cartridge, the exterior diameter of the outer annular body being nearly or quite equal to the diameter of the chamber of the gun in which it is to be fired.

15. A cartridge consisting of separate concentric annular bodies of explosive material perforated to increase their surface of combustion, and projections, ribs or rods, separating and holding said bodies concentric, and leaving large longitudinal air-spacing between them through which the gases from combustion pass to the front of the cartridge, the exterior diameter of the outer annular body being nearly or quite equal to the diameter of the chamber of the gun in which it is to be fired, the exterior diameter of the inner member being smaller than the bore of the gun and so secured to the outer that soon after combustion begins it will pass forward into the bore of the gun and be consumed while the outer body is consumed largely or wholly within the chamber of the gun.

16. A cartridge consisting of separate concentric annular bodies of explosive material perforated to increase their surface of combustion, longitudinal rods separating said bodies, so as to leave large air-spacing between them, and heads or nuts through which the rods secure the concentric bodies together.

17. A cartridge constructed with an outer annular body of slow-burning powder perforated with radial holes, with such thickness of walls that they will be substantially burned through at the time the projectile leaves the gun, and an inner annular body around a central stem of explosive material, said inner body being made up of series of longitudinal sections or thick plates separated from each other by thin ribbed plates, said longitudinal sections being perforated with a series of longitudinal holes, having such thickness of walls as will cause them to burn through when the projectile has reached that position in the chase of the gun where a large reduction of the burning-surface becomes desirable.

18. A cartridge constructed with an outer annular body of slow-burning powder perforated with radial holes, with such thickness of walls that they will be substantially burned through at the time the projectile leaves the gun, and an inner annular body around a central stem of explosive material, said inner body being made up of a series of longitudinal sections or thick plates separated from each other by thin ribbed plates, said longitudinal sections being perforated with a series of longitudinal holes, having such thickness of walls as will cause them to burn through when the projectile has reached that position in the chase of the gun where a large reduction of the burning-surface becomes desirable, the inner annular body being separated

from the outer by an annular space which forms a passage for the flow of gases to the front of the cartridge.

19. A cartridge constructed with an annular body perforated with a large number of radial holes minutely dividing up the walls for ignition and burning, with a rapidly-increasing surface of combustion, the size, form and arrangement of these perforations being such that the section of the perforation rapidly increases from the interior outward, and the walls around the perforations have substantially the same thickness throughout.

20. A cartridge constructed with an annular body perforated with a large number of radial holes minutely dividing up the walls for ignition and burning, with a rapidly-increasing surface of combustion, the size, form and arrangement of these perforations being such that the section of the perforation rapidly increases from the interior outward, and the walls around the perforations have substantially the same thickness throughout, said annular body having a large central orifice through which the products of combustion pass to the front of the cartridge.

21. A cartridge constructed with an outer and an inner annular body, one of which has a large number of radial perforations minutely dividing up the walls for ignition and burning and the other of which is constructed of a series of longitudinal sections perforated with a large number of longitudinal holes and separated from each other by ribbed plates which form igniting and venting passages.

22. A cartridge constructed with an outer and an inner annular body, the outer one of which has a large number of radial perforations minutely dividing up the walls for ignition and burning, and the inner of which is constructed of a series of longitudinal sections perforated with a large number of longitudinal holes, and separated from each other by ribbed plates which form igniting and venting passages.

The foregoing specification signed this 10th day of March, 1903.

ALBERT H. EMERY.

In presence of—
ALBERT H. EMERY, Jr.,
EDWIN S. CLARKSON.