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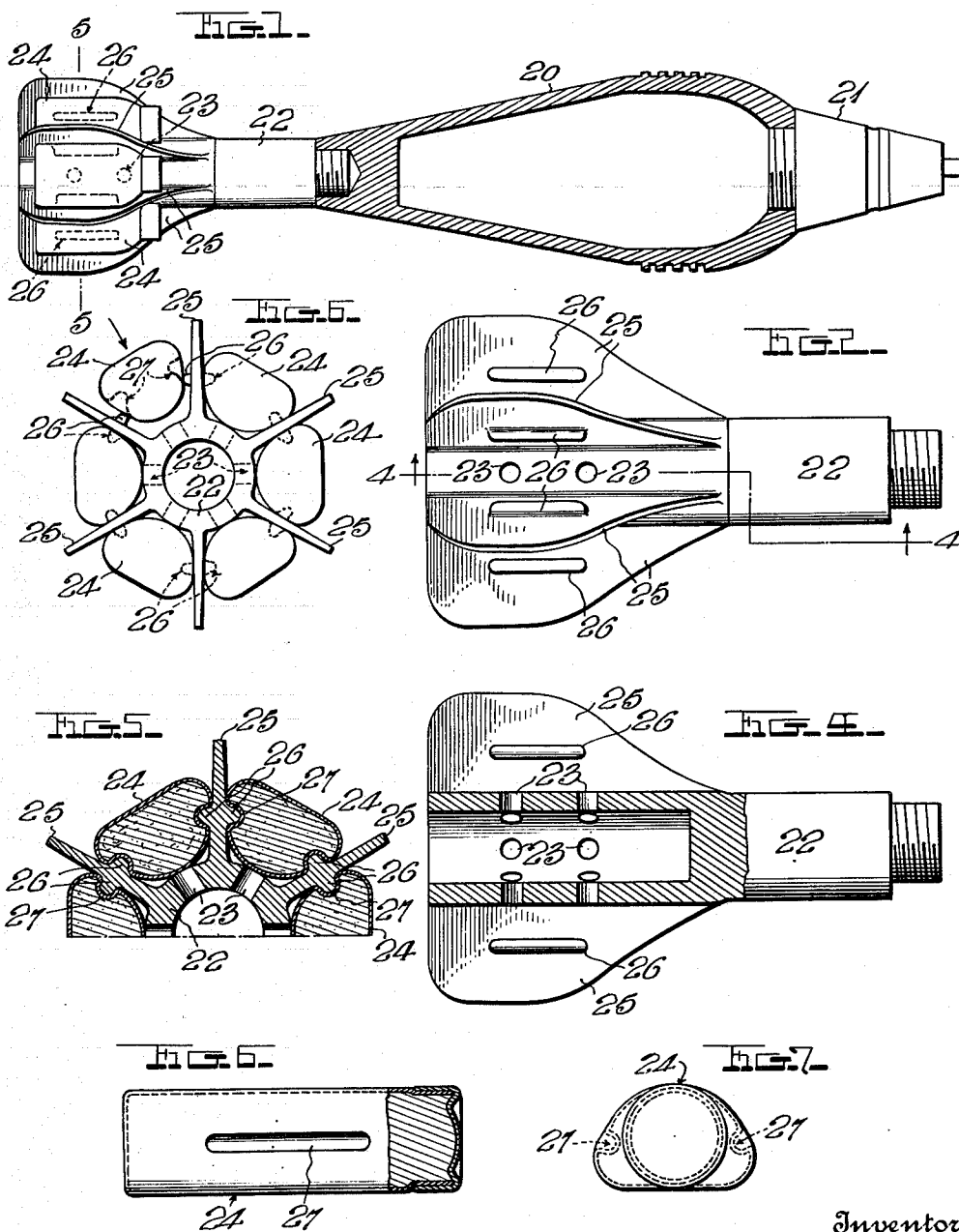
B. P. JOYCE

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PROJECTILE

Filed Oct. 7, 1935

2 Sheets-Sheet 1



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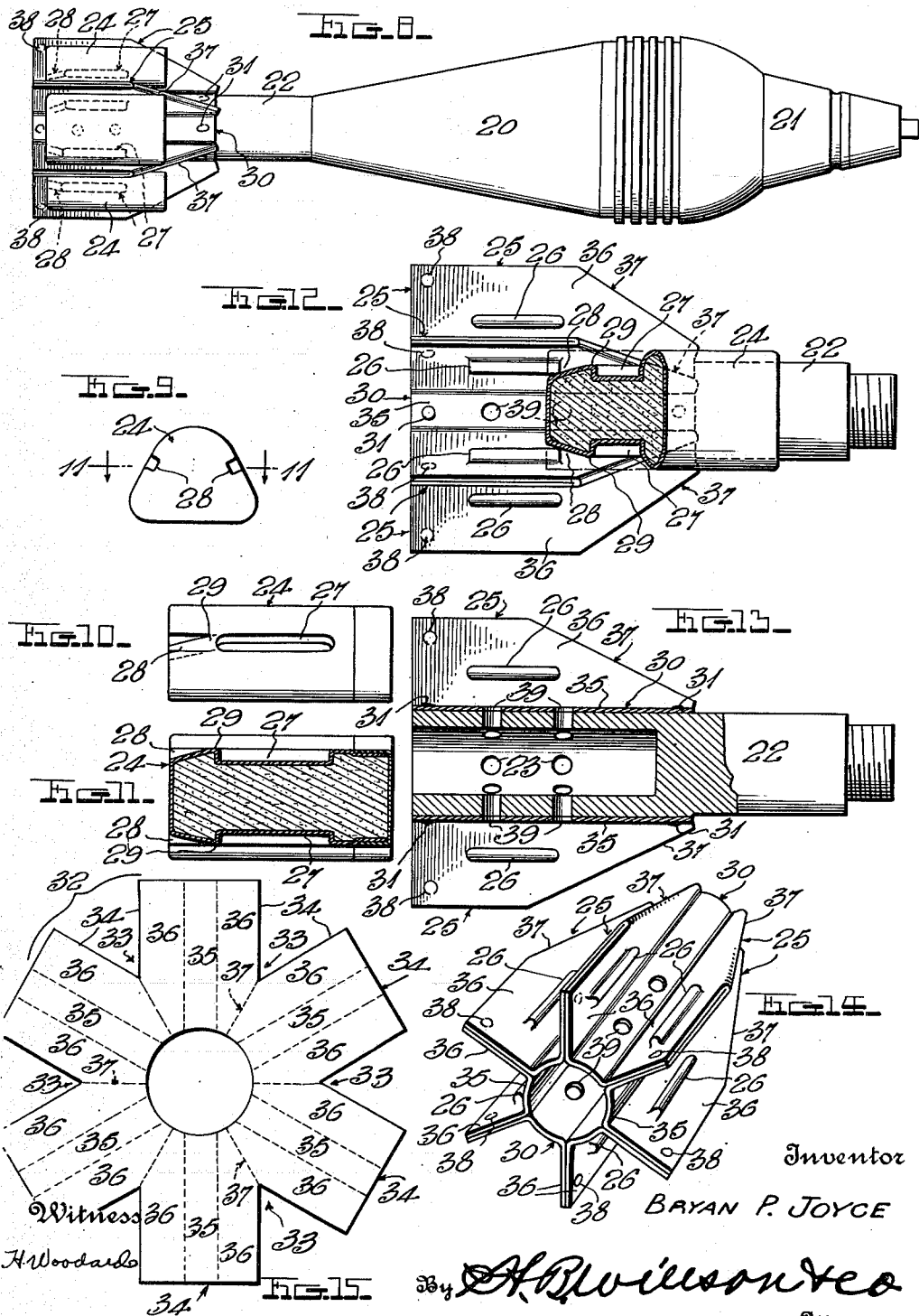
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UNITED STATES PATENT OFFICE

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PROJECTILE

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The invention relates primarily to projectiles for smooth-bore armament such as mortars. The projectile is of a type in which combustible capsules containing powder charges are placed between tail fins, and the principal object of the invention is to provide new and improved means for allowing the desired number of capsules to be quickly and easily placed between the fins and tightly held in place without requiring the use of wires, cord, or other fastening means separate from the fins and capsules.

In carrying out the above end, a further aim is to provide the opposed sides of the tail fins with novel longitudinal ribs spaced inwardly from their outer edges and engageable with grooves in the capsules to hold the latter in place.

A still further aim is to construct the grooved capsules of such resiliency that they may be snapped into engagement with the ribbed fins, enabling unusually quick connection of the capsules with the projectile, and allowing equally quick removal of one or more capsules if a smaller powder charge be desired.

Yet another object is to make novel provision whereby the fins and a sleeve by which they are secured to the projectile tail stem, may be formed from one annular metal plate, providing a simple, inexpensive, easily manufactured, and efficient construction.

With the foregoing and minor objects in view, the invention resides in the novel subject matter hereinafter described and claimed, the description being accomplished by reference to the accompanying drawings.

Fig. 1 is a side elevation partly in section showing a form of construction in which the ribbed fins are cast integrally with the projectile tail stem.

Fig. 2 is a detached side elevation on a larger scale showing the tail stem and the fins integral therewith.

Fig. 3 is an end elevation showing a number of the powder capsules secured in place and illustrating one capsule during the act of insertion.

Fig. 4 is a longitudinal sectional view partly in elevation as indicated by line 4—4 of Fig. 2.

Fig. 5 is a transverse sectional view on line 5—5 of Fig. 1.

Fig. 6 is a side elevation of one of the capsules.

Fig. 7 is an end elevation of the capsule shown in Fig. 6.

Fig. 8 is a side elevation showing a form of construction in which the tail fins and a sleeve by which they are secured to the projectile tail

stem, are formed from a single annular metal plate, and this view also illustrates capsules of a different form held in place between the fins.

Fig. 9 is an end elevation of one of the capsules shown in Fig. 8.

Fig. 10 is a side elevation of the capsule shown in Fig. 9.

Fig. 11 is a sectional view on line 11—11 of Fig. 9.

Fig. 12 is a side elevation partly broken away and in section showing the manner in which the capsules of Figs. 8 to 11 are inserted endwise between the fins.

Fig. 13 is a side elevation partly in section showing the fins and the carrying sleeve therefor secured upon the projectile tail stem.

Fig. 14 is a perspective view of the fins and the carrying sleeve before application to the tail stem.

Fig. 15 is a plan view of the annular sheet metal plate from which the fins and carrying sleeve are formed.

A hollow projectile body 20 is provided to contain an explosive, the front end of said body being provided with a firing head 21 to ignite the contents of said body, while the rear end of this body is provided with a suitably attached tail stem 22. This tail stem is of tubular form to receive the conventional firing cartridge (not shown), and said tail stem is provided with flame openings 23 to permit the firing cartridge to ignite the inflammable powder capsules 24, these capsules being held between tail fins 25 which radiate from the tail stem 22.

The opposed sides of the tail fins 25 are provided with longitudinal ribs 26 which are spaced inwardly from the peripheral edges of said fins, and the opposite side walls of the capsules 24 are formed with inwardly pressed portions providing them with longitudinal grooves 27 to receive said ribs 26, the groove formations and ribs being of less length than the length of said capsules, so as to hold the latter against endwise displacement, as well as against radial movement. When the capsules are in place, they are in direct contact with the tail stem 22 and they cover the openings 23, so that the instant the firing cartridge explodes and directs flame through these openings, the combustible capsules 24 will be ignited to fire their powder charges.

The capsules 24 are preferably formed from nitrocellulose, celluloid or other plastic substances and they are of such resiliency that they may be quickly and easily snapped into engagement with the ribbed fins. However, these capsules or con-

tainers may be made of other materials such as silk or muslin treated with a water-proofing compound so that the containers will be deformable to permit engagement with or disengagement from the ribs without losing their contents. In the form of construction shown in Figs. 1 to 7, the capsules 24 are designed to be radially pushed into place as illustrated at the upper left-hand portion of Fig. 3. During such pushing, contact of the capsules with the ribs 26 causes transverse contraction of the capsules but as soon as the grooves 27 start to engage the ribs 26, the resiliency of the capsule again expands it, seating it with a snap action and holding the grooves and ribs inter-engaged to snugly hold the capsule in place.

The capsule shown in Figures 8 to 12 is intended for endwise insertion between the fins 25, as indicated in Figure 12. To facilitate such endwise insertion, one end of the capsule is provided with entrance groove formations 28 for the ribs 26. The outer ends of these entrance grooves open through one end of the capsule 24 and said grooves decrease in depth toward their inner ends, being of negligible depth at said inner ends. The capsule is placed either between the front or the rear portions of the fins 25 and is pushed endwise, the entrance grooves 28 then receiving the ribs 26 with the result that the capsule portions 29 will be inwardly sprung until they clear said ribs, whereupon said portions 29 again snap outwardly under the resiliency of the capsule, so that the latter is tightly held in place with the ribs 26 snugly seated in the groove formations 27.

In Figs. 1 to 5, the fins 25 are formed integrally with the tail stem 22, being preferably cast thereon, and the ribs 26 are similarly formed on said fins. These ribs provide the fins with thickened longitudinal portions for reinforcing purposes as well as constituting capsule-holding means (see Fig. 5). In Figs. 8 to 14, the fins 25 are of sheet metal, are integrally formed with a sheet metal sleeve 30, and this sleeve is secured upon the tail stem 22 by spot welding 31, the combined reinforcing and capsule-holding ribs 26 being formed by outwardly stamping portions of the fins.

In forming the fin and sleeve construction of Figs. 8 to 14, I make use of an annular sheet metal plate 32 (Fig. 15). This plate is peripherally notched at 33 to provide it with a plurality of spoke portions 34. The notched annular plate is radially corrugated, with the corrugation bottoms 35 extending along the central portions of the spoke portions 34. The corrugations are of such depth toward their outer ends as to draw the corrugation bottoms 35 into sleeve-forming relation with each other as seen in Fig. 14, providing the sleeve 30. The corrugation side walls 36 which are stamped to provide the ribs 26, are drawn by the corrugating operation into such relation with each other as to form the fins 25. The inner edges of the side walls 36 are integrally joined with the longitudinal edges of the corrugation bottoms 35 which form longitudinal sections of the sleeve 30. The outer edges of the side walls 36, toward their front portions, are integrally connected by bight portions 37. The longitudinal edges of the walls 36, toward the rear ends of the latter, are formed by the plate portions which originally formed the edges of the notches 33. There being no bight portions to unite these edges, spot-welding 38 is preferably employed.

At any desired stage of manufacture, the sleeve

sections 35 may have openings 39 formed therein to communicate with the openings 23 in the projectile tail stem 22.

While I have shown the tail piece with six fins, it will be understood that I may use five, seven or any desired number of fins on each tail piece.

It will be seen from the foregoing that novel provision has been made for carrying out the objects of the invention. Preferred features of construction have been shown but within the scope of the invention as claimed, variations may of course be made.

I claim:—

1. A projectile provided with radially disposed tail fins, each of said fins comprising a solid plate with smooth edges, the opposed sides of said fins being provided with stream-lined projections approximately midway between the inner and outer edges of said fins, and combustible powder containers located between said fins and having indentations receiving said projections.

2. A projectile provided with radially disposed tail fins, each of said fins comprising a solid plate with smooth edges, the opposed sides of said fins being provided with stream-lined projections approximately midway between the inner and outer edges of said fins, and resilient combustible powder capsules snapped between said fins and having indentations receiving said projections.

3. A projectile provided with a tubular tail stem to receive a firing cartridge, and radially disposed fins carried by said tail stem, each of said fins comprising a solid plate with smooth edges, the opposed sides of said fins being provided with stream-lined projections approximately midway between the inner and outer edges of the fins, and resilient combustible powder capsules snapped between said fins and having indentations receiving said projections; said tail stem being provided with flame openings over which said capsules extend when held between said fins by said projections and indentations.

4. A projectile provided with radially disposed tail fins, each of said fins comprising a solid plate with smooth edges, the opposed sides of said fins being provided with stream-lined projections approximately midway between the inner and outer edges of said fins, and resilient combustible powder capsules radially insertible between said fins and having indentations to receive said projections, said capsules due to their resiliency being transversely contractible when forced between said projections and being then transversely expandable to engage the indentations with said projections.

5. A projectile provided with radially disposed tail fins, the opposed sides of said fins being provided with longitudinal ribs spaced inwardly from the peripheral edges of said fins, and resilient combustible powder capsules insertible longitudinally between said fins and having longitudinal grooves to receive said ribs, said capsules having tapered end portions to engage said ribs and transversely contract said capsules as they are being longitudinally inserted, the resiliency of the capsules serving to expand them to engage the grooves with the ribs.

6. A projectile provided with radially disposed tail fins, the opposed sides of said fins being provided with longitudinal ribs spaced inwardly from the peripheral edges of said fins, and resilient combustible powder capsules insertible longitudinally between said fins and having longitudinal grooves to receive said ribs, said capsules having

longitudinal entrance grooves for said ribs, the outer ends of said entrance grooves being open through one end of the capsules and being of substantially the depth of the rib-receiving grooves, said entrance grooves decreasing in depth toward their inner ends, the depth of said inner ends being negligible.

7. A projectile provided with radially disposed tail fins, each of said fins comprising a solid plate with smooth edges, the opposed sides of said fins being provided with stream-lined projections approximately midway between the outer and inner edges of the fins, said projections being adapted for holding powder capsules between the fins.

8. A resilient combustible powder capsule for reception between radial tail fins, said capsule having an outer peripheral wall, an inner peripheral wall and side walls converging inwardly from said outer peripheral wall to said inner peripheral wall; said converging side walls having indentations located between the portions thereof which join said inner and outer peripheral walls, said indentations being adapted to receive fin-carried projections.

9. A resilient combustible powder capsule for endwise insertion between projectile tail fins, opposite sides of said capsule being provided with longitudinal grooves to receive ribs on the fins, said capsule having tapered surfaces at one end to engage the ribs and transversely contract the capsule while it is being inserted, the capsule being then expandable by its own resiliency into engagement with the ribs.

10. A resilient combustible powder capsule for endwise insertion between projectile tail fins, opposite sides of said capsule being provided with longitudinal grooves to receive ribs on the fins, said capsule having longitudinal entrance grooves for the ribs, the outer ends of said entrance grooves being open through one end of the capsule and being of substantially the depth of the rib-receiving grooves, said entrance grooves decreasing in depth toward their inner ends, the depth of said inner ends being negligible.

11. In a projectile having a tail stem, a sleeve secured around said tail stem and formed of longitudinally extending sleeve sections, and side walls corresponding in number to and formed integrally with the longitudinal edges of said sleeve sections, said side walls being disposed in fin-forming pairs with the walls of each fin united at their outer edges by an integral bight portion, said sleeve sections and side walls being formed from metal sufficiently stiff to maintain the fins in fixed radial relation with the tail, said side walls being provided with outwardly stamped por-

tions providing the fins with capsule-engaging ribs.

12. A method of forming projectile tail fins radiating from a sleeve, comprising the steps of radially corrugating an annular metal plate, pressing portions of the corrugation side walls to provide them with longitudinal ribs, and forming the corrugations with such increasing depth toward their outer ends as to draw the corrugation bottoms into sleeve-forming relation with each other, the fins being formed by the longitudinal ribbed corrugation side walls and being therefore adapted for holding powder capsules.

13. A method of forming projectile tail fins radiating from a sleeve, comprising the steps of peripherally notching an annular metal plate to provide it with spoke portions, radially corrugating said plate with the corrugation bottoms extending centrally along said spoke portions, the corrugations being of such increasing depth toward their outer ends as to draw said bottoms into sleeve-forming relation with each other, the fins being formed by the side walls of the corrugations and being therefore provided with peripheral edge portions formed by the edges of said spoke portions and adapted to engage a gun bore.

14. A projectile having longitudinal radially disposed tail fins, each of said fins being provided between its inner and outer edges with an integral longitudinal reinforcing portion which projects laterally from both side faces of the fin to provide capsule-holding ribs.

15. A projectile having longitudinal radially disposed tail fins formed integrally therewith, each of said fins being provided substantially midway between its inner and outer edges with an integral thickened longitudinally extending reinforcing portion which projects laterally from both side faces of the fin to provide capsule-holding ribs.

16. A resilient combustible powder capsule for reception between ribbed tail fins, said capsule having an outer wall, an inner wall and converging side walls, said side walls being provided with longitudinally extending inwardly pressed portions providing groove formations which are closed at least one end of the capsule, said groove formations being cooperable with the ribs of the fins.

17. A resilient combustible powder capsule for reception between ribbed tail fins, said capsule having an outer wall, an inner wall and converging side walls, said side walls being provided with longitudinally extending inwardly pressed portions providing groove formations which open through one end of the capsule but not through the other end thereof, said groove formations being cooperable with the ribs of the fins.

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