MEANS FOR HYPERGOLIC FLAME COMBAT

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Fig. 1.

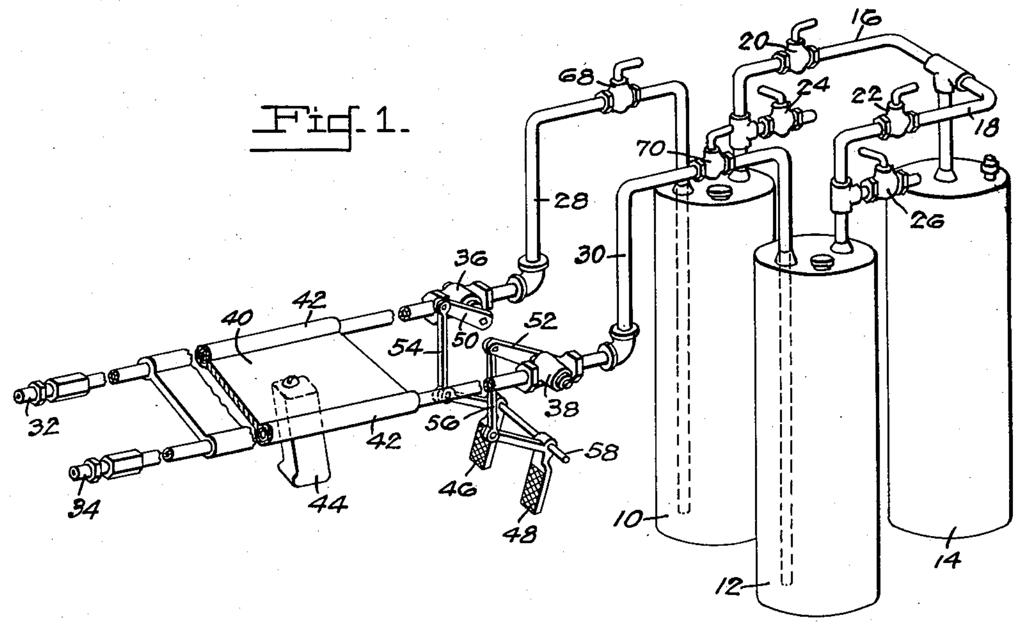


Fig. 2.

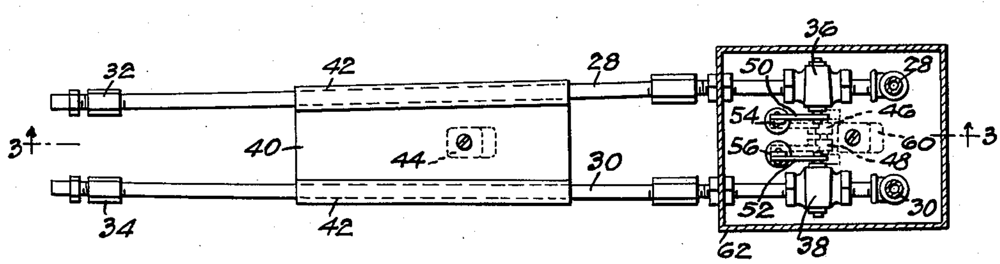
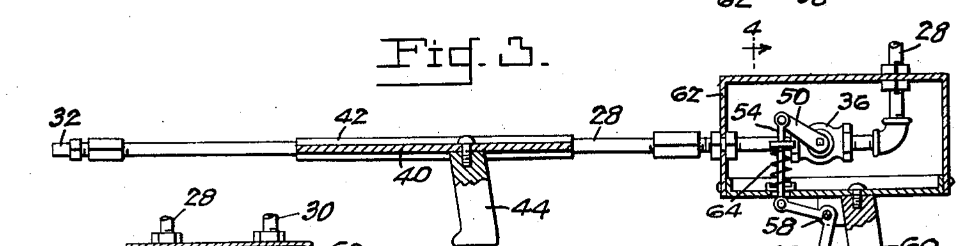


Fig. 3.



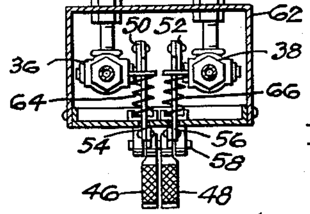


Fig. 4.

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MEANS FOR HYPERGOLIC FLAME COMBAT

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6 Claims. (Cl. 158—28)

This invention relates to a projector for ejecting hypergolic liquids and it is a primary object of the invention to utilize hypergolic bipropellant combinations ejected in either parallel or slightly converging streams so that ignition occurs when the propellants mix, without other igniting means.

An ancillary object of this invention is to simplify the design of a projector for ejecting hypergolic liquids to such an extent that the same is expendible, or at least some portions of the weapon would regularly be thrown away after use.

Another object of the invention is to provide for flame temperatures approximating 3000° K., which is considerably in excess of the gasoline-air flame temperature.

Still another object is to provide a projector for ejecting hypergolic liquids which is extremely versatile in use. The operating valves can be simultaneously opened to produce ignition and stoichiometric flame. If flame persistence is desired ejection of fuel only can follow the original ignition, in which case the fuel would air-burn at a reduced rate. Finally, when the target is of combustible material, initial bipropellant flame can be followed with ejection of oxidizer alone to accelerate the rate of combustion of the target.

A last object to be mentioned specifically is to provide a projector for ejecting hypergolic liquids which is simple and economical to manufacture, light in weight and easily manipulable, and which is generally efficient in service.

The invention is illustrated in the drawing, in which:

Figure 1 is a somewhat schematic isometric view, designed to show the general arrangement of the essential elements of the invention;

Figure 2 is a top plan view of a simple form of apparatus used in reducing this invention to practice;

Figure 3 is a vertical longitudinal sectional view taken substantially on the line 3—3 in Figure 2;

Figure 4 is a transverse sectional view taken on line 4—4 in Figure 3.

Similar characters of reference indicate similar or identical elements and portions throughout the specification and drawing.

Referring now to the drawing in detail, the apparatus includes a tank **10** comprising a reservoir for a fluid fuel, a tank **12** serving as a reservoir for a fluid oxidizer for said fuel, and a pressure tank **14** connected to tanks **10** and **12** by a bifurcated manifold having legs **16** and **18** and used to pressurize said fuel and oxidizer according to the adjustment of the pressure controlling valves **20** and **22**. Blow-off valves **24** and **26** may be provided.

One fuel used with success is aniline-furfuryl alcohol which was employed with red fuming nitric acid as oxidizer, although other bipropellant or multipropellant mixtures can be used. The prime essential in any propellant mixture used according to this invention is the hypergolic nature thereof. In this regard it is noteworthy that, for purposes of economy and efficiency, the mixture

as actually ejected should be stoichiometric producing the highest flame temperature, and hence the maximum heat with a minimum of fuel. The above named bipropellants produce a flame temperature of approximately 3000° K., which is considerably in excess of the temperature of a gasoline-air flame.

Pipes **28** and **30** connect the tanks **10** and **12** with the nozzles **32** and **34** and operating valves **36** and **38** are inserted in the pipes **28** and **30**. Suitable means for holding the pipes **28** and **30** in parallel or slightly converging relationship is provided in the form of a plate-like bracket **40** having edge portions **42** turned onto intermediate portions of said pipes. This bracket carries a handle **44**. The pipes **28** and **30** terminate adjacent the lower ends of the tanks **10** and **12**.

The operating valves **36** and **38** are individually manually operable by means of triggers **46** and **48** comprising depending portions of bell cranks operably connected to valve levers **50** and **52** by inflexible links **54** and **56**. The triggers are pivoted on a transverse axis member **58**, which is conveniently supported on the rear handle **60** mounted on the bottom of a casing **62** provided to cover and protect the operating valves **36** and **38**. Helical springs **64** and **66** are co-axially arranged on the links **54** and **56** and compressed between the bottom of the casing **62** and the levers **50** and **52** to bias the valves **36** and **38** into closed position and shut-off valves **68** and **70** are provided in the pipes **28** and **30** for further individual control and metering of the fuel and oxidizer as required.

The operation of the device is readily understood from the foregoing but it may be added that when the triggers are manually shifted to easily determined positions, fully retracted against the handle **60** for example, the streams of fuel and oxidizer will result in a stoichiometric mixture at some distance from the nozzles **32** and **34**. The actual ignition may occur either at the time of contact with the target or before the two streams strike the target, depending on whether the pipes **28** and **30** are parallel or slightly converging. A single trigger control may be provided in lieu of the two triggers **46** and **48** and the valves **36** and **38** operated thereby in unison but greater versatility is achieved by the illustrated trigger assembly or its equivalent since individual operation of the valves **36** and **38** allows initial ignition to be followed by a continued feeding of stoichiometric mixture, air burning of the fuel, or feeding additional oxygen for increasing the rate of burning of targets which include quantities of combustible material.

It will be clear that all the objects listed in the preamble to this specification are amply achieved by this invention and further description would appear to be unnecessary.

In the claims, the term "hypergolic liquids" means two liquids capable of igniting spontaneously upon contact or intermingling at ambient atmospheric temperatures.

What I claim is:

1. A body-supported mechanism for projecting two discrete streams of hypergolic liquids at a small angle of convergence to intermingle adjacent a remote target, comprising, first and second tanks each adapted to contain a respective one of the hypergolic liquids and mounted in side-by-side relation for support on the back of an operator, first and second conduits, each extending in laterally-spaced parallel relation from a respective tank, upwardly, forwardly over the respective shoulders of the operator, then downwardly and terminating in a second forwardly extending section, a pair of nozzles each fixed over the terminus of a respective one of said second forwardly extending sections, a bracket rigidly connecting said second forwardly extending conduit sections at a small angle of convergence in the forward direction, a

first grip for one hand of the operator secured to said bracket, first and second valves each in a respective one of said second forwardly extending conduit portions rearwardly of said bracket, a casing enclosing both said valves, a second grip for the other hand of an operator secured to said casing, a pair of triggers mounted in side-by-side contiguous relation on said casing for simultaneous operation by the finger of the hand of an operator holding said second grip and operating connections between each said trigger and a respective one of said valves.

2. A mechanism as recited in claim 1, a third pressure fluid tank fixed with respect to said first and second tanks rearwardly thereof, and pressure conduits from said third tank to each of said first and second tanks.

3. A body-supported mechanism for projecting two discrete streams of hypergolic liquids at a small angle of convergence to initially intermingle at a remote target comprising, first and second tanks each adapted to contain a respective one of the liquids and fixed in side by side relation for support upon the back of the operator, first and second conduits each extending in laterally-spaced parallel relation from a respective one of said tanks, forwardly over the respective shoulders of the operator, downwardly and terminating in forwardly-extending sections, a pair of nozzles each secured over the forward terminus of a respective conduit, a bracket rigidly connecting said conduits rearwardly of said nozzles for directing discrete streams of liquid from said nozzles at a small angle of convergence in the forward direction, a first grip for one hand of the operator secured to said bracket, first and second valves in each respective conduit rearwardly of said bracket, a casing enclosing said valves, a second grip for the other hand of the operator and secured to said casing, first and second triggers mounted to said casing in side by side relation for pivotal movement about a common transverse axis for simultaneous actuation by a finger of the hand of the operator holding said second grip, and means operable to open each said valve in response to pull on a respective trigger.

4. A mechanism as recited in claim 3, a third pressure tank fixed with and rearwardly of said first and second tanks and conduits connecting said third tank with said first and second tanks.

5. In a flame projector of the portable type, a container of pressurized liquid hypergolic fuel, a container of pressurized liquid hypergolic oxidizer, a flow conduit extending exteriorly of each container providing communication between said containers and free atmosphere, said flow conduits each including a unidirectional stream-producing nozzle at the terminus thereof to direct into the free atmosphere exterior of said flame projector discrete unidirectional streams of liquid fuel and oxidizer, means fixing said nozzles with respect to each other in substantially parallel alignment and spaced in close proximity, normally closed valving means in each of said flow conduits, and triggering means connected to said valving means for opening said flow conduits, said streams of hypergolic fuel and oxidizer following substantially parallel trajectories and intermixing for ignition upon splash contact with a target.

6. In a flame projector of the portable type, a container of pressurized liquid hypergolic fuel, a container of pressurized liquid hypergolic oxidizer, a flow conduit extending exteriorly of each container providing communication between said containers and free atmosphere, said flow conduits each including a unidirectional stream-producing nozzle at the terminus thereof to direct into the free atmosphere exterior of said flame projector discrete unidirectional streams of liquid fuel and oxidizer, means fixing said nozzles with respect to each other at a small angle of convergence and spaced in close proximity, normally closed valving means in each of said flow conduits, and triggering means connected to said valving means for opening said flow conduits, said streams of hypergolic fuel and oxidizer following trajectories having a small angle of convergence and intermixing for ignition proximate to a target.

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