United States Patent

Filippi et al.

[15] **3,695,246**

[45] **Oct. 3, 1972**

[54] **PNEUMATIC MACHINE GUN WITH PHOTO CELL INTERRUPTED CIRCUIT**

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[73] Assignee: **The United States of America as represented by the Secretary of the Navy**

[22] Filed: **June 10, 1971**

[21] Appl. No.: **151,681**

[52] **U.S. Cl.** .....**124/11,** 124/32, 124/48, 124/51 R, 124/30 R, 35/25, 273/106 R

[51] **Int. Cl.** **F41f 1/02**

[58] **Field of Search** ..124/11, 32, 48, 50, 51 R, 51 A; 35/25; 89/33 E

[56] **References Cited**

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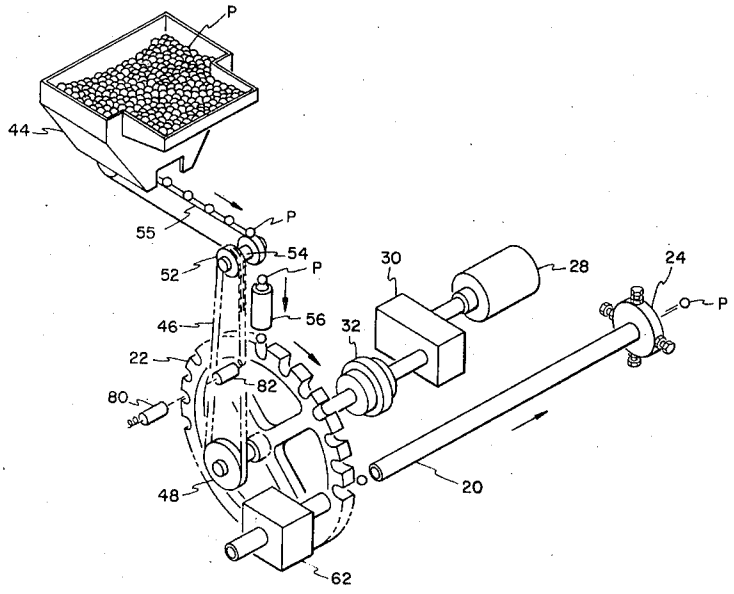
[57] **ABSTRACT**

A pellet firing pneumatic machine gun wherein a toothed wheel carries pellets from a hopper and conveyer assembly to a position adjacent one end of a barrel through which the pellets are propelled by an air blast from a solenoid valve, the periodic energization of which is effected by a photo-cell exposed to a light source, wherein the light source is placed on the opposite side of the periphery of the pellet delivering wheel from the photo-cell such that upon rotation of the wheel, the teeth thereof act to interrupt light from the light source falling on the photo-cell. In addition, a pellet slitting device mounted on the other end of the barrel, wherein the device includes adjustable blades which score the skin of dye containing pellets shot from a gun to render the pellets more frangible upon impact.

4 Claims, 6 Drawing Figures



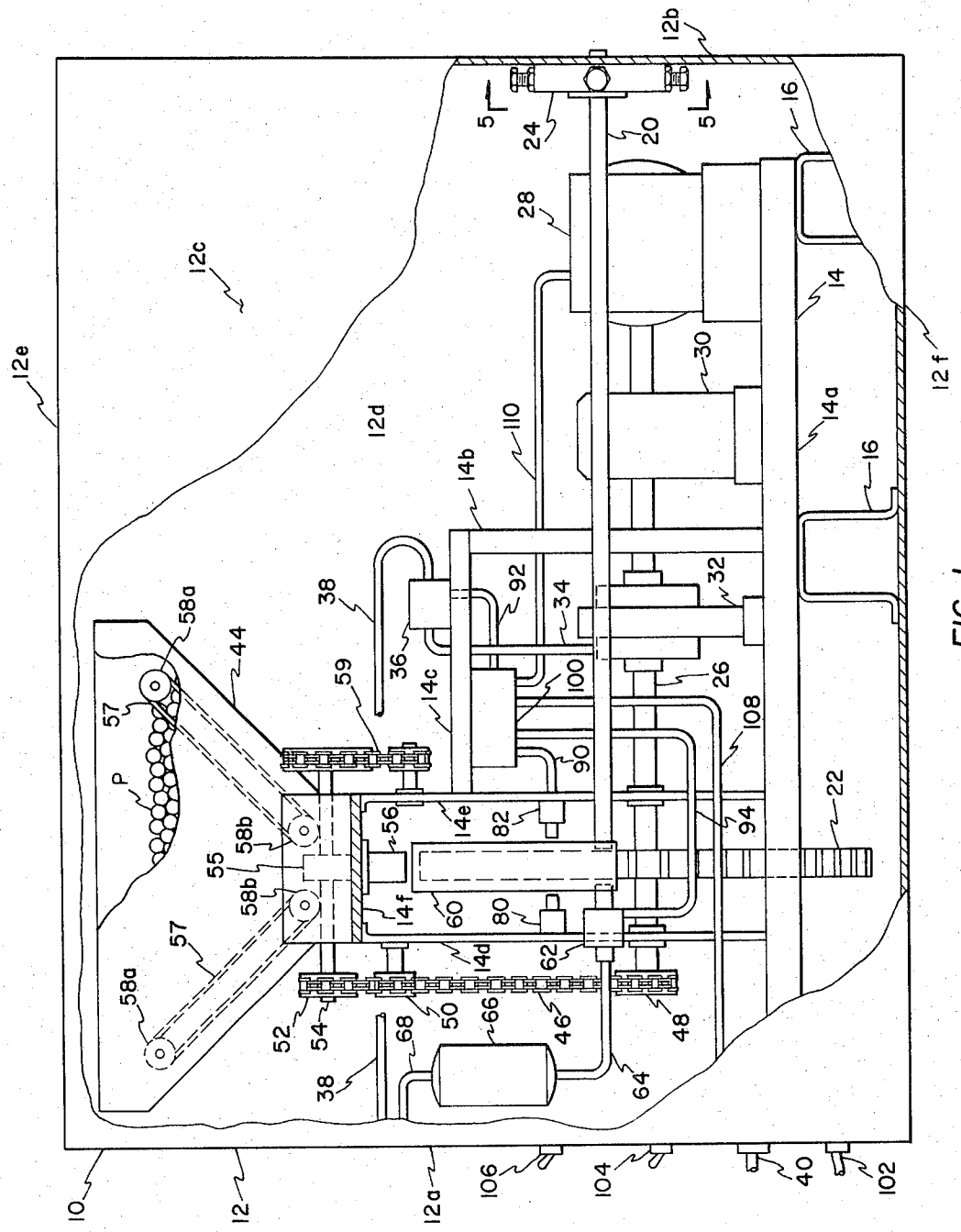


FIG. 1

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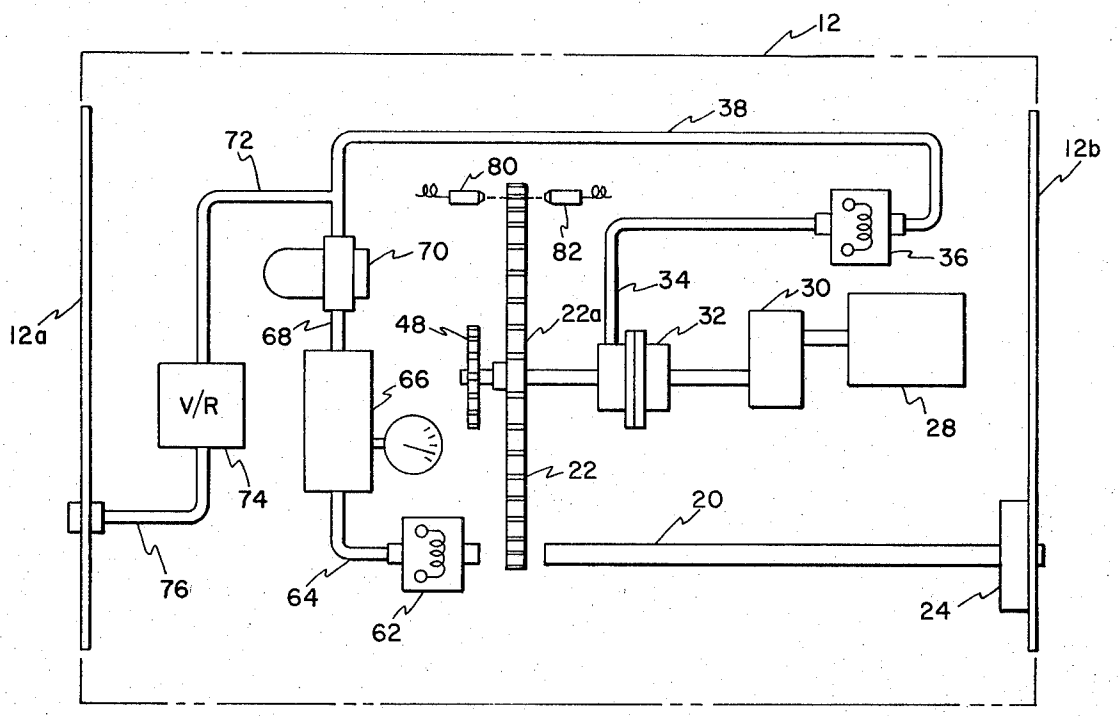

FIG. 2

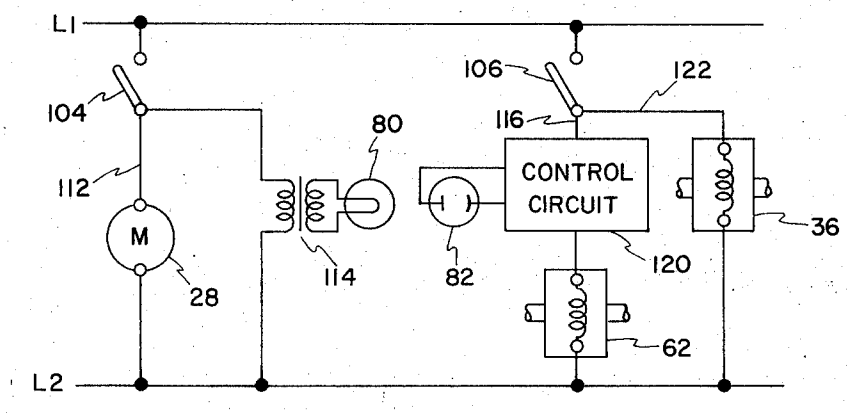

FIG. 4

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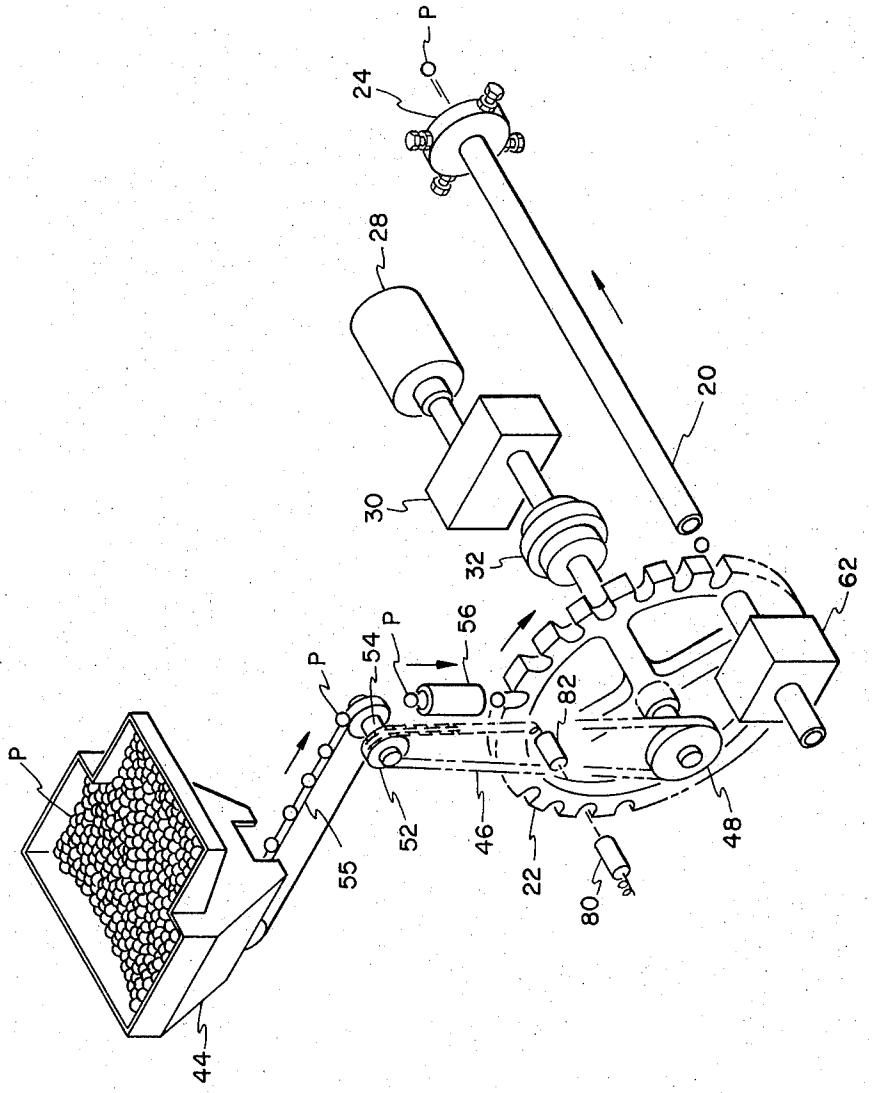

FIG. 3

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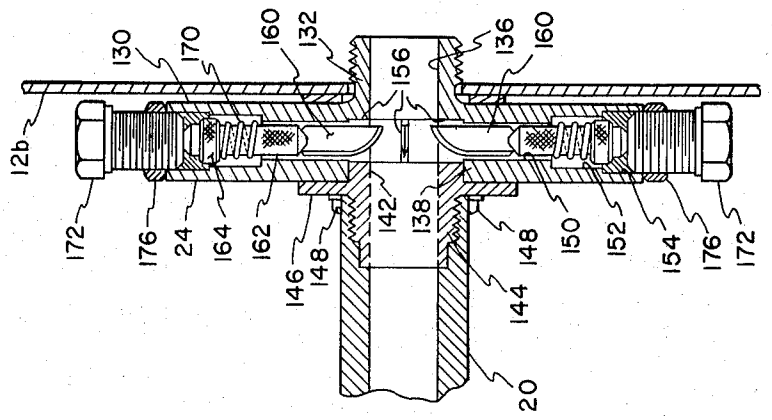

FIG. 6

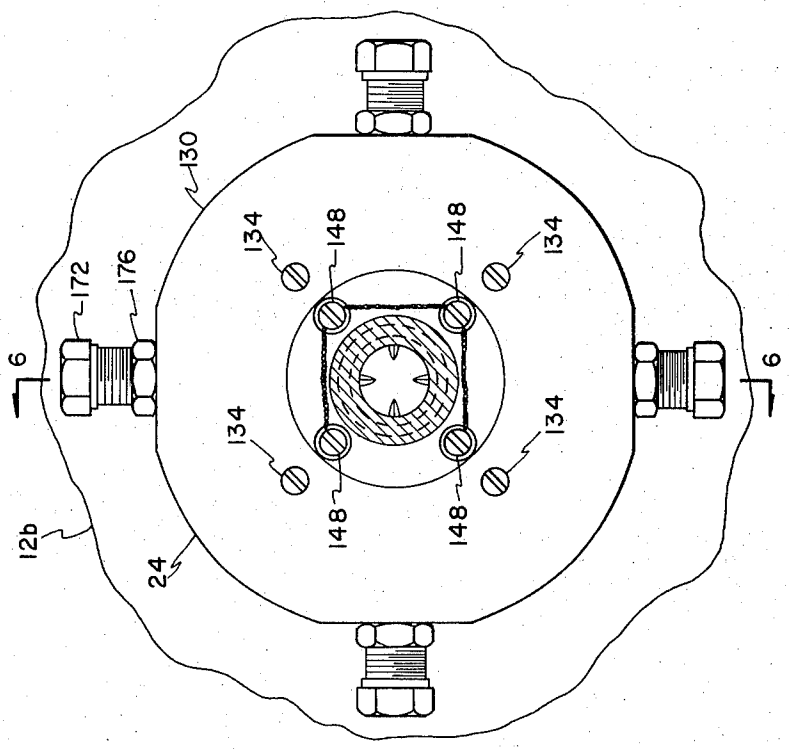

FIG. 5

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PNEUMATIC MACHINE GUN WITH PHOTO CELL INTERRUPTED CIRCUIT

BACKGROUND OF THE INVENTION

This invention relates to pneumatic machine guns or pellet propellers useful for training purposes, and more particularly to an improved propeller capable of "-firing" dye filled gelatin pellets which burst upon impact against trainee to provide a lasting and realistic indication of hits.

A variety of pneumatic machine guns have been proposed heretofore and generally share an arrangement by which pellets are conveyed from a magazine and placed, one at a time, in position to be propelled through a barrel by pressurized air released by a valve in timed relation to the arrival of the pellet in position to be fired. The timed relation has in most instances been determined by rotary cam means geared to the pellet conveyer means and mechanically actuating the valve or switch means in the case of a solenoid valve. An alternative has been a reciprocating air motor which controls the pellet delivery and valve operation.

In most of the foregoing arrangements the timing has been determined by mechanical arrangements, particularly cams and followers which are subject to wear and change of adjustment which adversely affect the nicety of timing which is needed for proper operation. Other timing arrangements such as have depended upon a build-up of pressure through a restriction, are limited to applications where the repetition rate is very low, e.g. in propelling baseballs for batting practice.

Prior art pneumatic machine guns have had as their principal purpose the training of personnel in operation and aiming at targets. There has been lacking a suitable machine gun or pellet propeller which could be used to provide simulated machine gun fire from a "nest" or building to be attacked by trainees. In this regard, it is considered desirable to fire dye containing pellets with sufficient velocity as to burst and mark trainees, when hit, and yet be relatively safe so as not to cause injury to the trainees.

SUMMARY OF THE INVENTION

With the foregoing in mind, it is one important object of the invention to provide an improved pneumatic propeller for pellets of the type utilizing a motor driven notched feeder wheel for carrying pellets from a supply to a position adjacent the barrel, and solenoid controlled valve for releasing a blast of air at the proper time to drive the pellet through the barrel, the improved propeller being characterized by novel valve actuating timing means.

Another important object of the invention is the provision, in an improved propeller of the foregoing character, of means for slitting or scoring the walls of a dye containing pellet as it passes from the propeller so that bursting of the pellet is assured upon impact even though the impact velocity is sufficiently low to render it unlikely that physical injury of a person hit would occur.

Other objects and advantages of the invention will become apparent from the following description of a presently preferred embodiment when read in conjunction with the accompanying sheets of drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a pellet propeller embodying the invention with portions broken away to reveal other portions;

FIG. **2** is a diagrammatic plan view of the pellet propeller;

FIG. **3** is a diagrammatic perspective illustration of the propeller;

FIG. **4** is a simplified electrical diagram illustrating the control system of the propeller;

FIG. **5** is a sectional view on an enlarged scale taken along line **4—4** of FIG. **1** and illustrating the pellet slitter forming part of the propeller; and

FIG. **6** is a sectional view taken substantially along line **6—6** of FIG. **5**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the form of the invention illustrated in the drawings and described hereinafter, there is provided a pellet propeller **10** which is operable from a source of pressurized air and a source of electric power such as 115 volts A.C. The pellet propeller **10** comprises a housing **12** formed of sheet aluminum or other suitable material and including **12***a*, **12***b*, side walls **12***c*, **12***d*, a tap wall **12***e*, and a bottom wall **12***f*. Within the housing is a frame **14** comprising a base plate **14***a* spaced above the bottom wall **12***f* by channel members **16**, and various upright and transverse members **14***b*, **14***c*, **14***d*, **14***e*, and **14***f* on which components described hereinafter are mounted.

These components include a barrel **20** mounted parallel to the base plate **14***a* and extending from adjacent the rim of a feeder wheel **22** toward the end wall **12***b* where it terminates in a pellet slitting device **24**. The feeder wheel **22** which has a plurality of evenly spaced teeth defining pellet receiving recesses in the periphery thereof is fixed to a shaft **26** and is adapted to be rotated during firing of the propeller by an electrical motor **28**. To this end the motor **28** is coupled through a gear reducer **30** to a pneumatic clutch **32** which is normally disengaged. The clutch **32** is actuated by pressurized air via line **34** when a solenoid valve **36** is energized, the latter being connected via line **38** to receive air brought to the propeller from a suitable source to a connection **40** at end wall **12***a*.

Mounted above the feeder wheel **22** is a pellet hopper and conveyer assembly, generally indicated at **44**. This assembly is driven in consonance with the feeder wheel **22** by a chain **46** leading around a sprocket **48** on shaft **26**, an idler sprocket **50** mounted on frame member **14***d*, and a sprocket **52** fixed to a shaft **54** extending from the hopper and conveyer assembly **44**. As is best illustrated in FIG. **3**, the assembly **44** comprises as part thereof, a moving belt conveyer **55**. A feed tube **56** having a vertical passage therethrough is mounted beneath the assembly **44** and terminates over the upper reach of the feeder wheel **22**. The feed tube **56** receives pellets from the belt **55** of the assembly **44** and deposits them one by one in the recesses in the periphery of the feeder wheel as it rotates.

The hopper assembly **44** advantageously further comprises means such as belts **57** carried by upper and

lower rollers **58***a* and **58***b*, the lower rollers being driven by suitable miter gears (not shown) from a chain **59** and associated sprockets. The purpose of the belts **57** is to agitate the pellets P within the hopper assembly **44** to prevent the formation of arches of pellets carried by the belt **55**. The hopper may additionally include heating means such as electrical resistance heating strips under the control of a thermostat to prevent the pellets from becoming hard or brittle under cold conditions and possibly injuring a trainee.

Approximately one quarter of the rim portion of the feeder wheel **22** is covered by a fender or shroud **60** which serves to prevent the pellets P from falling from the recess in the feeder wheel rim during their travel from the hopper and conveyer assembly **44** to the point of firing.

Mounted in alignment with the inner end of the barrel **20**, and on the other side of the path of travel of the feeder wheel **22**, is a solenoid valve **62**, which valve is connected via line **64** to an accumulator **66**. Referring to FIG. **2**, the accumulator **66** is connected via line **68**, an oiler **70**, line **72**, a regulator **74**, and line **76** to the high pressure air connection **40**. The regulator **74** serves to reduce the high pressure input to a lower, more constant value. The oiler **70**, serves to introduce a small quantity of oil into the air supplied to the valve **62** to lubricate the pellet and ease its travel through the barrel **20**. The regulator **74** and oiler **70** are conventional commercially items and need not be described in detail.

Mounted approximately 180° from the solenoid valve **62**, around the feeder wheel **22**, are a light source **80** and a photocell **82** between which is the path of travel of the peripheral teeth **22***a* of the feeder wheel. The photo-cell **82** forms part of the electrical control circuitry of the propeller which will be discussed more fully as the specification proceeds. The photo-cell **82**, the solenoid valves **36** and **62**, are connected by electrical cables **90**, **92**, and **94**, to a box **100** containing control circuit means later discussed with reference to FIG. **4**.

The propeller **10** is provided with an electrical cable **102** for connection to a source of A.C. power, conveniently 115 volts. A power switch **104** is mounted on the end panel **12***a* as is a firing switch **106**. These switches, the power cable **102**, the motor **28**, and the logic means are suitably interconnected as by electrical cables **108**, **110**.

Referring now to the diagram of FIG. **4**, the A.C. power supply is represented as lines L1 and L2. The switch **104** controls the supply of A.C. power via line **112** to the motor **28** such that upon closing the switch **104**, the motor will begin to run, which is the normal condition even though the propeller is not firing. The light source **80** is conveniently energized from a transformer **114** energized via switch **104**.

The firing switch **106** provides A.C. line current via lines **116** to a control circuit **120** for the firing solenoid valve **62**, and via line **122** to the clutch operating solenoid valve **36**. The photo-cell **82** is connected to the control circuit **120** which, in its simplest form, can comprise means such as trigger circuitry responsive to output of the photocell above a selected threshold to effect energization of the firing solenoid valve **62**. Preferably, however, the control circuit **120** also includes circuitry such as that disclosed in U.S. Pat. No. 3,418,494 which will assure that the solenoid valve **62** will be come energized at the beginning of the half A.C. cycle, either positive or negative, following the reaching of the threshold, and will persist only for that half cycle. This provides for crisp, positive, and uniform action of the firing solenoid valve **62**.

Referring to FIGS. **5** and **6**, the pellet slitter **24** comprises a generally flat circular body **130** having an externally threaded central boss **132** which extends through an opening in the end panel **12***b* of the propeller housing and is adapted to receive a cap to exclude dirt and moisture when the propeller is not in use The slitter **24** is conveniently secured to the end panel **12**b by screws **134** extending through the body **130**. The boss **132** has a central bore **136** the diameter of which matches that of the barrel **20**. A large counter bore **138** receives one end **142** of a barrel adapter **144** which has a radial flange **146** secured to the body **130** as by screws **148**.

The adapter **144** is externally threaded and is received in the correspondingly internally threaded end of the barrel **20**.

The body **130** has four radial bores **150** extending from the periphery thereof inwardly as far as the counter bore **138**. The outer portions of the bores **150** are counterbored as at **152** and threaded as at **154**. The bores **150** communicate with the bore **136** through slots **156** which are adapted to receive knife blades **160**. The blades **160** are fixed to radially movable blade holders each having a stem portion **162** slideable in the bore **150** and larger diameter head portion **164** in the counterbore **152**. A compression spring **170** is disposed in each counterbore **152** and resiliently urges the blade holder and blade **160** outwardly. An adjusting screw **172** is threaded into each of the counterbores **152** and bears against the head portion **164** of the corresponding blade holder. The screws **172** may be turned to adjust the amount of the knife blades **160** which will protrude into the bore **136** and may be secured in adjusted position by lock nuts **176**. With the knife blades fully retracted, the pellets are not affected. However, the blades may be extended into the bore **136** as shown to make four shallow slits in the pellet skin as it leaves the barrel. Such slitting causes the pellets to rupture more easily upon impact, thereby reducing the pain inflicted on persons hit.

Obiously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In a pellet propeller operable from a source of A.C. electrical power and a source of compressed air and including a motor, a toothed wheel adapted to be driven in rotation by said motor for conveying pellets from storage means to a firing position adjacent a barrel, and firing solenoid valve means for releasing a blast of compressed air to fire each pellet, the improvement comprising:

a light source disposed on one side of the periphery of said wheel;

photo-cell means mounted on the opposite side of the periphery of said wheel such that light from

said source falling on said photo-cell means is periodically interrupted by teeth of said wheel and said photo-cell provides an electrical output which fluctuates at the frequency of the passing of said teeth; and

circuit means responsive to said fluctuations to effect energization of said solenoid valve means in timed relation to rotation of said wheel.

2. A pellet propeller as defined in claim 1, and further comprising:

pneumatic clutch means between said motor and said wheel;

clutch operating solenoid valve means connected between said source of compressed air and said clutch means;

firing switch means operable to energize said clutch solenoid valve means to cause said clutch means to complete connection of said motor to said wheel to initiate firing.

3. A pellet propeller as defined in claim 2, and further comprising:

pelter slitter means mounted on said barrel and comprising blade means extending into the path of said pellets and operative to slit the pellets as they are fired.

4 A pellet propeller as defined in claim 3 and wherein said slitter means comprises:

a body having a central bore in axial alignment with said barrel, said body having a plurality of radial bores extending inwardly toward said central bore but terminating short thereof, a plurality of radially extending slots each connecting one of said radial bores with said central bore;

a plurality of blades each disposed in one of said slots;

a plurality of blade holders each having one of said blades fixed thereto and each disposed for radial movement in said radial bores;

spring means resiliently urging said blade holders and blades radially outwardly from said central bore; and

screw means disposed in said radial bores and operative to advance or retract said blade holders and blades with respect to said central bore.

* * * * *