Sept. 23, 1958 R. K. BOLE ET AL 2,853,563

INTERVALOMETER

Filed Feb. 16, 1953

FIG. 1

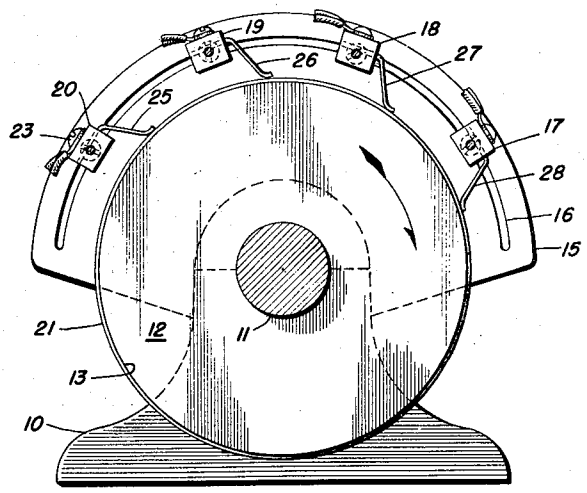
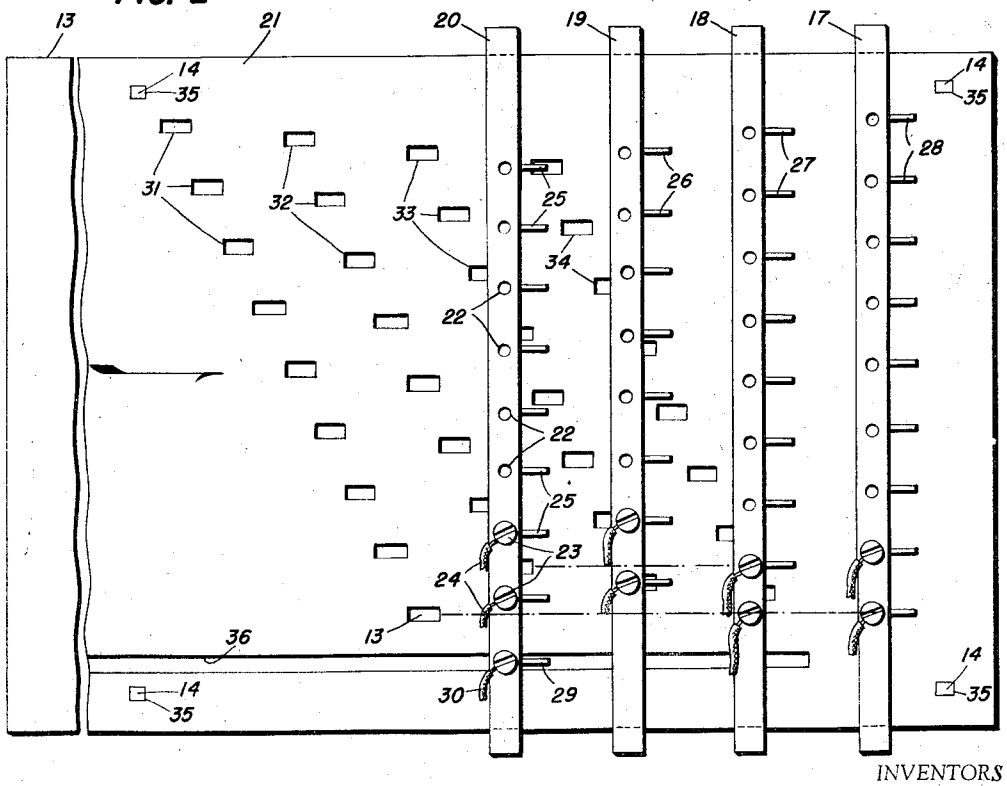


FIG. 2



INVENTORS

ROBERT K. BOLE

MAURICE H. BALLER

BY A. O'Brien

Q. Baxter Warner

ATTORNEYS

United States Patent Office 2,853,563 Patented Sept. 23, 1958

2,853,563

INTERVALOMETER

Robert K. Bole, Bethesda, Md., and Maurice H. Baller, Washington, D. C., assignors to the United States of America as represented by the Secretary of the Navy

Application February 16, 1953, Serial No. 337,255

2 Claims. (Cl. 200—8)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to a selective firing device to control the sequential firing of a battery of rockets or explosives from a suitable launcher and more particularly to an interval switching arrangement whereby a plurality of electrical circuits may be opened and closed at predetermined time intervals.

Conventional intervalometers utilizing a rotating drum with numerous contacts or selector points necessitate an excessively long drum to accommodate a single terminal bar on which are mounted the contact points or brushes. In the event that additional contact points were to be added to provide additional contacts many of the existing contact points had to be redistributed on the contactor supporting bar and the drum surface contact positions redesigned in order to cooperatively engage with the newly positioned contact points. Practical limitations of space, size and capacity of the individual drum and contactor supporting bar restricted additional contact areas. Normally additional duplicate units had to be installed to carry the additional changes thereby necessitating not only a duplication of equipment but also a requirement for synchronizing the newly installed unit with the original installation.

It is important in a timing device to be used in launching a battery of rockets or explosives that there be provision for a flexible variable fire pattern, adapted to fulfill the requisites for the target to be fired upon. In prior art devices after the initial timing sequence was obtained the cycle of operation was permanently fixed because there was no provision incorporated either on the drum or terminal bars to vary the timing or interval sequence.

The present invention has for an object the use of a compact timing drum affording ample space about its periphery to mount a plurality of parallel spaced terminal bars or strips supporting numerous electrical contactors.

It has for a further object the provision of an intervalometer with a variable time sequence.

A further object is to provide the conductive drum assembly with a greater number of contactor points than were utilized formerly in a timing device.

It also has for its object an apparatus particularly suitable for modifying individual sequential timing intervals requisite in rocket firing to achieve an optimum target pattern.

Another object is to simplify the construction of an electrical ignition system which will afford rapid modification both to minor variations in timing intervals by shifting the relative distance between terminal bars as well as alteration of the complete firing pattern merely by interchanging sequence pattern sleeves.

A further object is to utilize more fully the full periphery of the drum by providing rows of series spaced apertures on the drum surface independent of one another.

In carrying the invention into effect, as illustrated by the particular embodiment herein disclosed, a constant speed motor or any constantly rotating energy source may be used for the prime mover to rotate the intervalometer drum which has an electrically conductive surface. Encompassing the periphery of the drum surface is a perforated insulating covering material in which perforations or apertures have been selectively determined to obtain a desired rocket firing pattern. Circumferentially spaced from the cylindrical surface of the drum, mounted on segmental sectors, is a plurality of adjustable terminal strips. Mounted on the individual terminal strips is a series of contactors or brushes, each contactor engaging the perforated covering material on the drum surface in accordance with a predetermined pattern, and upon contact with the conductive surface of the drum an electrical charge is transmitted through the contactor to a connecting lead wire which is in turn connected to a terminal on the rocket launcher, ultimately discharging one rocket from a battery. Relative displacement of the terminal strips alters the sequence of firing and the resultant fire pattern. Major modifications may be made by substituting another insulating belt or sleeve which incorporates a modified perforated structure to produce a changed firing sequence.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is an end sectional view taken from a plane passed normal to the drum axis showing the relative arrangement of the rotatable drum and the circumferentially spaced terminal strips mounted in the arcuate openings of the segmental sectors; and

Fig. 2 is a development of a selected pattern on the insulating sleeve shown in cooperation with the contactors mounted on the terminal strips longitudinally traversing the sleeve and drum.

Now by reference to the accompanying figures of the drawing, a preferred form which the invention takes will be described in detail.

Referring to Fig. 1 the drum supporting frame **10** rotatably supports the drum shaft **11** which may be driven by a constantly rotating motor or a prime mover directly coupled or connected by a gear or pulley arrangement (not shown). A cylindrical drum **12** mounted on the drum shaft **11** rotates with the shaft **11** in the frame **10**. The cylindrical surface **13** of drum **12** is made from an electrically conductive material, preferably copper. This surface may be made integral with the drum or constitute a coated conductive sleeve fastened to the periphery of the drum by any suitable means, such as, by cooperation with drum protuberances **14** (Fig. 2).

Segmental sectors **15** are securely mounted on the frame **10** parallel to the ends of the cylindrical drum **12**, each sector has a continuous arcuate guideway or slot **16** circumferentially spaced from the periphery of the drum **12**. The arcuate guideway **16** within the sector **15** provides a circumferentially spaced slot in which a plurality of terminal strips **17**, **18**, **19**, and **20** are slidably mounted for peripheral displacement about the rotatable drum **12**, and the terminal strips are spaced radially equidistant from the surface of the drum **12**. Suitable friction fastening means engage each of the terminal strips **17**, **18**, **19**, and **20** through the arcuate guideway **16** retaining the strips in selected position but permitting relative movement about the drum **12** with respect to the adjacent terminal strips.

Terminal strips **17**, **18**, **19**, and **20** are circumferentially spaced about the periphery of the drum **12** parallel to one

another and to the longitudinal axis of the drum **12** and maintain this parallel relationship when displaced in any selected position. Each terminal strip of the group **17**, **18**, **19**, and **20** is an elongated narrow nonconductor member extending over the full cylindrical width of the drum **12**. Tapped terminal holes **22** spaced equally on each of the terminal strips are to be engaged by wire lead screws or terminal strip posts **23** for retaining individual wire leads **24** thereby connecting the individual contactors **25** of the intervalometer to a selected circuit. Similar connections are made on each of the terminal strips. Electrically cooperating with the wire leads **24** affixed to and projecting downwardly from the terminal strips **17**, **18**, **19**, and **20** and in surface engagement with the periphery of the drum **12** are series of drum surface contactors **28**, **27**, **26**, **25**, respectively, equally spaced along the terminal strips. As shown in Fig. 2 a number of single wire leads **24** may be connected to separate drum contactors **25** on terminal strip **20** through terminal posts **23**, however, of course wire leads from other rocket launcher batteries may be spliced and connected to the single terminal strip post **23** if desired.

The common ground drum surface contactor **29** and the wire lead **30** are mounted laterally on terminal strip **20** beyond the series of contactors **25**. This ground contactor **29** will engage the electrically conductive surface **13** of the drum **12** during drum rotation to complete the electrical circuit through the drum for each of the contactors in the series **25**, **26**, **27**, and **28**.

Encircling the electrically conductive peripheral surface **13** of the drum **12** is an insulating sheet or sleeve **21**. Sleeve **21** and drum **12**, shown in a developed plan view in Fig. 2, is a typical constant interval firing pattern. Series of small rectangular apertures **31**, **32**, **33**, and **34** selectively positioned longitudinally and laterally on the insulating sheet **21** conform to a predetermined firing pattern.

The desired pattern shown on insulating sleeve **21** has been selected so that the perforated apertures of series **34** are coincidently aligned to cooperate with terminal strip **20** through drum contactors **25**; series **33** cooperates with terminal strip **19** through drum contactors **26**; series **32** cooperates with terminal strip **18** through drum contactors **27**; and series **31** cooperates with terminal strip **17** through drum contacts **28**, respectively, in that order as the drum **12** rotates in a clockwise direction as shown in Fig. 1. An elongated ground slot **36** is positioned on insulating sleeve **21** enabling the ground surface contactor **29** to make electrical contact with drum cylindrical surface **13** as the contactors engage the conductive surface of the drum **12**.

The insulating sleeve **21** is maintained in the correct relative position on the drum surface **12** by drum protuberances **14** which project through the sleeve **21** to retain perforations **35** cut at suitable locations on the sleeve **21**, or the sleeve **21** may be fastened in place by other suitable fastening means of an adhesive nature.

The electrical circuit is completed to a designated point beyond the intervalometer whenever the drum **12** rotates the conductive cylindrical surface **13** and insulating sleeve **21** so that one drum surface contactor of the series **25** passes from above the insulating sleeve **21** into intimate contact with the electrically conductive drum surface **13** through one of the apertures in the series **34** permitting current to pass through the lead wire **24** and the common ground surface contactor **29** contacting drum surface **13** through the elongated ground slot **36**, completing the electrical circuit. The remaining contactors of the series **25** will progressively engage successive apertures in series **34** until exhausted. Then the succeeding terminal strip **19** will have its contactors **26** engage a mating series **33** on the drum periphery in the proper sequence and so on for each of the remaining terminal strips. Altering the relative positions of the terminal strips **17**, **18**, **19**, and **20** will vary the timing sequence between strips and with respect to the other strips. A modified constant firing pattern sleeve may be substituted for that shown in Fig. 2 which will yield a completely changed firing sequence. The combinations which may be produced are sufficiently flexible and varied to achieve the most desirable fire pattern for any target objective.

Varying the aperture openings longitudinally affords a convenient means for altering the length of time during which the contactor remains in electrical contact with the conductive drum surface thereby closing the circuit for the desired time interval.

Obviously 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. An intervalometer for use with a multiple explosive launcher to provide a selective firing sequence for firing a battery of rockets, said intervalometer comprising; a rotatably mounted drum, an electrically conductive material securely fastened to and encircling the periphery of the drum, an insulating material with apertures therein substantially covering the conductive material on the drum, projections on the periphery of the drum, said apertures selectively positioned laterally and longitudinally on the insulating material to expose the conductive material through the apertures and to engage the projections on the drum to retain securely the insulating material, segmental sector plates with arcuate openings therein spaced from the opposite ends of said drum, a plurality of terminal strips extending across the drum and circumferentially mounted parallel to one another and to the drum axis engaging the arcuate openings in the sector plates for slidable adjustment therein, series of electrically conductive drum surface contactors selectively spaced on the terminal strips and separately mounted to engage electrically the conductive material on the drum through said apertures, and a common ground drum surface contactor on one of said terminal strips to engage electrically the conductive material through one of said apertures, each series of contactors laterally and circumferentially spaced from each other, thereby completing an electrical circuit which fires individual rockets in accordance with a predetermined firing plan pattern.

2. An intervalometer for use with a multiple explosive launcher to provide a flexible variable fire pattern for sequence firing of a battery of rockets, comprising a rotatably mounted drum having a peripheral conductive surface, an electrically insulating sleeve encircling said conductive surface with circumferentially spaced series of circumferentially and laterally spaced apertures and with an elongated slot, said apertures and slot exposing the conductive surface of said drum, segmental sector plates spaced from opposite ends of said drum, each sector plate having an arcuate guideway spaced from the periphery of said drum, a plurality of elongated terminal strips slidably mounted in said guideway of said sector plates extending across the drum and spaced therefrom parallel to one another and to the drum axis, series of electrically conductive drum surface contactors selectively laterally spaced on each of the terminal strips and separately mounted, said contactors engaging electrically the conductive surface on the drum through said apertures of said sleeve, and a common ground drum surface contactor on one of said terminal strips engaging electrically the conductive surface through said elongated slot of said insulating sleeve thereby completing an electrical circuit which fires the rockets of the battery in accordance with a predetermined firing plan established by the arrangement of the apertures and the placement of the terminal strips in the guideways.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

449,044	Johnson	Mar. 24, 1891
1,384,559	Giles et al.	July 12, 1921
1,400,261	Bowker	Dec. 13, 1921
1,466,951	Edwards	Sept. 4, 1923
2,163,190	Carlson et al.	June 20, 1939
2,302,923	Zimarik	Nov. 4, 1942
2,421,893	Lambert et al.	June 10, 1947
2,440,906	Metzger	May 4, 1948
2,454,882	Oakley	Nov. 30, 1948
2,477,741	Haberman	Aug. 2, 1949
2,488,228	Nims et al.	Nov. 15, 1949