

March 28, 1944.

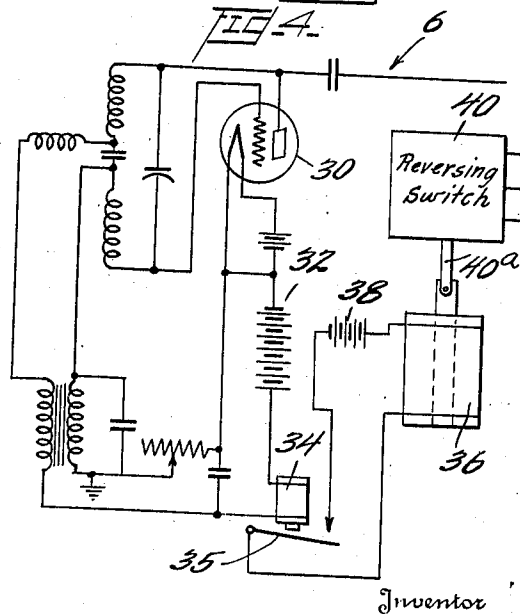
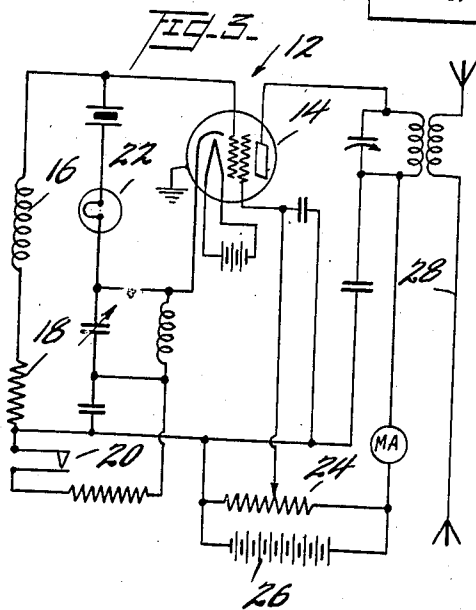
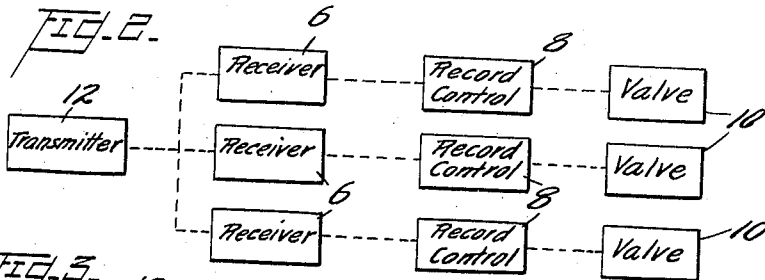
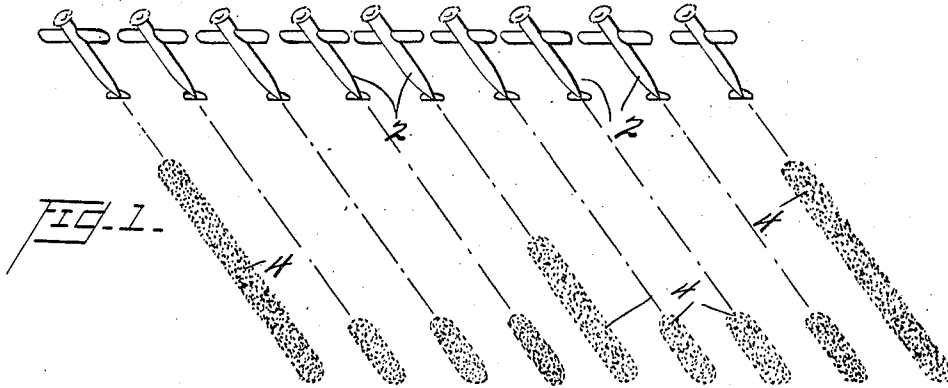
J. T. REMEY

2,345,153

METHOD OF AND RECORDED CONTROL FOR SKY WRITING

Filed Nov. 7, 1940

3 Sheets-Sheet 1



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March 28, 1944.

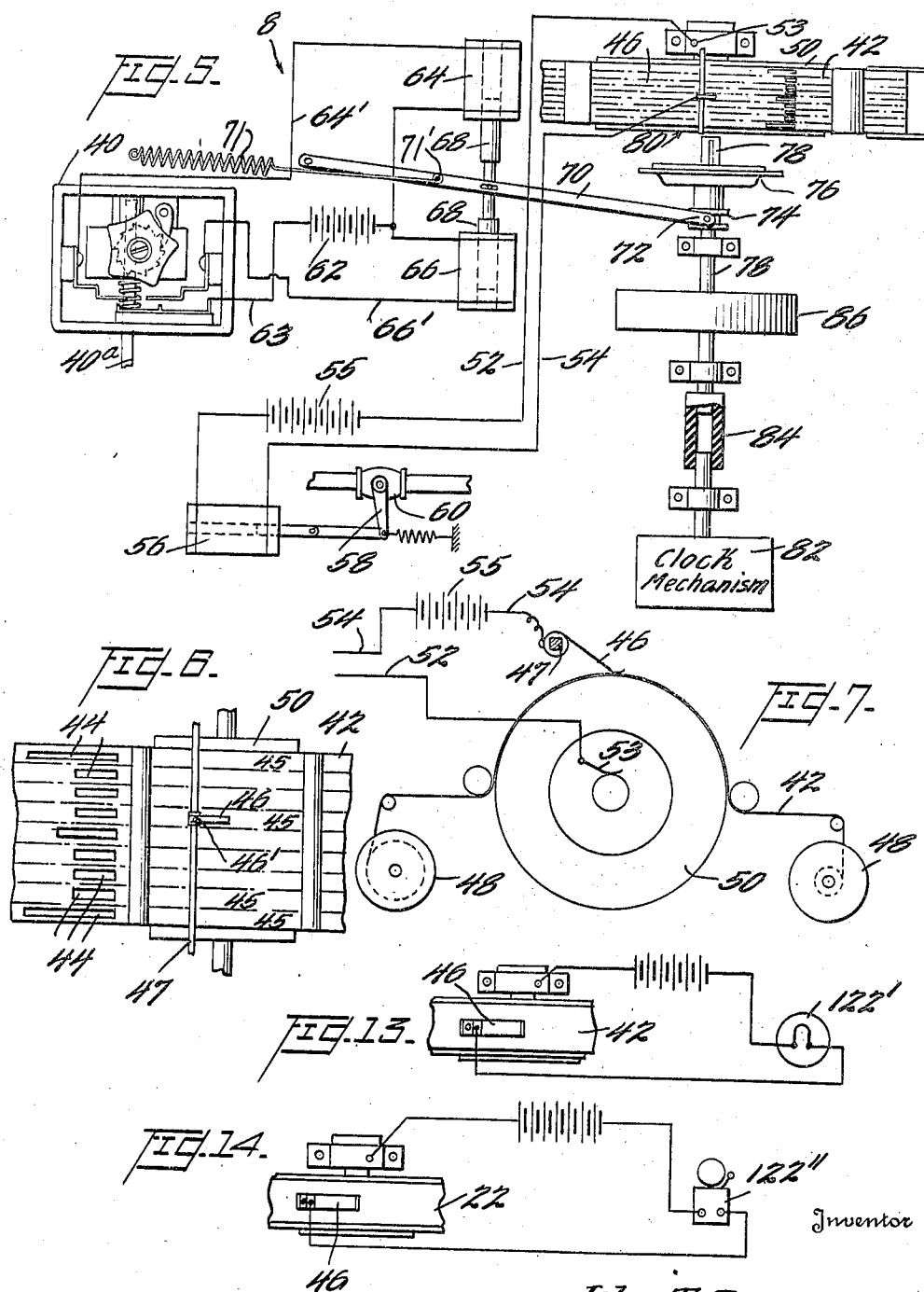
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2,345,153

METHOD OF AND RECORDED CONTROL FOR SKY WRITING

Filed Nov. 7, 1940

3 Sheets-Sheet 2



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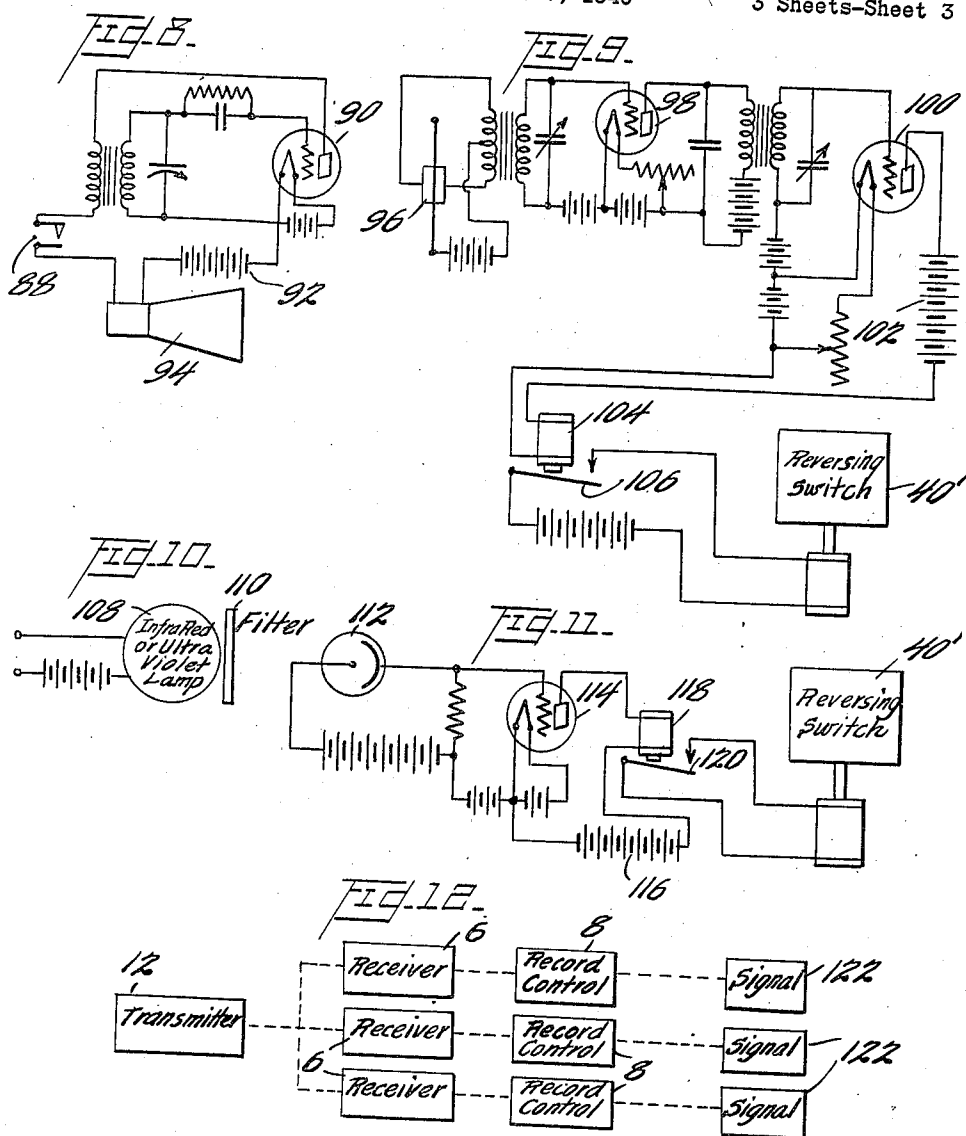
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METHOD OF AND RECORDED CONTROL FOR SKY WRITING

Filed Nov. 7, 1940

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,345,153

METHOD OF AND RECORDED CONTROL FOR
SKYWRITING

John T. Remey, New York, N. Y.

Application November 7, 1940, Serial No. 364,748

16 Claims. (Cl. 40—127.1)

This invention is a method and apparatus for forming letters or symbols in the air by means of contiguous and substantially parallel smoke trails, released from a plurality of airplanes.

In my prior Patent No. 1,716,794, dated June 11, 1929, there is disclosed a method and apparatus for forming letters or symbols in the air by means of contiguous and substantially parallel smoke trails, and the present invention is an improvement over such prior patent.

In my prior patent there is disclosed a column carrying smoke forming material, which column is carried through the air, in nearly vertical position, by being suspended from a moving aircraft. This column is provided with a number of smoke-emitting valves, the opening and closing of which are controlled, so that the length and placement of the several smoke trails is such as to build up a letter or symbol.

In the present invention, a similar principle is utilized, in that a plurality of smoke emitting valves is provided, but in this case each valve together with corresponding smoke forming mechanism, is carried by an individual airplane and these airplanes fly in contiguous and parallel paths, the valve in each plane being operated so as to control the placement and length of smoke trail formed by that plane.

The several planes, say ten or fifteen in number, for example, fly in formation. This may be "company front" formation, in horizontal or vertical planes, or in echelon formation, in horizontal, vertical or diagonal front formation.

The several planes are not mechanically connected. Each plane, however, is provided with controllable means for forming at least one heavy smoke trail, and with means for starting and stopping the smoke trail as desired.

In order to form a letter or symbol, the length and placement of the various smoke trails must be accurately coordinated and controlled. According to this invention, this control is effected by a patterned record, analogous to the record used in a player piano, or analogous to the record used in forming letters on travelling electric signs.

Each plane is provided with such a patterned record. This record may be connected to control the smoke releasing mechanism directly, so as to form smoke trails in the air corresponding to the letters or symbols of the record, or the record may be connected to give a visual, audible or tactile signal to the operator, who thereupon operates the smoke valve for releasing the smoke trail in accordance with the timing and duration of

such signal, to form smoke trails in the air corresponding to the letters or symbols of the record.

In the preferred embodiment of the invention, all the records are started simultaneously, and one of the main objects of this invention is to provide means utilizing a radio wave, a sound wave or an invisible light wave for starting the control record in the several planes simultaneously. However, each of these types of waves has individual characteristics, as to speed of travel, frequency and wave length, and so are not to be regarded as equivalents in all respects.

In the preferred embodiment of the invention, the patterned records for the several planes will be duplicates. If ten planes are used, each record will have ten longitudinally extending channels and a variably positionable or other pick-up device will be provided in each ship to respond to the particular slots or other pattern on the record assigned to the particular channel for that ship. Each ship will use the channel on its record corresponding to its place in the flying formation. In other words, the middle ship will be controlled by the slots or indicia in the middle channel of its record, for example, while the end ships will be controlled by the respective slots or indicia in their respective end channels.

While, as above suggested, the travelling record, which is driven by clockwork, could be arranged to be started either by the received wave or by the operator and then would carry through to completion the formation of the desired sign, it is also within the contemplation of the invention so to control the record that it may be started and stopped at will, either by the received wave or by the operator, in response to a visual, audible or tactile signal.

In my copending application, Serial No. 364,747, filed on even date herewith, there is disclosed a method and apparatus for forming letters or symbols in the air, the letters or symbols being formed by contiguous parallel smoke trails formed by airplanes flying in parallel paths. The present invention accomplishes a similar result, the feature differentiating the present invention over said other application being the use of a patterned record in each airplane, the markings or indicia on said record determining the length and placement of the smoke trails and therefore determining the character of the letter or symbol. In my copending application Serial No. 364,749, filed on even date herewith, there is also provided a patterned record which is started manually or by clockwork, such record either

controlling the smoke valve directly, or operating a signal to tell the operator when to operate the smoke valve.

The main features of the present invention having been thus outlined, further features of construction and operation will be described in connection with the accompanying drawings.

In these drawings:

Fig. 1 is a perspective view of a plurality of planes flying in parallel paths, shown as forming the letter "E";

Fig. 2 is a diagrammatic view for illustrating the operation of one embodiment of the invention;

Fig. 3 is a wiring diagram showing a transmitter for sending a radio wave;

Fig. 4 is a wiring diagram for showing a receiver for a radio wave;

Fig. 5 is a view showing the travelling record and cooperating driving mechanism;

Fig. 6 is an enlarged view of a portion of the patterned record;

Fig. 7 is an end view of part of the mechanism of Fig. 5;

Fig. 8 is a wiring diagram showing means for generating a sound wave;

Fig. 9 is a wiring diagram showing means for receiving and amplifying the sound wave and connected to operate a smoke valve;

Fig. 10 is a diagram showing means for generating an invisible light ray;

Fig. 11 is a wiring diagram showing means for receiving and amplifying such light ray;

Fig. 12 is a diagrammatic view showing the operation of the invention where the record operates a signal to guide the operator in controlling the emission of smoke;

Fig. 13 shows the operation of a visual signal to guide the operator; and

Fig. 14 shows the operation of an audible signal to guide the operator.

Referring now to these drawings, in which similar reference characters indicate similar parts, Fig. 1 shows a plurality of airplanes 2 flying in contiguous and parallel paths, the several planes having released smoke trails 4 which are also contiguous and parallel, the length and placement of the trails having been controlled to form the letter "E".

The term "smoke" as used in this specification is used simply for convenience and is not to be limited to products of combustion, but is intended to cover a visible cloud, which may be formed, as is well understood in this art, by injection of oil into the exhaust pipe, by a spray of titanium tetrachloride, or by a double spray of ammonium chloride and hydrochloric acid, or in other ways, as may be desired.

In that embodiment of the invention where the control is automatic, shown in Fig. 2, each plane is provided with a wave receiver 6 which is connected to control the operation of a patterned record 8, which in turn controls a smoke releasing valve 10.

The several records are started simultaneously by sending to all the planes a wave from a transmitter 12, located on the ground or in one of the planes 2 or in another plane.

The control or starting wave may, as has been mentioned, be a radio wave, a sound wave or an invisible light wave.

Where a radio wave is used, a transmitter such as that shown in Fig. 3 may be used. This transmitter is of a known type, involving the "Tri-tet" circuit and is merely briefly illustrated here and

comprises an amplifying tube 14 which may be of the "6L6" type, and further including a radio frequency choke coil 16 and grid leak 18 and starting key 20. The circuit also comprises a small dial light 22, a screen voltage divider 24 and a B battery 26. The output of the plate circuit is impressed on the antenna 28 in the usual way.

Each plane is provided with a suitable receiver, a known type of which is shown in Fig. 4. This is a superregenerative circuit and comprises amplifying tube 30 (RK42), on the grid of which the incoming wave is impressed in the usual way, the plate circuit including a B battery 32 and relay 34. The armature 35 of the relay is connected in circuit with the solenoid 36 and battery 38 to operate a switch 40, which may be a starting switch for starting the patterned record, or which may be a reversing switch which will start the patterned record on a received signal and stop it again on the next signal.

The patterned record shown in Fig. 6 may comprise a longitudinal strip 42 of paper or the like provided with slots 44 cut therein, these slots being arranged in longitudinally extending channels 45 corresponding to the number of airplanes used. If nine planes are used there would be nine channels 45, one for each plane and the slots 44 would be placed in the record 42 in a position and relationship corresponding to the position and relationship that it is desired to have in the finished smoke trails.

A duplicate record such as described is in each ship, but each ship will form smoke trails corresponding only to the slots 44 that are in the channels 45 on the record assigned to that ship. In other words, the fourth ship will pick up the slots 44 only in the fourth channel of the record and will not be affected by any of the other slots. This is effected by a brush 46, which is laterally adjustable with respect to the record, by being slidably positioned on the transverse bar 47 by set screws 48, so that it may be set for any particular longitudinal zone on the record.

The record 42 may be unwound from and wound up on reels 48 and led over a conducting drum 50, normally insulated from the brushes 46 but arranged so that when a brush 46 passes through a slot 44, a circuit is closed through wire 52, electrically connected with the drum 50 at 53, drum 50, brush 46, wire 54 and source of power 55, to energize a solenoid 56 which is connected to the operating handle 58 of a smoke releasing valve 60, to release a smoke trail of a length and placement corresponding to the length and placement of the corresponding slot in the record.

Instead of the slotted record 42, it is obvious that other types of patterned record could be used, of the type used for forming traveling letters in electric signs. For example, actual letters of conducting or non-conducting material could be placed on a traveling belt and brought under brushes 46 arranged to close respective circuits through solenoids 56 as they contacted the respective brushes. This type of traveling circuit closing device, for closing circuits in accordance with a pattern in the form of traveling letters, is well known and is shown, for example, in the following patents: 1,189,419, Bach, 1916; 1,193,138, Hanson, 1916; 1,478,691, Bagge, 1923; 1,717,370, Coleman, 1929.

The switch 40 could be simply a starting switch to start the patterned record into operation, in which case it would be directly connected to start

the clock 82, referred to below, which in turn would be directly connected to drive the drum 50. However, the switch 40 is preferably a reversing switch, arranged to start and stop the patterned record, and is of the type shown in the patent to Holland No. 1,495,592, of May 27, 1924, where successive operations of the plunger 46 of that patent close alternate circuits. The plunger 40a on Figs. 4 and 5 corresponds to plunger 46 of the Holland patent. The switch 40 is connected with source of power 62 by wire 63 and when actuated by its plunger 40a, sends a current through either wire 64' to solenoid 64 or wire 66' to solenoid 66, to actuate their common armature 68, which is connected to pivoted arm 70, to start or stop the patterned record. The end 72 of arm 70 has a pin and stirrup connection with the collar 74 which bears against the clutch member 76 splined on the shaft 78, so that when the member 70 is actuated in one direction or the other, the clutch face 76 is brought into engagement or removed from engagement with the clutch face 80 on the drum 50 over which the patterned record 42 travels, to start or stop the record, as the case may be. Connected to arm 70 at 71' is a spring 71 which serves to hold arm 70 to one side or the other of dead center, so that clutch 76 is held positively in or out of engagement with clutch face 80.

The shaft 78 is continuously driven by some constant speed source, such as a clockwork 82, connected therewith by a rubber or resilient connection 84 for absorbing the intermittent movement of the clockwork, the sleeve 84 being connected to the shaft 78 on which is mounted the flywheel 86 for further steadying the shaft 78.

To summarize the operation of the mechanism described, a radio wave sent from the transmitter 12 is simultaneously received by the several receivers 6. Solenoid 36 actuates switch 40, which sends a current through solenoid 64 or 66; arm 70 is actuated, clutch members 76 and 80 are thrown into engagement, drum 50 starts and the record 62 moves over the drum 50. The brushes 46 in the respective planes actuate their respective smoke valves 60 to release smoke trails corresponding in length and placement with the length and positioning of the slots 44 in the record 42. The record may continue in operation until another signal is received by receiver 6, resulting in actuation of switch 40 to send current through the other solenoid to return the parts to the positions shown in Fig. 5.

Instead of starting the record by a radio wave, it may be started by a sound wave, and a sound transmitter for that purpose is shown in Fig. 8. This circuit is known and comprises a starting key 88, amplifying tube 90, and B battery 92, in circuit with a loud speaker 94, for sending out a wave of a frequency which is picked up by the receiver shown in Fig. 9. This receiver comprises a microphone pick-up 96 responsive to the frequency of the wave emanating from the loud speaker 94. The received wave is impressed on the grid of the tube 98 and the output of this tube is impressed through the usual connections on the grid of the tube 100 and the plate circuit of this tube is in circuit with the B battery 102 and relay 104. The armature 106 of the relay circuit actuates a reversing or starting switch 40' which is connected in the same way that the switch 40 is connected, that is to say, it may be directly connected to start the clock 82, or may be connected to actuate the shift lever 70 of Fig. 5 for starting and stopping the patterned record.

The patterned record may also be started by a ray of invisible light, such as infra-red or ultra-violet, emanating from the ray generator 108, which may be passed through a suitable filter 110.

Each plane is provided with means for receiving the invisible light ray, such as is shown in Fig. 11. This arrangement is also known, and comprises a photoelectric cell 112, the current from which is impressed on the grid of an amplifying tube 114, the plate of which is in circuit with a B battery 116 and relay 118. The armature 120 of the relay closes a circuit through a reversing switch 40' of the same type as 40, Fig. 5, for starting the patterned record in operation.

In the foregoing description, the patterned record is arranged to control directly the operation of the smoke valve 60. However, the patterned record can be used to provide an indirect control, in that it may be connected to produce a visible, audible or tactile signal which is observed by the operator and the operator then operates the handle 58 of the smoke valve for turning the smoke on and off in accordance with the signal perceived by him. Referring to Fig. 12, the transmitter 12, the several receivers 6 and the several record controls 8 are the same as already described. However, each record, instead of operating the smoke valve directly, operates a visible, audible or tactile signal 122 and when the operator sees, hears or feels the signal, he turns the smoke valve on. With such an arrangement, and referring to Fig. 13, the brush 46 operates in the same manner as the brush 46 of Figs. 5 and 6, as already described, for closing a circuit in accordance with the slots in the patterned record. The brush 46 of Fig. 13 closes a circuit through a visible signal 122', namely, a light, while in Fig. 14 the brush closes a circuit through an audible signal, namely, a buzzer 122''. Instead of a light or buzzer, a tactile signal could obviously be used, as is well understood by those skilled in the art. When the signal is on, the operator holds the smoke valve open, and when it stops, he closes the smoke valve.

While the preferred embodiments of the invention have been described in some detail, it should be understood that these embodiments are illustrative and not restrictive of the invention and that it may be carried out in other ways.

I claim as my invention:

1. The method for forming letters or symbols in the air by means of parallel smoke trails, comprising the steps of flying a plurality of airplanes, each of which is equipped with controllable smoke emitting mechanism, in contiguous and substantially parallel paths, sending a signal in the form of a wave to each airplane, amplifying the received signal and using said amplified signal to start the operation of a movable record in each airplane, the pattern of the record carried by a particular airplane determining the length and placement of the smoke trails released by that airplane, the smoke trails released by the several airplanes being parallel and cooperating to form individual and successive letters or symbols.

2. The method for forming letters or symbols in the air by means of parallel smoke trails, comprising the steps of flying a plurality of airplanes, each of which is equipped with controllable smoke emitting mechanism, in contiguous and substantially parallel paths, sending a signal in the form of a wave to each airplane, amplifying the received signal and using said amplified signal to start the operation of a movable record

in each airplane, which record in turn controls the operation of the smoke-emitting mechanism in that airplane, to form parallel smoke trails, the length and placement of the smoke trails released by a particular airplane being determined by the pattern on the record carried by that airplane, the smoke trails released by the several airplanes cooperating to form individual and successive letters or symbols.

3. In an apparatus for forming letters or symbols in the air by means of smoke trails, an airplane provided with smoke emitting mechanism, for forming an elongated trail of smoke control means, including a movable patterned record, for use in controlling said smoke emitting mechanism, so as to form horizontal elongated smoke trails of controlled length at controlled intervals, and means for receiving and amplifying a wave signal, operatively connected to said record control means.

4. In an apparatus for forming letters or symbols in the air by means of smoke trails, an airplane provided with smoke emitting mechanism, for forming an elongated trail of smoke control means, including a movable patterned record, connected to operate said smoke emitting mechanism, so as to form horizontal elongated smoke trails of controlled length at controlled intervals, and means for receiving and amplifying a wave signal, operatively connected to said record control means.

5. In an apparatus for forming letters or symbols in the air by means of smoke trails, an airplane provided with smoke emitting mechanism, for forming an elongated trail of smoke means, including a patterned record, for controlling said smoke emitting mechanism, so as to form horizontal elongated smoke trails of controlled length at controlled intervals, means for driving said record at a constant speed, and means for receiving and amplifying a signal wave, for starting said record into operation.

6. In an apparatus for forming letters or symbols in the air by means of smoke trails, an airplane provided with smoke trail forming mechanism, a patterned record, divided into zones, corresponding to the total number of smoke trails to be formed, and variably positionable means, settable for operation in a selected one of said zones, for use in controlling said smoke trail forming mechanism, to form smoke trails in accordance with that part of the patterned record located in said selected zone.

7. The method of forming letters or symbols in the air by the use of parallel smoke trails comprising the steps of flying a plurality of airplanes in substantially parallel paths, releasing smoke trails in parallel relationship from said airplanes the length and placement of which trails are controlled by a series of substantially identical patterned records, one for each airplane, each plane however releasing smoke trails only in accordance with a particular portion of the record assigned to that plane, said records all being started at the same time by a signal wave.

8. The method of forming letters or symbols in the air, comprising the steps of flying a plurality of airplanes in substantially parallel paths, simultaneously releasing parallel, intermittent smoke trails of controlled length at controlled intervals from the several airplanes, and controlling the length and placement of the several trails by the use of a patterned record in each airplane, said smoke trails cooperating to form individual and successive letters or symbols.

9. The method of forming letters or symbols in the air, comprising the steps of flying a plurality of airplanes in substantially parallel paths, simultaneously releasing parallel, intermittent smoke trails of controlled length at controlled intervals from the several airplanes, and controlling the length and placement of the several trails by the use of a patterned record in each airplane, said smoke trails cooperating to form individual and successive letters or symbols said records all being started at the same time by means of signal waves sent to the respective airplanes.

10. Apparatus for forming letters or symbols in the air by means of parallel smoke trails, comprising a plurality of airplanes, arranged to fly in parallel paths and each equipped with smoke emitting mechanism, and a movable patterned record in each airplane, for use in operating said smoke emitting mechanism to form parallel smoke trails of controlled length at controlled intervals, in accordance with indicia carried by the patterned record, said smoke trails cooperating to form individual and successive letters or symbols.

11. Apparatus for forming letters or symbols in the air by means of parallel smoke trails, comprising a plurality of airplanes, arranged to fly in parallel paths and each equipped with smoke emitting mechanism, and a movable patterned record in each airplane, directly connected to operate said smoke emitting mechanism to form parallel smoke trails of controlled length at controlled intervals, in accordance with indicia carried by the patterned record, said smoke trails cooperating to form individual and successive letters or symbols.

12. Apparatus for forming letters or symbols in the air by means of parallel smoke trails, comprising a plurality of airplanes, arranged to fly in parallel paths and each equipped with smoke emitting mechanism, a movable patterned record in each airplane, for use in operating said smoke emitting mechanism to form parallel smoke trails of controlled length at controlled intervals, in accordance with indicia carried by the patterned record said smoke trails cooperating to form individual and successive letters or symbols and means for receiving and amplifying a signal wave for starting said record into operation.

13. Apparatus for forming letters or symbols in the air by means of parallel smoke trails, comprising a plurality of airplanes, arranged to fly in parallel paths and each equipped with smoke emitting mechanism, a movable patterned record in each airplane, directly connected to operate said smoke emitting mechanism to form parallel smoke trails of controlled length at controlled intervals, in accordance with indicia carried by the patterned record said smoke trails cooperating to form individual and successive letters or symbols and means for receiving and amplifying a signal wave for starting said record into operation.

14. Apparatus for forming letters or symbols in the air by means of parallel smoke trails, comprising a plurality of airplanes, arranged to fly in parallel paths and each equipped with smoke emitting mechanism, a movable patterned record in each airplane, for use in operating said smoke emitting mechanism to form parallel smoke trails of controlled length at controlled intervals, in accordance with indicia carried by the patterned record said smoke trails cooperating to form individual and successive letters or symbols and

means for driving said record at a constant speed.

15. Apparatus for forming letters or symbols in the air by means of parallel smoke trails, comprising a plurality of airplanes arranged to fly in parallel paths and each equipped with smoke emitting mechanism, a movable patterned record in each airplane, directly connected to operate said smoke emitting mechanism to form parallel smoke trails of controlled length at controlled intervals, in accordance with indicia carried by the patterned record said smoke trails cooperating to form individual and successive letters or symbols and means for driving said record at a constant speed.

16. Apparatus for forming letters or symbols in the air by means of parallel smoke trails, comprising a plurality of airplanes arranged to fly in

parallel paths, each equipped with smoke trail forming mechanism, a movable patterned record in each airplane, for use in operating said smoke trail forming mechanism to form parallel smoke trails of controlled length at controlled intervals, said smoke trails cooperating to form individual and successive letters or symbols, the several patterned records in the airplane being substantially identical and divided into longitudinal zones, and a device in each plane, variably positionable with respect to the patterned record and settable to cooperate with a particular zone in the patterned record carried by that plane, and operatively connected to said smoke trail forming mechanism.

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