

U.S. PATENT OFFICE

CANADA

DO YOU OWN IT?

ALL IN YOUR USE PREVIOUS MAIL

Whereas

Carl J. Crane and Raymond H. Stout,

of Dayton,

Ohio,

U.S.A.,

have partitioned the Commission of Patents, comprising for the grant of Patent for some  
alleged new and useful improvement in Navigational Control Means,

in their application of which invention is contained in the specification of which application is  
hereunder attached, and made a condition of the grant of patent, to have  
congruent with the  
requirements of the Patent Act.

Now Therefore the present Patent grants to the said

Carl J. Crane and Raymond H. Stout,

their executors, administrators, legal representatives and assigns, for the term of all  
Invention Days from the date of this patent, the exclusive rights, privilege and liberty of  
making, constructing, manufacturing, condonating, for others, to be used, in the Dominion of  
Canada, the said invention, subject nevertheless to adjudication before any court  
of competent jurisdiction.

Provided that the grant hereby made is subject to the conditions contained in  
the Act aforesaid.

In Testimony Whereof, I have hereunto set my hand,  
and caused the Seal of the Patent Office to be affixed.  
affixed at the City of Ottawa, in the Dominion of Canada,  
this Twenty-second day of July, in  
the year of Our Lord one thousand nine hundred  
and forty-one,

*J. T. Whitehill*  
Commissioner of Patents.

REPRESENTATIVE IN CANADA.

Entered under Section 30 of the Patent  
Act 1935.

Name..... *Marks & Clark*,  
Address..... 56 Sparks St.,  
Ottawa, Ontario.

449,846

TO ALL WHOM IT MAY CONCERN:

Be it known that Carl J. Crane and Raymond K. Stout, both citizens of the United States of America, of Wright Field, Dayton, State of Ohio, United States of America, having made an invention entitled IMPROVEMENT IN NAVIGATIONAL CONTROL MEANS, the following is a full, clear, and exact disclosure of the nature of the said invention and of the best mode of realizing the advantages thereof:

This invention relates to navigation and direction finding, and more particularly to apparatus for automatically controlling and indicating the course of a vehicle, such as an aeroplane or marine vessel.

One of the objects of the present invention is to provide a new and improved device for automatically guiding a vehicle toward a selected radio transmitting station.

Another object is to provide novel and improved means, responsive to received radiant energy, for actuating a controlled member, such as an automatic pilot, directive antenna of a direction finder, steering motor, or the like.

Another object is to provide novel means, responsive to received radiant energy, to control a source of pneumatic, light or thermal energy, for actuating a controlled member of the type above indicated.

The above and other objects will appear more fully hereafter in the detailed description of the invention, which is to be read in connection with the accompanying drawings, wherein like reference characters refer to like parts throughout the several views. In the drawings,

FIG. 1 is a front elevation of a vertical pointer type indicator of a radio compass embodying the present invention;

FIG. 2 is a front elevation of the same type compass illustrating a different embodiment of the invention;

FIG. 3 is a diagrammatic representation, partly in section, of one embodiment of the invention illustrating the use of pneumatic control energy for operating a relay;

FIG. 4 is a front elevation of a vertical pointer type indicator of a radio compass embodying the present invention;

FIG. 5 is a similar diagrammatic representation of another embodiment of the invention illustrating the use of a different type of pneumatic relay;

FIG. 6 is a diagrammatic representation of another embodiment of the invention illustrating the use of light energy to actuate a control unit;

FIG. 7 is a similar diagrammatic representation of another embodiment of the invention using thermal energy to actuate a control unit;

Generally speaking, the invention comprises the novel combination with a radio direction finder or magnetic, light or thermal means to control the adjustment member of an automatic pilot or a steering motor. By this means, a ship or aircraft can be automatically maintained on a desired course without the intervention of the human pilot once the course has been set, and may be made to proceed to its destination wholly without manual adjustment of the controls by the navigator or pilot. If desired, the direction finder may operate to control the rotation of a loop antenna, so that a pilot or navigator may ascertain his position along his course in a well-known manner.

Referring now to FIG. 1, 8 designates the right-left indicator of an ordinary radio compass, not shown. Indicator 8 may be of the usual galvanometer or synchrotype type, having a moving coil or moving magnet 9 driving a pointer 10. The pointer carries a closure or screen 11 which registers with ports 12 and 13 to be described hereafter, when the pointer swings to the right or left in response to deviations of the vessel from its course.

In the embodiment of the invention shown in FIG. 3, a conventional radio compass or direction finder antenna 15 is connected to the moving coil 9 of right-left indicator 8 of FIG. 1. The ports 12 and 13 form the ends of air ducts 16 and 17 to which are connected collapsible corrugated relay members 18 and 19, commonly known in the art as "sylphons". These members 18 and 19 are sealed at their outer ends and carry movable contacts 20 and 21, respectively, adapted to engage stationary contacts 22 and 23, respectively, to close a normally open electrical circuit, as will be described. Contacts 22 and 23 are connected by means of a common conductor 24 to one side of a battery 25 which provides energy for relay coils 26 and 27, having a common armature 28. Armature 28 actuates a single-pole, double-throw switch 29 to close a circuit through either contacts 30 and 31 or 31 and 32 to a reversible motor 33. Motor 33 is drivably connected by a shaft 34 with a unit 35, which may comprise an automatic pilot or a steering motor, for steering the vessel, or a loop rotator assembly for indicating direction, or other control device.

Suitable evacuating means 36 and 37 are attached to branches 28 and 39 of the ducts 16 and 17 to periodically draw air through these ducts in the direction indicated by the two curved arrows.

In the operation of this device, when pointer 10 moves off vertical, indicating a deviation from the course, it will close one of the ports 12 or 13, such, for example, as the port 13, thereby shutting off flow of air through said port and causing the pressure in duct 16 to be considerably lowered and the sylphon 18 to collapse. Upon collapse of sylphon 18, contact 20 is brought into engagement with contact 22, thereby closing the circuit of relay 26 and causing the relay switch 29 to close the contacts 30 and 31, thereby rotating the motor 33 in a direction suitable to

cause adjustment of the automatic pilot or steering device 55 to bring the vessel or craft back on its course.

The unit 35 may also comprise a loop rotator assembly, in which case rotation thereof by the motor 33 serves to indicate direction instead of automatically correcting the course, as above described.

The evacuating means 36 and 37 are arranged to be interrupted periodically, so that the suction does not prevent the free movement of the pointer 10.

FIG. 4 shows another embodiment employing pneumatic means for actuating a relay which in turn controls some type of steering or indicating mechanism. In this form, the right-left indicator 8 carries the vertical pointer 10, which is actuated by the radio compass and antenna 15, as described above, to close the ports 12 and 13 in which ducts 40 and 41 terminate. The ducts 40 and 41 lead to a common chamber 42, housing an air turbine relay 43 and having a common exhaust passage 44 attached to which is a suitable means 45 for periodically drawing air through ducts 40 and 41. Shaft 46 of turbine 43 is connected to actuate the unit 35, above described.

In the operation of this embodiment, when the craft is on course pointer 10 will be in its vertical position, allowing free admission of air to both ports 12 and 13. The air in ducts 40 and 41 will be at the same pressure and, since equal amounts will circulate around opposite sides of turbine 19, there will be no resultant motion of the turbine. When, however, the right-left indicator shows a deviation from the course, pointer 10 will assume a position over either the port 12 or 13. If, for example, the pointer 10 closes the port 12 or duct 40, as shown in FIG. 4, the evacuating means 45 will continue to draw air through

duct 40 and air will flow in the direction indicated by the arrows, causing rotation of turbine 43 in a counter-clockwise direction.

Should the craft deviate in the other direction, pointer 10 will shut off the flow of air in duct 41, allowing air to flow through duct 40 and causing turbine 43 to rotate in a clockwise direction.

The unit 35 is thus reversibly actuated, as described in connection with FIG. 3.

In FIG. 5 there is shown another embodiment of the invention which employs light-sensitive devices, such as photo-electric cells of any suitable type. Two suitable light sources 47 and 48 are positioned to throw parallel beams through two ports 12 and 13 in the face of right-left indicator 8, which indicator may be of the type shown in FIG. 1. Pointer 10 is shown in its on-course position midway between the two ports allowing light beams 49 and 50 to be directed upon photo-electric cells 51 and 52, which are connected to electrical circuits including batteries 57 and 58 to actuate sensitive relays 53 and 54 having armatures 55 and 56.

Armatures 55 and 56 are shown in their operated position with their contacts 59 and 60 open. The contacts 59 and 60 are adapted to close the circuits for power relays 26 and 27, respectively, which operate as described in connection with FIG. 3 to close the circuit to the reversible motor 33 for actuating the unit 35. The relays 26 and 27, switch 29, motor 33, unit 35, and associated mechanism are similar to those described above and are given like reference characters.

In this embodiment, when pointer 10 moves to right or left, it intercepts one of the beams of light, such as beam 49, thereby causing a change in the electrical resistance of photoelectric cell 51 and causing sensitive relay 53 to release its armature 55 and thereby close the circuit of relay 26, which in

turn closes contacts 31 and 32 and causes the motor 33 to operate in a direction suitable to effect the desired correction in the unit 35.

In Fig. 2 is shown the same type of indicator 8 as is illustrated in Fig. 1 and having a pointer 10 which carries an elongated closure or screen 14 adapted to close the ports 12 and 13 when pointer 10 is in its vertical or on-course position. This device is particularly adapted to use in the embodiments shown in Figs. 6 and 7.

Two embodiments of the invention employing thermal means for actuating suitable relays are shown in Figs. 6 and 7 respectively. In Fig. 6 a source of heat 62 is energized by suitable means, such as battery 63, and, by means of the reflector 64, the heat is directed against the screen 14 of the vertical pointer 10 which is shown in more detail in Fig. 2. Thermostatic or heat sensitive switches 65 and 66, composed of abutting and coextensive strips of dissimilar metals, as is understood in the art, are positioned to receive heat through the ports 12 and 13. These switches 65 and 66 carry contacts 67 and 68, which are normally open but which are adapted to close against contacts 69 and 70, respectively. The two switches 65 and 66 are separated by means of a shield or screen 71, the function of which will be described presently. Switches 68 and 69 are in circuit with power relays 26 and 27, respectively, which are similar to those shown in Fig. 3 and actuate a similar reversible motor 33 and unit 35.

Upon deflection of screen 14, indicating a deviation from the course, heat will be allowed to impinge upon either of the thermostatic switches 65 or 66, depending upon the direction of deflection. Screen 71 effectively prevents heat, which may be directed against switch 65, for example, from being transmitted

across to switch 66. Upon closing of either of the switches, the proper power relay will be operated and the unit 35 will be operated in the same manner as described in connection with Fig. 3.

Fig. 7 shows a similar heat source 62, energized by battery 63 and having its rays directed against screen 14 by means of the reflector 64. Instead of the thermostatic switches just described, the circuit of Fig. 7 employs two coils 72 and 73 which may be composed of wire having either a positive or negative temperature-resistance coefficient, as desired.

These coils are connected to sources of potential, such as batteries 57 and 53, for energizing the relays 53 and 54 in circuit therewith. These relays are similar to those shown in Fig. 5 and actuate relays 26 and 27 to control the reversible motor 33 and unit 35 in the manner above described. When screen 14 is deflected, heat will be thrown upon either coil 72 or 73 and will cause the resistance of that coil, for example, coil 72, to either increase or decrease. If the wire of coil 72 has a positive temperature-resistance coefficient, then the sensitive relay 53 will be normally operated as shown in the drawing, and as the heat increases the resistance of the wire, the energizing current for relay 53 will decrease to a value such that armature 55 will be released, thus closing the circuit of power relay 26 through contact 59 and causing rotation of motor 33 which in turn will effect the desired correction of unit 35.

The ports 12 and 13 shown in Figs. 1 and 2 have been shown as being circular. They may, however, be of any shape desired, and the screens or plates 11 and 14 carried by pointer 10 may be made of any desired shape, such as rectangular. In Fig. 3, pointer 10 carries a plate 14 which is rectangular in shape.

the sylphones 18 and 19 have been shown as connected to electrical contact arms 20 and 21 which in turn are connected in an electrical circuit. It is to be understood, however, that sylphones 18 and 19 can be adapted to operate any suitable type of relay, such as an oil valve or any suitable mechanical or electrical device.

For simplicity, the light beams in Fig. 5 have been shown as operating directly upon the photo-electric cells 51 and 52 without the use of any focusing system. Suitable lenses may, however, be interposed if desired. In some instances, the intermediate or sensitive relays 53 and 54 can be dispensed with and the photo-electric cells connected to directly actuate the power relays 26 and 27. In the embodiments shown, interception of the light has been effected by means of a screen 11 on the vertical pointer 10. However, the pointer 10 may be entirely eliminated and the moving coil of the right-left indicator may carry a mirror which, upon deflection of the coil, will reflect light from a single source to either of cells 51 and 52, as desired.

Coils 72 and 73 of Fig. 7 have been described as having positive temperature-resistance coefficients. They may, however, have a negative coefficient, and in that case the relays and the circuit with coils 72 and 73 may be arranged to be normally released and to be operated by increased current flow when the heat is directed upon the proper coil. The release of these relays would then cause operation of the power relays in the manner described above.

While certain specific embodiments of the invention have been illustrated and described, it is to be expressly understood that the invention is not limited thereto and that various changes may be made in the construction and arrangement of parts, as will occur to those skilled in the art. Particular attention has been

called to the use of the invention in connection with aircraft and marine vessels, but the invention is not limited to use thereon, since it is readily adaptable for use on land vehicles, such as war tanks. Reference will be primarily had, therefore, to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A tank

2. A tank

3. A tank

4. A tank

5. A tank

6. A tank

7. A tank

8. A tank

9. A tank

10. A tank

11. A tank

12. A tank

13. A tank

14. A tank

15. A tank

16. A tank

17. A tank

18. A tank

19. A tank

20. A tank

21. A tank

22. A tank

23. A tank

24. A tank

What is claimed is:

1. A navigation instrument for automatically keeping a vehicle on a given course comprising a reversible motor means to control the course of said vehicle, a pair of pneumatic transmission channels to selectively and reversibly actuate said motor means, a radio compass having a right-left indicator actuated in accordance with the directional effect of received radiant energy, and a screen actuated by said indicator to control said transmission channels so as to cause the motor means to correct any deviation in the course of said vehicle.
2. A navigational instrument comprising a reversible motor control means, a pair of pneumatic transmission channels to selectively and reversibly actuate said means, directional means responsive to received radiant energy, and a screen actuated by said directional means to control said transmission channels so as to actuate said motor control means in accordance with changes in direction.
3. A navigational instrument comprising a reversible motor control means, a pair of transmission channels to selectively and reversibly actuate said means, directional means responsive to received radiant energy, means including a light beam to control said transmission channels, and means actuated by said directional means to control said light beam.
4. A navigational instrument comprising a reversible motor control means, a pair of transmission channels to selectively and reversibly actuate said means, directional means responsive to received radiant energy, means including a heat beam to control said transmission channels, and means actuated by said directional means to control said heat beam.

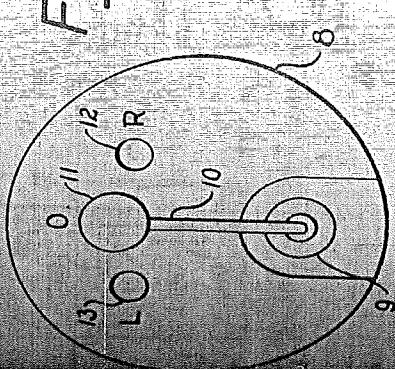
5. A navigational instrument comprising a reversible motor control means, a pair of pneumatic transmission channels to selectively and reversibly actuate said means, directional means responsive to received radiant energy, a stationary plate having a pair of ports, a local source of energy, a single member actuated by said directional means to control the flow of energy from said local source through said ports, and means responsive to said flow of energy to control said transmission channels so as to actuate said motor control means in accordance with changes in direction.
6. A navigational instrument comprising a reversible motor control means, a pair of transmission channels to selectively and reversibly actuate said means, directional means responsive to received radiant energy, pneumatic motor means to control said transmission channels, means including a pair of ports to control the operation of said pneumatic means, and unitary closure means for said ports actuated by said directional means to control said pneumatic motor means so as to actuate said motor control means in accordance with changes in direction.
7. A navigational instrument comprising a reversible motor control means, a pair of transmission channels to selectively and reversibly actuate said means, directional means responsive to received radiant energy, a plate having a pair of ports, means directing a light beam therethrough, photo-electric means actuated by said light beam to control said transmission channels, and closure means for said ports actuated by said directional means to control said light beam so as to actuate said motor control means in accordance with changes in direction.
8. A navigational instrument comprising a reversible motor control means, a pair of transmission channels to selectively and reversibly actuate said means,

directional means responsive to received radiant energy, a plate having a pair of ports, means directing radiant heat energy therethrough, thermal-responsive means actuated by said radiant heat energy to control said transmission channels, and closure means for said ports actuated by said directional means to control said radiant heat energy so as to activate said motor control means in accordance with changes in direction.

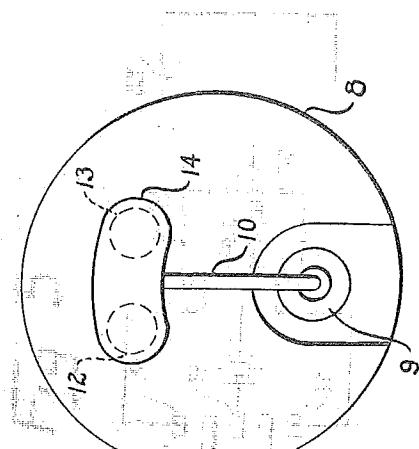
9. An apparatus of the class described, a motor to be controlled, a reversible motor for actuating said number, directional means responsive to received radiant energy including a screen, a pair of transmission channels selectively controlled by said screen, and means operatively connected to said channels for reversing said motor.

GNED At Wright Field, Dayton, O., USA this 5th day of January 1938.

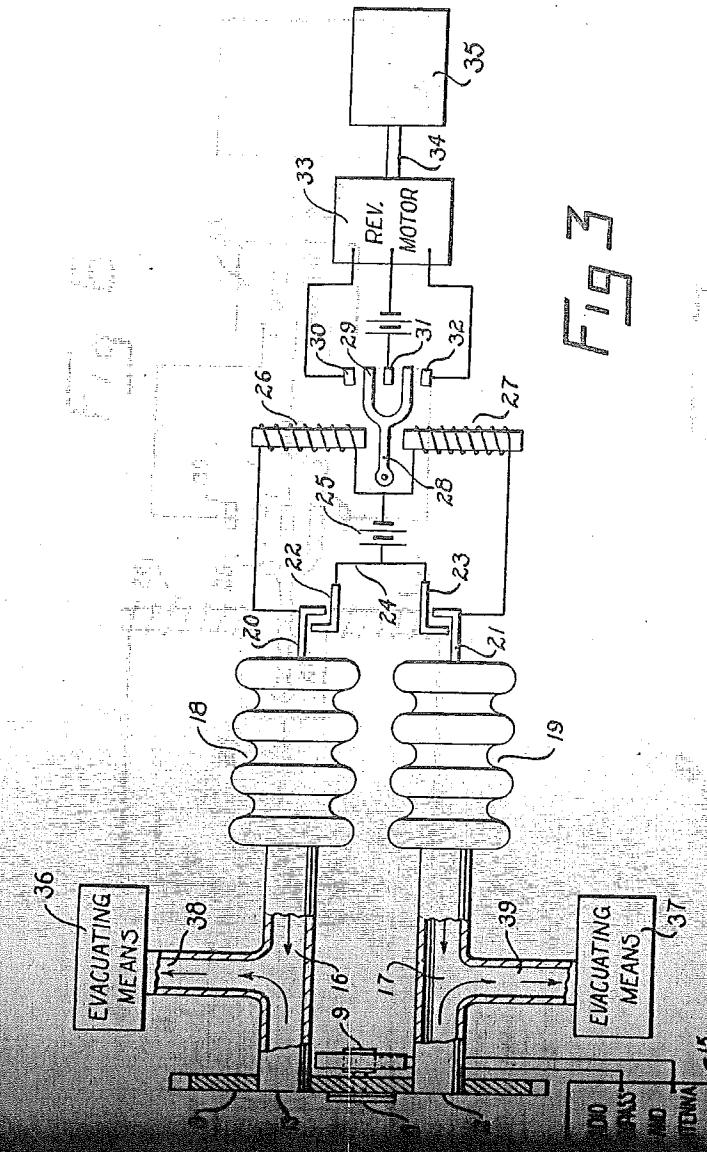
Carl Koenig  
Raymond F. Stoldt



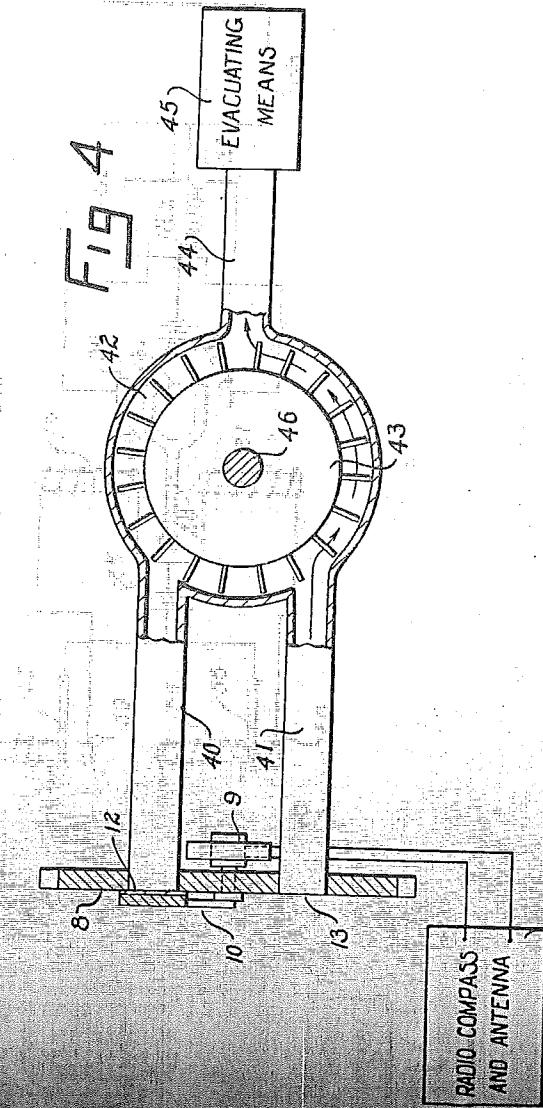
**FIG. 1**



**FIG. 2**



**FIG. 3**



**FIG. 4**

Certified to be the drawings referred to  
in the specification hereto annexed.

*J. J. Haas*

1938

INVENTOR

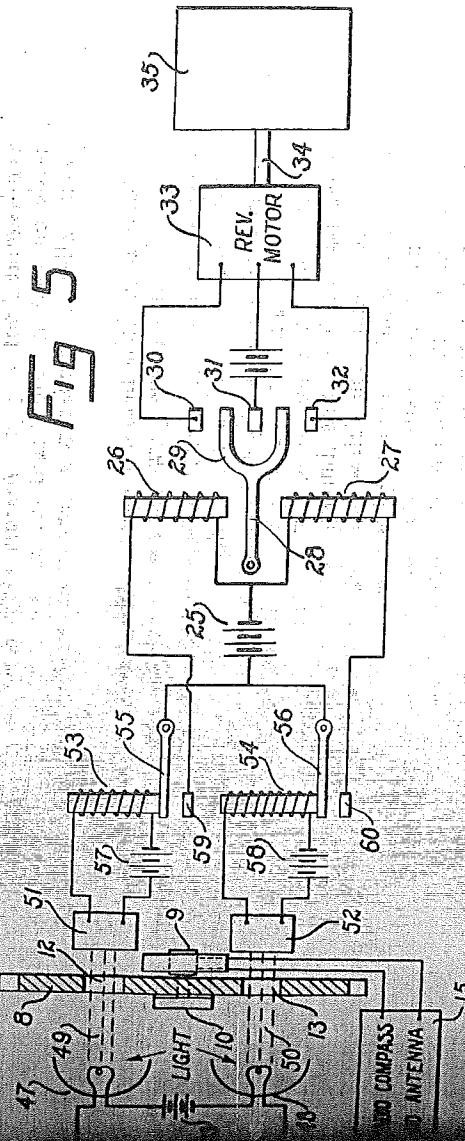
*H. J. Crane*

*B. J. Strode*

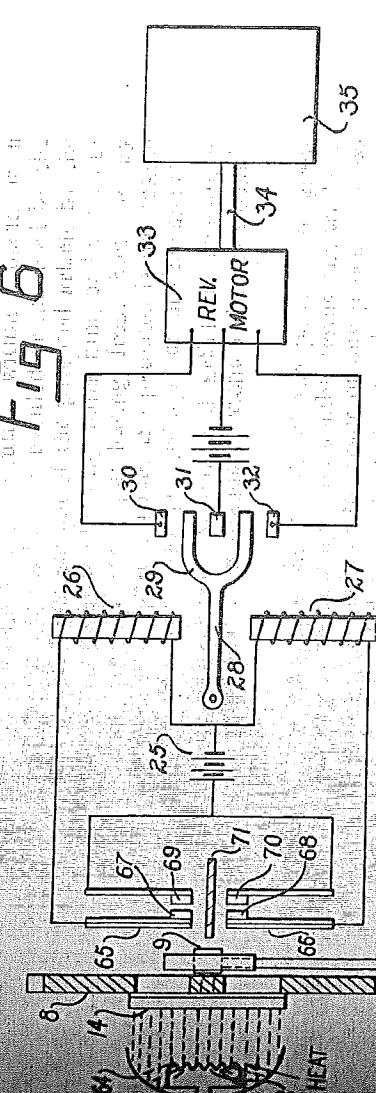
*Murdochless*

ATTORNEYS

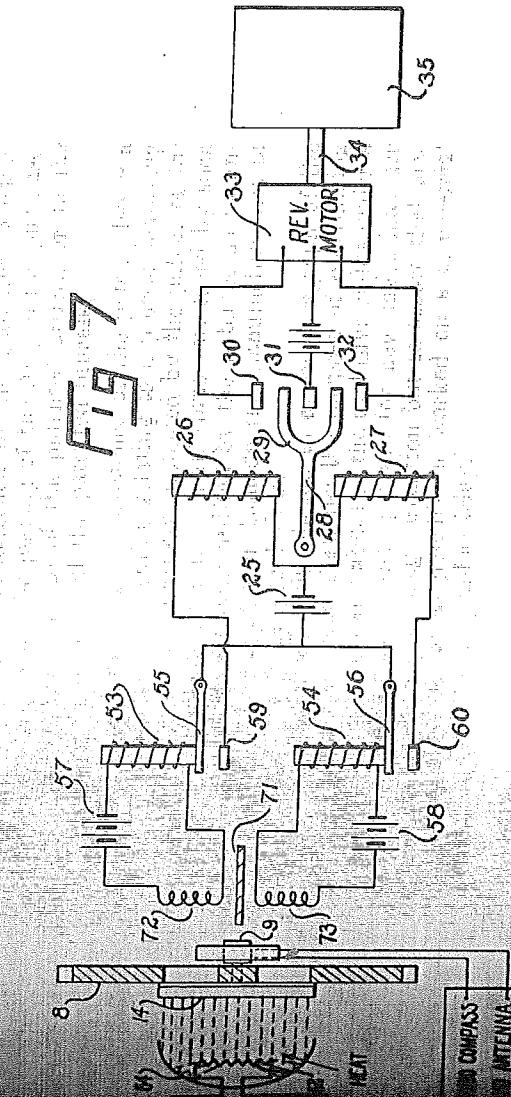
CANTO 10



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Certified to be the drawings referred to  
in the specification hereto annexed.

193  
Applied to be the drawings referred to  
in the specification hereunto annexed.

LITERATOR

La J. G. D. Gould & Son  
1870

Murphy & Black  
ATTORNEYS

The attention of Patentees is called to the following section of  
The Patent Act, 1935.

Abuse of  
rights under  
patents.

"**65.** (1) The Attorney General of Canada or any person interested may at any time after the expiration of three years from the date of the grant of a patent apply to the Commissioner alleging in the case of that patent that there has been an abuse of the exclusive rights thereunder and asking for relief under this Act.

What  
amounts to  
such abuse.

(2) The exclusive rights under a patent shall be deemed to have been abused in any of the following circumstances:—

- (a) If the patented invention (being one capable of being worked within Canada) is not being worked within Canada on a commercial scale, and no satisfactory reason can be given for such non-working:
- Provided that, if an application is presented to the Commissioner on this ground, and the Commissioner is of opinion that the time which has elapsed since the grant of the patent has by reason of the nature of the invention or for any other cause been insufficient to enable the invention to be worked within Canada on a commercial scale, the Commissioner may make an order adjourning the application for such period as will in his opinion be sufficient for that purpose;

- (b) If the working of the invention within Canada on a commercial scale is being prevented or hindered by the importation from abroad of the patented article by the patentee or persons claiming under him, or by persons directly or indirectly purchasing from him, or by other persons against whom the patentee is not taking or has not taken any proceedings for infringement;
- (c) If the demand for the patented article in Canada is not being met to an adequate extent and on reasonable terms;

- (d) If, by reason of the refusal of the patentee to grant a licence or licences upon reasonable terms, the trade or industry of Canada or the trade of any person or class of persons trading in Canada, or the establishment of any new trade or industry in Canada, is prejudiced and it is in the public interest that a licence or licences should be granted;

- (e) If any trade or industry in Canada, or any person or class of persons engaged therein, is unfairly prejudiced by the conditions attached by the patentee, whether before or after the passing of the Act, to the purchase, hire, licence, or use of the patented article, or to the using or working of the patented process;

- (f) If it is shown that the existence of the patent, being a patent for an invention relating to a process involving the use of materials not protected by the patent or for an invention relating to a substance produced by such a process, has been utilized by the patentee so as unfairly to prejudice in Canada the manufacture, use or sale of any such materials.
- (3) It is declared with relation to every paragraph of the next foregoing subsection that, for the purpose of determining whether there has been any abuse of the exclusive rights under a patent, it shall be taken that patients for new inventions are granted not only to encourage invention but to secure that new inventions shall so far as possible be worked on a commercial scale in Canada without undue delay."

Patentees are advised to acquaint themselves with this and the other provisions of the Act.