Oct. 3, 1939. J. F. NEVILLE 2,174,804

FLIGHT METER

Filed April 18, 1938 2 Sheets-Sheet 1

Fig. 1.

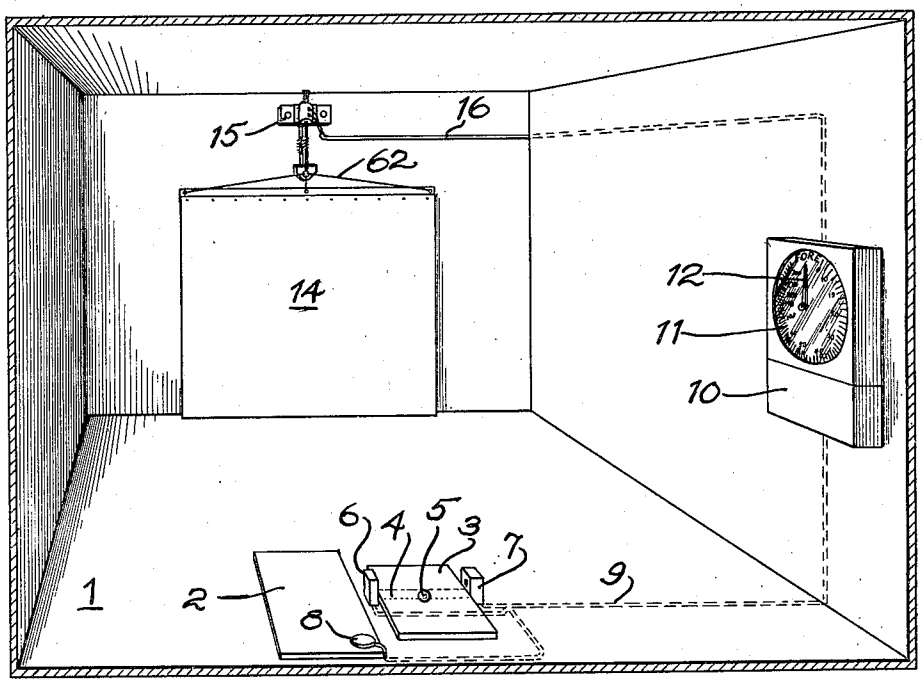
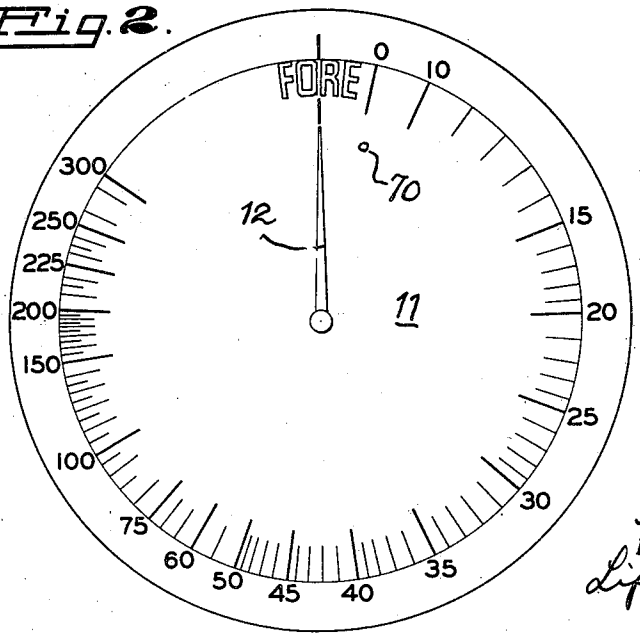


Fig. 2.



INVENTOR,
JOHN FRANCIS NEVILLE.
BY
Lippincott & Metcalf
ATTORNEYS.

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Fig. 3.

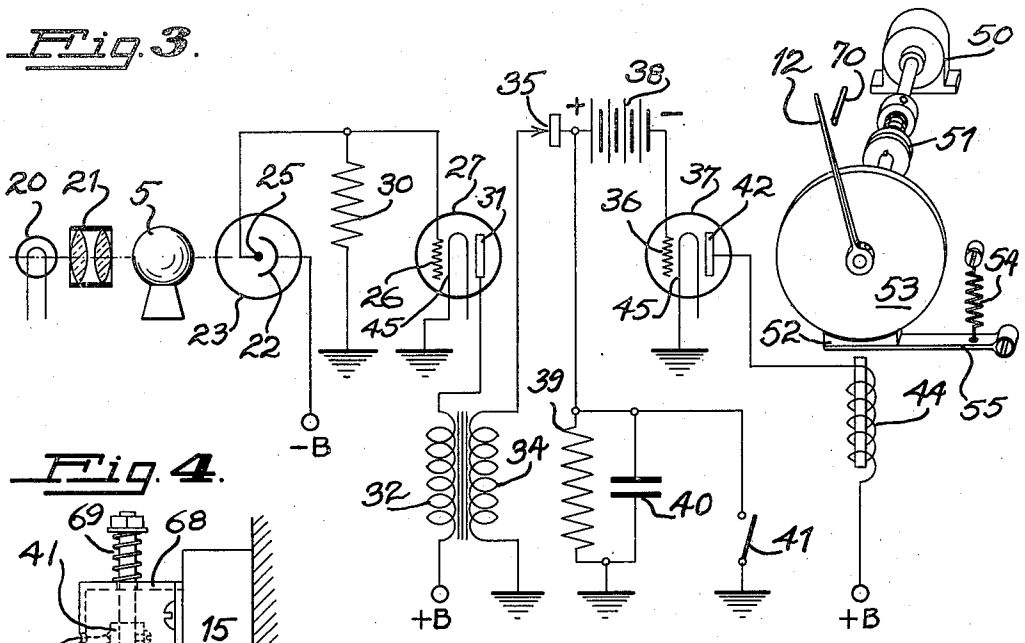


Fig. 4.

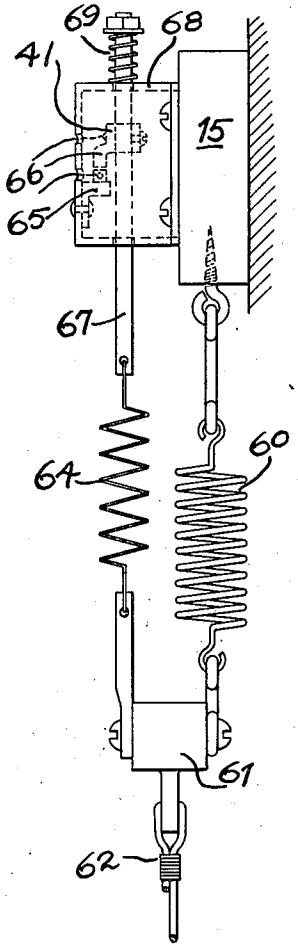
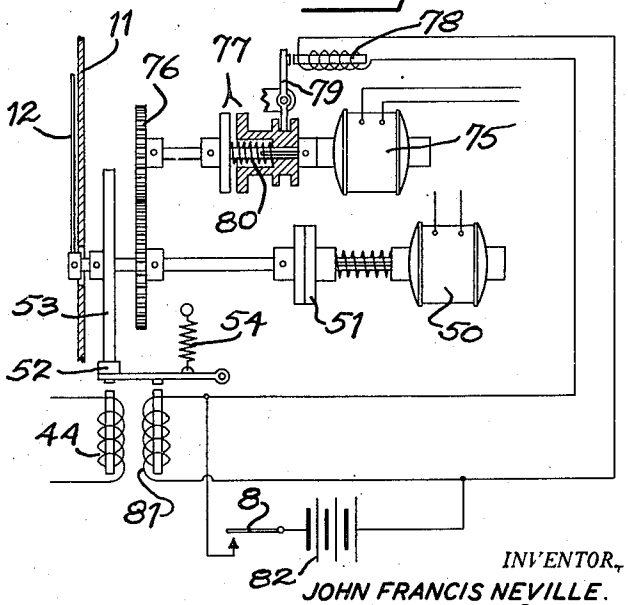


Fig. 5.



INVENTOR,
JOHN FRANCIS NEVILLE.
BY
Lippincott & Metcalf
ATTORNEYS.

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UNITED STATES PATENT OFFICE

2,174,804

FLIGHT METER

John Francis Neville, San Francisco, Calif., assignor, by mesne assignments, to Fair-Way Company, a corporation of California

Application April 18, 1938, Serial No. 202,738

4 Claims. (Cl. 161—18)

My invention relates to flight meters, and more particularly to an apparatus for measuring the time of flight of a projectile in terms of distance. My device is particularly applicable for use in training persons in the art of playing golf, and may be used in conjunction with a range of fixed length.

Among the objects of my invention are: to provide a golf range of fixed length, together with means for timing the flight of a golf ball over the range, and translating the time of flight into terms of distance; to provide a means and method of obtaining a distance reading in a projectile range of fixed length; and to provide a simple and efficient training device for use in teaching the game of golf.

My invention possesses numerous other objects and features of advantage, some of which, together with the foregoing, will be set forth in the following description of specific apparatus embodying and utilizing my novel method. It is therefore to be understood that my method is applicable to other apparatus, and that I do not limit myself, in any way, to the apparatus of the present application, as I may adopt various other apparatus embodiments, utilizing the method, within the scope of the appended claims.

My invention may be more fully understood by direct reference to the drawings, wherein

Fig. 1 is a diagrammatic perspective view of an indoor fixed distance range, suitable for applying my invention to the game of golf.

Fig. 2 is a face view of one preferred form of indicating dial for use in conjunction with my device.

Fig. 3 is a circuit diagram of one preferred form of timing device.

Fig. 4 is a view in elevation, showing the target suspension and shut-off switch.

Fig. 5 is a diagram showing apparatus and cooperating electrical circuit for resetting dial readings.

In playing the game of golf, not only is it necessary for the player to learn accuracy in placement of the golf ball, but it is also necessary for him to be able to regulate the power of his strokes in such a manner that specific distances be obtained. In general, the distance over which the ball will travel, presupposing the trajectory is proper, will depend upon the velocity of the ball at the beginning of its flight. My invention is designed to read this velocity directly in terms of distance, and thus enable the player, in a fixed distance range, to regulate the power of his strokes to achieve accuracy in distance.

Referring directly to Fig. 1, which shows a perspective view of an indoor range in a room 1, a foot mat 2 is provided for the player to stand on, adjacent which, in the proper playing position, is located a ball mat 3 provided with markings 4 for the positioning of a golf ball 5. Immediately in front of the ball, when teed, a beam of light is thrown across the mat from a lamp house 6 to a photoelectric cell house 7. A reset switch 8 is provided on foot mat 2 in convenient reach of the player, and all connections travel in a main cable 9 to dial cabinet 10, the latter having a large dial 11 visible to the player, over which recording hand 12 travels. At a fixed distance away from ball 5 is positioned a target 14, preferably of canvas, resiliently hung from a target fixture 15 containing a stop switch. The stop switch leads enter a stop cable 16 passing to dial cabinet 10.

One preferred operational circuit is shown in Fig. 3. Here, light source 20 is projected by lens 21 in front of ball 5, and is focused on cathode 22 of photoelectric cell 23. Cathode 22 is energized in the usual manner from the negative end of a B power source, and the anode 25 of the photoelectric cell leads directly to grid 26 of input tube 27 and is resistance coupled to the grid by input resistor 30. While tube 27 is shown as the typical three-electrode vacuum tube, it may be, of course, of any of the modern types suitable for use in amplifying the output of a photoelectric tube.

Anode 31 is connected through primary 32 of an amplifying transformer and is positively energized in the usual manner from the B source. One end of amplifying transformer secondary 34 is grounded; the other end leads through a rectifier 35 to grid 36 of an output tube 37 through a biasing battery 38.

A timing circuit comprising resistor 39, and shunted by capacity 40, is connected from the positive end of battery 38 to ground, and the stop switch 41 shorts the timing circuit to ground. Anode 42 of the output tube is connected through electromagnet 44 to a positive B source. Cathodes 45 of amplifier tube 27 and output tube 37 are energized in manners well known in the art.

Recording hand 12 is driven by a small motor 50 through a friction clutch 51, and under normal circumstances the recording hand 12 is prevented from rotating by brake 52, pressed against brake drum 53 by brake spring 54, the clutch 51 slipping continuously when the recording hand 12 is standing still. Brake arm 55 carrying brake 52 may be made of magnetic ma-

terial, and electromagnet 44 is presented to this arm in such a manner that when it is energized the brake 52 will be withdrawn from drum 53, and recording hand 12 will rotate in accordance with the rotation of motor 50.

Stop switch 41 is shown in detail in Fig. 4. Here, stop switch fitting 15 has attached thereto a main target spring 60 carrying the entire weight, through distributing block 61 and support wires 62, of target 14, which is raised at the bottom to be clear of the floor of the range. Also attached to distributing block 61 through switch spring 64 is stop switch 41, comprising a stationary contact 65 and a movable contact 66, operated by connection through rod 67 to switch spring 64. Rod 67 passes entirely through stop switch case 68 and is provided with a return spring 69. The springs 64 and 69 are so balanced that when the target 14 is perfectly quiescent the switch points 66 and 65 are out of contact. When, however, a ball hits target 14, the energy imparted to target 14 by the ball causes a vertical oscillation of the target, due to the support thereof by spring 60, and this oscillation causes switch points 66 and 65 to make contact.

The operation of the device so far outlined is simple. Recording hand 12 is set against the zero stop pin 70, either by hand or by a resetting mechanism, later to be described. The player takes his position on foot mat 2 and places ball 5 behind the line of light entering photo-tube 23. Motor 50 driving the recording hand 12 is energized to rotate continuously. Instantly the ball is struck, it passes through the line of light, interrupts the steady photo-tube current, and causes an electrical surge through amplifier tube 27, this surge being passed through transformer windings 32—34 through rectifier 35, which is used in case any surge oscillations take place, onto grid 36 of output tube 37. Grid 36 is normally maintained by bias battery 38 at a negative potential sufficient to prevent any large amount of current from passing through the tube and energizing electromagnet 44. The phase of the surge is adjusted to be placed upon grid 36 as a positive potential overcoming the negative bias from battery 38, thereby allowing current to pass through output tube 37. This current passes through solenoid 44, withdraws brake 52 from drum 53, and allows recording hand 12 to rotate in synchronism with motor 50.

Under ordinary circumstances, however, and with the ordinary type of coupling system between the amplifier tube and the output tube, current through the output tube 37 would immediately fail, allowing brake 52 to contact drum 53 and stop the hand, with no relation to the flight of the ball. However, I so proportion timing condenser 40 that a portion of the surge charge is stored thereon for a sufficient length of time to maintain output tube 37 in current passing condition over the entire range of dial 11. Thus, due to the initial impulse only, the recording arm 12 would pass completely around the dial.

However, stop switch 41 is positioned to short out condenser 40 and release its charge, so that when the ball hits the target 14, and stop switch 41 is closed, all charge on condenser 40 is dissipated, and the biasing battery 38 at once reestablishes the negative potential on output grid 36, cutting off current through solenoid 44 and allowing brake 52 to stop recording hand 12. Thus, recording hand 12 will rotate only between the time that the light path is broken and the time that the stop switch 41 closes. This time is the time of flight of the ball between the tee and the target.

The time of flight, however, does not give the player any information which he can directly utilize. Consequently, I have designed a series of dial markings representing time in terms of distance, as shown in Fig. 2, and I have chosen 300 yards as representing the fastest time of flight ordinarily possible for the ball to traverse the distance between tee and target when hit by a competent player. Thus, all readings will be directly in terms of distance, and if desired the players may not only compete for maximum distance, but they may also attempt to regulate stroke power to have the ball traverse the space between tee and target in a time representing any specific shorter distance.

While I have described my device as utilizing a hand reset, I prefer to utilize an electrical reset, shown diagrammatically in Fig. 5. Here, in this case, motor 50 drives recording hand 12 over dial 11 through the friction clutch 51. I also provide an auxiliary motor 75, driving recording hand 12 through gears 76, and separate the gears 76 from motor 75 by a clutch 77, this clutch being electrically operated by clutch solenoid 78 through clutch arm 79, and normally kept disengaged by disengagement spring 80. Clutch solenoid 78 is in parallel with a second brake release solenoid 81, and solenoids 78 and 81 are energized from reset source 82 through the reset switch 8 positioned on foot mat 2.

The operation of the resetting mechanism is simple. When the player is ready and the ball 5 teed up, the player steps on the reset switch 8 and this, through action of the additional clutch release solenoid 81, takes the brake 52 off from drum 53 and clutches reset motor 75 to rotate recording hand 12 back to zero position through gears 76, the rotation of hand 12 being made against the friction of clutch 51. As soon as the recording hand 12 hits pin 70 both clutches will slip, and then when reset switch 8 is opened, brake 52 immediately locks recording hand 12 in the zero position and recording hand 12 will stay in that position until the shot is made.

I have found my device to be completely practical as a training device, and I have also found that it is a great improvement over the usual indoor golf range in that it allows training not only in accuracy of placement, but in the regulation of the power imparted to the ball, with accurate measurement thereof in terms of distance.

I claim:

1. Apparatus of the class described comprising, in combination with a projectile, a light beam positioned in front of said projectile when at rest, photoelectric means for creating an electrical surge when said light beam is interrupted by said projectile, means for storing the energy of said surge, a timing device normally quiescent, means for starting and maintaining operation of said timing device by continuous leakage of surge energy from said storage means, a target at a fixed distance from said projectile when the latter is at rest, and means responsive to movements of said target caused by impact of said projectile for discharging said storage means, thereby stopping said timing device.

2. Apparatus in accordance with claim 1, wherein the means for storing the energy of said surge is a condenser, and wherein the means responsive to movements of said target is a switch

shorting the condenser when the target is impacted by said projectile.

3. A circuit for timing projectile flight over a fixed distance comprising a light beam, a photoelectric tube in the path of the light beam, said beam being positioned to be interrupted at the beginning of flight of said projectile, a thermionic tube responsive to change in light of said beam when interrupted by said projectile, capacity means for storing the output of said thermionic tube in response to said change in light, a second thermionic tube, means normally biasing said second tube to a minimum output current condition, means for continuously applying the stored energy on said condenser to overcome said bias and cause said second tube to pass current, a timing device, means for utilizing the current passed by said second tube to start and maintain said timing device in registering condition, a target, and a switch closed by movements of said target when impacted by said projectile, said switch shorting said condenser and thereby dissipating said charge and stopping said timing device.

4. A circuit for timing projectile flight over a fixed distance comprising a light beam, a photoelectric tube in the path of the light beam, said beam being positioned to be interrupted at the beginning of flight of said projectile, a thermionic tube responsive to change in light of said beam when interrupted by said projectile, capacity means for storing the output of said thermionic tube in response to said change in light, a second thermionic tube, means normally biasing said second tube to a minimum output current condition, means for continuously applying the stored energy on said condenser to overcome said bias and cause said second tube to pass current, a timing device, means for utilizing the current passed by said second tube to start and maintain said timing device in registering condition, a target, a switch closed by movements of said target when impacted by said projectile, said switch shorting said condenser and thereby dissipating said charge and stopping said timing device, and electrical means for resetting said timing device.

JOHN FRANCIS NEVILLE.