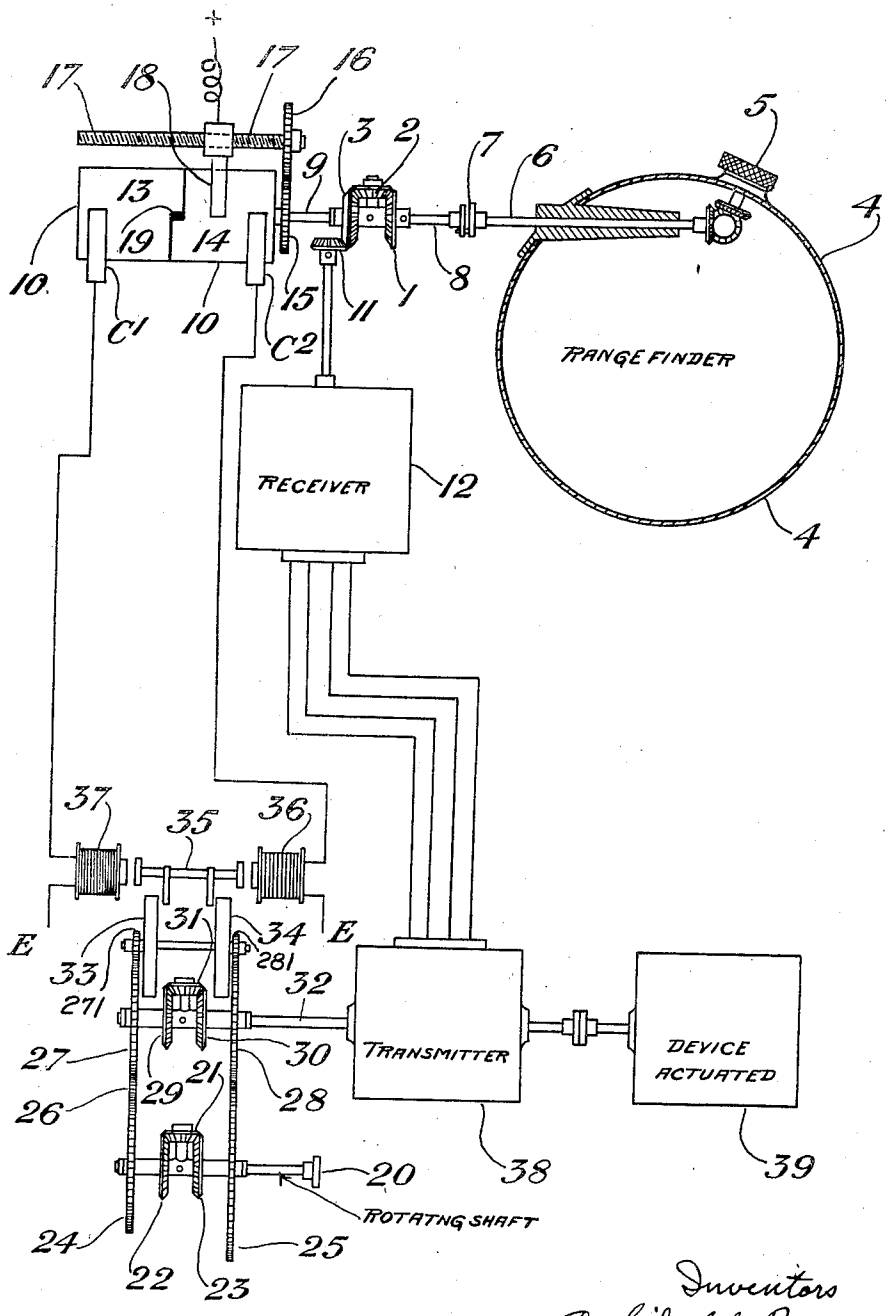
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APPARATUS FOR THE CONTROL OF GUN FIRE

Filed August 16, 1921



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APPARATUS FOR THE CONTROL OF GUN FIRE.

Application filed August 16, 1921. Serial No. 492,871.

To all whom it may concern:

Be it known that we, ARCHIBALD BARR and WILLIAM STROUD, subjects of the King of Great Britain and Ireland, and both of Caxton Street, Anniesland, Glasgow, Scotland, have invented new and useful Improvements in Apparatus for the Control of Gun Fire (for which we have filed application in Great Britain, December 12, 1913, Patent No. 28,681), of which the following is a specification.

Our invention has reference to the electrical transmission of indications from a rangefinder to a fire control or other station where the electrical impulses actuate a receiving instrument which operates a visual indicator (for instance one exhibiting ranges) or actuates further apparatus which produces motions corresponding to intervals of range on a uniform or other desired scale.

For convenience we shall designate by the term "transmitter" apparatus which controls electrical impulses sent to a receiver, and by the term "receiver" apparatus directly actuated by such impulses, working on the step-by-step system by means of three or more electro-magnets energized successively.

It has previously been suggested that a transmitter should send impulses corresponding to the movements of the working head, or other moving part at the rangefinder and not necessarily corresponding to equal intervals of range. If the working head of the rangefinder is geared directly to the transmitter of apparatus working on the usual step-by-step principle, the following disadvantages will be apparent:—

(1) It may not be possible to move the working head with great rapidity from a very high to a very low range or vice versa, without putting the transmitter and receiver out of step.

(2) If from any cause the electrical circuit of the transmitter is broken at the time the working head is operated, the transmitter and receivers may be put out of step.

(3) There will be much additional friction to be overcome in the operation of the working head.

Our present invention is designed to overcome these disadvantages. Instead of attaching the transmitter directly to the working head we employ a commutating device capable of being advanced by more than one complete revolution in either the forward or backward direction from a neutral position by operation from the working head through a differential gear, and provide motor mechanism for driving a transmitter and receiver, or receivers, working according to the step-by-step system in which three or more electromagnets are energized successively, the motor mechanism being adapted to be brought into operation by electrical means controlled by the commutating device to drive the transmitter in a forward or backward direction in conformity with the extent and direction of advance imparted to the commutating device, the receiver, or one of them, being utilized by operation through the differential gear to restore the commutating device to its neutral position. For this purpose we may arrange that the working head operates the element 1 of a differential gear 1, 2, 3, the jockey element 2 being arranged to move a brush relatively to two contacts C^1 C^2, while the element 3 may be operated by a receiver, so as to restore the position of the brush to its neutral or zero position relatively to the contacts. We shall assume that in the neutral position the brush is insulated from the two contacts.

The motor mechanism may be constructed in a variety of ways, one of which we proceed to describe. We may arrange an electrical motor, say, at the fire control station, which shall drive a transmitter in the forward direction when contact C^1 is made and backwards when C^2 is made. This transmitter may be of the type described in our prior specification of United States Patent No. 1,009,013, dated 14th November 1911, although other suitable types of transmitters may be used instead. This transmitter may be arranged to send electrical impulses to a receiver situated at the rangefinder, which receiver operates the element 3 of the aforesaid differential gear in such a direction as to restore the position of the brush to its neutral position. In this way the working head of the rangefinder may be operated backwards and forwards with great rapidity while the transmitter and receiver will follow this motion at their leisure.

The appended drawing illustrates one method of carrying our invention into effect. The view contained in the drawing is a diagram showing in the upper portion appara-

tus situated at or near the rangefinder, and in the lower portion apparatus situated at a distant station.

The range finder is shown in section at 4, the working head 5, which operates the measuring mechanism of the instrument is geared to a shaft 6, which by means of a clutch 7 drives a shaft 8 to which the bevel 1 of the differential gear 1, 2, 3 is fixed. The spindle of the jockey element 2 is fixed to the shaft 9 which drives a commutator 10. The element 3 of the differential can be driven by the bevel wheel 11 fixed to a shaft capable of being rotated by a receiver 12, which latter may take the form of a suitable electro-magnetic stey-by-step receiver.

As the working head 5 is turned through any given (say large) angle the jockey 2 is moved through a certain number of turns and fractions of a turn, thereby causing an equal rotation of the commutator 10. This commutator acts as a device for indicating the motion of the jockey 2, and it also serves as a means of operating mechanism to drive receiver 12 and bevel wheels 11 and 3, so as eventually to bring back jockey 2 to its zero position, in which case the number of turns of 11 will be a measure of the number of turns of the working head 5.

The commutator 10 consists of two metal portions 13 and 14 arranged as shown in the figure with the brush C^1 resting on 13 and C^2 upon 14. As the commutator 10 is rotated the insulated brush 18 (to which the + terminal is connected) is caused to travel axially by means of the spur wheels 15, 16 and screw 17. Thus, in the position shown in the figure current will pass from the brush 18 through the part 14 to the brush C^2. This current will operate mechanism shown in the lower part of the figure so as to cause 12 to rotate in such a direction as to bring the commutator back to such a position that the brush 18 is resting upon the insulating portion 19 separating 13 and 14.

We shall next shortly describe the motor mechanism upon the lower part of the figure. This is constructed upon similar lines to mechanism shown on the right hand side of Figures 7 and 13 of our prior specification of United States Patent No. 1,050,512, dated 14th January 1913, and consists of a shaft 20 (continuously driven, say, by a motor) to which is fixed the spindle of the jockey 21 gearing with the bevels 22 and 23. Spur wheels 24, 25, are fixed to 22 and 23 respectively. The spur wheel 24 drives 27 through an idle wheel 26 while 25 drives 28 directly. The bevels 29 and 30 are fixed to 27 and 28 respectively, while the spindle of the jockey element 31 is fixed to the shaft 32. Gearing into the spur wheels 27 and 28 are pinions 271 and 281 carrying flies 33 and 34 respectively. The arrangement is so designed that if 34 is stopped, shaft 32 rotates in one direction, but if 33 is stopped the rotation is reversed. The stoppage of one or other of these flies is controlled by a single armature 35 moved to the right when the electro-magnet 36 is energized, and to the left when 37 is energized. In the particular position shown in the figure where the working head has been suddenly turned through several revolutions, thus bringing the brush to the position shown on the part 14, current will flow through C^2 to 36 thus pulling 35 to the right and stopping the fly 34. The shaft 32 is then driven in the appropriate direction causing the transmitter 38 (say, of the type described in our specification of United States Patent No. 1,009,013, dated 14th November 1911) to rotate and thus driving the receiver 12. This operation will continue till the brush 18 is brought back to the insulating piece 19 when the current through C^2 will be broken and 35 which is mounted or is so acted on by a force that it tends to remain in a neutral position, the position in which it is shown in the drawing will be brought back to the neutral position.

We may now couple to the transmitter 38 a device to be actuated, say any apparatus 39 which we may desire to move in accordance with the motions of the working head of the rangefinder.

We are aware that in certain kinds of distant control arrangements commutating devices consisting of circular rings subdivided into two parts by insulating pieces placed at opposite ends of a diameter of the ring have been employed, but we are not aware that commutating devices capable of being turned through a large number of revolutions for the purpose of securing in a compact form a means of indicating a large number of steps has been employed in association with mechanism capable of driving the commutating device back to its neutral position.

We claim:—

1. Apparatus comprising a rangefinder, a working head of the rangefinder, differential gear, an electrical commutating device, a transmitter, a receiver to be actuated by the transmitter, the electrical commutating device being operatively connected by the differential gear with the working head of the rangefinder and the receiver, motor mechanism for driving the transmitter, an electrical driving connection from the transmitter to the receiver for actuating the receiver, and means controlled electrically by the commutating device for bringing the motor mechanism into operation, for the purposes set forth.

2. Apparatus comprising a rangefinder, a working head of the rangefinder, differential gear, an electrical commutating device, a

transmitter, a receiver to be actuated by the transmitter, an electrical driving connection from the transmitter to the receiver for actuating the receiver, the electrical commutating device comprising a drum connected for rotation by the differential gear with the working head of the rangefinder and the receiver, the drum having two electric conductor sections insulated from each other, a supply brush resting on the drum for supplying current to the conductor sections and two collector brushes one for each conductor section, means for moving the supply brush axially as the drum is rotated so as to cause it to pass from a neutral position onto one or other of the conductor sections, motor mechanism for driving the transmitter, and electrical means associated with the two collector brushes for bringing the motor mechanism into operation, for the purposes set forth.

3. Apparatus comprising a rangefinder, a working head of the rangefinder, a differential gear, an electrical commutating device, motor mechanism, a transmitter, a receiver to be actuated by the transmitter, a first connection for communicating motion from the working head of the rangefinder to a first element of the differential gear, a second connection for communicating motion from a second element of the differential to the commutating device, a third connection for communicating motion from the receiver to a third element of the differential, means associated with the commutating device and with the motor mechanism for controlling the action of the motor mechanism, a driving connection from the motor mechanism to the transmitter, and an electrical driving connection from the transmitter to the receiver, for the purposes set forth.

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