Jan. 13, 1925. 1,522,509

R. GIRARDELLI

TRANSMISSION DEVICE

Filed May 3, 1920

Fig. 2.

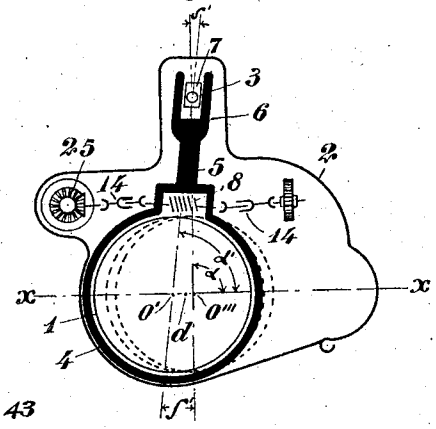


Fig. 1.

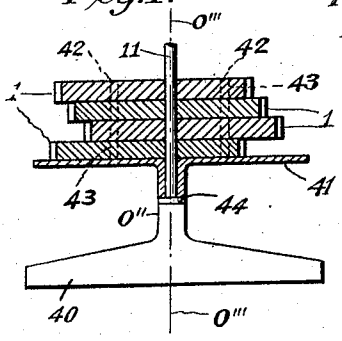


Fig. 3.

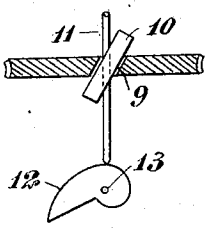
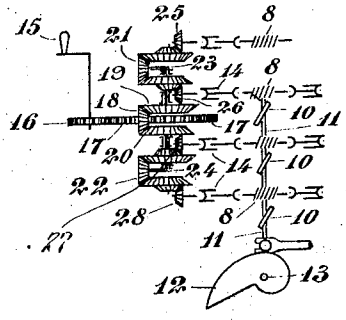


Fig. 4.



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UNITED STATES PATENT OFFICE.

RICCARDO GIRARDELLI, OF ROME, ITALY.

TRANSMISSION DEVICE.

Application filed May 3, 1920. Serial No. 378,638.

To all whom it may concern:

Be it known that I, RICCARDO GIRARDELLI, a subject of the King of Italy, residing at Rome, in the Kingdom of Italy, have invented certain new and useful Improvements in Transmission Devices, of which the following is a specification.

It happens often that in the transmission of angular movements from a controlling station to several distant points where the controlled stations are located—as it is the case for instance in the control of gun fire or search-lights, and the like—the angles of rotation to be transmitted to the different receiving stations have different values variable according to the relative positions of the receiving stations and the controlling apparatus.

The ordinary methods for the transmission of angular movements would require in such cases either to correct severally the angles transmitted to each of the receiving stations, or the use of as many transmission apparatus as there are stations or groups of stations, which must receive different angles.

The object of the present invention is to overcome said difficulty by the use of a single transmitting apparatus which, by a single movement imparted to it, transmits at the same time different angles to the various receiving stations.

In order to secure the aforesaid result the transmitting apparatus according to the present invention comprises a set of elementary devices moved together by a single movement and, each one of which transmits to the station, or to the group of receiving stations controlled by the same, the angle impressed to the transmitter corrected in the required manner.

In the drawing annexed herewith, which serves to illustrate diagrammatically a manner of carrying into practice the present invention:

Fig. 1 shows a front view of the apparatus with the casing removed;

Figure 2 is a top view of one of the elements of the transmitting device;

Fig. 3 shows an arrangement for varying the law of transmission of the device according to Figs. 1 and 2;

Fig. 4 shows a side view of a group of said elements.

The apparatus comprises substantially as many toothed discs —1— (Fig. 1) as there are stations. These discs being arranged one above the other are supported by the lateral expansions —41— of a tubular pivot —o''— supported in its turn by a stationary base —40—. The discs —1— are provided with diametrically opposite holes —42— for the passage of rods —43— designed to connect said discs with each other, which discs are arranged eccentrically in respect of the axis —o'''—o'''— of the hollow pivot —o''—. The eccentricity of the discs in respect of said axis may be varied, as will be explained hereinafter, by means of a rod —11— apt to shift them laterally in respect of the axis —o'''—o'''—. The openings —42— are shaped in such a way as to permit said shifting, the axis of the rod —11— being in alignment with the axis of the tubular pivot —o''—. Said rod is able to shift in the tubular pivot guided by the expansions —44—. The eccentricity of the discs in respect of —o'''—o'''— is determined in relation to the interval existing between the various stations, said eccentricity being variable in function of the distance by means of a cam capable of shifting the rod —11— upward or downward. Each disc —1— has a collar —4— (Fig. 2) revolving upon the disc by means of a worm —8— capable of meshing with teeth on the periphery of the disc. The whole device is enclosed in a frame —2— revolving around the axis —o'''—. The upper portion of this frame carries the sighting telescope which turns with the same about pivot —o''—. A shaft —3— fastened to the frame connects all the blocks —7—, more particularly described hereinafter, in such a way as to establish a connection between the rotary movement of the frame —2— and the simultaneous rotary movement of all the collars —4—. In Fig. 2 is represented one of the elements of the transmitting device, said element being designed to transmit the movement of the telescope from a controlling station —S— to an intermediate station —S^1—.

In Fig. 2, —1— represents one of the toothed discs mounted with an eccentricity o'—o''' relative to the axis o'''—o''' of the pivot o''—. The eccentricity o'—$o'''=d$ is regulated in accordance with the position of

the receiving station and also with the distance of the target observed in the manner set forth hereafter. Upon the disc 1 is fitted a revolving collar 4, carrying a worm 8 and an arm 5 with a forked end 6, within which may slide a block 7 revolving around pivot 3. Said collar acts as an eccentric strap; the worm, which engages the teeth of the disc 1 and is carried by the collar while turning, revolves also bodily around the disc 1, carrying along the collar 4, which acting by means of the fork 6 and block 7 upon the pivot 3 (fastened to the frame 2), causes the revolutions of the parts 3, 2 and of the sighting telescope around the axis —o'—.

Supposing that the worm turns on its own axis until it has caused the whole system (telescope, pivot 3, frame 2) to revolve around the axis O′ about an angle a, the collar 4 will have rotated around the axis O′ about an angle a', which, by reason of the eccentricity 0′ 0″ is smaller than a by the quantity s. There will always exist the relation $a-a'=s'$; and reckoning the angles a clockwise from the line x x, the values of s will be: nought when $a=o$ and $a=180$, positive for $a=0$----180, negative for $a=180$--360. It is further obvious that while the telescope, together with the frame 2 and the pivot 3 rotates about the angle a, the worm 8 will have completed a number of revolutions in proportion to $a-s=a'$. In the case of gun sighting or of the control of searchlights, the corrective angle is a function of the parallax due to the distance intervening betwen the transmitting and the receiving stations.

The parallax however depends not only on the value of the rotation angle of the telescope, i. e., the bearing of the target, but also on its actual distance. Therefore the correction angle must vary both with the direction of the sighting telescope and the distance of the target.

In order to obtain this result it will suffice to render the eccentricity, o', o' variable in function of the distance. For such purpose there is provided in the disc 1 (Fig. 2) an inclined opening 9 into which slides a rod 10 fastened to a vertical rod 11, controlled by a cam 12.

With this arrangement, assuming that the rotation of the cam 12 around its own axis 13 is a function of the distance of the target observed, by conveniently shaping the cam, it will be always possible to obtain, that by the axial displacement of the rod 11, the eccentricity O′ O″ of disc 1, be brought to the exact value giving the correction of the parallax.

By putting together several elements as afore described in each one of which the rod 10 has a convenient inclination, it is clear that in every disc may be obtained a different eccentricity and therefore different angles s' s'' s'''.

Therefore it will ensue $a=a'+s'=a''+s''=a'''+s'''+$etc., and consequently $a'=a-s'$, $a''=a-s''$, $a'''=a-s'''$.

It is therefore necessary that the various worms 8 make numbers of revolutions proportional respectively to a'; a''; a'''; etc.

A system of differential gears diagrammatically shown in Fig. 3 is provided for said purpose.

The figure shows four worms: the topmost engages a disc concentric with the rotation axis—o''—, Fig. 1, while the lower worms engage three other discs all having different eccentricities.

The discs are stationary, and the forks 6 of all the straps 4 are connected to the frame 2 through shaft 3 so that by rotating the crank 15, the frame 2 will be turned to train the telescope on the target, and the amount of rotation of each worm 8 depends on the eccentricity of its disc with respect to the pivot of frame 2, gears 14 thus being turned different amount to properly train the guns or searchlights.

By rotating the crank 15, through wheels 16 and 17 (carrying the satellite pinion 18) the movement is transmitted to the differential 18—19—20 and therefore to the axles 23 and 24, which carry the pinions 21 and 22; these, through their respective differentials, cause to revolve the pinions of screws 25, 26, 27 and 28.

It will be apparent that while the pinions 25, 26, 27, 28 rotate their corresponding worms 8 about angles which have a constant ratio to the number of revolutions of the crank 15 and while the worms 8, in their turn, each rotate around the corresponding discs 1 through the same angle, due to the eccentricity of the collars 4, the values of the angle s in the four elements will be different as explained above, according to the different values which have been assigned to the eccentricity a by suitably rotating the cam 12.

The worms are connected with the driving pinions on one side and with the transmitting organs on the other, by means of joints 14, which allow the worms themselves to slightly oscillate around pivot 3.

As it may be seen in this way is obtained that a single movement of rotation impressed to a common controlling organ is transmitted at the same time, to a plurality of stations, which may be in any number whatsoever, each one receiving the angle modified with the correction pertaining to it.

I claim as my invention:

1. In a transmission device comprising a single driving shaft, a plurality of driven shafts and a group of differential gears interposed between the said driving shaft and

the said driven shafts, means adapted to determine during operation the continuous variation of the speed ratios between the said driven shafts and the said driving shaft, and between the said driven shafts relative to each other, the said means for determining the variation of the speed ratios comprising eccentrics of variable eccentricity and having their collars connected with the shafts to be driven by the said driving shaft, the arrangement being such as to enable the speed of all the said driven shafts, except one, to be reduced to zero.

2. A transmission device as specified in claim 1, including means for sharing among the driven shafts the total number of revolutions imparted to them by the driving shaft.

In testimony whereof I have affixed my signature in the presence of two witnesses, this 8th day of April, 1920.

RICCARDO GIRARDELLI.

Witnesses:
GIOVANNI GIRARDELLI,
LETTUNI LABSAETTO.