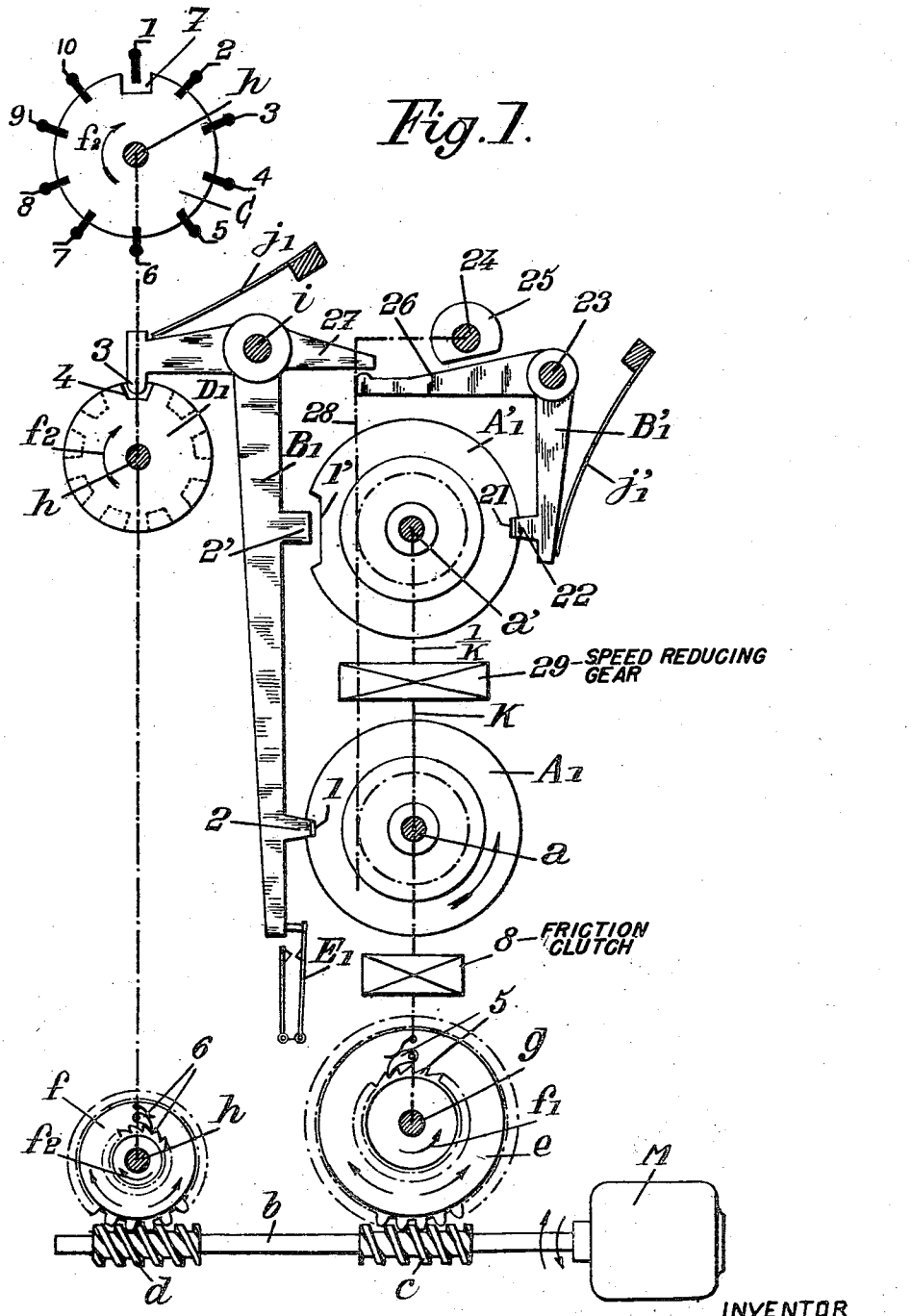
Nov. 27, 1951 A. J. MERLES 2,576,305

DEVICE FOR POSITIONING PARTS

Filed April 20, 1948 4 Sheets-Sheet 1



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Fig. 3

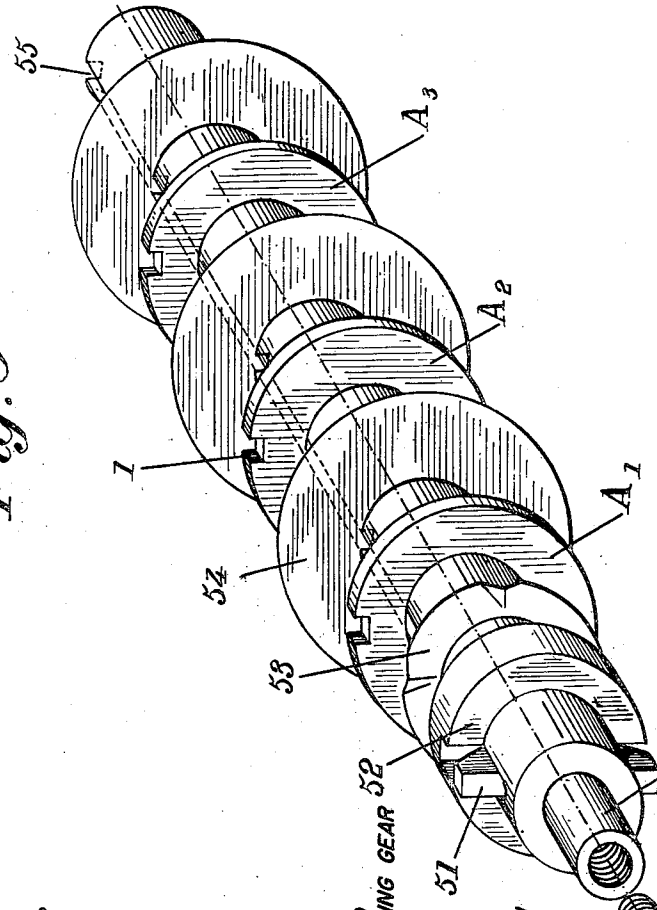
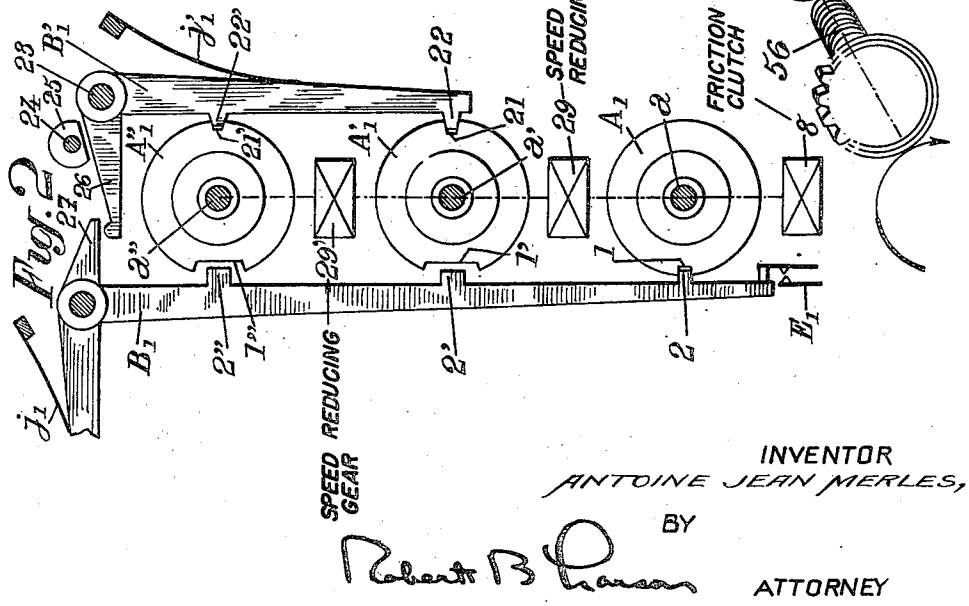


Fig. 2



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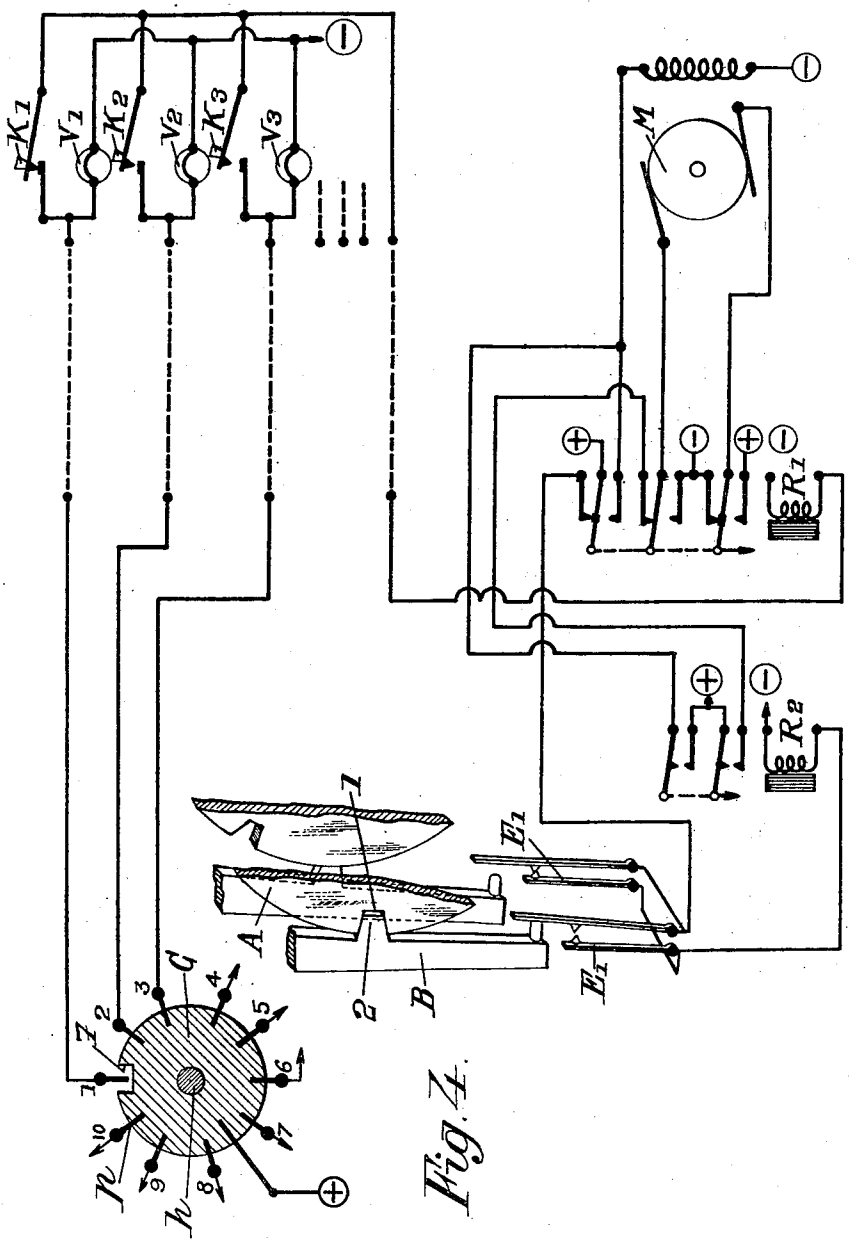


Fig. 4.

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Fig. 5.

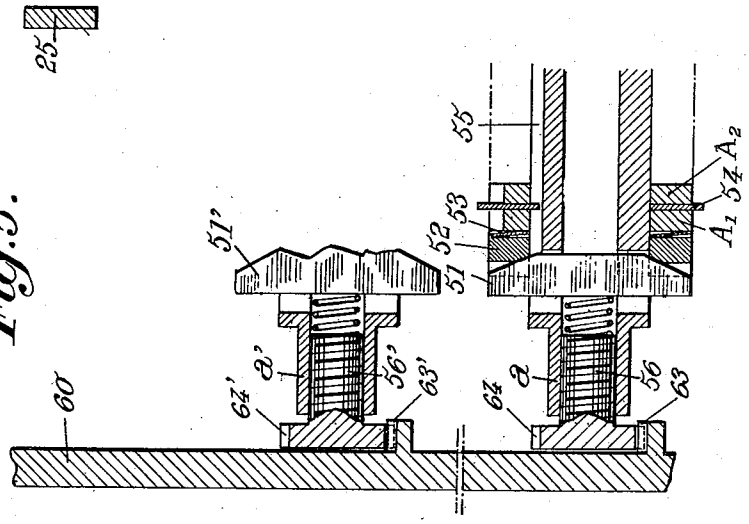


Fig. 7

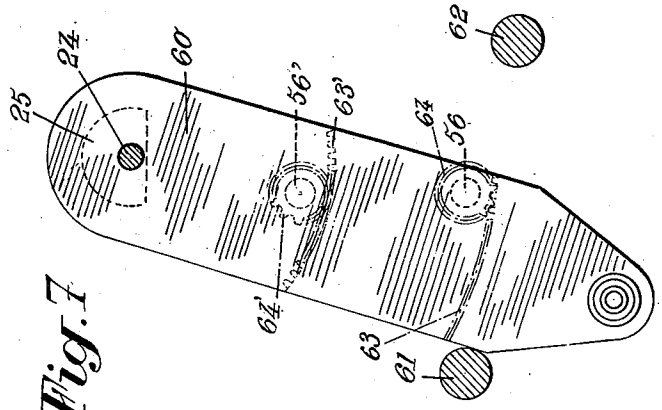
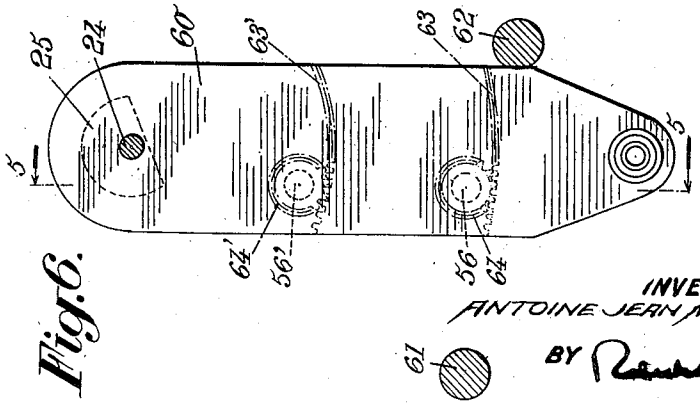


Fig. 6.



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UNITED STATES PATENT OFFICE

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DEVICE FOR POSITIONING PARTS

Antoine Jean Merles, Paris, France

Application April 20, 1948, Serial No. 22,193
In France December 20, 1947

3 Claims. (Cl. 74—10.2)

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The present invention relates to devices for positioning parts such, in particular, as elements of radioelectric transmitters or receivers, of the type described in my U. S. patent application Ser. No. 779,704, filed October 14, 1947, for "Positioning Devices," in which devices the parts to be controlled, once brought into the desired position, were positively locked in this position.

In this application I described only examples in which the angles of rotation of the parts to be positioned ranged from 0 to 360°.

The object of the present invention is to provide a device of this kind which permits of rotating the parts to be positioned through angles which may be greater than 360°, i. e. through angles α equal to $n \times 360° + \alpha'$, with α' ranging from 0 to 360°.

With this object in view, according to my invention, the control shaft through which the part to be positioned is operated is coupled through a speed reducing gear with another shaft so that the total angle of rotation of this last mentioned shaft is never greater than 360° and the means for positively locking the control shaft are operatively connected with the other shaft so as to be able to work only when said second mentioned shaft has rotated through an angle corresponding to the desired number of revolutions of said control shaft.

Other features of my invention will appear from the following detailed description of some preferred embodiments thereof, given merely by way of example, and in which:

Fig. 1 is a diagrammatic view of a device according to my invention;

Fig. 2 is a part view corresponding to a modification;

Fig. 3 is a perspective view on a larger scale of a device for securing in a removable manner positioning discs on a shaft;

Fig. 4 shows an electric diagram for use in connection with the device of Fig. 1;

Fig. 5 is a sectional view on an enlarged scale on the line 5—5 of Fig. 6;

Fig. 6 is a front view of control means for devices as shown by Fig. 3;

Fig. 7 is a view similar to Fig. 6 but showing a different relative position of the parts.

According to the embodiment illustrated by Fig. 1, the device is intended to position a shaft a used for driving, through any mechanical device (gears, racks, etc.), a part such as an adjustable inductance coil, for instance, this shaft being able to occupy any of a number of positions, say ten. For this purpose I fit on said

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shaft a, in a manner adjustable at will by the operator, ten discs A (A_1, A_2 . . . . A_{10}) including each a notch 1, intended to permit positive locking engagement with the finger 2 of one of the locking levers.

Shaft is coupled through a speed reducing gear 29, of the positive drive type (i. e. without possibility of slipping in the transmission and with as little play as possible), with another shaft a', which is also fitted with ten discs A' (A'_1, A'_2 . . . . A'_{10}) corresponding to discs A, respectively, and analogous thereto, in particular adapted to be individually adjusted in the desired angular positions with respect to their shaft a'. Each of these discs A' is provided with a notch 1'. The ratio of the speed reducing gear is such that shaft a' is never required to rotate through an angle greater than 360°.

To each group A, A' of discs there corresponds a locking lever B (B_1, B_2 . . . B_{10}) with fingers 2, 2' adapted to engage notches 1, 1', respectively, this lever being independent and movable about an axis i. Springs j (j_1, j_2 . . . j_{10}) push said levers in the direction that tends to urge fingers 2, 2' toward discs A, A' and also fingers 3, carried by a second arm of said levers, toward cams D to be hereinafter referred to. Means such as contact E, inserted in suitable electric circuits, are provided to stop shaft a, when fingers 2, 2' have entered their notches, 1, 1'.

On another shaft h are mounted ten cams D (D_1, D_2 . . . D_{10}) corresponding each to one lever B and the corresponding discs A, A'. These cams, rigid with axis h, are positioned at an angle of 36° from one another and are each provided with a notch intended to cooperate with the corresponding finger 3.

Shafts a and h are driven from a motor M in the following manner:

Motor M drives shaft a through shaft b, endless screw c, wheel e in mesh with said screw, a free wheel device 5, shaft g and a friction clutch 8, this arrangement permitting manual operation of this shaft a in both directions without having to disconnect motor M (since free wheel 5 permits rotation of shaft a in one direction and friction clutch 8 in the other).

On the other hand, motor M drives shaft h through the same shaft b, an endless screw d, a wheel f in mesh with said endless screw and free wheel 6. The gear ratio of transmission means d, f with respect to that of transmission means c, e is such that, for any given speed of motor M (shaft b), the speed of revolution of shaft h is the same as that of shaft a'.

Free wheel devices 5 and 6 are so arranged that when motor M is running in one direction, it drives shafts a and a' in the direction of arrow f_1, but does not drive shaft h, whereas, when said motor is running in the opposed direction, it drives shaft h in the direction of arrow f_2 but does not drive shafts a, a'.

Control of the running of motor M, first in one direction to drive shaft h, to operate cams D and then in the opposite direction to operate discs A, A', is obtained through an electric system (Fig. 4) including the following elements:

a. A ten positions switch including a conductor disc C, keyed on shaft h connected to the positive terminal of a source of current, and ten fixed contact studs p. Disc C is provided with an insulating notch 7 so that it is in electric contact with these studs p with the exception of the one that is located in this notch 7;

b. A control box (to permit control from a distance), this box comprising contacts K (K_1, K_2 . . . K_{10}) respectively connected to said contact studs p and, preferably, signal lamps V, which will be for instance all switched on (or off), except the one that corresponds to the position that is chosen, these signal means permitting supervision from a distance;

c. A reversing relay R_1;

d. A stopping relay R_2 connected with contact or contacts E_1.

The operation of such a system is as follows:

If it is supposed, for instance, that K_1 is closed and that the system is in position 1 (Fig. 1), it suffices in order automatically to obtain position 3 to close contact K_3, which characterizes this position, while opening contact K_1, that was closed.

Relay R_1 is then supplied with current through the following circuit: +, contact 3 of switch C, contact K_3, relay R_1 —. Relay R_1 is operated.

Motor M is supplied with current, and turns in the direction corresponding to the drive of shaft h, (arrow f_2), so that discs D and switch C are rotated. This movement goes on until the insulating notch 7 of said switch comes opposite contact stud p_3, which brings relay R_1 back to rest position.

During this movement, lever B_1 is first lifted under the action of tooth 3 leaving notch 4. It remains in this position, teeth 2 and 2' being therefore disengaged from notches 1 and 1'. As for the other levers B, they were already lifted since they were not engaged in their notches. At the end of this movement, lever B_3 is in a position such that its finger 3 is opposite the notch 4 of disc D_3, whereas its fingers 2 and 2' are rubbing on the periphery of the corresponding discs A_3 and A'_3.

On the other hand, it should be noted that, as all levers B are lifted, contacts E are closed: it follows that as soon as relay R_1 comes back to rest the motor starts in the opposed direction under the action of relay R_2 which is energized through the following circuit: + taken on the plates of relay R_1 at rest, contacts E, relay R_2 and —.

This rotation of motor M causes shafts a and a' to be driven in direction f_1 whereas h remains at rest. During this rotation, shaft a is rotated to make n full revolutions and a fraction α' of a revolution. All the levers B with the exception of B_3 are held by their fingers 3 applied against the periphery of the corresponding discs D. As for B_3, as above stated, its finger 3 is located opposite the notch 4 of its disc D_3. Therefore, in the course of the rotation of shaft a, the finger 2 of lever B_3 would engage into the notch 1 of the corresponding disc A_3 which passes n times opposite it if this were not prevented by the fact that the finger 2' of this lever B_3 is, during these n revolutions, running along the periphery of disc A'_3, which prevents any possibility of pivoting of lever B_3 toward the right. It is only when disc A'_3 has rotated through an angle corresponding to n revolutions of shaft a that the notch 1' of disc A'_3 comes opposite the tooth 2' of lever B_3 and permits engagement of finger 2 with notch 1. Contact E_3 is then opened and relay R_2 brought back to position of rest. Motor M stops and the operation is finished, its result having been to bring shaft a into the desired position 3 and positively to lock it in this position.

In order to enable finger 2 to engage correctly into its notch 1, without any risk of interference resulting from the cooperation of the corresponding finger 2' with its notch 1', said notch 1' is made substantially wider than its finger 2', so that finger 2' is ready to drop into notch 1' a short time before finger 2 comes exactly opposite its notch 1. However, of course, the angular play thus provided between 1' and 2' must be smaller than the angle through which shaft a' turns for one revolution of shaft a.

In view of the fact that fingers 2' engage with a certain play in their notches 1', it is advantageous, especially in order to permit adjustment of discs A' on shaft a' (which adjustment is performed by rotating shaft a' with respect to said discs disconnected therefrom and held in fixed angular position), to provide means for holding discs A' in fixed angular position. These means are of course to be kept normally out of action.

The means in question consist, as shown by Fig. 1, in levers B' (B'1, B'2, etc.) all freely pivoted, independently of one another, about a common spindle 23, each of these levers being provided with a tooth 22 adapted to engage, practically without play, a corresponding notch 21 provided in the corresponding disc A'. Said notches 21 are substantially narrower than fingers 2' so that there is no risk of these fingers engaging in notches 21.

Levers B' are urged toward their position of engagement with the corresponding discs A' by springs j' (j'_1 j'_2 . . . etc.) but they are held in inoperative position by a common cam 25 mounted on a shaft 24. On the other hand, each lever B' is rigid with an arm 26 engaged under a projection 27 of the corresponding lever B so that when a lever B has not its finger 2' engaged in the notch 1' of the corresponding disc A' it prevents the corresponding lever B' from engaging its tooth 22 into the notch 21 of said disc A'. This result might be obtained by making use of cams D.

With such an arrangement, adjustment of the angular position of a disc A and the corresponding disc A' is performed as follows:

Supposing the parts to be in the position shown by Fig. 1, i. e. the teeth 2 and 2' of lever B_1 engaged in the notches 1 and 1' of the corresponding discs A_1 and A'_1, the operator brings cam 25 into the position shown by the drawing.

Lever B'_1 is operated by its spring j'_1 to engage its tooth 22 into the notch 21 of disc A'_1, this operation being possible because the projection 27 of lever B_1 is lifted due to said lever B_1 having pivoted toward the left when its teeth 2 and 2' engaged into notches 1 and 1', respectively. But all the other levers B' are held in

inoperative positions by the lowered projections 27 of the corresponding levers B.

The operator then disconnects discs A_1 and A'_1 from shafts a and a', respectively. He can then proceed to the desired adjustment by rotating shaft a, while discs A_1 and A'_1 remain locked in fixed position by lever B_1 and B'_1.

When this adjustment has been performed, discs A_1 and A'_1 are again locked on their respective shafts a and a', cam 25 is turned to rotate lever B'_1 out of engagement with its disc A'_1 and the system is ready for operation.

Instead of acting separately upon the means for locking discs A and A' on their shafts a and a' and on cam 25, I might perform these operations simultaneously through a common control as diagrammatically shown at 28.

An example of means for locking the above mentioned discs, for instance discs A, on their shaft is illustrated by Fig. 3.

In this construction, shaft a is provided with a groove 55 in which are engaged projections of corresponding shape of annular elements 54 thus slidably keyed on said shaft.

Each of these elements 54 is adapted frictionally to engage a corresponding disc A (A_1, A_2, A_3) when pressed against it in the axial direction.

Normally all these elements 54 are strongly applied against their discs A respectively, due to the action of a transverse pin 51, pushed toward the right of Figs. 3 and 5 by a screw 56 engaged in shaft a, this pin 51 pushing a ring 52 which, through a resilient disc 53, tightly applies the adjoining elements 54 and A against one another. Discs A are then securely locked by friction with respect to shaft a.

When it is desired to adjust the angular position of one of the discs A, screw 56 is loosened. The friction between each of the discs and the corresponding element 54 can thus be reduced so that, if one of these discs is positively prevented from rotating (by means of its lever B brought into positive engagement therewith) shaft a can be rotated with respect to this particular disc. As for the other discs, as nothing opposes their rotation together with shaft a, the frictional connection with this shaft is still sufficient to keep them in the relative positions they occupied with respect to said shaft.

After this adjustment operation it suffices to tighten screw 56 to lock all of the discs securely on their shaft.

Of course, the same arrangement is provided for shaft a', corresponding elements being designated by the same reference members with prime indices.

The above mentioned common control means 28 might advantageously be interposed between screw 56 and shaft 24.

These control means are for instance constituted by a lever 60 keyed on said shaft 24 and oscillable between two positions, respectively shown by Figs. 6 and 7, determined by abutments 61 and 62.

Lever 60 is in the form of a plate the rear face of which (as shown by Figs. 6 and 7) is provided with circular racks or rows of teeth 63, 63' meshing with the toothed heads 64, 64' of screws 56, 56'.

Thus, when lever 60 is brought into the position of Fig. 6, screws 55 and 56' (corresponding to shafts a and a') are tightened by circular racks 63, 63' rotating the toothed heads 64, 64' of said screws respectively. Discs A and A' are locked on their respective shafts. Cam 25 is in

the position which locks arms 26 and levers B' in inoperative position.

When lever 60 is moved into the position of Fig. 7, cam 25 is brought into the position that releases arms 26 and enables levers B' to engage discs A'. The circular racks 63, 63' of lever 60 turn the heads 64, 64' of screws 56 and 56' to loosen said screws, thus releasing discs A and A'.

Fig. 2 relates to a modification according to which a third shaft a'' is driven by shaft a' through a speed reducing gear 29', discs A'' provided with notches 1'' being adapted to cooperate with fingers 2'' carried by levers B, the whole working in a manner analogous to that above described with reference to Fig. 1. Such an arrangement permits more accurate positioning and, chiefly, satisfactory working when the number of revolutions to be transmitted to shaft a is very high. If the gear ratio of each of the speed reducing gears is 10, the number n of revolutions and angle α' can easily be read on dials driven by the respective shafts.

While the essential features of my invention have been shown in the accompanying drawings, as applied to a system of the kind illustrated by Fig. 1 of the drawings of my prior U. S. application above referred to, it should be well understood that they might be incorporated in any other suitable systems of the same kind, for instance such as disclosed by Figs. 4 and 6 of this prior application.

It is pointed out that my device permits of obtaining a very high accuracy in the positioning of the parts to be controlled, the absolute errors that may take place averaging $\frac{1}{100}$ of a degree.

It should be well understood that the device according to my invention is applicable also to the case in which the shaft to be controlled rotates through angles not higher than 360°. In this case, this shaft would be a', transmission means c, e, 5, g and 8 being interposed between motor M and shaft a'. Such an arrangement would multiply by K (ratio of gear 29) the precision of the positioning device.

Devices according to my invention may be used for the construction of counters, for instance by making use of the arrangement of Fig. 2.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of my invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

What I claim is:

1. A device for positioning a shaft journalled in a frame which comprises, in combination, a plurality of juxtaposed discs fixed on said shaft coaxially therewith, said discs being provided with notches in their peripheries located in different radial planes respectively, another shaft journalled in said frame, a speed reducing gear interposed between said two shafts having a gear ratio such that the second mentioned shaft turns through at most 360° for the maximum number of revolutions of the first mentioned shaft, a plurality of juxtaposed discs fixed on said second mentioned shaft coaxially therewith and provided with notches in their peripheries located in different radial planes respectively, each disc of the second shaft being located in the same plane as one disc of the first shaft, respectively, a plurality

of levers each located in one of said planes, respectively, and pivoted in said frame about an axis parallel to said shaft, each lever being provided with two projections adapted to accommodate the notches of the corresponding discs, respectively, spring means operatively connected with said lever for urging said projections toward the peripheries of said discs, respectively, cam means for holding said levers out of contact from said discs, respectively, said cam means being adjustable to release only one of said levers at a time into engagement with the corresponding disc, selector means for adjustment of said cam means, a motor operative by said selector means for bringing said cam means into the selected position and rotating said shaft until the lever in operative position engages both of its projections into the respective notches of the corresponding discs and stops and locks said shaft in the desired position, the notch provided in each of the discs mounted on the second mentioned shaft being wider than the corresponding tooth, the angular play between said notch and said tooth being however smaller than the angular displacement of said last mentioned shaft that corresponds to one revolution of the other shaft, and a supplementary locking device for the discs mounted on the second shaft, this device being adapted to be brought into or out of action at will.

2. A device according to claim 1, further including a unidirectional kinematic connection between the elements of this supplementary locking device and the levers, respectively, so that said supplementary locking device can be operative only on the disc locked by the corresponding lever.

3. A device according to claim 1, including tightening means for securing the discs on their respective shafts, and means for bringing the supplementary locking device into or out of action in response to operation of said tightening means.

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