

June 21, 1932.

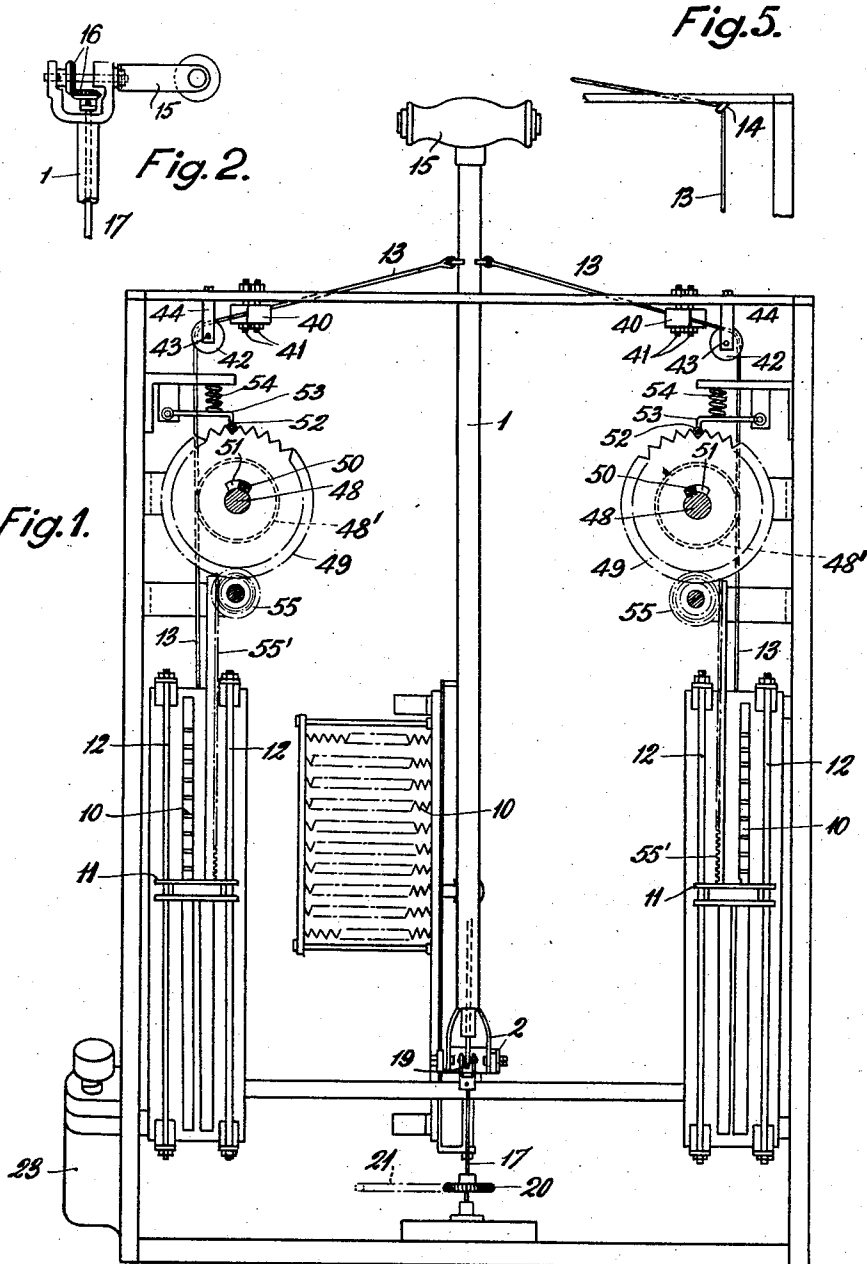
C. VOLK

1,864,329

CONTROL MECHANISM

Filed July 2, 1928

2 Sheets-Sheet 1



INVENTOR.
Conrad Volk.
by Arthur J. Surshme.
Attorney.

June 21, 1932.

C. VOLK

1,864,329

CONTROL MECHANISM

Filed July 2, 1928

2 Sheets-Sheet 2

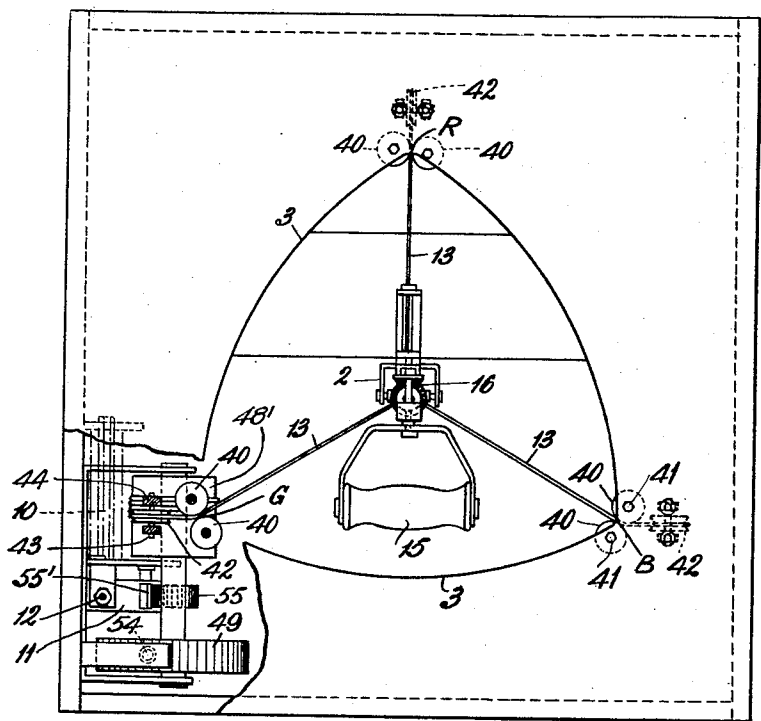


Fig. 3.

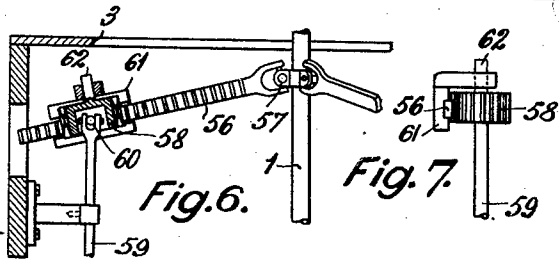


Fig. 6.

Fig. 7.

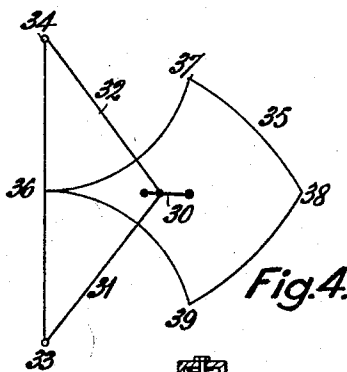


Fig. 4.

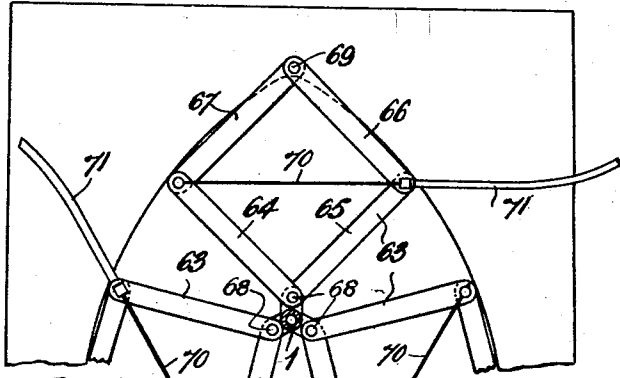


Fig. 8.

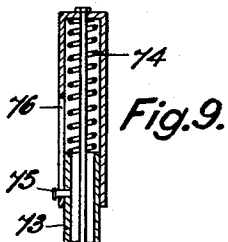


Fig. 9.

INVENTOR
Cornad Volk
by: Arthur J. S. S. S.
Attorney

UNITED STATES PATENT OFFICE

CONRAD VOLK, OF BRIGHTON, ENGLAND

CONTROL MECHANISM

Application filed July 2, 1928, Serial No. 289,843, and in Great Britain July 8, 1927.

This invention relates to control mechanism which enables up to four variables to be controlled simultaneously with one hand, each position of the control handle giving a definite adjustment of every variable. The mechanism can be applied to any case where such control is desirable and the control of colour lighting, of white lights at different positions say in photographic studios, engine controls, aircraft control and the control of wireless apparatus may be given as examples.

In its broadest aspect the invention comprises a universally jointed lever which actuates two or three radial control members which pass away from it through points fixed in relation to the joint upon which the lever is mounted. The fixed points and joint are relatively arranged so that the control members are fully actuated by lateral movements as well as straight line movements of the lever in relation to the fixed points. The invention also includes the case where the lever is replaced by a member universally slidable in a plane, that is the equivalent of a lever of indefinite length. A further control may be independently actuated by a movement in relation to the axis of the lever that is by rotation or longitudinal movement. Preferably the range of movement of the lever is limited by a gate set out as described below.

In order that the invention may be fully understood and practiced it will be further described with reference to the accompanying drawings, in which—

Figure 1 is an elevation,

Figure 2 a detail view, and

Figure 3 is a plan view, of one embodiment of the invention.

Figure 4 is a diagrammatic plan of another embodiment,

Figure 5 is an elevation of a detail constructional modification,

Figure 6 is a detail view of an alternative arrangement in which the radial members comprise racks actuating pinions at the fixed points,

Figure 7 is a detail view taken at right angles to Figure 6,

Figure 8 is a detail view of a further alternative arrangement in which the radial members comprise linkages,

Figure 9 shows diagrammatically a telescopic axial control.

Considering first the simplest case of two radial members shown in Figure 4 of the accompanying drawings. It is clear that if the lever 30 be moved in a plane containing the joint, the lever and the two fixed points 33 and 34, one control member 31 will be paid out as the other 32 is drawn in and thus two controls to which the members 31 and 32 are attached can be actuated so that the sum of their settings is constant. For example one door may be opened and another closed, or one light dimmed and another brightened. By moving the lever out of the above mentioned plane both controls can be drawn upon and the sum of the control settings will no longer be constant but any combination up to full actuation of both controls obtained. To assist in obtaining any relative proportion and total sum of adjustment the movement of the lever may be circumscribed by a closed gate 35 of substantially lozenge shape which will be bounded by two arcs described about the fixed points 33 and 34 as centre respectively, one with radius giving the zero position of the control and the other with radius giving the full position of the control. To enable a closed figure to be obtained the radial control members must in general be long enough to allow both to be at zero together. The limiting case will be when they occupy this position with the lever in the plane containing the joint, the lever, and the fixed points when one corner 36 of the gate will be in the said plane as shown. If the effect of moving the lever in contact with the gate be considered it will be seen that at one point 36 both controls are at zero. On moving away towards 37 control 32 remains at zero, and control 31 gradually increases till 100% is reached at 37. Along the next side control 31 remains at 100% and control 32 increases to 100% at the next corner 38 diagonally opposite the 0.0 corner 36. From 38 control 32 remains at 100% and control 31 decreases to 0 at the next corner. From 39 control 31 remains at 0 and 32 decreases

to 0 at 36. It will be seen that by intermediate movements of the lever 30 out of contact with the gate any proportion less than 100%, 100% can be obtained and that the mechanism will therefore provide every possible combination between 0, 0 and 100, 100. Moreover, there will only be one lever position for any particular combination setting. By providing a twist or telescopic control on the lever a third variable may be controlled independently of the other two and thus any combination between 0 and 100% of all three controls obtained. It will of course be understood that in particular cases what has been described as the 0 position may in fact be a partly actuated position for one or more of the controls, and that the controls may operate in the reverse direction when the 0, 0 and 100, 100 positions will be at 38 and 36 respectively.

Considering now the case of three radial members, as shown in Figures 1 and 3. The device as illustrated comprises a lever 1 provided with a handle 15 and carried on a universal joint 2. To the lever are secured the three radial members here consisting of flexible cords 13 which pass away between rollers 40 which form the fixed points. The fixed points are marked R G and B which may represent the variables to be controlled by the device. It is clear that if the lever 1 be moved between two of the fixed points 14 through an arc 3 about the third, the first two controls 13 will be paid in and out respectively in such a manner that the sum of their adjustments is practically constant while the third control is unaffected. Similarly for any other two, while different combinations of all three can be obtained by setting the lever inside the figure bounded by the three arcs 3. As before the lever may be circumscribed by a gate which will be defined by the said three arcs 3. To obtain an equal control over each radial member the fixed points 14 will be at the vertices of an equilateral triangle, while the lever joint 2 will be on a perpendicular to the mid point of the plane of the triangle.

The control possibilities of this arrangement can be considerably varied while still maintaining the features of a definite combination for every position of the lever. It will be understood that more than three control members cannot be used without limiting the range of combinations. If each control varies from α -100% over the whole movement of the lever away from the fixed point, by going round the gate every position will give one control at 100% and the other two at positions in which their sums are 100%. Thus in moving the lever 1 say from R to B 100% of G will be constantly obtained while the sum of R and B will be 100% starting from R=0, B=100 to R=100, B=0. With the lever at the mid point, each control will be at 50%. It is therefore clear that 100% of each cannot be

obtained although any relative proportions can be obtained.

The controls can also be arranged to work the opposite way, that is each control varying from 100%-0 over the whole movement of the lever away from a fixed point. Here travel round the gate will give one control at 0 and the other two at positions in which their sums are 100%. Thus in moving the lever 1 say from R to B, G will be constantly at 0 while the sum of R and B will be 100% starting from R=100, B=0, to R=0, B=100. With the lever at the mid point each control will again be at 50%. As before 100% of each cannot be obtained although any relative proportion can be obtained.

To enable 100% of all three variables to be obtained the controls may be arranged so that when the lever is at the centre all three variables are at 100% each remaining at 100% while the lever moves towards the fixed point for the respective variable and diminishing to 0 when the lever moves away from the centre to the side of the gate opposite the fixed point. This arrangement gives any combination of two variables plus 100% of the third. The reverse arrangement, 0 at the fixed point and 100 from the centre to the remote side will provide two controls at 100 plus any proportion of the third up to 100. In a further arrangement the three variables may be at 0 at the centre, remaining so during movement to the respective fixed point, while increasing to 100% from the centre to the gate side remote from the fixed point. This arrangement gives any combination of two variables alone from 0 to 100%. The reverse arrangement of 100 at the fixed point and 0 from the centre to the remote side will give any proportion of each control by itself only.

It will be understood that different arrangements of control for each variable may be provided and that the ranges need not be from 0-100%.

As before a twist or telescopic control may be provided which may control a fourth variable independently, or it may control all three variables simultaneously either arithmetically, that is to say adding or subtracting equally to or from each variable irrespective of the position of the lever, or geometrically that is to say effecting the same ratio of change in each variable irrespective of the position of the lever. Such an additional control will also enable the mechanism to control three variables so as to give any combination of each from 0-100%.

The cords 13 make slight vertical movements, during the movements of the lever 1, which are taken care of by the pairs of cylindrical rollers 40 on spindles 41 parallel to the mid position of the lever. From the roll-

ers the cords 13 may pass over a pulley 42 on a spindle 43 and may actuate the variables to be controlled directly or through multiplying or, as shown, reducing gears, or by remote control. Conveniently the spindles 41 are bolted direct to the gate 3 while the spindle 43 is carried in brackets 44 secured to the gate.

A simpler arrangement of fixed point for use with cords 13 is shown in Figure 5. Here the cords simply pass through eyes 14 secured to the framework of the apparatus but it will be understood that this construction is not so good as that shown in Figures 1-3.

Alternatively to flexible cords the radial members may comprise rigid members such as racks actuating pinions as shown in Figures 6 and 7, or linkages as shown in Figure 8.

In Figure 6 each radial member comprises a rack 56 universally jointed to the lever 1 at 57, and engaging a pinion 58 located at the fixed point. To allow for the slight tilt involved by the movement of the lever, each pinion is mounted on a shaft 59 which actuates the desired variable controlled by the apparatus, by means of a universal joint 60 within the body of the pinion. The racks are maintained in mesh with the pinions by means of guide members 61 mounted on spindles 62 rigid with the pinions.

In Figure 8 the lever 1 actuates three linkages 63. Each linkage comprises four bars 64, 65, 66, 67 jointed together to form a rectangle. One joint 68 is pivoted to the lever 1 and the diagonally opposite joint 69 is pivoted to a fixed point. The other two joints form the anchorages of the inner and outer members 70, 71, of a Bowden mechanism by which the desired variables are controlled. The radial members may be provided with stops which provide a virtual gate but preferably the lever is circumscribed by an actual gate as illustrated since its visibility aids in making the adjustments. The radial members may also actuate or carry indicators showing the setting of their particular variables.

Where an axial additional control is used the lever may be telescopic, the telescoping action operating a further flexible or rigid member. As seen in Figure 9 the handle 72 of the lever 1 is slidably mounted and actuates a rigid rod or flexible member 73 which effects the additional control. If desirable or necessary a spring such as 74 may be used which normally retains the handle in one position, here the outermost. The handle is prevented from coming right off the lever by a pin 74 projecting into a slot 76 in the handle. Preferably, however, as shown in Figures 1, 2 and 3, a twist grip is provided. The handle 15 is rotatable on an axis at right angles to the lever, the rotation

being transmitted through bevel gears 16 to a shaft 17 carried within the lever 1 and having a universal joint 19 with the same center as the lever joint 2. As shown the shaft 17 carries a pinion 20 actuating a rack or chain 21, but a drum and cord may be used instead. Preferably the full range of control of the twist grip is provided by a small rotation of the handle 15 for convenience in manipulation.

It will be understood that though the mechanism will give adjustments with infinite gradation it may be used in cases where the control has to be made in small steps. Where such steps have to be made in jerks as is often necessary in the making and breaking of electric contacts, the radial members may actuate a step by step mechanism adapted for this purpose. Thus, as shown for example in Figures 1 and 3 they may each be passed around a drum 48' and carry a weight (not shown) to keep the cord taut. The drum 48' is fast on a shaft such as 48 carrying a wheel 49 coupled to the shaft by an arrangement permitting lost motion for instance the key 50 and wider keyway 51. The wheel is toothed and a roller 52 on a blade 53 pressed by a spring 54 works on the teeth so that when the roller just passes over the head of a tooth the wheel jumps on till the roller is midway between the teeth. Alternatively a ratchet may be used. The wheel 49 will operate the actual contact mechanism say through a pinion 55.

As an example of an actual control Figures 1 and 3 show the device fitted with electric resistances which may be used for example for controlling electric light sources. Such light sources may for example be those located at different points in a photographic studio when a rapid and definite control of lighting can be obtained. Or they may be sources giving coloured light of the three primary colours so that any desired coloured light may be projected.

The resistances 10, comprise twelve or other suitable number of stages from maximum current to off. The resistance is advantageously of the form in which a contact member 11 is slidably mounted on guides 12 to travel over the various resistance stages. The co-acting contacts of the latter may be arranged in relation to the slider-guides, so that the slider has a degree of idle travel before the first stage of dimming is reached.

Each slide 11 carries a rack 55' meshing with a pinion 55 itself meshing with the corresponding wheel 49, and the arrangement may be such that movement of the lever towards the corner will cause the slider to move (against gravity, spring or the like) to the maximum current position; movement away from the corner will allow the slider to descend over the resistance, until such time as the lever has reached the limit of its travel

from the corner, as governed by the gate 3, and the slider has been shifted to a degree giving the off position. By this arrangement, an extremely wide variation of portions of the three currents is obtained.

It is to be understood that movements may be imparted to the lever of the present invention and its handle by automatic and mechanical means, according to a pre-arranged cycle, or set-sequence. Such a modification is contemplated for, inter alia advertising and display apparatus.

What I claim is:—

1. A control mechanism comprising a frame structure, a lever universally jointed to said structure, two radial control members each secured to said lever and passing away through respective points fixed on said structure in such positions that said radial control members can be fully actuated by lateral movements as well as straight line movements on said lever in relation to said fixed points, a twist grip member mounted on said lever, a rotary additional control member carried axially of said lever, and means coupling said twist grip to said additional control member.

2. A control mechanism comprising a frame structure, a lever universally jointed to said structure, two radial control cords each secured to said lever and passing away through respective points fixed on said structure, and step by step mechanism actuated by each of said radial control members.

3. A control mechanism comprising a frame structure, a hand actuated movable member, means on said structure for restraining said movable member so that a point thereon is maintained within a defined surface, two independent radial control members actuated by said movable member, and a third independent control member carried by said movable member and actuated by movements with respect to an axis perpendicular to the instantaneous plane of movement of the points of attachment of said two radial control members to said movable member.

4. A control mechanism comprising a frame structure, a hand actuated movable member, means on said structure for restraining said movable member so that a point thereon is maintained with a defined surface, three independent radial control members each secured to said hand actuated member and passing away through respective points fixed on said structure in such positions that each said radial control member can be fully actuated by lateral movements as well as straight line movements of the hand actuated member in relation to the corresponding fixed point, and an additional control member carried on said hand actuated member and actuated by movements with respect to an axis perpendicular to the instantaneous plane of movement of the points of attach-

ment of said radial control members to said hand actuated member.

In testimony whereof I have signed my name to this specification.

CONRAD VOLK. 70

75

80

85

90

95

100

105

110

115

120

125

130