June 9, 1953 J. H. BENNETT, JR 2,641,629

CONTROL WHEEL AND WIRING

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Fig. 1.

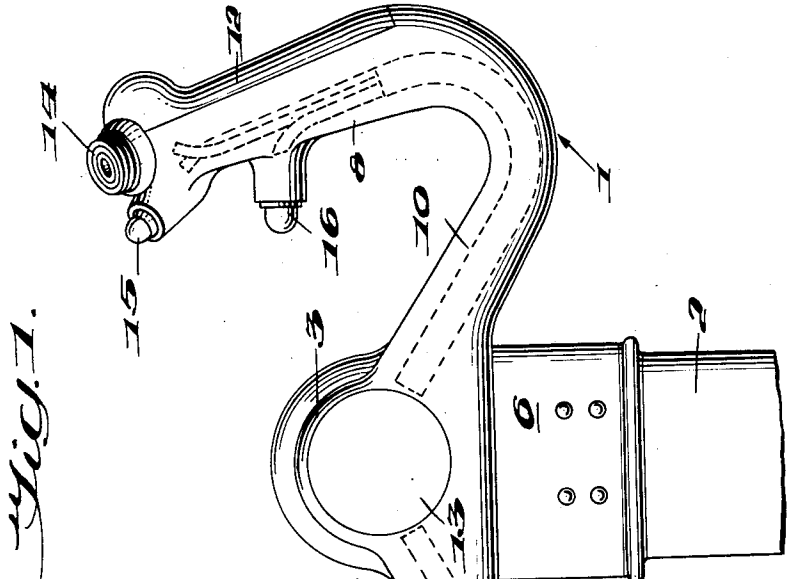

Fig. 2.

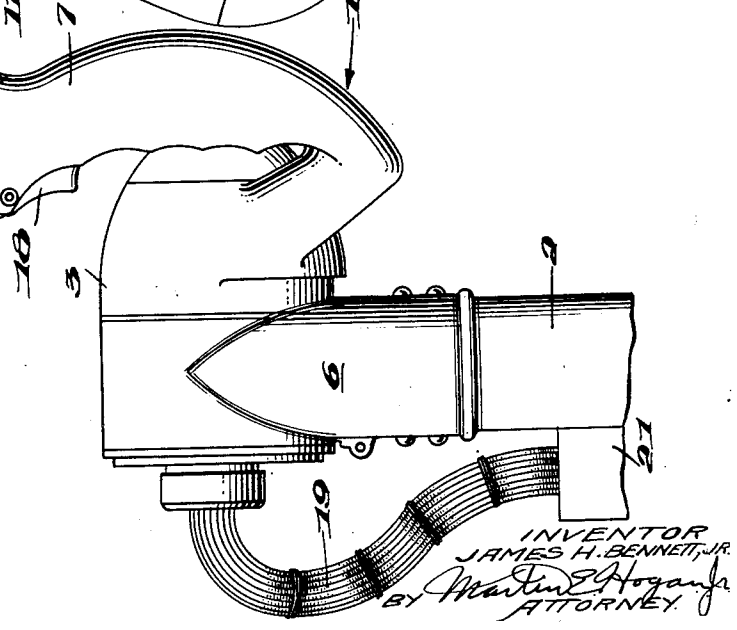

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Fig. 4.

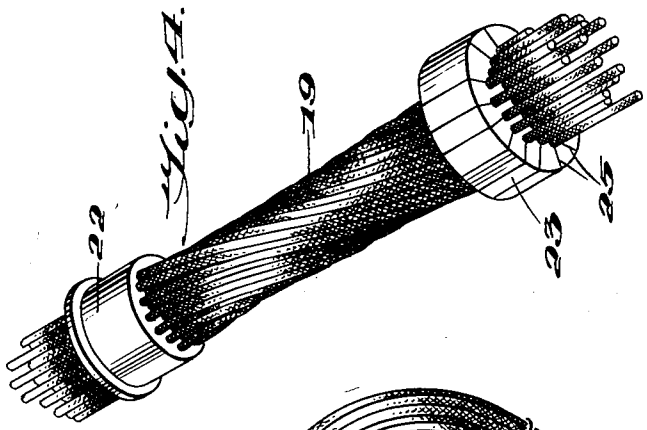
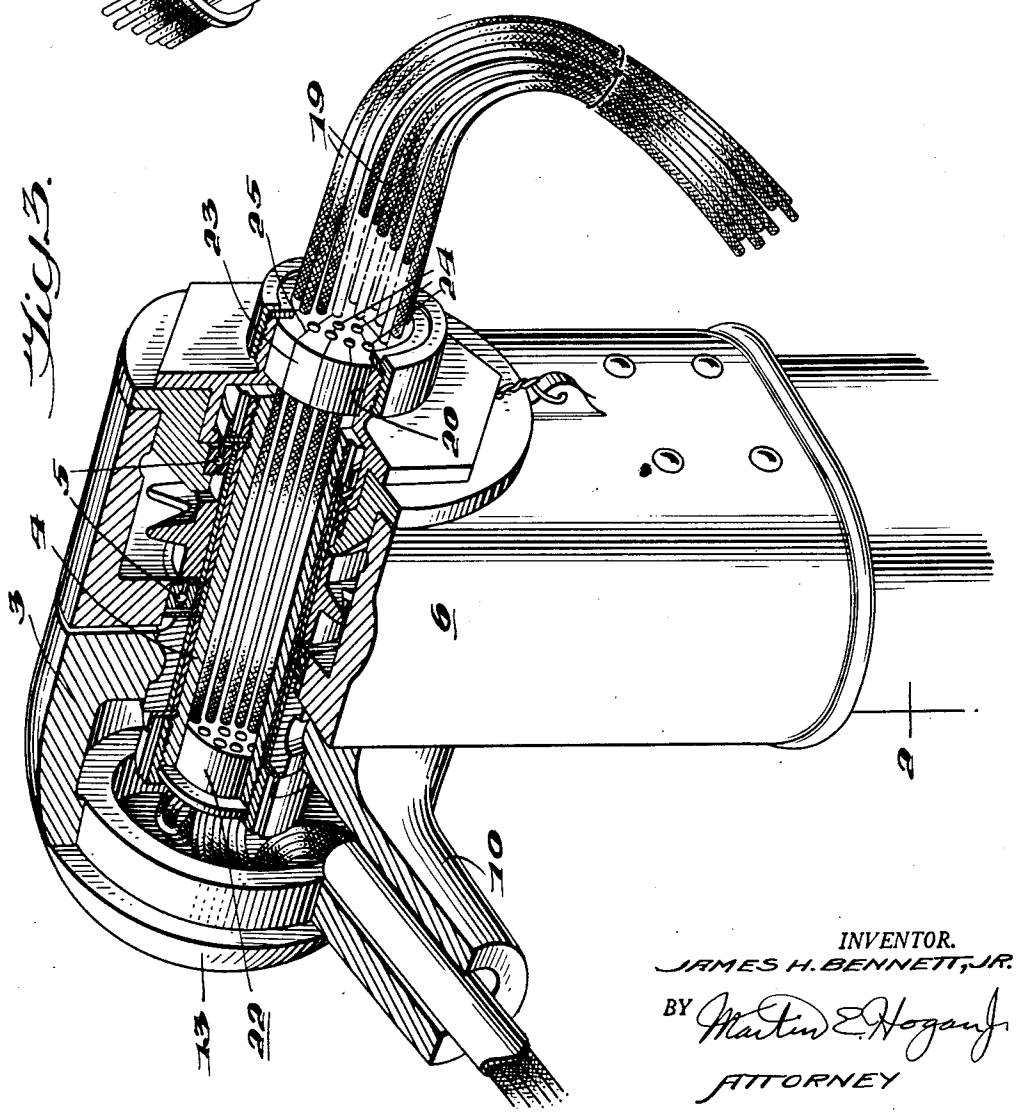


Fig. 3.



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2,641,629

CONTROL WHEEL AND WIRING

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5 Claims. (Cl. 174—86)

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This invention relates to an improved control wheel for an airplane and particularly to the manner in which electrical connections may be brought to the numerous control switches located thereon.

In the modern airplane, particularly of the military type, it has become more and more common to locate various control switches upon the pilot's control wheel so that they may be readily actuated without interfering with his ability to continuously maneuver the aircraft. These switches are usually arranged on the grip portions of the control wheel assembly where they may be actuated by movement of the thumb or fingers of the pilot. As the number of these switches has steadily increased, the number of electrical leads has likewise increased (to as many as 20 or 30 in some cases), and the problem of bringing these electrical leads through the swivel mount for the control wheel has become correspondingly more severe. While, where a relatively small number of wires is involved, slip rings may perform this function reasonably satisfactorily, where a large number of wires must be led through the swivel connection to the control wheel, a slip ring assembly becomes too bulky and complicated to give trouble-free action. There has therefore been a continuous search for a method of bringing a large number of leads through to the control wheel which would provide a trouble-free, light and relatively compact arrangement.

An object of this invention is to provide an arrangement for bringing a large number of electrical leads through from a relatively stationary control column to a swivelly mounted control wheel on the upper end thereof.

It is a further object to provide in such an assembly an arrangement which is free from sliding contacts and yet in which the individual leads will not be subject to prohibitive wear or strain.

A further object is to provide an improved arrangement for running a plurality of electrical connections through a swivel joint.

Further and other objects will become apparent from a consideration of the following specification and claims taken in view of the accompanying drawing.

In the drawing:

Figure 1 is a rear view of the upper portion of the control column showing applicant's improved control wheel mounted thereon.

Figure 2 is a side view of the control wheel assembly.

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Figure 3 is a fragmentary perspective view showing in detail the manner in which the electrical leads are arranged with the swivel connection between the control column and the control wheel.

Figure 4 is a fragmentary perspective view showing the position of the various leads when the wheel has been rotated to its full extent in one direction from neutral position.

The improved control wheel assembly includes a control wheel 1 swivelly mounted on the upper end of a control column or support 2 for limited oscillation relative thereto. The wheel 1 includes a hub portion 3 which in turn includes a generally cylindrical sleeve assembly 4, rigid therewith and mounted for rotation about its longitudinal axis by spaced bearings 5 carried by the head portion 6 of the control column. Sleeve assembly 4 and head portion 6 constitute therefore a swivel connection between the wheel 1 and the support 2. The wheel further includes a pair of grip portions 7 and 8 connected to the hub by spokes 9 and 10 formed integrally therewith. As is shown in Figures 1 and 3, the hub, spokes and grip portions of the wheel are hollow, access to the interior being provided by means of removable cover plates 11 and 12 on the grips and a removable hub cap member 13. Arranged within the grip portions of the wheel are a plurality of switches which include actuator elements 14, 15, 16, 17 and 18 extending outwardly through suitable openings in the grips, and so located that they may be conveniently operated by the thumb or fingers of the pilot while his hands are resting on the control wheel. The various electrical leads 19 for these switches extend from the switch terminals through the hollow interior of the grip portions and spokes of the wheel and then extend through the hollow interior of the sleeve 4 and outwardly through a suitable opening 20 provided in the forward side of the head portion 6. From this point the leads are cabled together and extend to a suitable junction box 21 located on the forward side of the control column 2 as shown in Figure 2.

If these leads 19 were merely cabled together where they pass through the swivel joint they would rob against one another and against the interior of the sleeve, as the control wheel was oscillated back and forth, to such an extent that in a very short time the insulation of the individual leads would be worn off and shorts would occur. On the other hand, were these leads allowed to run loosely through the swivel joint,

they would tend to entangle and kink to such an extent that they would very rapidly break. To overcome these difficulties, I have provided the following novel arrangement for supporting and guiding the leads through the swivel joint.

As shown in Figure 3, a pair of spacer elements or glands **22** and **23** are provided, gland **22** being rigidly carried by the wheel assembly and gland **23** being rigidly carried by the head **6**. Gland **22** is made in the form of a generally cylindrical plug of phenolic material and is rigidly carried at the rear end of the sleeve assembly **4** interiorly of the hub **3**. Gland **23** is a similar plug, preferably of rubber or rubber-like material, fixedly mounted in the opening **20** of the head **6** and, as clearly shown in Figures 3 and 4, is spaced axially from the spacer element **22**.

Each spacer element or gland is provided with a plurality of spaced holes **24**, one for each lead, the holes being similarly located in each spacer and being preferably symmetrically arranged about and parallel to the axis of the swivel joint. To facilitate insertion and removal of the leads from the rubber spacer **23** (as when the wheel assembly is being removed from the control column for inspection or replacement) the holes **24** therein are connected by generally radial slits **25** with the outer periphery of the spacer. The spacers **22** and **23** are so oriented that, when the control wheel is in its neutral position about the swivel axis, the corresponding holes in the two spacer elements are in substantial alignment. The individual leads **19** extend through the holes in spacer element **22**, then axially along the swivel joint, and out through the corresponding holes in the fixed gland **23** as clearly indicated in Figure 3, so that, with the wheel in neutral position, the individual leads are supported in spaced relationship parallel to the axis of the swivel joint.

The extent of rotative movement of the control wheel is limited, by conventional structure (not shown) in this particular case to about 120° either side of neutral position, and Figure 4 shows the positions of the various leads when the wheel has thus been rotated to its full extent in the counter-clockwise direction looking forwardly. Since the individual leads are, in the neutral position, spaced from one another, they are free to twist completely independently of one another and even in the extreme position shown there is but very slight rubbing action between any two adjacent leads. The holes **24** in the glands, being preferably made of such size as to closely embrace the outer surface of the leads tend to oppose any tendency of the leads to slide endwise therethrough. Gland **23**, being of somewhat flexible material, may flex slightly inwardly as the wheel is rotated from neutral position to relieve any tension forces which might otherwise obtain in the individual leads.

This arrangement for bringing leads through a swivel joint, particularly where the extent of swivel movement is limited as in the case of a control wheel, has been found to most effectively solve the problems which have heretofore confronted those skilled in the art. The above described control wheel arrangement has undergone extensive testing through a full 240° of continuous oscillations and under extreme variations in temperature, well beyond any which would be anticipated in actual use in an airplane, and has been found to perform most satisfacily. The arrangement is extremely compact, light in weight, and permits ready installation or removal from a control column and has been found to be far more satisfactory than any arrangement heretofore known or used for this purpose.

While but a certain number and arrangement of switches has been shown, it is obvious that either more or fewer switches could be employed without in any way departing from the principle of this invention. Other changes and modifications will be obvious to those skilled in the art and can be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim as my invention:

1. In a control wheel assembly including a support, a control wheel having a hub mounted on said support for limited oscillation relative thereto about a predetermined axis, a plurality of electrical devices carried by said wheel, and a plurality of electric leads for said devices carried by said support and extending to said devices; means for supporting said leads comprising a spacer element rigidly carried by said support adjacent said axis, and a second spacer element spaced axialy from said first spacer element and rigidly supported by said hub, each of said spacer elements being provided with a plurality of spaced holes extending therethrough substantially parallel to said axis, one for each of said plurality of leads, said leads extending from said support, through the holes in said first spacer, then through the corresponding holes in said second spacer and thence to said devices, said leads, when said wheel is in neutral position, being spaced from one another and extending substantailly parallel to said axis between said spacers, and one of said spacers being adapted to resiliently oppose axial movement of said leads during rotation of said control wheel from its neutral position.

2. In a swivel joint for a control wheel, a support, a movable member pivotally carried by said support for limited oscillation about a predetermined axis relative thereto, a spacer element rigidly carried by said support adjacent said axis, a second spacer element rigidly carried by said movable member spaced axially from said first spacer element, each of said spacers being provided with a plurality of holes spaced from one another and extending generally parallel to said axis, and a plurality of electrical leads extending between said support and said movable element, said leads extending from said support, through the holes in said first spacer element, thence through the corresponding holes in said second spacer element and to said movable element, the arrangement of holes in said spacer elements being such that when the movable element is in neutral position, the leads extend substantially parallel with the axis in spaced relationship to one another between said spacers, and one of said spacers being adapted to resiliently oppose axial movement of said leads during rotation of said member from its neutral position.

3. In combination with a relatively fixed support, a member swivelly connected to said support for limited oscillation relative thereto about a predetermined axis, and a plurality of electrical leads extending from said support to said member, means for guiding and supporting said leads comprising a first spacer element fixedly carried by said support adjacent said axis and a second spacer element spaced axially from said first spacer element and fixedly carried by said member for movement therewith, each of said spacer elements being provided with a plurality of spaced holes, one for each of said leads, adjacent said

axis and extending substantially parallel thereto, each of said holes being of such size as to snugly embrace a lead extending therethrough, said leads extending from said support, through the first spacer element, then through the second spacer element and to said member, said spacer elements being so oriented that when the member is in neutral position about said axis, the leads will extend in spaced relationship to one another, substantially parallel to said axis, between said spacer elements, and one of said spacers being adapted to resiliently oppose axial movement of said leads during rotation of said member from its neutral position.

4. In combination with a relatively fixed support, a member swivelly connected to said support for limited oscillation relative thereto about a predetermined axis, and a plurality of electrical leads extending from said support to said member, means for guiding and supporting said leads comprising a first spacer element fixedly carried by said support adjacent said axis and a second spacer element spaced axially from said first spacer element and fixedly carried by said member for movement therewith, each of said spacer elements being provided with a plurality of spaced holes, one for each of said leads, adjacent said axis and extending substantially parallel thereto, each of said holes being of such size as to snugly embrace a lead extending therethrough, said leads extending from said support, through the first spacer element, then through the second spacer element and to said member, said spacer elements being so oriented that when the member is in neutral position about said axis, the leads will extend in spaced relationship to one another, substantially parallel to said axis, between said spacer elements, one of said spacer elements being formed of flexible rubber-like material whereby, upon movement of said member from neutral position, said one spacer element may flex slightly in a generally axial direction to minimize strain in said leads.

5. In a swivel joint for a control wheel, a relatively fixed support, a movable member swivelly carried by said support for limited oscillation about a predetermined axis relative thereto, said member including a generally cylindrical sleeve assembly rigid therewith, the axis of which is substantially coincident with said swivel axis, a plurality of electrical leads extending from said support, through the interior of said sleeve, to said movable member, and a pair of spacer elements for supporting and guiding said leads through said joint, a first of said spacer elements constituting a plug rigidly secured in one end of said sleeve for rotation therewith and the other of said spacer elements being rigidly secured to said fixed support opposite the other end of said sleeve, in alignment with and axially spaced from said first spacer element, said spacer elements each being provided with a plurality of spaced holes extending therethrough substantially parallel to said axis, said leads extending through said holes in said spaces, said holes being of such diameter as to closely embrace said leads and being correspondingly arranged in both of said spacers, said spacers being so oriented that, when the movable member is in neutral position, the individual leads will extend in spaced relationship to one another through and between said spacers and substantially parallel to said swivel axis, and one of said spacers being adapted to resiliently oppose axial movement of said leads during rotation of said member from its neutral position.

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