Sept. 30, 1947. J. A. HERBST 2,428,218

TELEGRAPH RELAY

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Fig. 1.

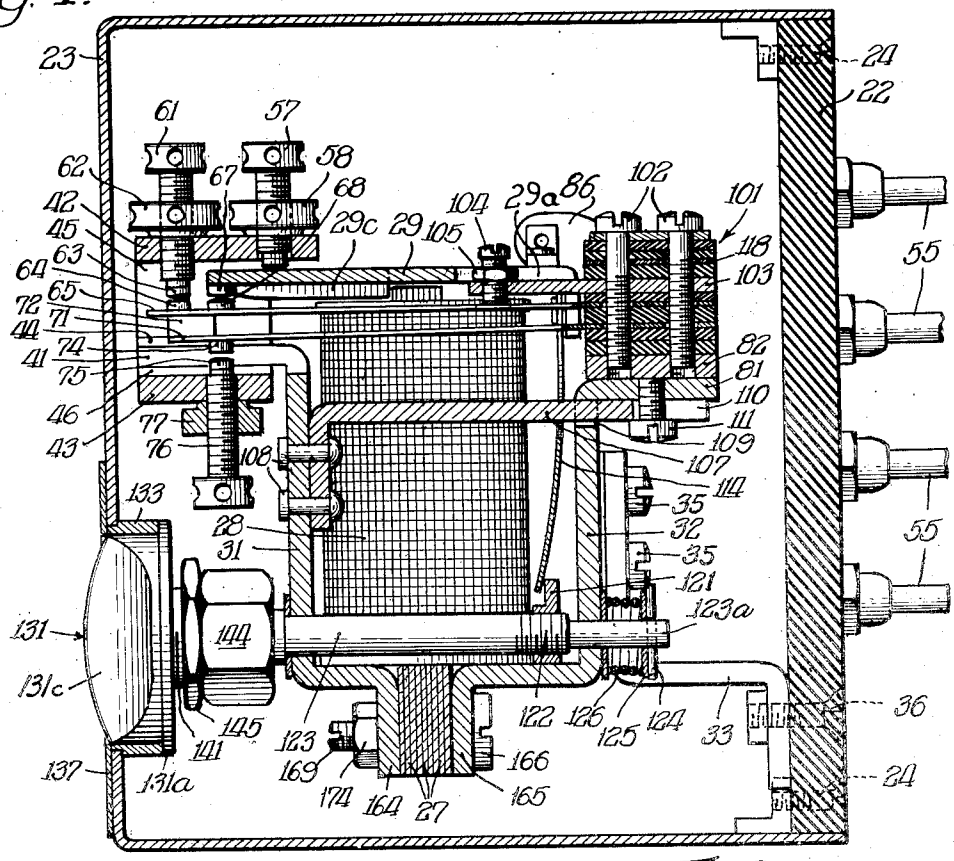


Fig. 2.

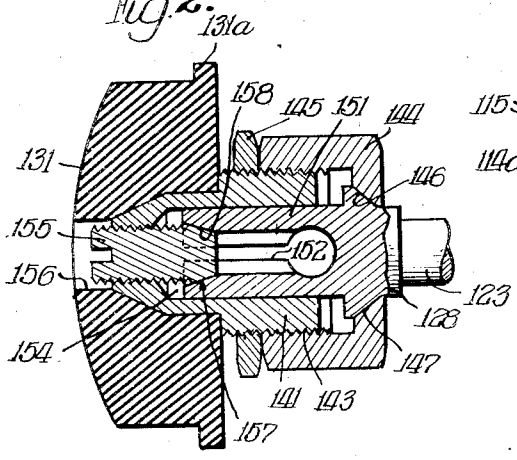
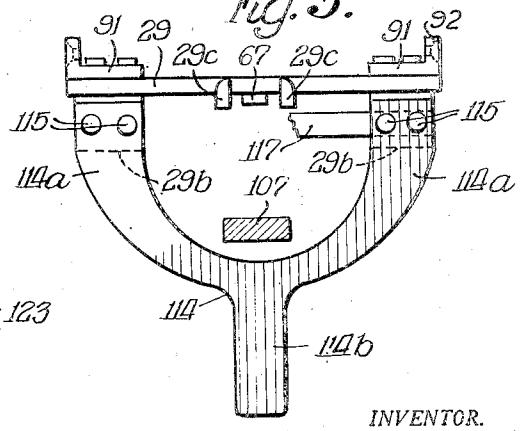


Fig. 3.



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TELEGRAPH RELAY

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7 Claims. (Cl. 267—1)

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The present invention relates to relays for telegraph systems and the like. This improved relay is preferably used as a line and repeating relay in printing telegraph systems. More particularly, its principal field of utility is in printing telegraph systems using the "neutral" method of transmission wherein current and no-current conditions are employed on the line for signaling, in contrast to the "polar" method employing reversals of current on the line, but it will be understood that the invention is not necessarily limited to use with such systems.

One of the principal features of the invention is the provision of improved means for adjusting the spring tension acting on the relay armature. The relay is completely enclosed in a dust-tight casing and the armature tension is adjusted from outside the casing through the rotation of an externally accessible knob provided with cooperating scale indicia. The knob rotates an adjusting shaft which varies the armature tension, and after the tension has been thus adjusted through said knob and shaft to meet a particular circuit condition the knob can be released from the shaft and rotated until its pointer indicates zero on the scale indicia, whereupon the knob can be again tightened or secured to the shaft without disturbing the set position of the shaft. Thus, the knob can be reset to zero after making the preliminary tension adjustment to meet a circuit condition, without having to open the dust-tight casing or disturb the adjusting shaft and its associated parts.

In the accompanying drawings illustrating one preferred embodiment of my invention:

Figure 1 is a vertical axial sectional view of my improved relay apparatus, there usually being two companion relay units in a single casing with their respective adjusting knobs both accessible from the front of the casing;

Figure 2 is a fragmentary sectional view on a larger scale showing the releasable coupling arrangement between the adjusting knob and the tension adjusting shaft; and

Figure 3 is a front elevational view of the armature spring.

Referring to Figure 1, the complete relay assembly usually comprises two companion relay units enclosed within a common housing comprising the insulating back panel 22 and the removable sheet metal cover 23 which is releasably secured to the back panel by the screws 24. The two relay units are substantially identical in physical structure, and hence only one of these units has been shown in detail. The two relay units are connected together electrically to form a complete repeater assembly, one relay being connected to the upline side of the circuit and the other relay being connected to the downline side of the circuit, these relays being

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frequently referred to as the "west" relay and the "east" relay.

The fundamental elements of each relay structure comprise the U-shaped core structure 27, the two relay coils 28 on the legs of this core structure, and the armature 29 which responds to the energization of the coils. The core structure 27 is built up of a stack of U-shaped laminations, preferably composed of silicon steel of the desired characteristics. This core structure 27 is clamped between a front frame member 31 and a back frame member 32, which frame members also carry the contacts, the armature and the other parts of the relay assembly. The back frame 32 is secured to the insulating panel 22 by a vertically extending mounting bracket 33 and any suitable horizontally extending mounting bracket (not shown). An upwardly extending leg of this bracket 33 is secured to the back frame 32 by the screws 35, with an insulating strip intervening to insulate the bracket from the frame. A downwardly extending leg of the bracket is secured to the back panel by the screws 36.

The front frame 31 mounts the several relay contacts in a position forwardly of the coils 28. To this end, the upper portion of said front frame is formed with two forwardly bent horizontal arms 41 which mount an upper contact support 42 and a lower contact support 43. Insulating strips 44 are disposed on the upper sides of the supporting arms 41, and spacing blocks 45 are mounted above the insulating strips 44. The upper contact support 42 is in the form of a metallic bar extending in bridging relation across the upper surfaces of the spacing blocks 45. Referring to the mounting of the lower contact support 43, insulating strips 46 are disposed against the undersides of the supporting arms 41, and the lower contact support 43 is also in the form of a bar which is assembled against these lower insulating strips. These parts are all clamped together by pairs of suitable clamping screws.

The upper contact support 42 mounts a stop screw 57 and a contact screw 61. The stop screw 57 threads down through a tapped hole in the support 42 and has its lower end disposed in position to function as an abutment stop for limiting the upward movement of the armature 29. A lock nut 58 serves to lock this stop screw in any adjusted position. The contact screw 61 likewise threads down through a tapped hole in the support 42, and is also provided with a lock nut 62 for locking the screw in any position of adjustment. A contact point 63 preferably composed of cemented tungsten carbide is brazed to the lower end of the screw 61. The contact 63 is normally in engagement with a similar contact point 64 composed of like material and which is brazed or spot welded to the front end of an upper

contact spring 65 disposed directly below the armature 29. This contact spring is in the form of a long leaf spring, preferably composed of beryllium copper, with its rear end anchored in a contact spring pile-up, as I shall later describe. Brazed or spot welded to the lower outer surface of the armature 29 is a movable contact 67 which is adapted to move down into engagement with a cooperating contact 68 which is brazed or welded to the upper surface of the contact spring 65 directly in rear of the contact 64. The downward oscillation of the armature 29 in response to energization of the coils 28 moves the contact 67 down into engagement with the contact 68, thereby flexing the spring 65 downwardly and separating the contact 64 from the stationary contact 63.

Disposed below the upper contact spring 65 is a generally similar contact spring 71 which is made to respond to the movement of the upper contact spring through an interposed insulating block 72. This insulating block or collar 72 is riveted to the front end of the lower contact spring 71 and bears constantly against the under side of the upper contact spring 65. Said lower contact spring is also preferably composed of beryllium copper and has its rear end supported in the contact spring pile-up which is carried by the rear frame member 32. Brazed or spot welded to the under side of the lower contact spring 71 is a movable contact 74 which is adapted to engage a stationary contact 75 when the two contact springs 65 and 71 are flexed downwardly by downward oscillation of the armature 29. The lower stationary contact 75 is brazed to the upper end of an adjustable contact screw 76 which threads through a tapped hole in the lower contact support 43. A lock nut 77 screws against the support 43 and locks the screw 76 in any position of adjustment. It will be seen from the above that downward oscillation of the armature 29 will first engage contacts 67 and 68, will then separate contacts 63 and 64, and will then engage contacts 74 and 75. The circuit controlling functions performed by this sequence of contact making and breaking operations have not been described because they constitute no part of the present invention. All of the above enumerated contacts are preferably composed of the aforementioned cemented tungsten carbide, which is an alloy comprising tungsten, carbide and a quantity of cobalt which serves as a cement. The alloy may also include some silver, if desired. These contacts are exceptionally free of trouble, and do not require cleaning, filing or other maintenance.

Referring now to the hinge mounting for the armature and to the mounting for the contact spring pile-up, it will be seen that the back frame member 32 is formed with a rearwardly extending flange or shelf portion 81 on the upper side of which is mounted a base plate 82. Provision can be made whereby this base plate 82 can be shifted or adjusted fore and aft relatively to the shelf portion 81 and can also be swiveled horizontally relatively to said shelf portion for the purpose of bringing proper alignment between the pairs of contacts 63—64, 67—68, and 74—75. Extending upwardly from the ends of the adjustable plate 82 are hinge brackets 86, which are of duplicate construction except that one is right hand and the other left hand. The hinge members of the armature are illustrated in Figure 3, from which it will be seen that the cross bar portion of the armature has rearwardly extending arms 29a to each of which is riveted an L-shaped hinge bracket 91. Each of these hinge brackets is formed in its upwardly extending leg with a conical socket 92 in which is adapted to be seated a steel ball bearing. The forwardly extending arm of the adjacent hinge bracket 86 is disposed in close proximity to the angle bracket 91 and is provided with a tapped hole for receiving a suitable mounting screw. This mounting screw is also formed with a conical socket which forms a seat for the other side of the bearing ball. The above described construction provides an inexpensive form of antifriction bearing for the armature 29 which can withstand severe shock loads and vibration and which functions efficiently over long periods of time without attention.

Referring again to the upper and lower contact springs 65 and 71, the rear ends of these springs are mounted in a pile-up indicated generally at 101 in Figure 1. This pile-up comprises successive laminations of insulating material for insulating the contact springs from each other and from adjacent parts, and two clamping screws 102 pass down through the pile-up and thread into tapped holes in the adjustable base plate 82. Assembled in the pile-up 101 above the upper contact spring 65 is a tension adjustment bracket 103 which has a forwardly projecting front end that bears a tapped hole for mounting an adjustment screw 104 and lock nut 105. Threading the screw 104 upwardly or downwardly adjusts the tension effective on the two leaf springs 65 and 71. These two springs are formed with an initial tension which normally holds the upper spring 65 pressed upwardly against the end of the screw 104 with a substantial tension, and by adjusting this screw downwardly a greater or lesser amount varying degrees of tension can be taken off the pair of springs 65, 71. This tension adjustment enables the sensitivity of the relay to be adjusted to different strengths of current flow, and also enables the tension to be adjusted to the desired point for preventing rebound of the armature and springs.

Provision is made so that the fore and aft spacing between the upper end of the front frame member 31 and the upper end of the rear frame member 32 can be adjusted as desired, following which the upper ends of these frame members can be fastened together in rigid relation. This is accomplished through an L-shaped spacer bar 107, best illustrated in Figure 1. The downwardly extending front leg of this bar is secured to the front frame member 31 by the rivets 108. The rear end of said bar passes through an opening 109 in the upright portion of the back frame member 32 and is formed with a longitudinal slot 110 for receiving a clamping screw 111 which passes upwardly through this slot and threads into a tapped hole formed in the horizontal flange or shelf portion 81 of the frame member 32. Loosening of the clamped relation between the bar 107 and screw 111 enables the upper ends of the frame members 31 and 32 to be shifted relatively to each other in the fore and aft plane for enabling the contact points to be brought into accurate alignment as viewed in the transverse plane (Figure 1), whereupon the tightening of the screw 111 serves to rigidly clamp the upper ends of the two frame members 31 and 32 together. The bar 107 is relatively narrow and is disposed centrally between the two relay coils 28.

The armature 29 is normally retained in its upper retracted position by a Y-shaped leaf spring 114 best shown in Figure 3. The upwardly

extending arms 114a of the spring 114 are secured by rivets 115 to lugs 29b extending downwardly from the laterally spaced arms 29a of the armature. The spring 114 is positioned directly in back of the relay coils 26, with the tie bar 107 passing between the side arms 114a, 114a of the spring. This spring is preferably composed of beryllium copper, similarly to the contact springs 65 and 71, such material affording high electrical conductivity and great resistance to fatigue. The latter characteristic of the contact springs and of the tension spring 114 enables the relay to maintain its initial adjustment over long periods of time. Electrical connection for the movable armature contact 67 is established through a thin flexible conducting ribbon 117 (Figure 3) which has one end fastened under the rivets 115 at one side of the armature and which has its other end connected to a terminal clip which is assembled within the pile-up 101. Connection is continued from this terminal clip to one of the mounting jack prongs extending from the rear insulating panel 22. The provision of this conducting ribbon 117 and the insulated mounting of the hinge brackets 36 insures that no current flow occurs through the ball hinge mounting. The outer arm portion of the armature 29 is preferably formed with downwardly bent side flanges 29c along its side margins for stiffening this arm portion.

Referring again to the Y-shaped tension spring 114 (Figure 3), the downwardly extending stem portion 114b of the spring is capable of being flexed back and forth in the space between and to the rear of the two relay coils 26, 26. The lower end of said stem portion is biased against an adjustable abutment 121 consisting of a traveling nut composed of insulating material and having a threaded bore which engages over a thread 122 formed on a rotatable adjusting shaft 123. This shaft 123 is disposed centrally between the relay coils 26, 26, and the front portion of the shaft has bearing support in a bearing aperture in the front frame member 31. A reduced rear extension 123a of the shaft has bearing support in the back frame member 32, and a cotter pin 124 and washer 125 carried by said reduced extension serve to hold a compression spring 126 under sufficient pressure to provide a friction detent which prevents accidental rotation of the shaft and also holds the shaft against end play. As shown in Figure 2, an annular shoulder 126 near the front end of the shaft is normally held against a thrust washer bearing against the front frame member 31. A manually rotatable control knob 131 is adapted to be clutched to and unclutched from the rotatable adjusting shaft 123 through a unique construction of axially releasable clutching mechanism. The knob is composed of any suitable insulating material and comprises a peripheral rear flange 131a and a narrow cylindrical body portion molded to form a diametrical rib 131c. The knob is recessed back into the front face of the sheet metal cover 23, said cover being provided with a rearwardly extending ring 133 for receiving the knob. The peripheral flange 131a of the knob is adapted to abut against the rear edge of the ring 133 for establishing a dust-tight joint between the knob and the housing. Furthermore, substantially the entire body of the knob is set back into the housing so that the knob is substantially flush with the front surface of the housing. A suitable pointer or index marker on the diametrical rib 131b of the knob is adapted to cooperate with

right and left sets of suitable numerical indicia provided on a front marker plate 137.

Referring now to the releasable clutching device, best shown in Figure 2, a metallic thimble or clutching sleeve 141 is molded into the body of the knob 131, the front reduced portion of this thimble being knurled to effect rigid attachment with the knob. Screwing over the threaded rear end 143 of the thimble 141 is a coupling nut 144. A lock nut 145 screws over the thread 143 in advance of the coupling nut 144 for locking the nut 144 to the thread 143 in any longitudinally shifted point of adjustment. An internal conical clutching surface 146 is formed in an end wall of the nut 144, and is adapted to bear against an external conical clutching surface 147 formed on an enlarged forward portion of the shaft 123. The shaft 123 is also formed with a radially expansible and contractible clutching shank 151 extending forwardly from the conical clutching portion 147. Radial expansion and contraction of the shank is permitted by forming it with a central bore and then slotting the shank diametrically, as indicated at 152, so as to form two halves capable of a limited inward and outward movement. This expansible shank extends into a cylindrical bore 154 formed in the thimble 141. The reduced front end of the thimble 141 is internally threaded for receiving a releasing screw 155 which is accessible through an axial front opening 156 in the knob. A tapered inner end 157 on the screw 155 is adapted to engage a correspondingly tapered seat 158 formed in the front end of the expansible shank portion 151. In the assembly of the relay, the thimble 141 is screwed backwardly or forwardly within the nut 144 to the proper position for disposing the peripheral flange 131a in a snug fit against the inner end of the ring 133. This establishes a substantially dust-tight joint between the knob and the housing. The lock nut 145 serves to lock the thimble 141 in any adjusted position within the nut 144. After the relay has been connected into a particular transmission line it must be adjusted to meet the conditions of inductance and capacity inherent in that line. If the signals transmitted over that line have a spacing bias the tension of the armature spring 114 must be adjusted in one direction to accommodate or compensate for said bias, and, conversely, if the signals have a marking bias the tension of the spring 114 must be adjusted in the other direction to compensate for that bias. This preliminary adjustment of the relay may necessitate one or more revolutions of the shaft 123 in one direction or the other. Having adjusted the relay to meet the particular circuit condition inherent in the circuit to which it is connected, it is desirable that the knob 131 be then reset to a zero position without affecting the adjustment which has been transmitted through shaft 123 to spring 114. Such is accomplished by releasing the wedging screw 155 through opening 156 in the knob, whereupon clutching pressure is released between the conical clutch surfaces 146, 147 and between the expansible shank 151 and the bore 154 of the thimble. This permits the knob to be freely rotated relatively to the shaft so that the knob can be revolved to position the pointer 134 in line with the "zero" indication 138, without rotating the shaft 123. Having thus reset the knob to zero, the releasing screw 155 is again tightened up through the axial opening 156. The wedging action exerted by this screw expands

the expansible shank 151 outwardly into rigid clamping engagement with the bore 154 of the thimble, and also forces the conical surfaces 146, 147 into firm engagement. Thus, it will be seen that by virtue of the above described construction the knob 131 can be adjusted to different positions axially of the shaft 123, and can also be clutched rotatively in different angular positions relatively to said shaft, the axial releasing of the clutching mechanism through the instrumentality of screw 155 enabling the knob to be recessed back into a substantially flush position within the housing 23.

While I have illustrated and described what I regard to be the preferred embodiment of my invention, nevertheless it will be understood that such is merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention.

I claim:

1. In a device of the class described, the combination of a movable member, spring means for normally urging said movable member in one direction, a shaft operative to adjust said spring means, a housing for said device, a knob for rotating said shaft recessed into said housing to lie substantially flush with the outer wall thereof, adjusting means adjustable from the interior of said housing for adjusting the axial position of said knob along said shaft, and clutching means releasable from the exterior of said housing for adjusting the angular position of said knob around said shaft.

2. In a device of the class described, the combination of a movable member, spring means for normally urging said movable member in one direction, rotatable tension adjusting means for adjusting the tension of said spring means, a cover for said device having an opening therein, a stationary sealing flange extending inwardly from said cover around said opening, a knob mounted in said opening and connected with said rotatable tension adjusting means, and a rotatable sealing flange on said knob adapted to coact with the inner portion of said stationary sealing flange to establish a substantially dust-tight joint between said cover and said knob.

3. In a device of the class described, the combination of a movable member, spring means acting on said movable member, a shaft, means actuated by said shaft for adjusting said spring means, a knob for actuating said shaft, and releasable clutching means for connecting said knob to said shaft comprising an expansible shank on said shaft, a thimble carried by said knob engaging over said expansible shank, a thread on said thimble, a nut screwing along said thread, a thrusting surface on said nut engaging with a coacting thrusting surface on said shaft, and a releasing screw within said thimble adapted to exert axial and outwardly acting radial force against said expansible shank.

4. In a device of the class described, the combination of a control shaft, a knob for revolving said shaft, mechanism for adjustably clutching said knob to said shaft in different angular positions and in different axially shifted positions comprising a thimble slidably and rotatably mounted on said shaft and carrying said knob, screw threaded means acting exteriorly of said thimble for effecting axial shifting adjustments of said thimble along said shaft, radially expansible clutching means at the outer end of said

shaft, and screw means threading axially of said knob for causing outward expansion of said clutching means within said thimble whereby to secure said knob to said shaft in different desired angular settings.

5. In a device of the class described, the combination of a control shaft, a knob for revolving said shaft, a split shank portion on the outer end of said shaft capable of outward radial expansion, a thimble in said knob engaging over said split shank portion, adjusting means acting in rear of said knob for effecting axial shifting adjustments of said thimble and knob along said shaft, and a screw having threaded mounting in said thimble axially of said knob and operative to engage said split shank portion for expanding the latter outwardly into clutching engagement with said thimble for locking said knob in different angular settings.

6. In a device of the class described, the combination of a control shaft, a knob for revolving said shaft, a housing having an opening therein associated with said knob, said knob having an annular sealing surface adapted to coact with said opening to establish a substantially dust-tight joint between said housing and said knob, and mechanism for adjusting the axial position of said annular sealing surface relatively to said opening comprising a nut having threaded attachment to the back side of said knob and bearing against a thrust surface carried by said shaft, and a screw having threaded mounting within said knob and bearing against another thrust surface carried by said shaft, said nut and said screw being operative to shift the axial position of said knob along said shaft.

7. In a device of the class described, the combination of a control shaft, a knob for revolving said shaft, a housing having an opening therein associated with said knob, said knob having a rotatable sealing flange adapted to coact with said opening to establish a substantially dust-tight joint between said housing and said knob, a split shank portion at the outer end of said shaft capable of radial expansion, a thimble in said knob engaging over said shank portion, an external thread on the rear end of said thimble, a nut screwing over said external thread and having an inwardly extending flange at its inner end, an annular stop shoulder on said shaft engaged by said inwardly extending flange to limit the outward shifting movement of said knob along said shaft, an internal thread in the outer end of said thimble, a screw mounted in said internal thread, and a conical shoulder in said split shank portion engaged by the inner end of said screw for limiting the inward shifting movement of said knob along said shaft, the engagement of said screw against said conical shoulder expanding said split shank portion into clutching engagement with the bore of said thimble.

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