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Malone

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[54] **ELECTRICAL CONDUCTOR ADJUSTING MEANS FOR MEDICAL DIAGNOSTIC EQUIPMENT**

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[51] **Int. Cl.**..... **H02g 11/00**

[58] **Field of Search** ..... 128/DIG. 4, 2.06 E, 2.1 E; 179/95; 191/12, 12.2, 12.4; 108/39, 139; 339/5 RL, 8 RL, 148, 6 RL

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[57] **ABSTRACT**

This invention relates to an apparatus for electrically connecting a plurality of remotely located sensor elements with corresponding input terminals of a centrally located electrical read-out means such as an electrocardiogram. More particularly, a plurality of conductors are adjustable in effective length to correspond generally with the spacing distances between the sensors and the electrical read-out means. Such adjustment is effected by a plurality of recoil reels mounted on a platform which is in turn rotatable about a fixed vertical axis. The platform may, therefor, be rotated to a preselected position to orient the conductors in a direction causing minimum entanglement of the conductors as each is displaced from a retracted to an extended position.

2 Claims, 3 Drawing Figures

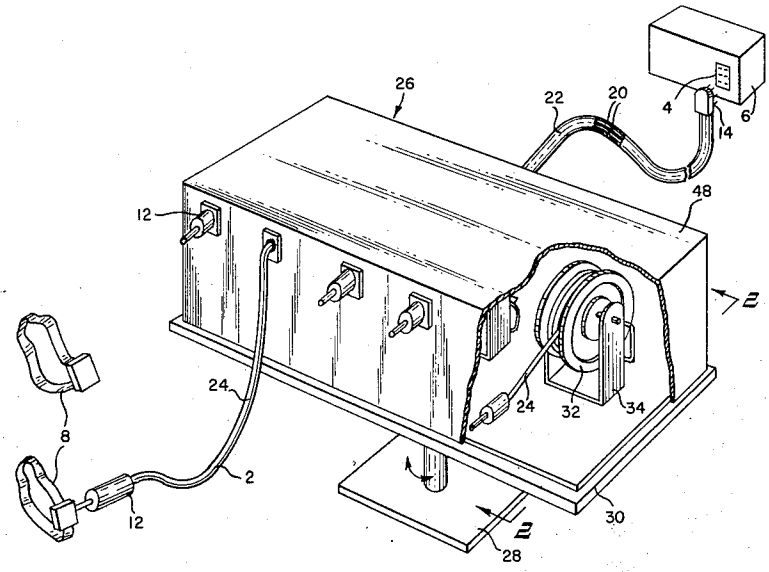
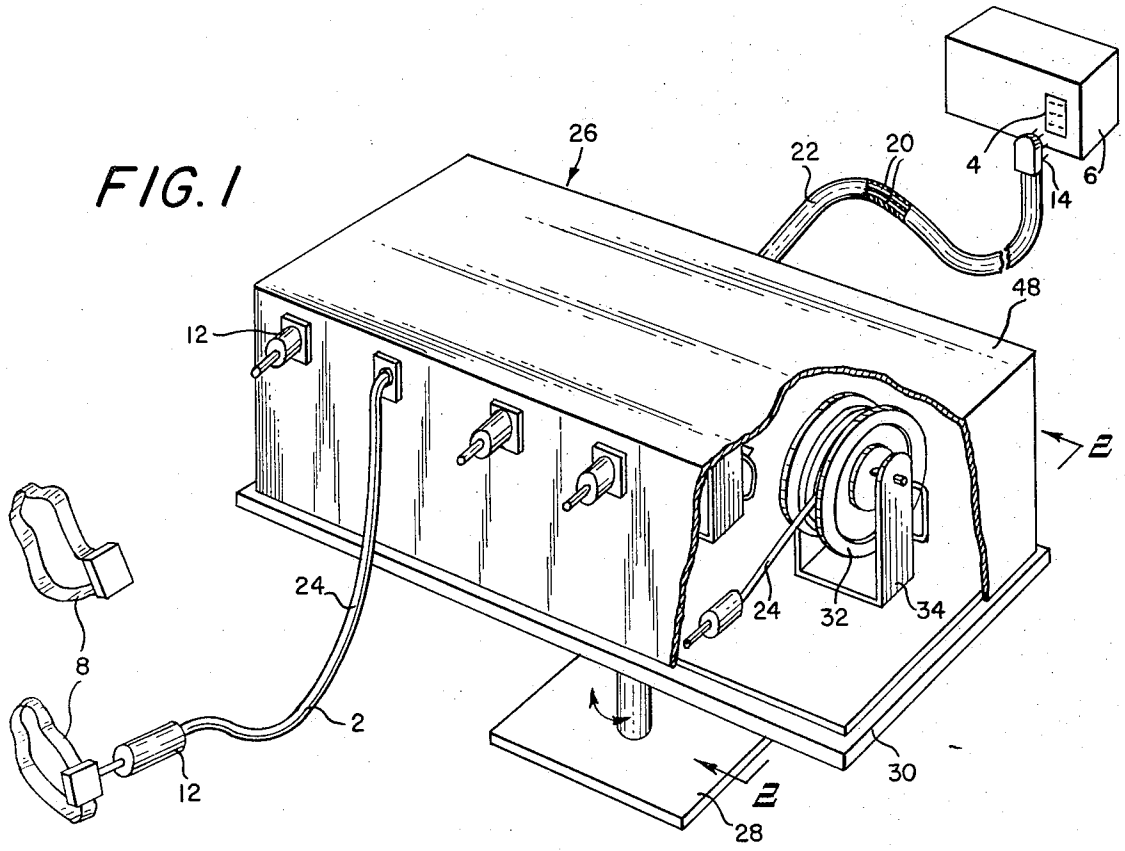


FIG. 1



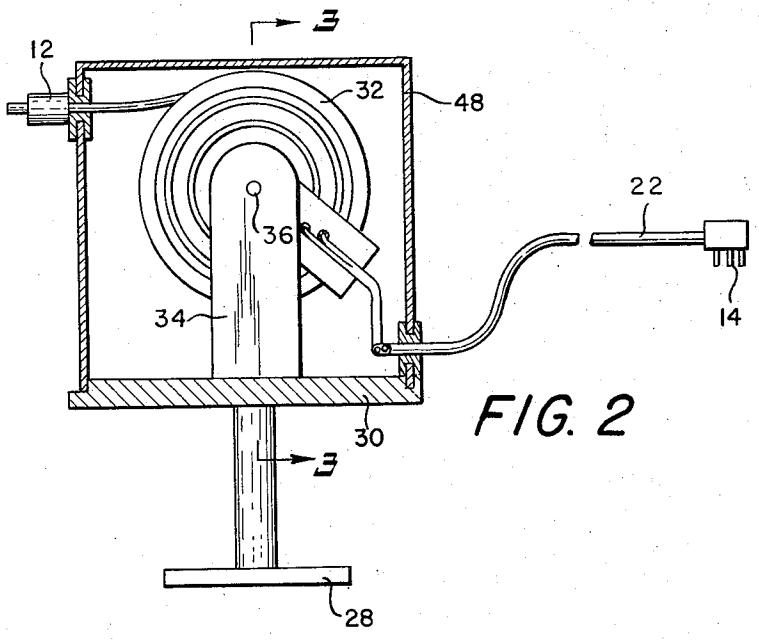


FIG. 2

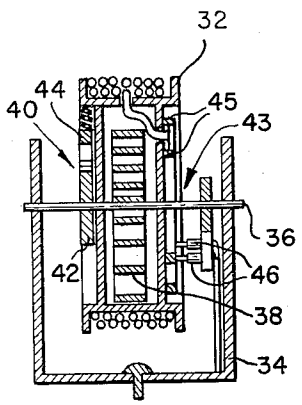


FIG. 3

ELECTRICAL CONDUCTOR ADJUSTING MEANS FOR MEDICAL DIAGNOSTIC EQUIPMENT

BACKGROUND OF THE INVENTION

Electrical diagnostic equipment such as electrocardiograms frequently necessitate the use of numerous electrical conductors in the form of flexible insulated cables to serve as electrical conductors between randomly located sensors and corresponding input terminals on the electrical read-out means. It has been conventional practice to use individual, loose-hanging leads for such connection purposes, thereby resulting in the conductors becoming entangled and worn. The use of a worn or tangled lead can cause short circuits or improper connection with input terminals and sensors to say nothing of increased equipment handling and replacement costs.

SUMMARY OF THE INVENTION

One object of this invention is to provide electrical connective apparatus for diagnostic equipment which overcomes the drawbacks of the prior art by preventing the electrical conductors from becoming entangled and worn during repeated use.

Another object of this invention is to provide apparatus for electrically connecting a plurality of remotely located sensor elements with corresponding input terminals of a centrally located electrical read-out means comprising a plurality of separate conductors adapted for connection at one end with the sensor elements and at the other end with the input terminal of a read-out device, respectively, and means adjusting the effective lengths of the conductors to correspond generally with the spacing distances between the sensors and the electrical read-out means, respectively, wherein the adjusting means includes a base, a platform mounted for rotation on the base, a plurality of reels mounted for rotation on the platform, said conductors being at least partially wound on said reels, and a plurality of spring means normally biasing the reels in a first direction of rotation to wind the conductors thereon, whereby a minimum entanglement of said conductors is produced during displacement of the conductors relative to each other.

Yet another object of this invention is to provide an electrical connecting apparatus including a plurality of reels mounted on a platform for independent rotation about a common horizontal axis having a fixed orientation with respect to said rotatable platform, whereby the platform may be rotated to a preselected position to orient simultaneously the conductors in a direction causing minimum entanglement of the conductors as each is displaced from a retracted to an extended position.

Still another object of this invention is to provide control means for an electrical connecting apparatus of the type described, wherein the control means normally allows said reels to rotate only in a direction causing the conductors to be extended in effective length.

Still another object of this invention is to provide an electrical connecting apparatus of the type described wherein the conductors include a pair of leads and include first and second sections connected from the rotatable platform to the read-out means and sensors, respectively, and wherein the first and second sections

are electrically connected by at least one circular contact and one biased brush.

Yet another object of this invention is to provide an electrical connecting apparatus of the type described including a removable plastic cover attached to the platform containing apertures through which the conductors pass.

These and other objects will become clear from the following detailed description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a cut-away perspective view of the electrical connecting apparatus of this invention;

FIG. **2** illustrates a cross-sectional view of the electrical connecting apparatus of this invention taken along lines **2—2** of FIG. **1**; and

FIG. **3** is a cross-sectional view of a conductor reel taken along lines **3—3** of FIG. **2.**

DESCRIPTION OF THE PREFERRED EMBODIMENT

The apparatus of this invention, as shown in FIG. **1,** comprises a plurality of electrical conductors **2** which can be selectively connected between the input terminals **4** of a diagnostic readout means **6,** such as an electrocardiogram and a plurality of remotely located sensors **8,** respectvely. In order to gather the desired medical data, the sensors are applied to the human body to transduce respiratory movement or blood pressure into an electrical signal which can be transmitted to the electrocardiogram by means of conductors **2.** One end of each conductor is adapted to be connected to one of the sensors by means of a plug **12,** while the other end **14** is adapted for connection to input terminals **4** of the electrocardiogram **6.** Each conductor, which may contain one or more leads, includes a first conductive section **20** (shown in cutaway in FIG. **1**) extending between the input terminals and the rotatable platform. All such first conductive sections are brought together to form a composite cable **22,** thereby reducing the number and length of loosely hanging leads conventionally used to bridge the spacing distances between the sensors located on a patient's body and the electrocardiogram readout means. In addition, each conductor **2** includes a second conductive section **24,** the length of which may be varied by an adjustng means **26** to correspond generally with the spacing distances between the sensors and the electrical readout means, respectively. To accomplish this function, the adjusting means includes a stationary base **28** and a substantially horizontal platform **30** rotatably mounted on the base for angular movement of upto 270° about a fixed central axis. By such an arrangement, the spacing distance over which the loose cables must travel can be shortened because, as a practical matter, the diagnostic readout means may not be brought as close to the patient due to its size and weight as can the adjusting means **26.**

Mounted on the base for rotation about a common horizontal axis having a fixed orientation with respect to the rotatable platform is a plurality of reels **32** on which can be wound the second conductive section of the conductors, respectively. Each reel is mounted on platform **30** by means of a U-shaped bracket **34** which carries a stationary shaft **36** about which the reel may rotate. Within the reel is a recoil spring **38** attached at

one end to the stationary shaft and at the other end to the reel. The spring normally biases the reel in a first direction of rotation to wind the conductor thereon. Control means **40** are also provided for each reel for normally allowing the reel to rotate only in a direction causing the conductor to unwind therefrom. The control means includes a stationary ratcheted stop wheel **42** mounted on shaft **36** and a biased pawl **44** mounted for rotation with the reel. The pawl normally engages the stop wheel to prevent rotation of the reel in the first direction due to the recoil spring. To allow rotation in the first direction, the pawl is moved to an inoperative position by conventional means responding to tension on the conductors or by a manually controlled latch (not shown in the drawings).

To insure continuous, interference-free electrical connection between the first and second conductive sections of each conductor, each reel is provided with electrical means **43** including at least one pair of circular contacts **45** mounted on the side of the reel opposite the pawl and at least one pair of contact brushes **46** biased toward the circular contacts. The circular contacts are electrically connected to the leads of the second conductive section of one of the conductors and the brushes are connected to corresponding heads of the first conductive section of the same conductor, whereby a continuous electrical connection exists between the ends of each conductor as the second section is being wound and unwound from the reel.

As seen in FIGS. **1** and **2**, a removable plastic cover **48** is attached to platform **30** for completely surrounding the reels. On the rear side, the cover contains an aperture for receiving the composite cable **22** and on the front side a number of smaller apertures are formed in alignment with the top of each reel, respectively, to provide passage for the second conductive sections of the conductors, respectively. As is shown in FIG. **1**, plugs **12** are larger in diameter than the frontal apertures in order to prevent the ends of the conductors from passing into the plastic cover.

Apparatus has been disclosed for simply and conveniently eliminating the need for using loose, fixed-length leads between a centrally located readout diagnostic means and a plurality of remotely located sensors such as would be attached to the body of a patient being diagnosed. The provision of a plurality of reels mounted side by side on a platform which in turn is pivotally mounted to a base allows one entire section of the conventional conductors to be brought together into a single composite cable to thereby prevent entangling these conductor sections. Entanglement of the remaining conductor sections extending from the platform to the patient is reduced to a minimum by the provision of adjustable conductor lengths and by the provision of a rotatable platform allowing all of the conductors to be simultaneously oriented in the optimum direction.

I claim:

1. Apparatus for electrically connecting a plurality of remotely located sensor elements with corresponding input terminals of a centrally located electrical read-out means for medical diagnostic equipment, comprising

a. a plurality of separate conductor means (**2**) each adapted for connection at one end with said sensor elements and at the other end with said input terminals, respectively;

b. a horizontal platform (**30**);

c. a plurality of reels (**32**) mounted on said platform for rotation about a common horizontal axis, said conductor means being at least partially wound on said reels, respectively;

d. a cover (**48**) connected with said platform to enclose said reels, said cover having a pair of opposed spaced vertical walls parallel with said horizontal axis, one of said walls containing a plurality of apertures arranged in a horizontal row opposite said reels for receiving said one ends of said conductor means, respectively, said other vertical wall containing a single opening through which the other ends of said conductor means extend;

e. base means (**28**) supporting said platform for pivotal movement about a vertical axis intermediate the ends of, and laterally offset from, said row of apertures, said platform being pivotably movable through an angle of about 270°;

f. spring means (**38**) normally biasing said reels in a first direction of rotation to wind the conductor means thereon, respectively; and

g. pawl and ratchet means normally preventing rotation of said reels in said first direction but freely permitting rotation of said reels in the opposite direction, said pawl and ratchet means being operable to a condition permitting free retraction of said reels in said first direction by said spring means, whereby the effective lengths of said conductor means correspond generally with the spacing distances between said sensor elements and said electrical read-out means, respectively.

2. Apparatus as defined in claim **1**, wherein each of said conductor means comprises

a. a first conductive section (**24**) wound at one end on the associated reel and extending at the other end through the corresponding aperture, each of said first conductive sections including on the portion external of the housing an enlargement (**12**) having a transverse dimension greater than that of said aperture, thereby to prevent the free end of said first conductive section from being drawn within said housing;

b. a second conductive section arranged at one end adjacent the reel and extending at the other end through said single opening for connection with said read-out means; and

c. slip ring means including circular and brush contacts for electrically connecting the adjacent ends of said conductor sections.

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