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FLEXIBLE-CABLE CONTROL SYSTEM

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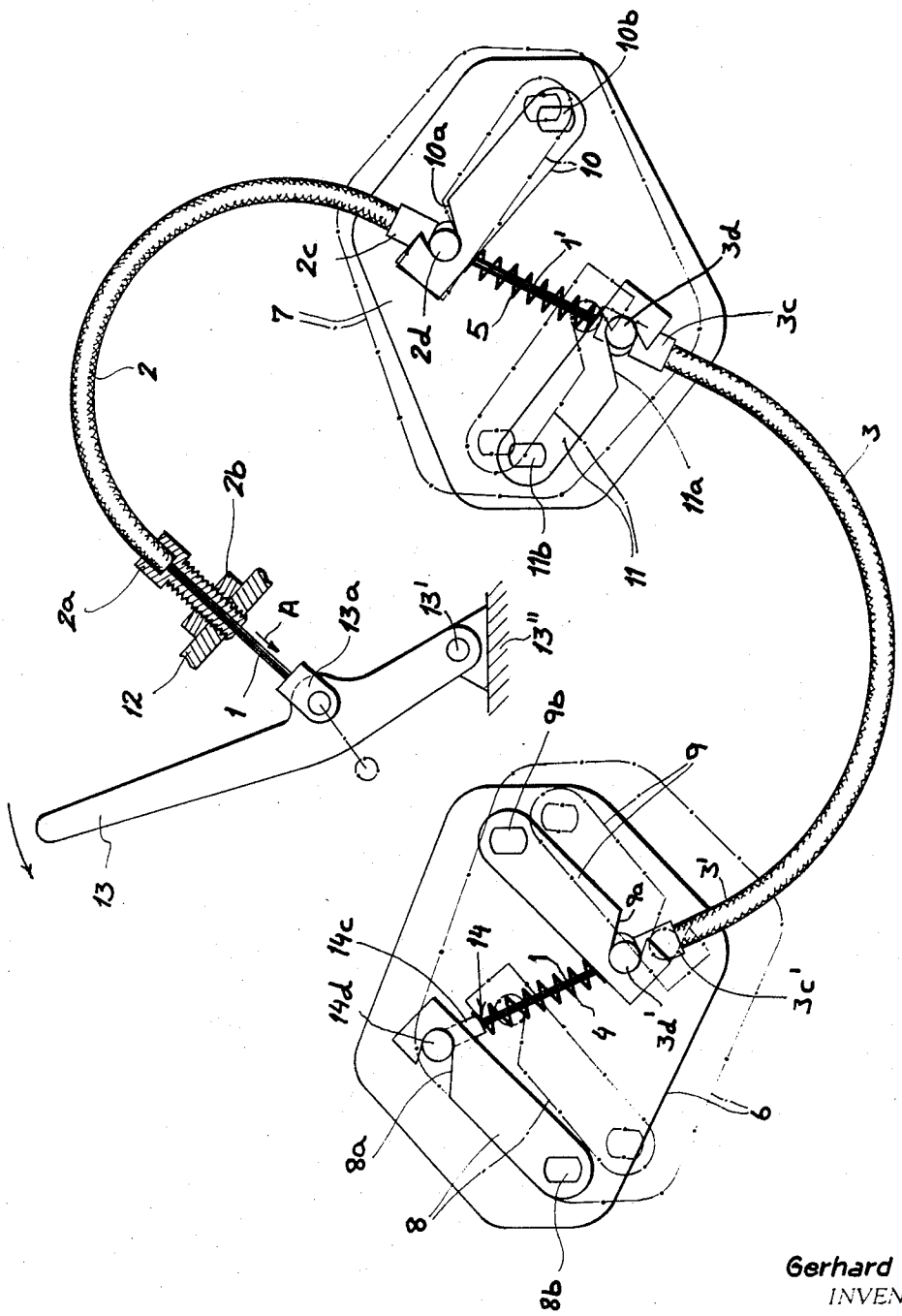

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FLEXIBLE-CABLE CONTROL SYSTEM

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ABSTRACT OF THE DISCLOSURE

A flexible-cable system for the concurrent actuation of two mechanisms each having a pair of relatively movable members adapted to be shifted for control of the mechanisms, wherein a flexible cable has a core wire and a plurality of sheath sections spaced apart therealong and anchored to a lever for drawing the core through the sections between which coil springs are provided.

My present invention relates to actuating and control systems of the Bowden-wire type and, more particularly, to force-transmission and motion-transmission systems using flexible cables.

Bowden wires or flexible-cable controls have been used for many purposes and, for example, in the automotive field, are commonly employed to open and close vents, release and lock latching mechanisms and to set and release locking, parking or emergency brakes. Outside of the automotive-vehicle field, they have been used to transmit motion to remote locations and to move a member out of engagement with an actuator. For the purposes of the present discussion, a Bowden wire or flexible cable will be understood to comprise a linearly movable flexible core surrounded by a relatively incompressible flexible sheath. At one end of the assembly, the core is displaced relatively to the corresponding extremity of the sheath to transmit traction or pressure to the cable at the other end thereof.

It has also been suggested to provide a number of flexible cables or Bowden wires of this type between a common actuator and a plurality of mechanical devices to be controlled thereby. In order to ensure a uniform application of force to all of the controlled elements, equalizing levers and other, similiarly functioning devices have been required. These systems are relatively complex and not always satisfactory.

It is, therefore, the principal object of the present invention to provide a Bowden wire or flexible-cable system for operating a number of controlled elements from a common source whereby the disadvantages of earlier Bowden wire systems are avoided.

This object and others which will became apparent hereinafter are attained, in accordance with the present invention, in a Bowden wire having a plurality of sections with a continuous core and separated sheaths in which, intermediate two such sections, a coil spring surrounds the core and bears in opposite directions upon the confronting ends of the sheath sections in the region in which the sheath sections are subdivided, the actuating elements being correspondingly coupled to the ends of the sheaths at the subdivision. A number of elements can be actuated by a single Bowden wire whose core passes through the entire assembly until it is anchored at its end to a final controlled element.

Thus it is a principal feature of this invention to provide a Bowden wire which comprises a single throughgoing flexible core wire connected at one end to an actuating member and at its other end to a controlled member,

the core being surrounded by a sheath means subdivided longitudinally into a plurality of sheath sections including a terminal section at one end cooperating with the controlled end of the core to actuate one mechanism and a terminal section at the opposite end relatively to which the core is displaced. The ends of the sections proximal to one another are urged apart by a number of coil springs corresponding to the number of subdivisions of the sections while between each pair of subdivided sections intermediate controlled mechanisms can be provided. According to a feature of this invention, at each of the connection points with the actuated mechanisms, a lever is provided having a slot in which a pivot pin of the sheath or core is pivotally received, the pin having an axis transverse to the core and projecting laterially therefrom. The slot may be open at one end to permit the pin to be inserted or removed conveniently. When two pins are provided at each mechanism for relative movement of respective levers in opposite directions, the slots of the corresponding levers open away from one another.

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing, the sole figure of which is a plan view of a Bowden wire system embodying the present invention.

In this drawing I show a Bowden cable whose flexible steelwire core **1** passes continuously through a pair of bent sheath sections **2** and **3** which are separated to expose the core wire at **1'** between them. Any number n of such sections may be employed with $n-1$ exposed regions **1'** in which coil springs **5** encircle the core wire and bear against the proximal ends of these sections **2** and **3** in this region. A further coil spring **4** at the end of the assembly is provided between a lever **8** and the terminus **3'** of the last section.

The actuating system of the Bowden-wire assembly comprises a lever **13** fulcrumed at **13'** to a support **13''** with respect to which the wall **12** is fixed. The lever **13** carries a bifurcated pivot **13***a* to which the core wire **1** is anchored so that, upon pivoting of the lever **13** in the counterclockwise sense, the core wire **1** is drawn in the direction of arrow A through the wall **12**. The wall **12** has a sleeve **2***a* threaded into it and clamped by a nut **2***b* and forms the fixed terminus of the initial sheath **2**. At the other end of the sheath section **2**, I provide a ferrule **2***c* carrying a laterally projecting pin **2***d* which is swivelably received in a slot **10***a* of a lever **10** which is fulcrumed at **10***b* to a plate **7**. The latter represents a floating housing or support structure, e.g., of an automatic vehicle brake, whose levers **10** and **11** are, upon movement of their free ends toward one another, designed to urge respective brakeshoes against, for example, a brake disk straddled by a floating yoke carrying the brakeshoes. Any other mechanism may be actuated in a corresponding manner.

The lever **11** is fulcrumed at **11***b* on the floating plate **7** and has a slot **11***a* in which a similar laterally projecting pin **3***d* is fitted. The pins **2***d* and **3***d* can be readily removed from the slots **10***a* and **11***a* which open away from one another. The pin **3***d* is formed on a ferrule **3***c* anchored to the sheath section **3** which, at its opposite end **3'**, carries another ferrule **3***c'* whose pin **3***d'* is removably received by the slot **9***a* of a lever **9**. As with the device **7**, a second mechanism **6** is provided for simultaneous and essentially uniform actuation by the cable and comprises two traction-actuable levers, e.g., levers **8** and **9**, which are fulcrumed at **8***b* and **9***b* to the plate **6**. The levers **8** and **9** have slots **8***a* and **9***a* opening away from one another and respectively receiving the pin **3***d'* of sheath **3** and a laterally projecting cylindrical pin **14***d*. The latter is carried by a ferrule **14***c* press-fitted onto the core wire **1** at its free extremity **14**.

When, during actuation of the device, the lever **13** is swung in the counterclockwise sense about its fulcrum **13'** and the core wire **1** is drawn in the direction of arrow A through the sheath sections **2** and **3**, the core wire directly swings the lever **8** about its fulcrum **8***b* in the clockwise sense as illustrated in the drawing. The reaction force applied to the plate **6** draws the fulcrum **9***b* to the left and, correspondingly, permits the sheath section **3** to transfer movement to the levers **9**, **10** and **11** until the compressive forces upon the springs **4** and **5** are equal. It will be evident that a significant advantage of this system derives from the fact that the force applied to the actuating lever **13** is uniformly distributed to the individual members **8** through **11** without any equalizing system and with a continuous core wire.

I claim:

1. A control system for the concurrent actuation of two mechanisms, each having a pair of relatively movable members adapted to be shifted for control thereof, said system comprising a flexible Bowden cable having a core wire anchored to one of the members of one of said mechanisms, a bent first sheath section extending from an actuatable end of said core wire to one movable member of the other of said mechanisms and anchored thereto at an end of said first sheath section distal from said end of said core wire, the end of said first sheath section proximal to said end of said core wire being held stationary with respect to said movable members, and a bent second sheath section surrounding said core wire while connecting the other members of both said mechanisms; and actuating means engageable with said end of said core wire.

2. The control system defined in claim **1**, further comprising a compression spring surrounding said core wire between said sheath sections and bearing thereon in opposite directions.

3. The control system defined in claim **2**, further comprising a compression-type spring surrounding said core wire and bearing upon the first-mentioned one of said members and said second sheath section for yieldably resisting relative displacement of the movable members of one of said mechanisms.

4. The control system defined in claim **3** wherein said mechanisms are movable relative to said stationary end of said first sheath section, said actuating means including a lever engaging said end of said core wire for drawing same through said sections.

5. The control system defined in claim **4** wherein the movable members of each mechanism are levers and said mechanisms are brake-actuating devices.

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