United States Patent [19]

Tripp

[11] **3,733,922**

[45] **May 22, 1973**

[54] **FLEXIBLE CONTROL LEVER FOR MECHANICAL DEVICES**

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[73] Assignee: **Interstate Sports Incorporated**, Houston, Tex.

[22] Filed: **Nov. 11, 1971**

[21] Appl. No.: **197,728**

[52] **U.S. Cl.** **74/523**, 74/489

[51] **Int. Cl.** **G05g 1/04**

[58] **Field of Search** ..... 74/531, 523, 501 R, 74/489, 488; 281/50 B

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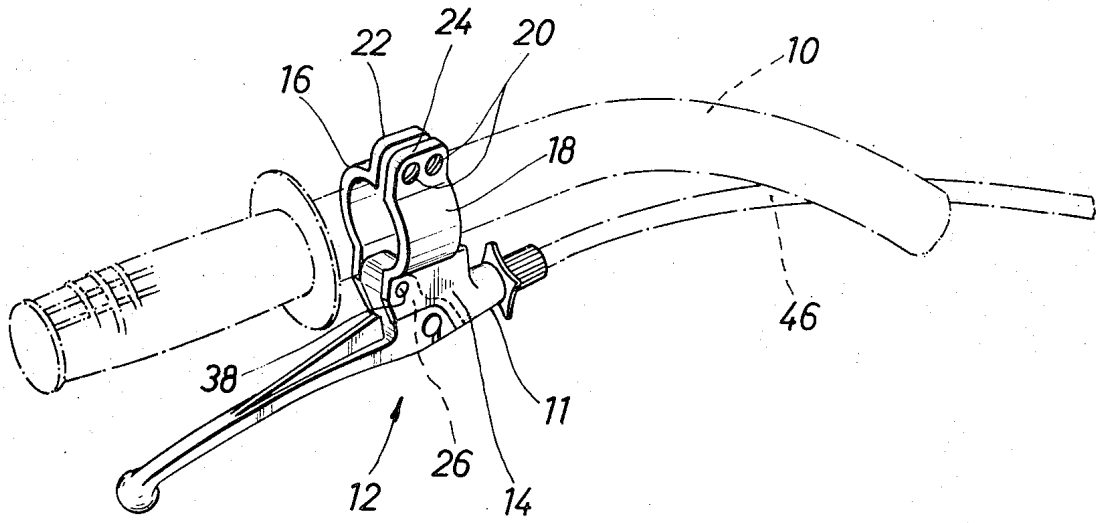
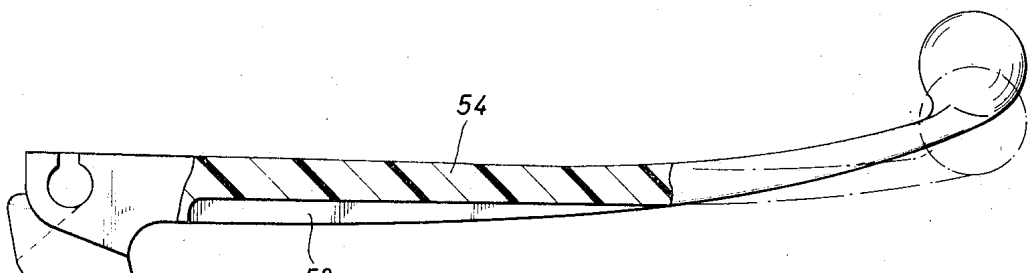
Primary Examiner—Milton Kaufman
Assistant Examiner—Frank H. McKenzie, Jr.
Attorney—Tom Arnold, Robert A. White, Bill Durkee et al.

[57] **ABSTRACT**

A flexible control lever for mechanical devices such as motocycles that facilitate precise and sensitive manual control of the mechanical device and prevent damage to the mechanical device by over-stressing of mechanical parts. The control lever may be adapted for manipulation by the hand or foot of the user during operation of the mechanical device. The control lever may include an integral web that cooperates with the control lever structure to gradually increase the resiliency of the control lever from a pivoted extremity thereof toward the free extremity thereof. The control lever may also be formed to define an elongated tapered groove that presents a control lever structure gradually increasing in resiliency from the pivoted extremity toward the free extremity thereof. The control lever may be composed of any one of a number of commercially available impact-resistant plastic materials to prevent breakage or other damage to the control lever upon receiving an impact.

13 Claims, 12 Drawing Figures





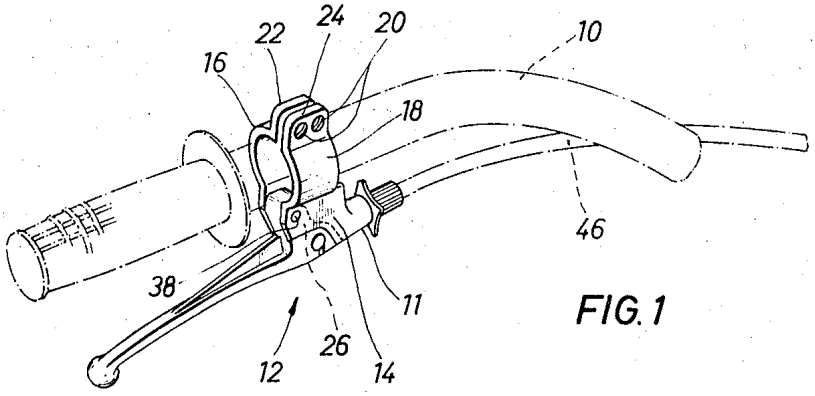


FIG. 1

FIG. 2

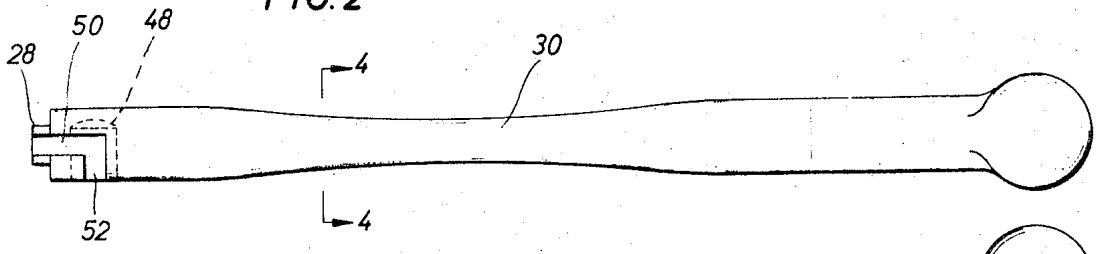


FIG. 3

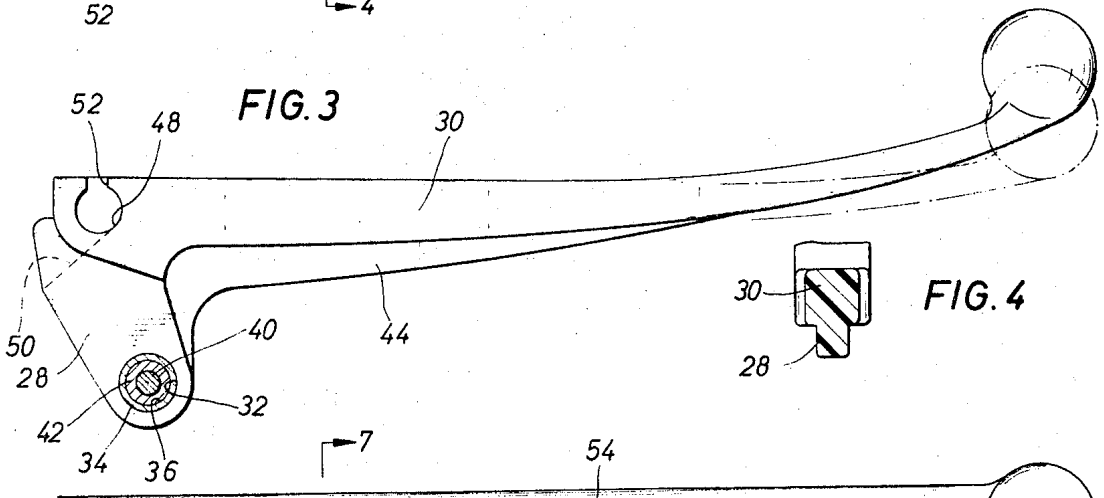


FIG. 4

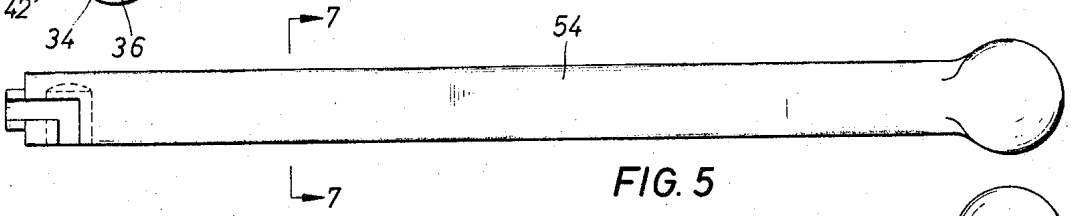


FIG. 5

FIG. 6

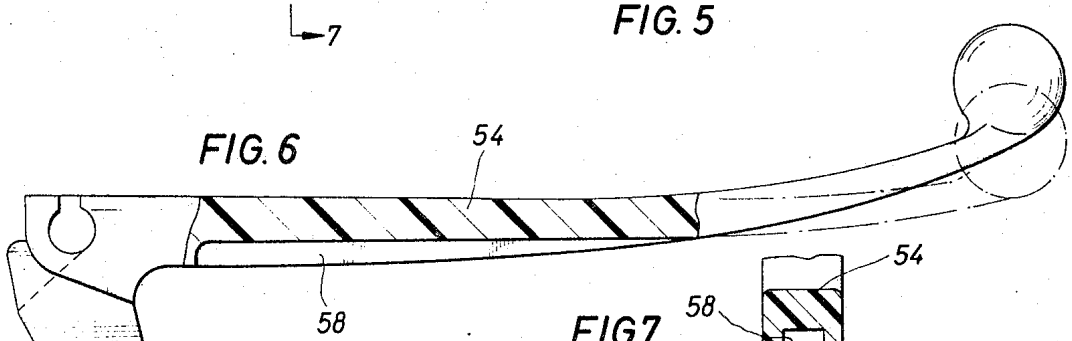


FIG7

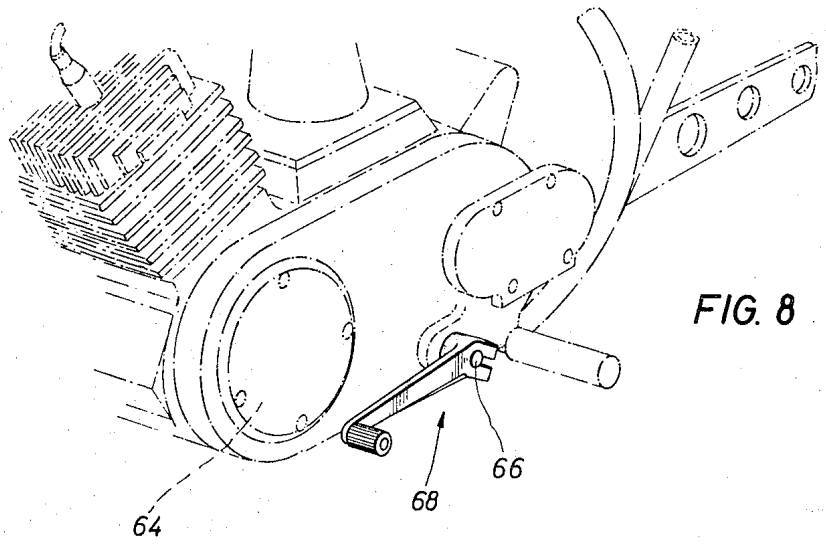
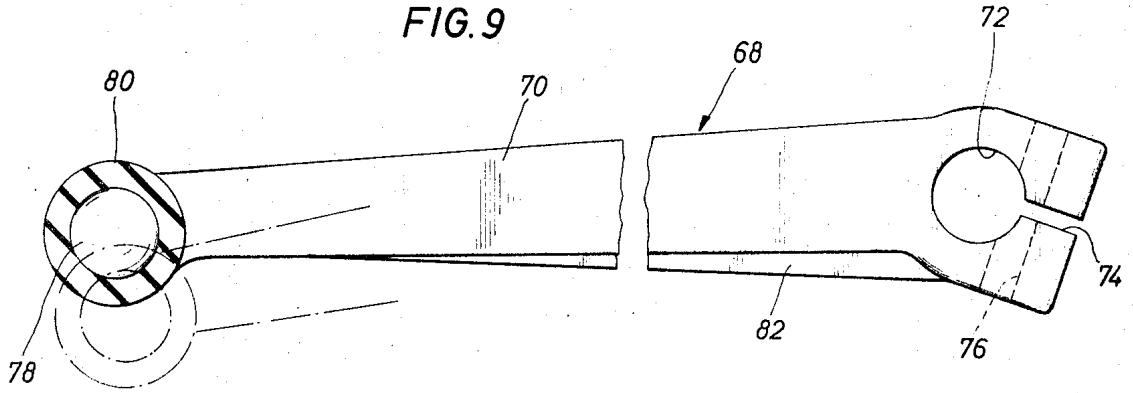


FIG. 8

FIG. 9



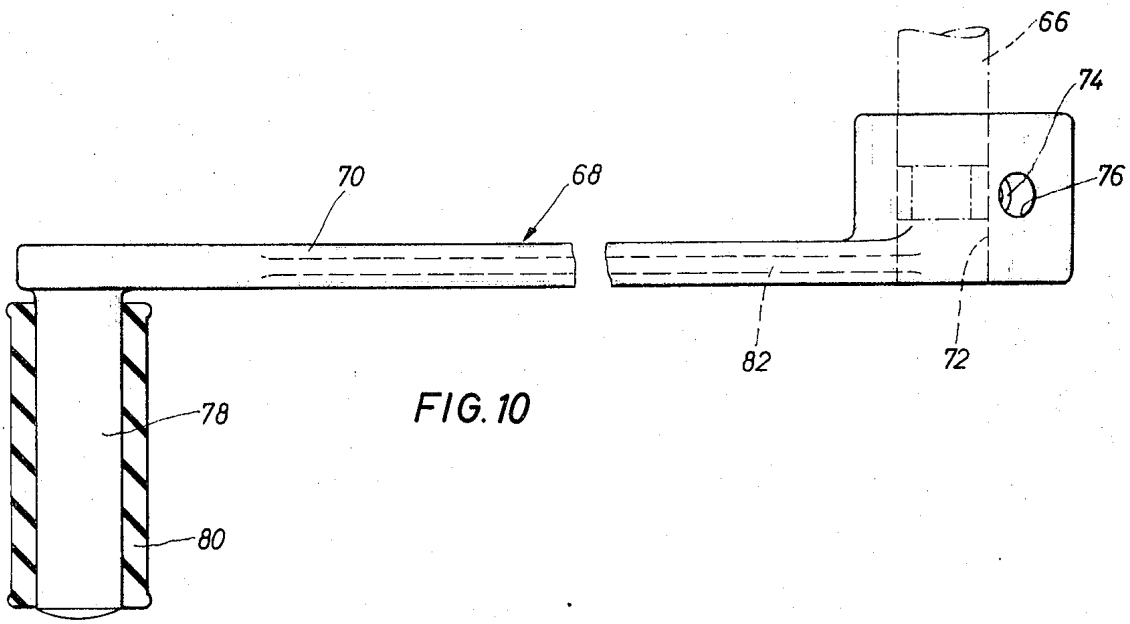


FIG. 10

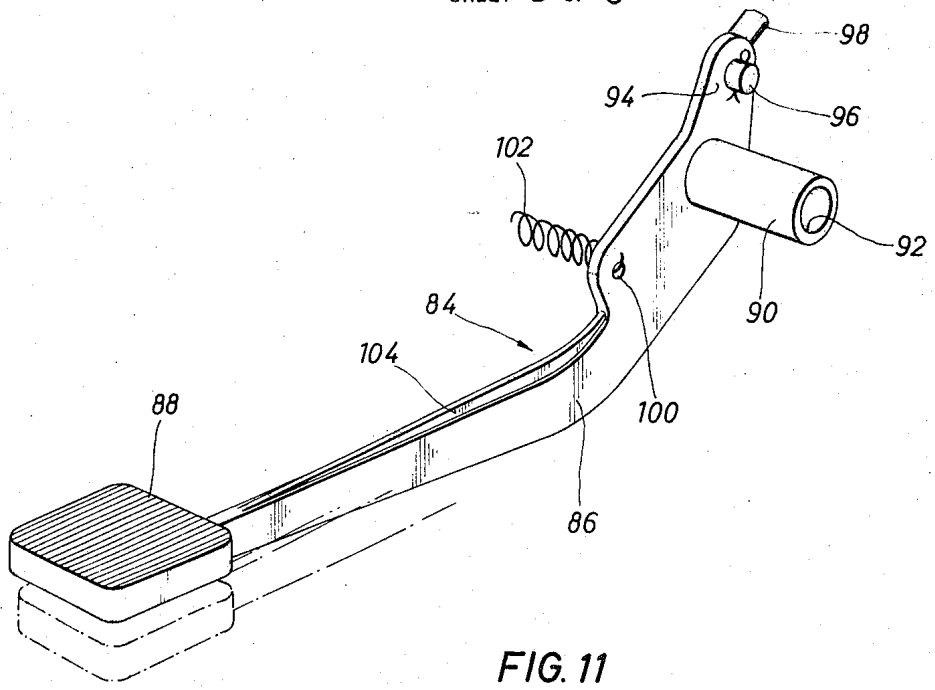
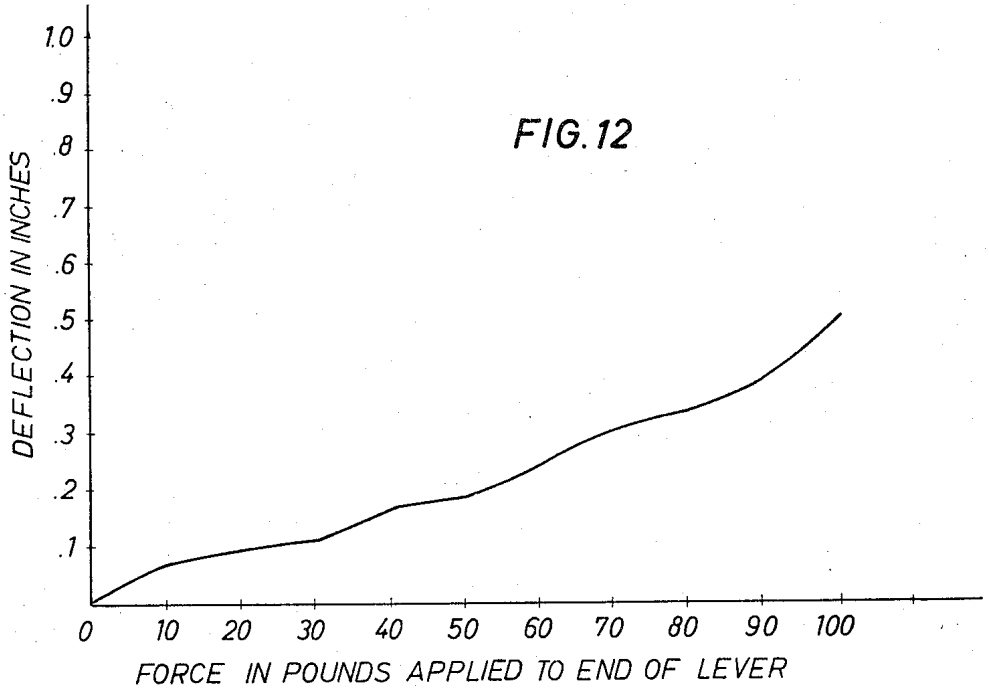

98
94
96
102
92
84
90
104
100
88
86

FIG. 11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DEFLECTION IN INCHES
0
10
20
30
40
50
60
70
80
90
100
FORCE IN POUNDS APPLIED TO END OF LEVER

FIG. 12

FLEXIBLE CONTROL LEVER FOR MECHANICAL DEVICES

FIELD OF THE INVENTION

This invention relates generally to control levers for mechanical devices such as motorcycles and more particularly to control levers having controlled flexibility to enhance the sensitivity or "feel" that is imparted to one manually actuating such levers during use of the mechanical device.

BACKGROUND OF THE INVENTION

In the operation of mechanical devices such as motorcycles, and especially motorcycles that are used under racing conditions, it is necessary that the operator of the motorcycle be extremely perceptive of all of the operating conditions of the machine to enable the operator to safely control the machine and yet achieve the maximum speed for which the machine is capable under the particular operating conditions involved. It is necessary that the operator of a machine, such as a motorcycle, have a perceptiveness, "feel" or awareness of the amount of mechanical pressure to be applied to the various operating levers to achieve optimum control of the machine.

After the operator has controlled any particular machine for a period of time, he develops what is known as a "feel" for the amount of pressures to be applied, but this condition of "feel" is difficult to master and to control if the control levers and other operating parts of the machine are stiff and inflexible.

Brake and clutch levers, whether actuated by the hands or feet of the operator, would lend better to the condition of "feel" if a degree of flexibility could be provided to allow slight controlled flexing of the control levers under various operating conditions.

For example, the "feel" of the hand brake lever of a motorcycle brake mechanism is determined by the "sponge" of the brake mechanism, the amount of stretching that takes place in the brake cable or brake linkage, and the amount of deflection that takes place when mechanical pressure is applied by the hand to the handlebar structure of the motorcycle. Since most motorcycle brake levers are composed of a relatively inflexible material such as aluminum and various aluminum-based alloys, it is obvious that the operator of the motorcycle must obtain the "feel" from parts of the brake system other than the mechanical lever itself.

The front brake system of most motorcycles is engineered to such a degree of safety that they can easily "over-stop" or slide the front wheel of the motorcycle at any speed of which the machine is capable. This feature, of course, is to provide a margin of brake safety to ensure proper braking ability at all speeds of machine operation. When brakes of any nature, and especially motorcycle brakes, are used repeatedly, such as would occur during racing conditions on winding race tracks, a condition of "fade" is likely to occur. The occurrence of a condition of brake "fade" during application of brake causes erratic operation of the brakes and reduces the "feel" to an undesirable level. It is quite easy under these conditions to cause sliding of the front wheel of the motorcycle if during application of normal hand pressure which of course is detrimental to the sta-

is composed of gravel, dirt or sand, because of the unpredictable nature of such surfaces.

For control levers such as gearshift levers on motorcycles that do not require closely controlled conditions of "feel" while the motorcycle is being operated, it would be desirable to provide lever structures that have a degree of flexiblity to provide cushioning against sudden development of forces that might otherwise cause damage to the mechanical parts to which the lever might be connected.

For example, in motorcycle racing as well as in general motorcycle riding, there is a tendency for the operator to over-exert forces on the gearshift lever, especially during the excitement of racing conditions. Application of excessive forces to the gearshift lever may cause the gearshift lever to bend or break, and additionally may cause damage to the engine casing of the motorcycle. Loads applied to the gearshift lever of motorcycles are generally transmitted to such mechanical parts as shifting forks, shifting drums, shifting pins, transmission gears and other miscellaneous parts of the gearshift mechanism, such as gear dogs, couplers, thrust washers, bushings, etc. If the gearshift lever is relatively stiff, sudden application of forces to the gearshift lever will cause a condition of impact upon the mechanical parts of the gearshift mechanism that may cause excessive wear of mechanical parts as well as possible causing damage thereto. For example, shifting forks, drums and pins are a frequent cause of motorcycle repair because of their susceptibility for being damaged by excessive forces being applied through the gearshift lever and also because of accelerated wearing of these parts resulting from application of excessive forces.

Another problem area that causes a considerable amount of motorcycle repair is the tendency of the operating levers to become broken in the event they are impacted or in the event excessive force is applied thereto. For example, if a motorcycle should fall over either during operation or while standing still, the hand-brake or clutch levers, being exposed at the extremities of the handlebar, may strike objects and may become broken. The same is likely to occur to foot-operated levers in the event a motorcycle should fall over.

Accordingly, it is a primary object of the present invention to provide a novel control lever structure for motorcycles or other similar machines that give the operator optimum "feel" characteristics or perceptiveness both in hand and foot levers, enabling the operator to achieve a wider margin of safety than is ordinarily possible during operation of such machines.

It is a further object of the present invention to provide novel control lever structures for machines that provide cushioning ability to prevent transmission of excessive forces to operating mechanisms such as the gearshift mechanism of a motorcycle or the like.

It is an even further object of the present invention to provide novel control lever structures for machines such as motorcycles that will not become permanently bent in the event the same are impacted against other objects.

Among the several objects of the present invention is noted the comtemplation of novel control lever struc-

should fall over either while in operation or standing still.

The present invention also contemplates the provision of novel control lever structures that are simple in nature, reliable in use and low in cost.

Other and further objects, advantages and features of the present invention will become apparent to one skilled in the art upon consideration of the written specification, the attached claims and the annexed drawings. The form of the invention, which will now be described in detail, illustrates the general principles of the invention, but it is to be understood that this detailed description is not to be taken as limiting the scope of the present invention.

SUMMARY OF THE INVENTION

A preferred embodiment of the present invention may comprise an elongated lever body that includes a pivot arm at one extremity thereof adapting the lever body to be pivotally attached to a mechanism that may be in turn supported by the handlebar structure of a motorcycle or the like. The elongated lever body may be composed of a relatively flexible material such as any one of a number of suitable impact resistant plastic materials such as nylon resin or the like to prevent breakage in the event the levers might be impacted. Such plastic materials also are capable of allowing a substantial degree of controlled flexibility of the lever structures to enhance a condition of "feel" by the operator of the operating characteristics of the machine.

The controlled flexibility of the control lever structure may be provided not only by the shape of the brake-lever structure itself, but also by the incorporation of a tapered rib that might be formed integrally with the lever structure to make the lever relatively inflexible in the area of the pivot and gradually more flexible toward the free extremity of the lever. In the alternative, the lever might be provided with a tapered groove formed therein that cooperates with the lever structure to increase rigidity of the lever in the area of the pivot and to make the lever gradually more flexible toward the free extremity thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

So that the manner in which the above recited features, advantages and objects of the present invention, as well as others which will become apparent are attained, can be understood in detail, a particular description of the invention, briefly summarized above, may be had by reference to the embodiments thereof which are illustrated in the appended drawings, which drawings form a part of this specification.

It is to be noted, however, that the appended drawings illustrate only typical embodiments of the invention and are, therefore, not to be considered limiting of its scope for the invention may admit to other equally effective embodiments

In the drawings:

FIG. 1 is a pictorial representation of a motorcycle hand lever mechanism shown in full line, being connected to a handlebar structure set forth in broken line.

FIG. 2 is a side view of a lever portion of the hand lever mechanism illustrated in FIG. 1.

FIG. 3 is a top view of the hand lever structure of FIG. 1, showing the integral rib and pivot structure sition of the hand lever upon being flexed by application of force thereto.

FIG. 4 is a sectional view taken along line 4—4 in FIG. 2.

FIG. 5 is a side view of the lever portion of a modified embodiment of the present invention.

FIG. 6 is a top view of the modified embodiment illustrated in FIG. 5 and showing an elongated tapered groove formed in the control lever structure to enhance the flexibility thereof.

FIG. 7 is a sectional view taken along line 7—7 in FIG. 5.

FIG. 8 is a pictorial representation in broken line of a motorcycle engine having a gearshift control lever constructed in accordance with the present invention connected thereto and being shown in full line.

FIG. 9 is a side view of the gearshift lever structure shown in FIG. 8 and illustrating, in broken line, the position of the gearshift lever upon being flexed by application of forces thereto.

FIG. 10 is a top view of the gearshift lever structure of FIG. 9.

FIG. 11 is a pictorial representation of a foot brake lever for a motorcycle mechanism constructed in accordance with the present invention.

FIG. 12 is a graphical representation of the amount of deflection in inches of force being applied in pounds to a control lever structure constructed in accordance with the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Now referring to the drawings and first to FIG. 1, there is shown a motorcycle handlebar structure, illustrated in broken line at 10, to which may be affixed a mounting bracket 11 of a hand-brake or clutch mechanism, illustrated generally at 12. The mounting bracket 11 may comprise a mounting bracket body 14 having a bifurcated portion defined by integral opposed clamp sections 16 and 18 that may be drawn into tight assembly with the handlebar structure 10 by screws 20 or the like that may extend through appropriately threaded apertures formed in tab elements 22 and 24. The tab elements may be formed integrally with the clamp sections 16 and 18, respectively.

The mounting bracket body 14 may be provided with an internal recess shown in part by broken lines at 26 within which is received a centrally located lever arm 28 that may be formed integrally with an elongated lever body 30. The lever arm 28 may be provided with an aperture 32 within which may be received a bushing 34 providing a bearing aperture 36 that may be disposed in alignment with apertures 38 formed in the mounting bracket body 14. A bolt member 40 may be extended through the aligned aperture 38 and may carry a bearing element 42 that may be disposed in bearing engagement with the bearing surface 36 of the bushing 34. Although a bearing structure is shown in FIG. 3, it may not be necessary to provide additional means for bearings if the material from which the control lever is composed has a bearing capability.

For the purpose of providing a mechanical structure allowing the operator to "feel" the sensitivity of the clutch or brake mechanism or the like to which the control lever 30 may be connected, it is considered desirable to provide a degree of flexibility in the control

any one of a number of commercially available suitable plastic materials that may be relatively flexible and may in addition be impact resistant. Various nylon resin compositions may be successfully employed, for example, to achieve a control lever structure that is both flexible within appropriate limits for optimum sensitivity and, in addition, is impact resistant to provide a lever structure capable of withstanding considerable deformation upon impact without breaking.

To further enhance the controlled flexibility of the control lever **30**, it may be appropriate to provide an integral elongated rib structure that may also be integral with the lever arm portion **28** of the control lever and may define a fillet between the lever arm **28** and the control lever body **30**. The rib **44** may be tapered and may cooperate with the control lever body to provide a relatively rigid portion of the lever body in the area immediately adjacent to the lever arm **28** and to provide a lever arm structure that becomes gradually more flexible toward the free extremity thereof. As illustrated in FIG. **2**, the lever arm mechanism may be flexed from an initial position, as illustrated in full line, to a broken line position upon the application of forces thereto such as might be applied by the hand of the operator controlling the machine.

It will be desirable to provide means for connection of the control lever to a control cable or bowden wire, such as might extend through a cable sheath **46**, as shown in FIG. **1**. As is conventionally the case, the control lever **30** may be provided with a generally cylindrical blind bore **48** within which may be received a cable restraining element, not shown. The blind bore **48** may be intersected by slots **50** and **52** formed in the control lever to facilitate insertion of the cable restraining element and cable into assembly with the control lever. As the lever body **30** is manipulated manually, the lever arm **28** is pivoted about the bolt **40** and the aperture **48**, with the cable restraint element disposed therein, will be moved arcuately about the pivot. When this occurs the cable, attached to the cable restraining element, will be moved linearly, thereby imparting controlling movement to a brake or clutch mechanism or any other suitable mechanical device to which the cable may be connected.

With reference now to FIGS. **5** and **6**, a modified lever body **54** is illustrated having a lever arm **56** constructed essentially identical with respect to the lever arm **28** of FIG. **3**. For the purpose of providing a substantially rigid area of the lever body adjacent to the lever arm **56**, a tapered groove **58** may be formed at least partially along the line of the lever body **54** in such manner as to vary the cross-sectional area of the lever body along the length thereof to facilitate enhanced flexibility toward the free extremity of the lever arm. The tapered groove **58** is formed centrally of the lever body **54** as illustrated in FIG. **7** providing elongated ribs or flanges **60** and **62** that define the elongated groove **58**. The rib or flanges **60** and **62** cooperate with the lever body **54** to provide graduated flexiblity to achieve a lever structure that is more flexible adjacent the free extremity thereof than at the area thereof adjacent to the lever arm **56**.

Referring now to FIG. **8**, there is illustrated in broken line an engine **64** of a motorcycle or the like from which extends a gearshift control shaft **66**. A foot control lever illustrated generally at **68** may be manipulated by the foot of an operator of the motorcycle to control the gears of the motorcycle transmission as the motorcycle is being operated.

With reference now to FIGS. **9** and **10**, the foot control lever **68** may comprise a lever body **70** having an aperture or bore **72** formed in one extremity thereof and adapted to be received by the control shaft **66** of the motorcycle. A slot **74** may be formed at one extremity of the lever body, such as by sawing or the like, to provide a bifurcated extremity through which a bore **76** extends. The bifurcated extremity may, if desired, have one portion thereof internally threaded to receive a bolt or the like for the purpose of drawing the aperture **72** into locked assembly with the control shaft **66**.

At the opposite extremity of the control lever **70** may be provided a transverse pin **78** about which may be received a resilient sleeve **80** that provides a nonslip surface to be engaged by the foot of the operator.

As in the case of the hand control lever mechanism, illustrated in FIGS. **2** through **6**, it is desirable to provide a lever structure that is substantially rigid adjacent its connection with the control shaft **66** and is gradually more flexible toward the free extremity thereof. The flexibility of this lever provides cushioning ability for absorbing or distributing forces applied to the control lever by the operator. According to the present invention, facility for controlling the flexibility of the control lever may conveniently take the form illustrated, particularly in FIG. **9** where a tapered rib **82** is shown to extend along at least a portion of the length of the control lever **70**. The rib **82** presents a substantially larger cross-sectional dimension adjacent to the aperture **72** than at the opposite extremity thereof. The foot control lever, therefore, becomes more flexible toward its free extremity by virtue of the gradually increasing cross-sectional dimension of the foot control lever defined in part by the elongated tapered rib **82**.

As is illustrated in FIG. **9**, the foot control lever **70** may yield from an initial unflexed condition, as illustrated in full line, to a flexed condition, as illustrated in broken line, upon the application of force thereto that might be exerted by the foot of the operator of the machine. As the foot control lever yields, forces transmitted through the foot control lever to the control shaft **66** of the gearshift mechanism will be cushioned and therefore will not be suddenly applied to any of the various parts of the gearshift mechanism with sufficient severity to cause excessive wear or damage thereto.

With reference now to FIG. **11**, the above features of the invention may be utilized with equal success in the provision of a foot brake lever structure that may be pivotally connected to the motorcycle frame and may be manipulated to actuate a brake rod to control the rear brakes of a motorcycle. According to the present invention, a foot brake mechanism may conveniently take the form illustrated in FIG. **11** where a foot brake lever illustrated generally at **84** is shown to include a curved brake lever body **86** having a brake pad **88** fixed to the free extremity thereof and being disposed for engagement by the foot of an operator of the motorcycle. A tubular element **90** may extend transversely at one extremity of the brake lever body **86** and may provide a transverse bore **92** through which may extend a bolt or other form of pivot, establishing pivotal connection of the brake lever body to the frame of the motorcycle.

posed to receive one extremity of the brake rod **98** of the motorcycle rear brake mechanism. The opposite extremity of the bellcrank **94** may be provided with an aperture **100** through which may extend the connector portion of a spring **102** that is capable of returning the brake lever to its initial position subsequent to being manipulated.

For the purpose of giving the operator a sensitive "feel" of the foot brake mechanism, it will be desirable to provide a substantial degree of flexibility in the brake lever body **86**, and according to the present invention, such may be accomplished by providing an elongated rib **104** formed integrally with the brake lever body and extending at least partially along the length thereof. The rib **104** is effective to present a substantially larger cross-sectional dimension adjacent to the tubular portion of the brake lever body than at the free extremity thereof and to present a gradually decreasing cross-sectional area along the length of the brake lever body to provide for gradually increasing flexibility toward the free extremity of the brake lever. Additionally, the rib **104** serves a structural purpose to control flexing of the lever. In operation, as forces are applied to the pad **88** by the foot of the operator, the brake lever will yield to the maximum illustrated by broken line and will provide cushioning for the brake system of the motorcycle in addition to enhancing the sensitivity or "feel" of the brake system by the operator. The flexibility of the lever may be utilized effectively to carefully control the brake system even at high speeds.

As with the structures disclosed above, the foot brake lever mechanism may be composed of any one of a number of suitable flexible plastic materials such as nylon resin or the like thereby providing a brake lever structure that is flexible and will yield substantially without becoming permanently bent. The brake lever structure, when composed of such material, will be relatively impact resistant and will not become broken in the event excessive forces might be applied thereto either by the operator or as the result of an impact with a foreign object.

Referring now to FIG. **12**, there is disclosed a graphical representation of the deflection in inches of a control lever constructed in accordance with the present invention, upon the application of force thereto in pounds. It is possible for the ordinary operator of a motorcycle to be capable of applying forces approaching **100** pounds to the extremity of a hand-brake control lever. As is illustrated graphically, a hand-brake lever composed of nylon resin material will deflect at the extremity thereof slightly less than 0.1 inches upon application of a force of 10 pounds thereto. Upon the application of a force of 50 pounds to the control lever, a yield of 0.2 inches is observed. A deflection of 0.5 inches may be observed upon application of a force of 100 pounds to a brake lever structure. It is apparent from FIG. **12** that considerable flexing will occur as forces are applied to a hand lever constructed in accordance with this invention. Such flexing is readily translatable by the operator into "feel" or perceptiveness of the condition of the brake system. As indicated above, I have provided a novel control lever structure that may be employed both for the hand and foot controls of machines such as motorcycles or the like. The control levers of my invention effectively provide the operator of in hand and foot control levers enabling the operator to control the machine with a wider margin of safety than is ordinarily within an operator's capability. When racing a machine such as a motorcycle the enhanced control available to the operator will allow safe operation of the motorcycle at greater speeds because of the enhanced "feel" characteristics that are developed through utilization of such control lever mechanisms. Moreover, in the excitement of motorcycle racing, the cushioning ability provided by flexible control lever structures will effectively prevent damage to motorcycle transmission parts that might otherwise occur as gears are rapidly changed during a race.

My invention also effectively protects the control levers of machines such as motorcycles from becoming broken in the event the same are impacted such as might occur when a motorcycle falls over either while operating or while standing still.

It is therefore seen that my invention is one well-adapted to attain all of the objectives and advantages hereinabove set forth, together with other advantages which will become obvious and inherent from a description of the apparatus itself. It will be understood that certain combinations and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of the present invention.

As many possible embodiments may be made of this invention without departing from the spirit and scope thereof, it is to be understood that all matters hereinabove set forth or shown in the accompanying drawings are to be interpreted as illustrative and not in a limiting sense.

Having thus illustrated and described my invention, I claim:

1. A manually actuated control lever for mechanical devices comprising:
- an elongated lever body composed of impact resistant flexible material and having a pivoting extremity and a free extremity;
- means adapted to pivotally mount said pivoting extremity of said control lever on a mechanical device; and
- means gradually decreasing the rigidity of said control lever from a substantially rigid portion adjacent said pivotal mounting means to a flexible portion adjacent the free extremity thereof.

2. A manually actuated control lever as recited in claim **1**:
- said means varying the rigidity of said control lever comprising an elongated rib formed integrally with said control lever; and
- said elongated rib extending along the length of said control lever and tapering in thickness from one extremity to the other extremity thereof.

3. A manually actuated control lever as recited in claim **1**:
- said means varying the rigidity of said control lever comprising an elongated rib extending at least partially along the length of said lever; and
- said elongated rib being tapered and being relatively thick adjacent said pivot and being relatively thin toward the free extremity of said lever body.

4. A manually actuated control lever as recited in claim **3**:

5. A manually actuated control lever as recited in claim 3:
said material being nylon resin.

6. A manually actuated control lever as recited in claim 1:
said means varying the rigidity of said control lever comprising elongated groove means formed at least partially along the length of said lever body; and
said elongated groove being tapered and having a maximum cross-sectional area adjacent said pivot means and a minimum cross-sectional area at the free extremity of said lever body.

7. A manually actuatable control lever for mechanical devices, said lever comprising:
an elongated lever body composed of flexible material;
pivot means provided at one extremity of said lever body; and
said control lever being tapered from a relatively thick and rigid portion adjacent said pivot means to a relatively thin and flexible portion at the other extremity of said lever body.

8. A manually actuatable control lever as recited in claim 7:
a tapered web being formed integrally with said lever body and extending at least partially along the length of said lever body; and
said tapered web being oriented with the thickest portion thereof disposed adjacent said pivot means.

9. A manually actuatable control lever as recited in claim 7:
said pivot means comprising a pivot arm extending in transverse relation to said elongated lever body;
a pivot aperture defined in said pivot arm; and
said tapered web being integral with said pivot arm and said lever body and defining a fillet therebetween.

10. A manually actuatable control lever as recited in claim 7:
said pivot means comprising a pivot arm extending transversely from said lever body and being integral therewith;
said lever arm having an elongated tapered groove defined therein, said groove having a larger cross-sectional dimension adjacent said pivot means than at the opposite extremity thereof; and
said elongated lever body being substantially inflexible adjacent said pivot means and gradually increasing in flexibility toward the free extremity thereof.

11. A manually actuatable control lever as recited in claim 7:
mounting bracket means; and
said lever body being pivotally connected at the pivotal extremity thereof to said mounting bracket means.

12. A manually actuatable control lever as recited in claim 11:
said mounting bracket means and said lever body being composed of flexible impact resistant material being plastic.

13. A manually actuatable control lever as recited in claim 7:
mounting bracket means including pivot pin means;
said pivot means of said lever body being pivotally received by said pivot pin means;
foot engagement means being provided at said free extremity of said lever body; and
web means being formed integrally with said lever body and extending at least partially along the length of said lever body and being tapered along the length thereof with the thickest portion of said web disposed at the pivoted extremity of said lever body.

* * * * *