

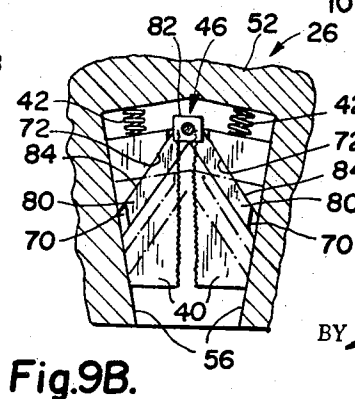
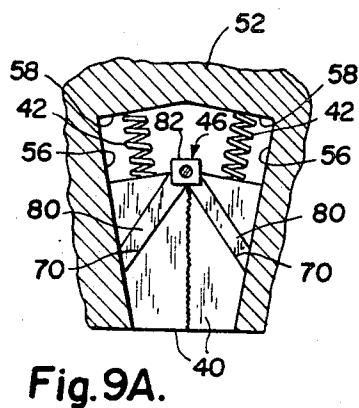
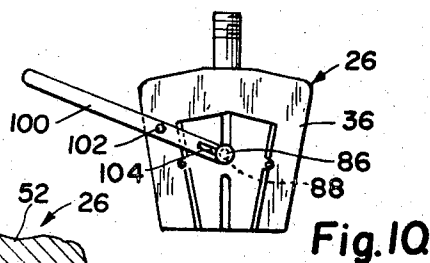
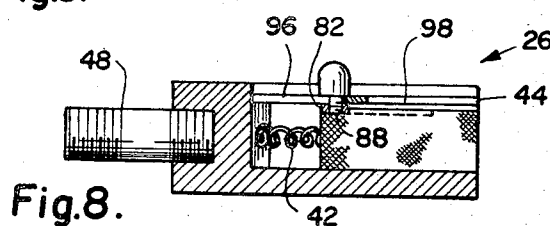
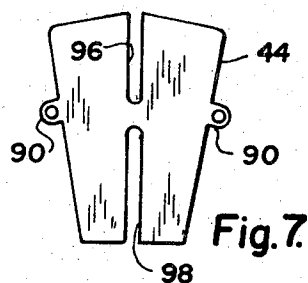
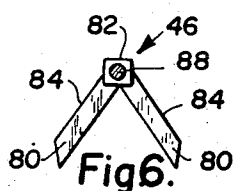
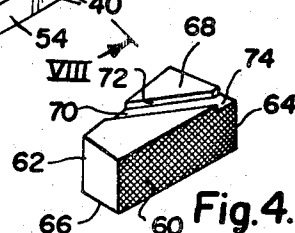
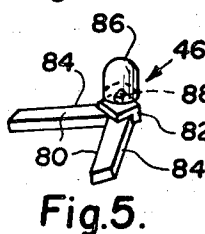
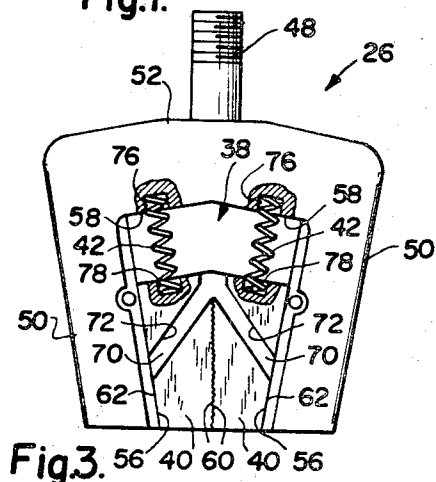
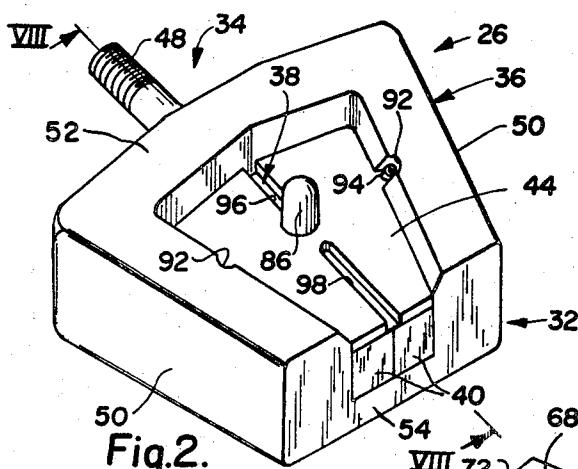
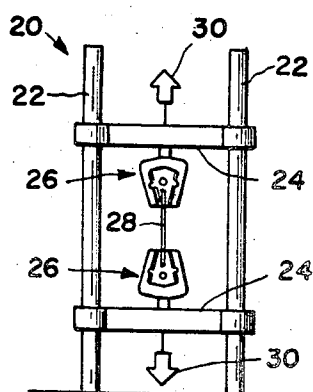
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3,403,549

TEST PIECE GRIPPING DEVICE

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TEST PIECE GRIPPING DEVICE

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ABSTRACT OF THE DISCLOSURE

Improvements in the construction of test piece gripping devices, and more particularly to improvements in gripping devices of the type used in conjunction with physical testing apparatus for gripping the opposite ends of test specimens undergoing pull tests.

As is known, gripping devices of the type described, are used in conjunction with physical testing apparatus wherein two of the gripping devices are used to grip the opposite ends of a test specimen. The gripping devices are forced apart by the power components of the physical testing apparatus, to subject the test specimen to various tensile forces. Among the physical properties of the test specimen, which are determined in this manner are yield strength, ultimate strength and breaking stress.

As is conventional, such gripping devices consist of a housing having oppositely inclined side walls. A jaw member is engaged with and slideable over each of the inclined side walls. The inclination of the side walls is such that as the jaw members are moved in one direction they are spread apart so as to receive the end of a specimen, and as the jaw members are moved in the opposite direction they approach each other to firmly grip the test specimen. Spring means acting on the jaw members are employed to urge the jaw members into the gripping position.

In gripping devices of the type described, means is provided for maintaining the jaw members engaged with the inclined side walls during their movement thereover. In the prior art, this means comprises, for example, pins or studs projecting transversely of the jaw members through inclined slots provided in the housing. The slots and the inclined side walls have the same inclination. Relatively complex mechanisms are employed to move the pins and hence the jaw members. As the jaw members are moved, the pins move through the slots and thereby maintain the jaw members engaged with the inclined side walls.

In order to provide the housing with the required slots, it is, of course, necessary to remove a certain amount of material from the housing. Removal of the material weakens the housing and reduces the maximum stress to which the gripping device may be subjected without breaking. Therefore, when slots are to be provided, the size of the housing must be increased to compensate for the loss in strength attributed to the slots.

Accordingly, as an overall object, the present invention seeks to provide a gripping device of improved construction whereby the gripping device is capable of withstanding maximum stresses in excess of the maximum stresses to which prior art gripping devices of comparable size could be subjected.

Another object of the invention is to provide improved cam means for moving the jaw members along the inclined side walls, said cam means being arranged such that it does not affect the strength of the housing.

A further object of the invention is to provide springs for urging the jaw members toward a gripping condition and arranged so that they do not interfere with the operation of the cam means which moves the jaw members.

The gripping apparatus of the invention comprises a housing having a cavity defined, in part, by oppositely

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inclined side walls. A pair of jaw members reside within the cavity and are slideably engaged with the inclined side walls. The jaw members have opposed faces adapted to grip a test piece therebetween. As is conventional, the jaw members are spaced apart as they are moved further into the cavity and they approach each other as the jaw members are moved to the opposite direction.

In accordance with the present invention, means, in the form of a unitary cam, moves both jaw members longitudinally of the housing while maintaining the jaw members engaged with the inclined side walls. The cam means is operable from one side of the housing and is arranged such that it does not require the above-described slots. Consequently, the housing remains substantially intact and is capable of withstanding stresses in excess of the maximum stress to which prior art gripping devices could be subjected.

Spring members, one for each jaw member, are provided for urging the jaw members into a gripping condition, that is, toward each other. In accordance with the invention, each of the spring members is supported parallel with one of the side walls, the arrangement being such that the spring members are compressed directly along their longitudinal axes and are not subjected to lateral bending. With this arrangement, the spring members do not urge the jaw members out of engagement with the inclined side walls.

Further in accordance with the present invention, the face of each of the jaw members is made substantially perpendicular to the inclined side wall with which each jaw member is engaged, rather than being made perpendicular to the gripping faces of the jaw members as in the prior art. Consequently, a lesser amount of material must be cut from the housing when forming the cavity and therefore the housing is considerably stronger.

The above and other objects and advantages of the present invention will become apparent from the following detailed description by reference to the accompanying drawings, in which:

FIGURE 1 is a schematic front view of a physical testing apparatus provided with the gripping devices of the invention;

FIG. 2 is an isometric view of the gripping device of the invention;

FIG. 3 is a front view, partly in cross section, of the gripping device of the invention having certain components removed therefrom;

FIG. 4 is an isometric view of a gripping jaw modified in accordance with the invention;

FIG. 5 is an isometric view of a cam member;

FIG. 6 is a plan view, partly in cross section, of the cam member of FIG. 5;

FIG. 7 is a plan view of a face plate;

FIG. 8 is a cross-sectional view, taken along the line VIII—VIII of FIG. 2, further illustrating the internal construction of the gripping device of the invention;

FIGS. 9A and 9B are fragmentary cross-sectional views, similar to FIG. 3, illustrating the operation of a cam means of the gripping device; and

FIG. 10 is a front view of the gripping device of the invention provided with a cam operating lever.

Referring now to FIG. 1, there is schematically illustrated a physical testing apparatus 20 comprising vertical columns 22 and rails 24 which are supported by the vertical columns 22. Means, not shown, are provided for moving the rails 24 along the vertical columns 22 to change their position relative to one another. The physical testing apparatus 20 is provided with gripping devices 26, of the invention, one connected to each of the rails 24 and shown gripping the opposite ends of a test specimen 28. Power components, schematically illustrated by the

arrows 30, when activated, force the rails 24 and hence the gripping devices 26 away from each other thereby subjecting the test specimen 28 to various tensile forces.

Referring now to FIGS. 2, 3 and 9A, the gripping device 26 has a test piece receiving end 32 and a connection end 34 adapted for connection to the rails 24. The gripping device 26 comprises, in general, a housing 36 having a cavity 38 in which reside a pair of jaw members 40 and spring members 42 urging the jaw members 40 into a clamping or gripping condition. A face plate 44 is secured to the housing 36 in overlying relation with the cavity 38. A cam member 46 (FIG. 9A) engaging both of the jaw members 40, serves to move jaw members 40 longitudinally of the housing 36. A threaded rod 48 adapts the housing 36 for connection to the rails 24.

The housing 36 is formed from a single piece of metal and comprises a pair of longitudinal side pieces 50, a crosspiece 52 connecting the side pieces 50 at corresponding ends thereof, and a longitudinal wall 54 extending between the side pieces 50 and to the crosspiece 52. The side pieces 50 provide a pair of opposed wedging surfaces 56 which converge away from the crosspiece 52 and which are engaged by the jaw members 40. The crosspiece 52 presents inclined cross surfaces 58 each of which is made substantially perpendicular to the wedging surface 56 with which it intersects.

Reference is now directed to FIG. 4 wherein one of the jaw members 40 is illustrated. It is to be understood that the jaw members 40 are similar in construction with the exception that each is a mirror image of the other. The jaw member 40 has a generally wedge-shaped configuration, including a gripping face 60, an inclined face 62 opposite thereto, an end face 64 which is made substantially perpendicular to the inclined face 62 and inner and outer faces 66, 68. When the jaw members 40 are installed in the cavity 38 of the housing 36, the inclined faces 62 are engaged with the wedging surfaces 56, as shown in FIG. 3, while the inner faces 66 are engaged with the exposed face of the longitudinal wall 54.

As stated above, the end face 64 of each of the jaw members 40 is made substantially perpendicular to the inclined side wall 56 with which each of the jaw members 40 is engaged. As a result of this construction and as best illustrated in FIG. 9A, the cross faces 58 are made substantially perpendicular to the inclined side wall 56 with which it intersects. Consequently, the crosspiece 52 is thicker and therefore stronger. In prior art gripping devices, portions of the crosspiece would be cut away so as to match the end faces of the jaw members which, conventionally, are made perpendicular with the gripping faces of the jaw members.

As can best be seen in FIGS. 3 and 4, an inclined groove 70 is provided in the outer face 68 of each jaw member 40. The inclined groove 70 presents a cam surface 72 which is preferably inclined at an angle of approximately 45° with the inclined face 62. The groove 70 commences at the inclined face 62 and terminates at the gripping face 60 adjacent the end face 64 in a longitudinally extending groove 74. The grooves 70, 74 cooperate to provide a modified Y-shaped groove adapted to receive the cam member 46 (FIGS. 5, 6) as will be described.

Referring now to FIGS. 3 and 9A, each of the spring members 42 has its opposite ends confined within sockets 76, 78 provided in the crosspiece 52 and the jaw members 40, respectively. Each opposed pair of the sockets 76, 78 is positioned such that the central axes of the sockets 76, 78 are coincident and extend substantially parallel with the adjacent one of the wedging surfaces 56. The overall arrangement is such that as the jaw members 40 are moved toward the crosspiece 52, the spring members 42 will be subjected to axially directed compression without lateral bending. Consequently, compression of the spring members 42 provides forces whose lines of action are parallel to the wedging surfaces 56. As a result, there are no forces acting on the jaw members 40 which tend

to separate the jaw members 40 from the wedging surfaces 56. As will be described, this arrangement prevents the spring members 42 from interfering with the operation of the cam member 46.

Referring now to FIGS. 5 and 6, the cam member 46 includes cam segments or arms 80 which diverge from a central cam portion 82. The arms 80 have a width and a thickness corresponding substantially with the width and depth of the grooves 70 and have leading cam edges 84 which engage and are adapted to slide over the cam surfaces 72 of the grooves 70. An actuating knob 86 is connected and spaced above the central cam portion 82 by means of a pin 88. The divergence of the arms 80 is equal to the divergence of the grooves 70 whereby, as shown in FIG. 9A, the cam member 46 is installed with the arms 80 fitting into the grooves 70 and with the central cam portion 82 fitting into the space defined by the grooves 74. As shown in FIG. 8, the central cam portion 82 projects above the arms 80 and serves as a bearing surface permitting free sliding thereof over the surface of the face plate 44.

FIG. 9A illustrates the relative positions of the jaw members 40 and the cam member 46 in the absence of a test specimen. In order to spread the jaw members 40, the cam member 46 is moved toward the crosspiece 52. As can be seen in FIG. 9B, movement of the cam member 46 causes the leading cam edges 84 to slide relative to the cam surfaces 72 and to exert forces thereon which cause the jaw members 40 to slide over the wedging surfaces 56. Inasmuch as the cam surfaces 72 are inclined at an angle of 45° with wedging surfaces 56, the force exerted by each of the leading cam edges 84 consists of two force components of equal magnitude. One force component has a line of action parallel to the wedging surface 56 and moves the jaw member 40. The other force component has a line of action perpendicular to the wedging surface 56 and maintains the jaw member 40 engaged therewith.

As stated above, the spring members 42 are positioned so that they are subjected to axial compression without lateral bending. Consequently, the spring members 42 do not apply reaction forces to the jaw members 40 which tend to displace the jaw members 40 from the wedging surfaces 56. The arms 80 of the cam member 46 slide freely in the grooves 70, that is without binding, when the cam member 46 is moved to spread the jaw members 40. More important, however, is the fact that when the cam member 46 is released, the jaw members 40 slide freely along the wedging surfaces 56 to firmly grip a test specimen.

The face plate 44 serves two functions, namely, to maintain the cam member 46 engaged in the grooves 70 and guide the cam member 46 during its reciprocal movement longitudinally of the housing 36. As can be seen in FIGS. 2 and 7, the face plate 44 is shaped to conform substantially with the shape of the cavity 38. Opposed, perforate ears 90 are provided on the face plate 44, which fit into corresponding wells 92 provided in the housing 36. Fasteners, such as machine screws 94, secure the face plate 44 to the housing 36.

Referring now to FIGS. 2, 7 and 8, the face plate 44 has a guide slot 96 which receives the pin 88. The guide slot 96 extends longitudinally of the housing 36 and causes the pin 88 and hence, the cam member 46 to undergo straight-line movement. The face plate 44 is also provided with a second slot 98 through which a test specimen may be viewed during its insertion between the jaw members 40.

Referring now to FIG. 10, the gripping device 26 may be provided with a cam actuating lever 100 which is pivoted as at 102, to the housing 36. The lever 100 has a slot 104 in one end through which extends the pin 88 of the actuating knob 86. Pivoting the lever 100 downward causes the jaw members (not visible) to be spread apart preparatory to receiving a test piece. The lever arm

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100 would be provided on larger size gripping devices 26 or on those gripping devices 26 wherein the spring members 42 are strong and cannot be compressed by hand.

Although the invention has been shown in connection with certain specific embodiments, it will be readily apparent to those skilled in the art that various changes in form and arrangement of parts may be made to suit requirements without departing from the spirit and scope of the invention.

I claim as my invention:

1. In a test piece gripping device comprising a housing having a test piece receiving end and an opposite end adapted for connection to physical testing apparatus, said housing having longitudinal side pieces, a crosspiece connecting said side pieces at corresponding ends thereof, and a longitudinal wall extending between said side pieces and to said crosspiece, said longitudinal side pieces providing a pair of opposed wedging surfaces which converge away from said crosspiece, and a pair of jaw members slideable over said wedging surfaces and including opposed faces adapted to grip a test piece therebetween, the improvement comprising: said jaw members having coplanar outer faces, each of said coplanar faces having a cam surface thereon which is inclined in a direction opposite to the inclination of the wedging surface with which each of said jaw members is engaged, a unitary cam member engaged with said cam surfaces, a single pin member secured to said cam member and projecting outwardly thereof for moving the cam member longitudinally of said housing to effect simultaneous movement of said jaw members along said wedging surfaces and hence into a spaced-apart condition for receiving a test piece therebetween, a face plate secured to said housing and overlying said cam members and said jaw member, said face plate having a longitudinal slot through which said pin member extends, and spring means interposed between said jaw members and said crosspiece for urging said jaw members along said wedging surfaces into a clamping condition.

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2. The improvement as defined in claim 1 wherein each of said cam surfaces is inclined at an angle of approximately 45°.

3. The improvement as defined in claim 1 wherein said spring means comprises a pair of spring members, one extending between each jaw member and said crosspiece, and means for maintaining each of said spring members substantially parallel with the adjacent one of said wedging surfaces whereby said spring members are subjected solely to axial compression when said jaw members are moved toward said crosspiece.

4. The improvement as defined in claim 1 wherein each of said cam surfaces comprises a surface of a groove provided in each of said coplanar faces, and wherein said unitary cam member has diverging cam segments each engaged in one of said grooves and slideable therein.

5. The improvement as defined in claim 1 wherein said crosspiece has a pair of cross surfaces which are inclined relative to one another and each of which is substantially perpendicular to the wedging surface with which it intersects, and wherein each of said jaw members has an end face which is parallel to the opposed one of said cross faces.

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