Aug. 18, 1959 F. W. LAMPE 2,899,995

CLAMP WITH PREDETERMINED CLAMPING FORCE INDICATING MEANS

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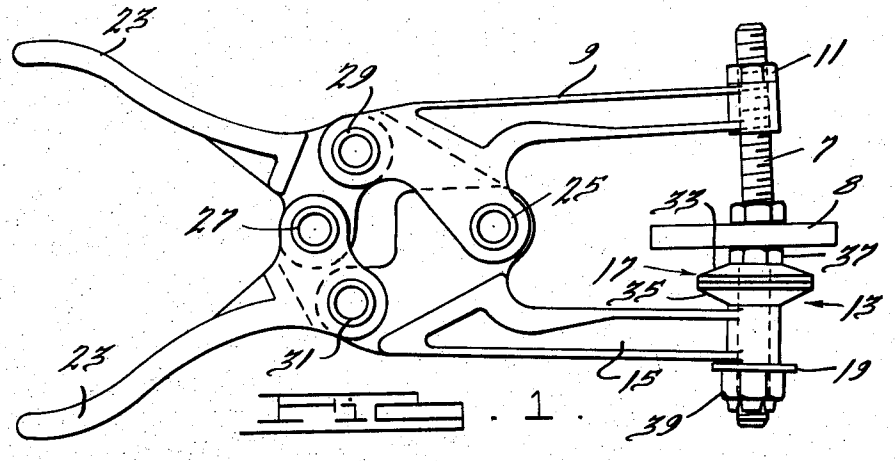


FIG. 1.

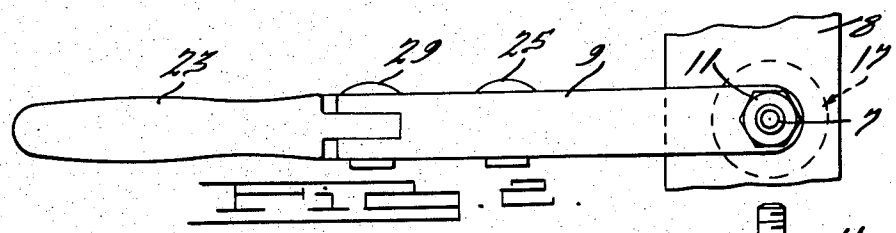
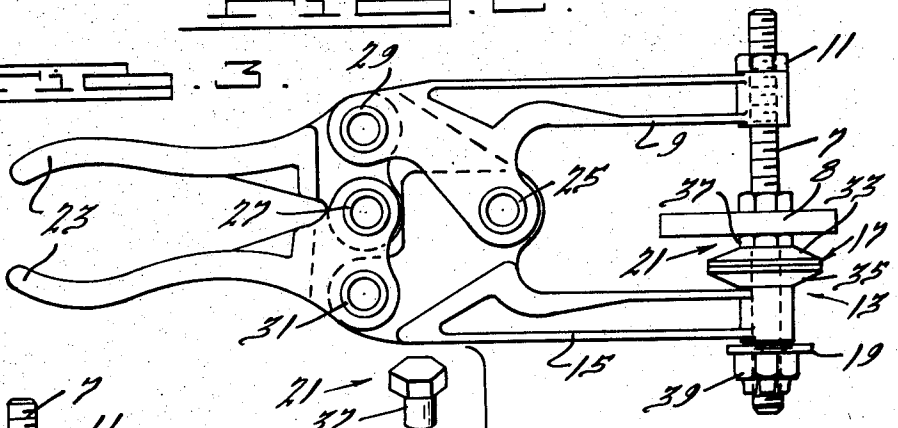


FIG. 2.

FIG. 3.



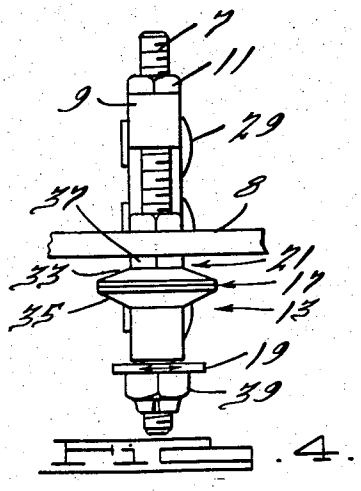


FIG. 4.

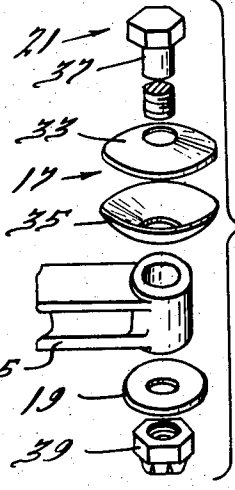


FIG. 5.

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CLAMP WITH PREDETERMINED CLAMPING FORCE INDICATING MEANS

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1 Claim. (Cl. 144—302)

This invention relates to clamping devices and more particularly to relatively small clamping devices having toggle action locking means.

It is a principal object of the invention to provide in combination with relatively small clamping devices, indicating means to determine when a predetermined clamping force is attained and to provide such indicating means in a form which is inexpensive, rugged in construction, and reliable in operation. More specifically, other objects of the invention are to provide small clamping devices with indicating means whereby the combination can be quickly adjusted to permit of clamping widely different objects with a known intensity of clamping force; to provide means for selectively setting the known or predetermined clamping force; to provide such indicating means in a form which can be simply affixed to one of the clamping jaws of a toggle action locking clamp and arranged to cooperate with the load adjusting means or spindle on the other one of the clamping jaws to accurately indicate when the predetermined intensity of applied clamping force is attained.

The above and other objects of the present invention will be apparent during the course of the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawings:

Figure 1 is a side elevation of a clamping device embodying the present invention, shown with the clamping jaws open preliminary to engaging work to be clamped;

Fig. 2 is a plan view of the structure of Fig. 1;

Fig. 3 is a view similar to Fig. 1 showing the clamping device applied to the work with the indicator in its free or movable position during application of a predetermined clamping force;

Fig. 4 is a right-hand side view of the structure of Fig. 3; and

Fig. 5 is an exploded view of the indicating means showing in detail the several parts thereof and their relation to the clamping jaw to which they are affixed.

The invention generally comprises the combination with a clamping device of indicating means to determine when a predetermined intensity of clamping force is attained. While the clamping device can take any of a variety of different constructions, there are special advantages realized when the indicating means is employed in combination with a clamping device of the type illustrated which has toggle action locking means and load adjusting means. The load adjusting means is preferably in the form of a threaded spindle **7** operating in the upper jaw **9** of the clamping device. The toggle action locking means is generally of well-known construction and its cooperation with the indicating means will be described hereinafter. A nut **11** may be employed to lock the threaded spindle **7** in any of its adjusted positions. Cooperating with the threaded spindle **7** is the indicating means generally designated **13** shown affixed to the lower jaw **15** of the clamping device. The indicating means comprises resilient means generally designated **17**, an indicator **19**, and preloading means generally designated **21**.

Of particular utility when provided with the indicating means of the present invention is the toggle action portable clamp shown. Its general construction and operation will be briefly described. The upper clamping jaw **9** and the lower clamping jaw **15** are pivotally connected together so as to be actuated in well known manner as a pair of levers fulcrumed at a common pivot connection **25**. The pair of clamping jaws **9**, **15** are opened and closed through force applied on a pair of handles **23**. The pair of handles **23** likewise operate as a pair of levers and are fulcrumed about a common pivot connection **27**. A pair of pivot connections **29**, **31** connect the handles **23** to the upper clamping jaw **9** and the lower clamping jaw **15**, respectively. Each of the pivot connections is of the double shear type although it is apparent the pivot connections could be of the single shear type. Assuming the clamping jaws **9** and **15** are in the open position, the handles **23** will likewise be in the open position. When it is desired to close the clamping jaws, the handles will be drawn together by the force applied to them and the common pivot connection **27** for the pair of handles **23** will be forced toward the throat of the clamping device to assume a position between the pair of pivot connections **29**, **31** joining the handles to the clamping jaws. As a result, the pivoted ends of the clamping jaws will be forced in an outward direction and will cause the clamping jaws **9** and **15** to pivot about their common pivot connection **25**, whereby the ends of the clamping jaws at the throat of the clamp will be forced inward. When resistance to inward movement of the clamping jaws is provided by a workpiece to be clamped, such as that shown and designated **8**, greater force must be applied to the pair of handles **23** and upon the application of such greater force the common pivot connection **27** for the handles will be forced into alignment with the pair of pivot connections **29**, **31** and such force applied to the handles will produce a multiplied clamping force between the clamping jaws. Continuation of the force applied to the handles moves the center of the common pivot connection **27** for the handles in line with the centers of the pair of pivot connections **29**, **31**, thereby locking the clamping device against any amount of outward force applied to the clamping jaws due to the dead center condition.

The toggle action thus described wherein the clamping device is locked in final locking position after the handles are released provides important advantages when employed in combination with the indicating means since the device can be quickly adjusted to produce a predetermined clamping force which is positively and securely maintained irrespective of the reactive forces developed between the clamping jaws. This unique function is useful in many industrial applications when a predetermined clamping force must be maintained.

The indicating means **13** is affixed to the lower clamping jaw **15** and its several parts will now be described. The resilient means **17** is preferably in the form shown and consists of a pair of dish shaped discs **33**, **35** disposed with their rims in contacting relation. Such an arrangement per se is well known in the art being termed generally "Belleville" springs. The resilient means **17** is adapted to be preloaded by the preloading means **21** preferably in the form of a threaded bolt **37** which extends through the resilient means **17** and is slidably engaged in the lower jaw **15** of the clamping device so as to be freely movable therein. The upper end of the bolt **37** bears against the upper disc **33**. Threadably engaging the other end of the threaded bolt **37** at the opposite side of the clamping jaw **15** on which the resilient means **17** is disposed is an adjusting nut **39**. Disposed

between the lower clamping jaw 15 and the adjusting nut 39 is the indicator 19 preferably in the form of a washer with a central aperture and knurling on the outside diameter through which the bolt 37 of the preloading means extends. The adjusting nut 39, which preferably is of the self-locking type, provides for adjustably preloading the resilient means 17 through its action on the bolt 37 and through the cooperation of the clamping jaw 15. When the adjusting nut 39 is tightened, the bolt 37 is drawn toward the lower jaw 15 of the clamping device, thereby applying a greater preloading force on the resilient means 17, and a greater restraint on the indicator 19 between the lower jaw 15 and the adjusting nut 39. The resilient means 17 is placed under a greater compressive force and, depending upon the characteristics of the several parts and particularly upon the spring constant of the resilient means, adjustment of the adjusting nut 39 will determine the predetermined force at which the indicating means will be operative. This predetermined force can be calibrated in terms of fractions of turns of the adjusting nut 39. Conversely, where the same predetermined clamping force is desired at all times, the adjusting nut 39 may be welded or otherwise solidly secured to the bolt 37.

The spindle 7 provides for adjustment of the applied load or clamping force between the clamping jaws in well known manner. Retraction of the threaded spindle 7 into the upper clamping jaw 9 so as to increase the throat gap decreases the clamping force applied between the clamping jaws when they are brought to bear upon a given workpiece by actuation of the handles into their locked position. Similarly, extension of the threaded spindle from the upper clamping jaw 9 so as to decrease the throat gap, increases the clamping force applied to the same workpiece when the handles are in their locked position. Thus, the opposed forces in the pair of clamping jaws are adjustable by means of the threaded spindle 7, deflection in the clamping jaws occurring when the throat gap is decreased and the higher clamping forces applied.

In operation, when it is desired to clamp work with a predetermined clamping force, the adjusting nut 39 is actuated to apply the predetermined force on the resilient means. The work to be clamped is disposed between the opened clamping jaws so as to be engaged on one side by the top of the bolt 37 and on the other side by the bottom of the spindle 7. Force is then applied to the pair of handles 23 so as to apply a multiplied clamping force to the clamping jaws 9, 15. If the clamping force is less than the predetermined force applied to the resilient means, the indicator 19 will remain restrained from movement. The clamping jaws are then removed from the work and the spindle 7 extended further from the upper clamping jaw 9 and the clamping device is again applied to the work; this time, with the handles in locked position, the clamping force is greater in intensity than previously. This operation is repeated, each time with adjustment of the spindle 7 to extend further from the upper clamping jaw 9. At such time as the applied clamping force equals the preloading force applied to the resilient means 17, the indicator 19 will no longer be restrained by the reactive force between the preloading means and the resilient means. This removal of restraint on the indicator 19 will provide indication that the applied clamping force is that which was desired to be applied to the work. If the spindle 7 is extended too far from the upper clamping jaw 9, the applied clamping force will exceed the predetermined force by more than is desired in the clamping operation and this condition is indicated by a very loose, free-moving indicator 19. In such an event, the spindle 7 is retracted slightly into the upper clamping jaw 9 and the adjustment is repeated until just the right amount of clamping force is applied as indicated by the condition of the indicator 19, whereby it is just movable by finger pressure applied thereto.

Figs. 3 and 4 exaggerate the position of the indicator 19 when it is just movable as indicated by the arrows. If the clamping force is less than the predetermined force, this condition will be indicated by too great a restraint on the indicator 19, whereby it cannot be moved by finger pressure applied thereto. Use of the clamping device for a few times enables one to judge with surprising accuracy when the predetermined force is attained.

Different objects having different dimensions and/or deflection characteristics can be clamped with the same desired clamping force within a range of accuracy which is useful for most industrial applications. An example of an industrial application wherein it is desired to apply a predetermined clamping force which must not be exceeded or diminished is in the molding of plastic parts or in the making of laminations with plastics. In such instances, it is frequently necessary to apply a molding pressure which must be maintained within certain limits. With the clamping device of the present invention, the desired molding pressure can be quickly applied with an accuracy well within these limits by adjusting the threaded spindle 7. The attainment of the desired molding pressure is independent of the dimensions or the deflection characteristics of the work to be clamped so long as there is sufficient resistance to clamping, as the attainment of the predetermined clamping force is brought about solely by interaction of the operative parts on the clamping device.

In the majority of applications, a single predetermined clamping force is all that is required, and in such instances reclamping with the same predetermined clamping force is the objective. The indicating means gives the assurance that the applied clamping force is the predetermined force. When it is desired to apply different predetermined clamping forces, the preloading means is adjusted to vary the preloading of the resilient means. For every predetermined force of clamping desired, the preloading means is adjusted by actuation of the adjusting nut 39 which is then left in its "set" condition and the clamping force is adjusted to equal this selected predetermined force by adjustment of the threaded spindle 7. Attainment of the selected predetermined force as stated is indicated by the freedom from restraint of the indicator 19.

It will thus be seen that there has been provided by this invention a clamping device in which the various objects hereinabove set forth, together with many thoroughly practical advantages, are successfully achieved. While the preferred embodiment of the invention has been shown and described, it is to be understood that various modifications, changes in size, shape and arrangement of parts may be resorted to without departing from the spirit of the invention or scope of the appended claim.

What is claimed is:

In a clamp having a pair of jaws movably mounted for travel of portions thereof toward each other; means on the clamp for indicating the application of a predetermined clamping force to work engaged thereby, said indicating means comprising a first work-engaging member adjustably mounted on one of said jaws, a second work-engaging member comprising a bolt member having the shank extended through said other jaw and having its head positioned opposite said first member, spring means extending between one side of said other jaw and said bolt head for exerting a resilient pre-load force on said bolt member in the direction of said first work-engaging member, a nut member mounted on said bolt member on the opposite side of said other jaw and positioned so that it is urged in the direction of the second jaw member by said pre-load force, and an annular indicating disk loosely positioned on said bolt so that it is freely movable longitudinally thereof and rotatable thereon, said disk being located on said bolt member between said second jaw member and said nut mem-

ber so that it is clamped therebetween by said pre-load force when the clamping force on said second work-engaging member is less than said pre-load force, said indicating disk being freely movable on said bolt member when the clamping force on said indicating disk is released in response to a force on said second work-engaging member equal to or greater than said pre-load force.

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