

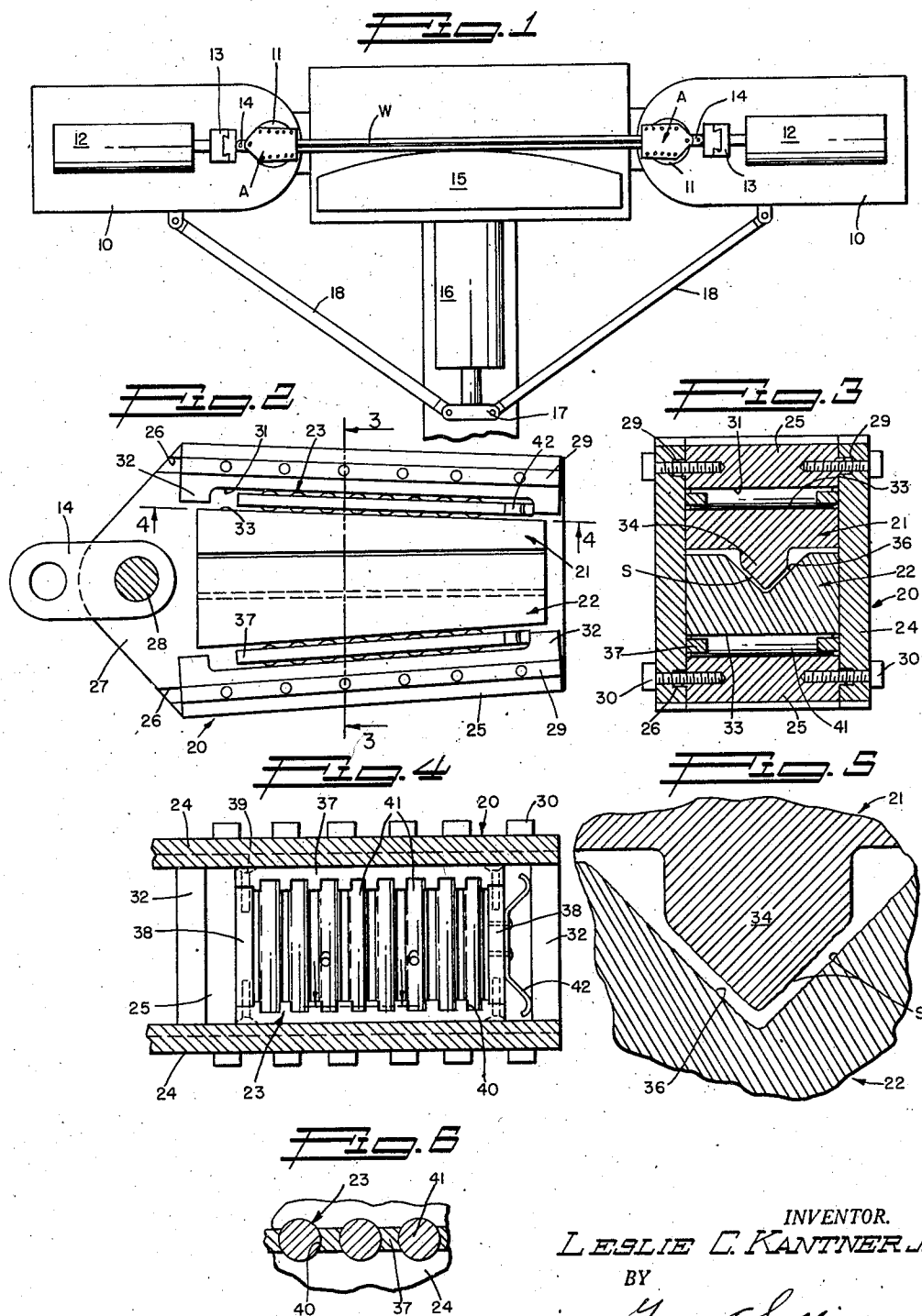
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SELF-ENERGIZING GRIP

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SELF-ENERGIZING GRIP

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This invention relates to gripping devices, and relates more particularly to grips for use in stretch-forming machines.

Stretch-forming machines are used extensively to give the required contours to aluminum alloy extrusions, preformed sheet metal stiffeners, etc. Such machines require grips for transmitting sufficient tensile loads to the work parts to maintain the metal of the work pieces within the plastic range during the stretch-forming operation. Many types of grips have been suggested and employed but few have proven entirely satisfactory. The principal cause of difficulty in the grips heretofore used results from the employment of serrations on the jaws or gripping surfaces. These serrations, usually formed by making notches in the metal surfaces, act to produce stress concentrations of sufficient magnitude to cause premature fracture of the work pieces.

A general object of the present invention is to provide grips for stretch-forming machines that are operable to transmit heavy tensile loads to the work parts without causing failure or fracture of the parts. The grips of the invention provide for a substantially uniform and fully distributed application of stress to the work, thus practically eliminating the possibility of premature fracture of the work.

Another object of the invention is to provide grips of the class referred to embodying jaws shaped to conform to the work and having surfaces prepared to assure a high coefficient of friction without a concentration of the stresses. The active gripping surfaces may be contoured to accurately conform to extruded sections or preformed work parts and are roughened as by sand blasting to maintain a firm positive grip without concentrating the stresses.

Another object of the invention is to provide grips of the character referred to that are entirely self actuating. The grips employ wedge jaws that are automatically energized to grip the work upon the application of tension.

Another object of the invention is to provide wedge type grips of the character referred to which embody sturdy, efficient anti-friction means for reducing to a minimum the sliding friction between the gripping jaws and the cases. The anti-friction means not only reduces friction when the jaws move forward to grip the work but also provides for instantaneous release of the jaws when the tensile load is removed from the work. The combination of the jaw faces providing a high coefficient of friction and the wedge action for actuating the jaws, assures a positive

grip on the work part throughout the stretch-forming operation.

Another object of the invention is to provide grips of the class referred to in which the tensile loads are exerted or applied through the center of gravity of the work piece. This eliminates lateral bending of the work piece at zones adjacent the grips.

A further object of the invention is to provide grips of the character referred to that are simple and inexpensive to manufacture and that are sturdy and compact in construction.

Other objects and features of the invention will be readily understood from the following detailed description of a typical preferred form of the invention in which reference will be made to the accompanying drawing in which:

Figure 1 is a plan view of one type of stretch-forming machine illustrating the grips of the invention associated with the machine;

Figure 2 is an enlarged plan view of one of the grips with the cover plate removed;

Figure 3 is a transverse detailed sectional view taken as indicated by line 3-3 on Figure 2;

Figure 4 is a fragmentary longitudinal detailed sectional view taken as indicated by line 4-4 on Figure 2;

Figure 5 is a greatly enlarged transverse detailed sectional view illustrating the active gripping faces of the jaws; and

Figure 6 is a fragmentary longitudinal sectional view taken as indicated by line 6-6 on Figure 4.

The grips provided by this invention are adapted for use on practically any type of stretch-forming machine, and if necessary, may be modified or adapted for use with machines of special construction. In Figure 1 I have illustrated grips of the invention associated with one type of stretch-forming machine, it being understood that this is merely a typical application of the invention and is not to be construed as limiting either the scope or application of the invention.

The stretch-forming machine illustrated in the drawing comprises two end blocks 10 supported for pivotal movement about vertical shafts 11. Cylinder and piston mechanisms 12 are mounted on the blocks 10 to oppose one another. Suitable adaptors 13 are secured to the piston rods of the mechanisms 12. The grips A are linked with the adaptors 13 by shackles 14. The work piece W is engaged in and extends between the two grips A. A block or die of selected configuration is secured to the

base of the machine to be at one side of the work piece W. A principal cylinder and piston mechanism 16 extends horizontally from the machine, and its piston rod carries a head 17. Links 18 are pivotally connected with the head 17 and with the blocks 10. When the work piece W has been engaged in the grips A the cylinder and piston mechanisms 12 are operated to impose an initial stretch or tensile load on the work. The cylinder and piston mechanism 16 is then operated to cause the blocks 10 to rotate about their shafts 11. This moves the jaws A and the ends of the work piece W toward the die 15 so that the work is stretched over the die to be contoured or shaped thereby. The present invention is not primarily concerned with the details of the stretch-forming machine and such details are not believed essential to a full understanding of the invention.

The two grips A may be identical and I will proceed with a detailed description of one of them, it being understood that this description is equally applicable to the other grip.

The grip of the invention may be said to comprise generally a case 20, wedge jaws 21 and 22, and anti-friction means generally indicated at 23 mounting the jaws in the case 20 for free operation.

The case 20 forms the body of the grip and serves to house the jaws 21 and 22 and the means 23. The case 20 is of simple construction and comprises two plates 24 and two spaced side members 25 secured between the plates. The plates 24 are simple flat parts, the longitudinal edges of which are forwardly convergent. Channels or grooves 26 are provided in the inner faces of the plates 24 in spaced parallel relation to their convergent edges. Where the grips A are horizontally arranged as illustrated, the plates 24 form the top and bottom walls of the case. The rear ends of the plates 24 have tongues 27 and the shackle 14 is received between the tongues. A vertical shaft 28 secures the shackle 14 to the tongues 27. The side members 25 are thick-walled plate-like parts having flat edges for contacting the inner sides of the plates 24. Tongues or keys 29 extend along these edges and fit the above referred to grooves 26. Series of cap screws 30 pass through openings in the plates 24 and are threaded into openings in the members 25 to connect the plates and members to form a box-like structure. The side members 25 are forwardly convergent, being flush with the above referred to convergent edges of the plates 24. The inner sides of the members 25 have machined or ground surfaces 31 to cooperate with the anti-friction means 23. Inwardly projecting ledges or flanges 32 occur at the opposite ends of the finished surfaces 31. From the above it will be seen that the case 20 is a simple readily assembled structure.

The jaws 21 and 22 are the active work engaging elements of the device. The jaws are in the nature of elongate wedge members whose inner sides are contoured or shaped to conform to the work piece W. The outer sides 33 of the jaws 21 and 22 are flat and are accurately machined to cooperate with the anti-friction means 23. The outer jaw surfaces 33 are pitched or have a wedge slope. I have found that the best results are obtained by giving the jaw surfaces 33 a wedge slope of twenty to one. The finished surfaces 31 of the case members 25 are correspondingly pitched to be parallel to the surfaces 33. Figure 2 of the drawing illustrates the manner

in which the pairs of opposing surfaces 31 and 33 are pitched with respect to the longitudinal axis of the grip.

The cross sectional contour or configuration of the jaws 21 and 22 depends upon the cross sectional shape of the work to be handled. In the particular case illustrated it may be considered that the work piece W is a simple part in the nature of an angle section. The male jaw 21 has on its inner side a longitudinally extending ridge 34 presenting inwardly convergent gripping surfaces adapted to engage in the angle sectioned work piece W. The female jaw 22 has a longitudinally extending groove 36 with outwardly convergent walls or surfaces for engaging with the outer surfaces of the work piece W. The ridge 34 and the groove 36 extend throughout the entire lengths of the jaws 21 and 22 and are uniform in shape. The surfaces presented by the ridge 34 and the groove 36 are related to evenly engage the surfaces of the work piece throughout the entire extent of the jaws.

The texture or character of the surfaces presented by the ridge 34 and groove 36 of the steel gripping jaws is an important feature of the invention. In preparing these surfaces they are first machined smooth and are then roughened to have a high coefficient of friction. I prefer to roughen the active jaw surfaces by sand blasting them subsequent to all hardening and machining operations. This treatment of the active gripping jaw surfaces provides a uniformly high coefficient of friction throughout the entire extents of the surfaces. Figure 5 illustrates the slightly roughened or sand blasted surfaces S, the roughness being exaggerated. There are no distinct sizable projections, serrations or edges on the gripping surfaces S for concentrating the stresses in the work piece, but there is an infinite number of extremely small irregularities which assure a full distribution of the stress throughout the entire surface areas. In actual practice the roughened surfaces S assure positive uniform gripping of the work W with no danger of failure by reason of stress concentrations.

The antifriction means 23 is provided to reduce to a minimum the sliding friction accompanying actuation of the jaws 21 and 22. The means 23 is in the nature of a roller bearing means comprising two like or identical assemblies. A bearing assembly is arranged at the rear side of each gripping jaw. Each bearing assembly includes a cage or roll retainer comprising a pair of longitudinally extending members 37 engaged at their ends by spacers 38. Screws 39 may connect the members 37 and spacers 38. Spaced sockets or notches 40 are provided in the opposing faces of the cage members 37. The walls of the notches 40 are cylindrically curved and the diameter of curvature is greater than the thickness of the members 37. Anti-friction elements or rollers 41 are arranged in the bearing cages to have their end portions received in the notches 40. The notches 40 serve to retain the rollers 41 in spaced generally parallel relation. The surfaces of the rollers 41 ride on the surfaces 31 of the case members 25 and cooperate with the rear surfaces 33 of the gripping jaws 21 and 22. The surfaces 31 and 33 are suitably hardened to prevent Brinelling by reason of the loads imposed by the rollers 41. The bearing assemblies are floating. That is, they may advance and retract in the case 20 when the gripping jaws are operated and released. The flanges 32 on the members 25 serve to limit this free movement of the bearing

assemblies. Bumper springs 42 are provided on the forward ends of the bearing cages to cooperate with the forward flanges 32. The springs 42 are in the nature of leaf springs having bowed out-
standing parts for striking the flanges 32. The
springs 42 prevent the roller bearing cages from
assuming extreme forward positions prior to full
actuation of the jaws and thus provide for ample
forward travel of the bearings during the gripping
operation. The springs 42 assist in restoring the
bearing to intermediate positions when the jaws
21 and 22 are released.

In operation it will be assumed that the grips
A of the invention are associated with the cylinder
and piston mechanisms 12 of the stretch-
forming machine. When the work part W is to
be stretch-formed its opposite end portions are
introduced into the grips A. The work piece is
readily inserted between the gripping jaws 21 and
22. The jaws 21 and 22 are normally free or re-
leased so that the work piece W may be easily
entered between the active surfaces S of the jaws.
When the cylinder and piston mechanisms 12 are
operated the relative axial movement between the
case 20 and the gripping jaws 21 and 22 results
in actuation of the jaws. It will be seen that rela-
tive movement between the surfaces 31 and 33
causes inward actuation of the jaws bringing the
jaw surfaces S into gripping engagement with the
work piece W. The rollers 41 engaged between
the wedge surfaces 31 and 33 reduce the sliding
friction to a minimum and assure full rapid
actuation of the gripping jaws. Thus with initial
operation of the cylinder and piston mechanisms
12 the gripping jaws 21 and 22 are operated to grip
the work piece W. The roughened jaw surfaces
S have a high coefficient of friction and obtain a
positive hold on the work piece without concen-
trating the stresses. The uniformly distributed
gripping effect produced by the sand blasted sur-
faces S permits the application of very high ten-

sile loads to the work piece W without danger of
fracturing the work. When the work piece W has
been put under the required initial tension, the
cylinder and piston mechanism 16 is operated to
rotate the blocks 10 so that the work W is
stretched about the die 15. The jaws 21 and 22
of the grips A retain their positive gripping en-
gagement with the work piece W during the
stretch-forming of the work. When the stretch-
forming operation has been completed and the
work piece W is relieved of tension, the jaws 21
and 22 are released. The anti-friction rollers 41
provide for the ready release of the jaws.

By removing the shackle bolt 28, the jaws 21
and 22 may be inserted and removed through the
rear of the case 20. It is to be understood that
the jaws 21 and 22 may be replaced by jaws de-
signed for the engagement of work pieces of
various cross sectional configurations. The in-
vention provides efficient self energizing grips em-
bodying readily replaceable gripping jaws
equipped with highly efficient gripping surfaces.

Having described only a typical form of the in-
vention I do not wish to be limited to the specific
details herein set forth, but wish to reserve to my-
self any variations or modifications that may
appear to those skilled in the art or fall within
the scope of the following claims.

I claim:

1. A grip comprising a casing having a pair of
gripping jaws adapted to grip the work, one of
said jaws having a wedge-shaped ridge thereon,
the other jaw having a correspondingly shaped
groove therein to receive the ridge, said jaws be-
ing movable toward each other to cause the ridge
to force the work into the groove to bindingly en-
gage the same therein.

2. A device as claimed in claim 1 wherein the
confronting surfaces of the ridge and groove are
minutely roughened.

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