

Sept. 1, 1925.

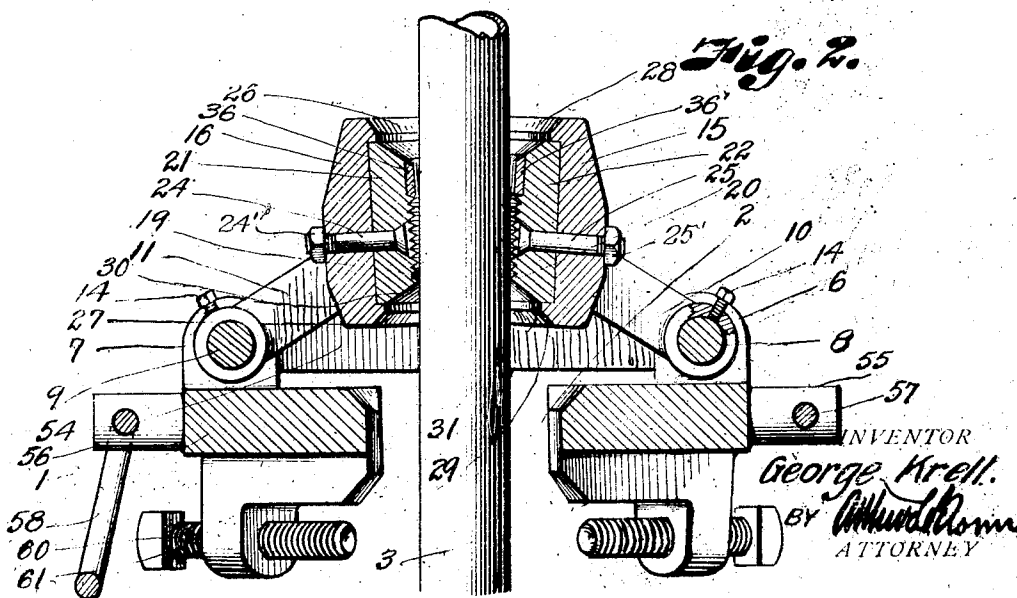
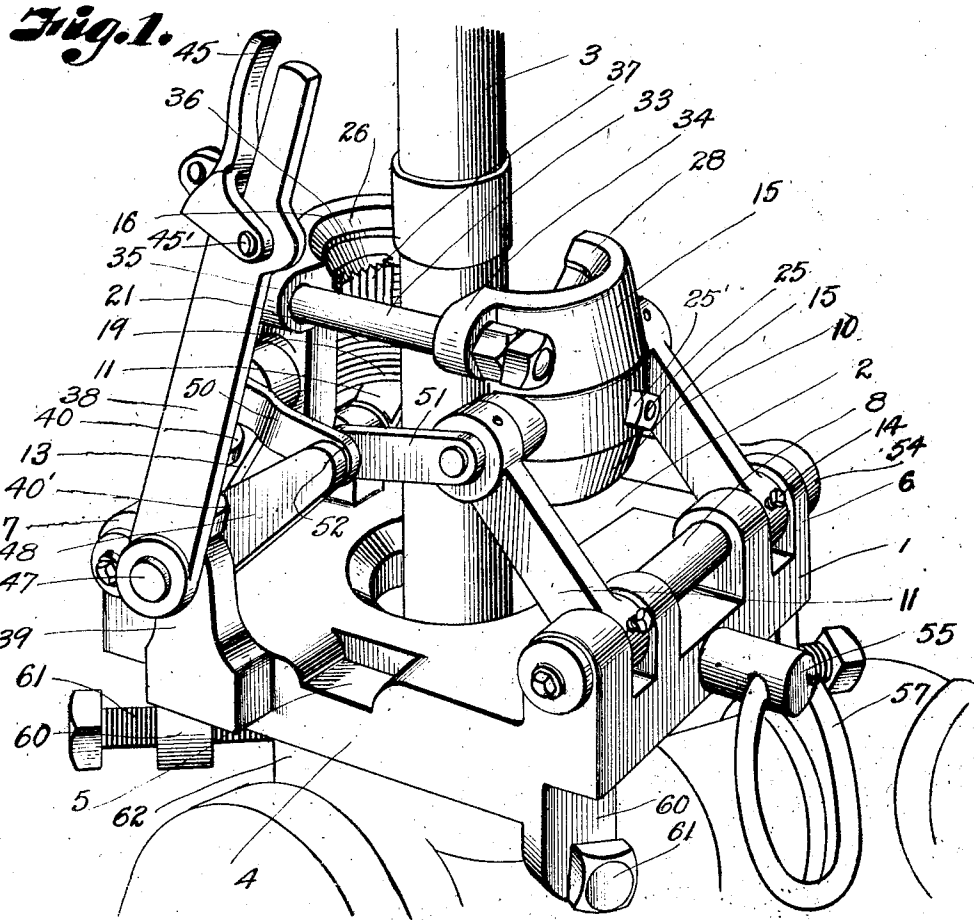
1,552,062

G. KRELL

CLAMPING DEVICE

Filed Nov. 28, 1924

2 Sheets-Sheet 1



INVENTOR
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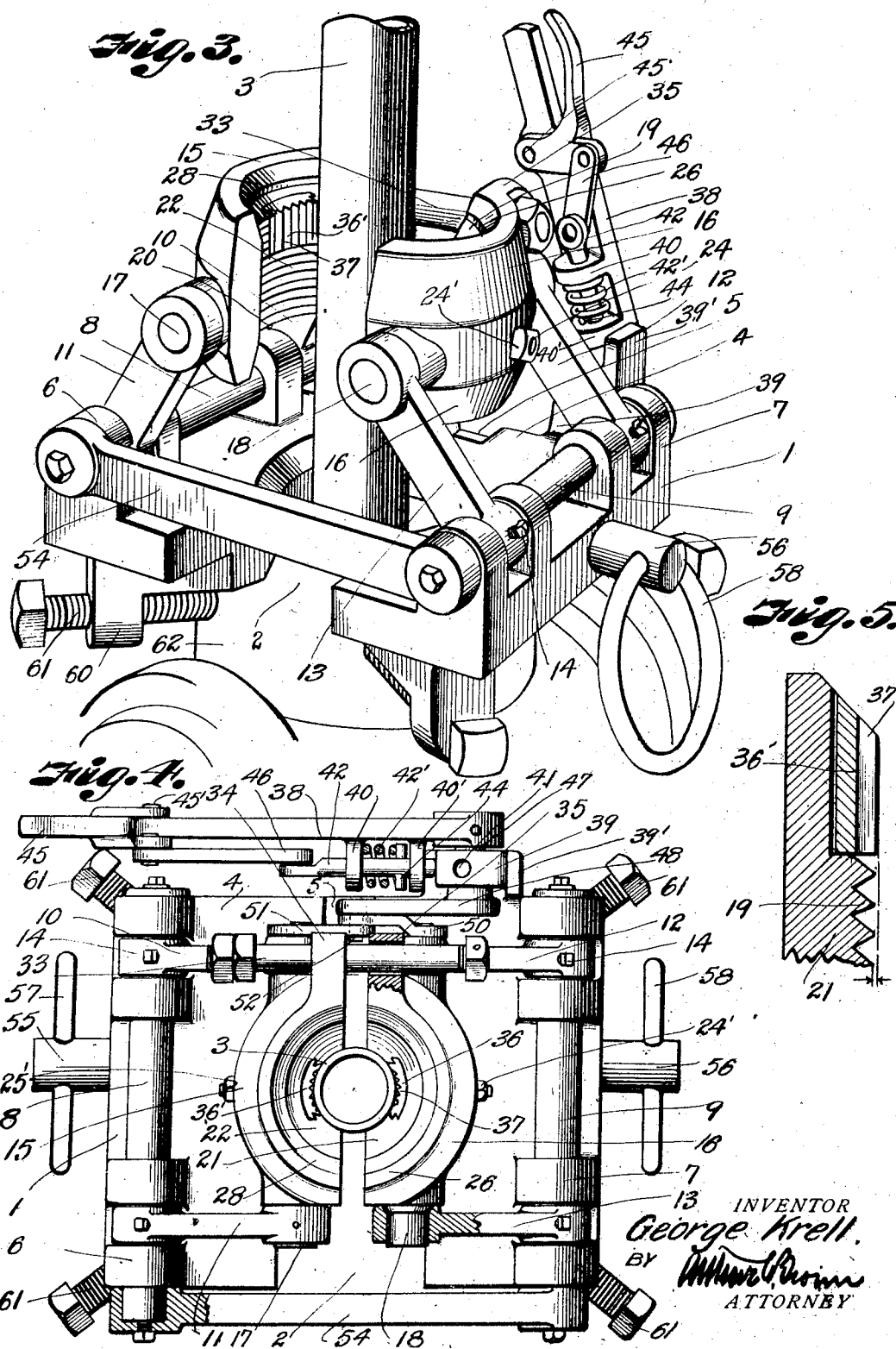
G. KRELL

1,552,062

CLAMPING DEVICE

Filed Nov. 28, 1924

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

GEORGE KRELL, OF SAPULPA, OKLAHOMA.

CLAMPING DEVICE.

Application filed November 28, 1924. Serial No. 752,648.

To all whom it may concern:

Be it known that I, GEORGE KRELL, a citizen of Germany, residing at Sapulpa, in the county of Creek and State of Oklahoma, have invented certain new and useful Improvements in Clamping Devices; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

This invention relates to clamping devices for pipe and the clamping mechanism has been especially designed for use in connection with devices used in the oil fields for drilling wells. For example, elevators for casings, sucker rods and the like, spiders for the casing and those devices are commonly known as clamps. All employ some form of jaw for gripping the pipe or sucker rod and in this respect there is an analogy between all three, but the construction of the supporting means or frame for the jaws in the elevator, the spider and the ordinary clamp differs. Therefore I would have it understood that in so far as the generic application of the jaws and their operating means is concerned, my invention contemplates the inclusion of such mechanism in any form of clamp but specifically the supporting means illustrated in the drawings is adapted for a spider. Hence in the claims the word clamping device is intended to be generic to any form of clamp.

The novel construction of the preferred embodiment of my invention will be clearly understood by reference to the following description in connection with the accompanying drawings, in which

Fig. 1 is a perspective view of a spider embodying my invention with the jaws in open position.

Fig. 2 is a vertical sectional view through the spider showing the jaws in clamping position.

Fig. 3 is a perspective view of a spider viewed from the side opposite to that shown in Fig. 1.

Fig. 4 is a plan view of the spider, and Fig. 5 is a fragmentary sectional view through one of the slips.

The base frame 1 is shown as substantially rectangular with a slot 2 in one wall

by means of which the frame can be moved into and out of position with respect to the pipe 3. The side wall 4 of the frame 1 is provided with a recess 5 to provide clearance for the toggle levers which operate the jaw member. These toggle levers will be described in detail hereinafter.

The frame 1 carries two sets 6 and 7 of upstanding bearing lugs, one set at each end. The lugs constitute bearings for the rock shafts 8 and 9 which support the rocker arms 10, 11, 12 and 13 rigidly fastened to the rock shafts by set screws 14. The purpose of providing the set screws so that the rocker arms will be fast to the rock shafts is to maintain the rocker arms of each set in parallelism, this being important because the rocker arms support the jaw members 15 and 16 provided with trunnions 17 and 18 mounted in the inner ends of the rocker arms.

The jaw members 15 and 16 are pivoted in the rocker arms below their transverse centers only so that the upper ends of the jaw members will tend to spread apart, due to the fact that the center of gravity of each jaw member is above the transverse center of the jaw member. This is impossible where there are pivotal connections for the jaws above the transverse centers. The purpose of so mounting the jaw member is to cause the lowermost teeth 19 and 20 of the slips 21 and 22 to firmly grip the article clamped, for example the pipe 3. Therefore if the lower teeth become worn, the next succeeding teeth will be sharp enough to obtain the necessary grip on the pipe. The slips 21 and 22 are shown as provided with transverse teeth 19 and 20, the slips being in the form of segments. They are removably fastened to the jaw members 15 and 16 by bolts 24 and 25. The slips are removable for two purposes, first so that the slips can be inspected or repaired and secondly because slips having faces cut on different arcs can be introduced in the same jaws for taking care of various sizes of pipe.

The ends of the jaw members 15 and 16 are beveled or flared outwardly as indicated at 26, 27, 28 and 29, so that the ends of the pipe will be properly guided between the jaws. The inner walls of the slips in the jaw members are also beveled as at 30 and 31, to permit the coupling on pipe 3 to pass through the jaws as the pipe is being removed. The jaws are maintained in sub-

stantially effective parallelism by the rod 33 which passes through the ear 34 on jaw 15 and through the ear 35 on jaw 16; it being desirable that the jaws firmly engage the pipe 3 to hold it suspended in the well, and since the teeth 19 and 20 for the slips 21 and 22 are arranged in horizontal planes, it will be apparent that tendency of the pipe to slip longitudinally will be eliminated. These teeth under all conditions will not be effective in preventing turning of the pipe about its axis so the pipe will have a tendency to slip when a wrench is used to connect or disconnect the pipe sections. In order to overcome the tendency of the pipe rods or the like to turn about its axis, I provide dies or inserts 36 and 36' which are provided with vertical or longitudinal teeth 37, the teeth of the insert projecting inwardly slightly beyond the teeth 19 so that they will grip the article to be clamped in a manner firm enough to prevent the article from turning about its axis. This is quite an important feature in any form of clamp, particularly those used in the oil fields. The main purpose of inseting the teeth 37 with respect to the teeth 19 is that, when the jaws take hold of the pipe, the teeth 37 will sink into the pipe just enough in excess of the teeth 19 to hold the pipe against turning when a wrench is applied to the next highest pipe section. If both sets of teeth were coincident at their outer edges and a wrench was used to turn the next highest pipe section, the teeth 37 would tend to grind off or at least fail to hold as efficiently as with the arrangement described.

Inasmuch as the jaws 15 and 16 have considerable weight, it is essential that some form of jaw opening mechanism be provided which may be conveniently operated with little power to spread the jaws apart, it being understood that the jaws always have a tendency to swing into clamping position due to the fact that they are supported above the rock shafts 8 and 9.

The jaw opening mechanism is illustrated as comprising a lever 38 pivoted to a lug 39 on the frame 1, the lug 39 having a stop projection 39' for the lever 38. Movable longitudinally in the guide lugs 40 and 40' on the lever 38 is a dog 42 which is normally urged into engagement with a recess 41 in lug 39 by an expansion spring 42', one end of which bears against lug 40 and the other against the pin 44. The dog can be moved out of engagement with any one of the openings 41 by a hand lever 45 pivoted to the lever 38 at 45' and connected to the dog by a link 46.

The lever 38 is fast to a rocking stub shaft 47 in the lug 39, the inner end of the rocking stub shaft carrying an arm 48 which is pivoted to the two toggle levers 50 and 51 in

turn connected to the trunnions of the jaw members 15 and 16. The inner ends of these levers may be received in the recess 5 when the jaws are in clamping position, the recess 5 being merely a clearance for the ends of the levers. It will be impossible to operate the lever 38 in such a manner that the pivotal connection 52 will be above a horizontal plane passing through the trunnions, because before that can occur, the lug 40 will contact with the stop 39'. Therefore the jaws will always have a tendency to seat themselves or drop into pipe or rod clamping position. When lever 38 is swung in either direction, shaft 47 rocks swinging arm 48 fast to it. The arm 48 imparts movements to the toggle links 50 and 51 which in turn rock links 10, 11, 12 and 13 fast to the rock shafts 8 and 9 so that the shafts 8 and 9 rock in their respective bearings.

Since one side of the frame is provided with a slit or slot 2, that side of the casting is braced by a tie rod or brace rod 54 connected to the rock shafts 8 and 9. The ends of the frame 1 are provided with outstanding projections 55 and 56 which carry links 57 and 58 whereby the frame may be connected to a hoist to move it into and out of functional position. The frame is also provided with depending lugs 60, one at each corner, each lug being provided with a set screw 61, by means of which the frame may be fastened to a support where the clamp is incorporated in a spider.

In actual practice I prefer to have the links 10, 11, 12 and 13 on angles of about 65° from the horizontal, as I find that this angle of inclination for the links insures an adequate gripping surface for the jaws and any lesser angle seems to lessen the gripping efficiency of the jaws. Obviously however, I do not wish to be limited to this particular angle.

When the parts are assembled and it is desired to use the invention as a spider, the frame may be clamped to its support, for example to the casing head 62. Then the pipe is lowered by the elevator to the desired depth, the spread jaws are adapted to seat themselves against the pipe and swing down to seating position to hold the pipe while a new section of pipe or casing is screwed on as is well understood, then the lever 38 will be operated to spread the jaws apart so that the pipe may be lowered a sufficient distance to allow a new section of pipe to be screwed on and so on until the desired length of string of pipe is provided. The position of the pivot point 52 is important because I have found that by pivoting the toggle levers 50 and 51 and the arm 48 at a point coinciding with the plane passing through the axis of the opening in the frame that the jaws can be opened with relatively little

power and that each jaw will tend to move substantially the same distance away from the center of the frame. Thus the jaws can be opened with greater facility than if the arm 48 was pivoted to one of the links 50 and 51 to one side of the center line of the frame.

When it is desired to remove the spider the bar 54 may be removed, then the spider can be slipped to one side because the slot 2 is wide enough to permit the largest sized pipe to pass through it.

In my former Patent #1,446,568, dated February 27, 1923 for an elevator, I have shown a certain form of jaw mechanism which has certain advantages in an elevator but since filing the application for that patent, I have developed the improvements in jaw mechanism enumerated in this application and I find by actual practice that the same form of jaw mechanism illustrated in this application and the same form of jaw spreading mechanism illustrated in this application is better adapted for the elevator than the mechanism shown in said patent. Therefore I recommend the jaw mechanism shown in this application and the jaw spreader shown in this application as a better form to be used in connection with an elevator. Practical experience has shown that if the fastening devices used for securing the slips in the jaws are insertable from the inner sides of the jaws and slips and do not pass through the jaws, difficulty is encountered in removing the fastening devices when the slips are to be changed. This is due to the fact that salt water causes corrosion about the fastening devices so that they freeze. Therefore I make the bolts 24 and 25 long enough to pass through the slips and through the jaw members and hold them by nuts 24' and 25'. This allows the fastening devices to be manipulated from the outside when it is desired to take out the slips. In other words, the nuts 24' and 25' can be removed and by tapping on the threaded ends of the bolts they can be loosened as the salt water does not affect the outside nuts. Even if it should the nuts are more accessible than the inner ends of the bolts.

Another feature in connection with the slips is that the holes through which the bolts pass are below the longitudinal center of the slips and of the jaws. The main purpose of this construction is to prevent the slips getting in upside down. With the arrangement shown it will be impossible to put the slips in incorrectly because the holes in the slips must match with the holes in the jaw members.

Attention is also called to the fact that there is a marked advantage in having the top end of the jaws swung outwardly when the pipe is about to be engaged by the jaws. The advantage is this; the lower teeth of

the slips first take hold and then the remaining teeth. Therefore the lowermost teeth take the shock and as they wear away the next higher teeth, still sharp, take the shock so that the teeth of the slips wear away progressively from the bottoms of the jaws to the tops instead of all the teeth wearing away simultaneously. According to my invention then there will always be sharp teeth on the slips until they have all worn off progressively from the bottom ends upward.

The location of the lever 38 with the arm 48 for operating the jaws is an important part of this invention, because the jaws 15 and 16 are quite heavy so that the leverage ratio must be considerable to spread them apart. Therefore by locating the pivot point of the lever 38 between the shafts 8 and 9, the necessary leverage can be obtained for opening the jaws.

Where the lever is mounted in actual alignment with one of the rock shafts 8 or 9 or outside the rock shafts 8 or 9, an excessively long lever 38 is necessary so long indeed as to make the inclusion of a lever almost prohibitory. Particularly is this true where the mechanism is used in connection with an elevator, for it should be borne in mind that attention must be paid to clearances for the walking beam and the like when the string of pipe is being lowered or when the tubing is being pulled.

Inasmuch as different diameters of pipe are used it is desirable to have the slips 21 and 22 removable. A set of slips can be made to be used in a single set of jaws for varying diameters of pipe. The sets consist of a number of pairs of slips, all the pairs having the same arc or curve on their outer faces but the inner faces of each pair will differ as to arc or curve, the arc being that which will best suffice for a particular diameter of pipe. Therefore if the device is used for a 10-inch pipe and it is desirable to operate on 8-inch or 6-inch pipe, it will be only necessary to remove the 10-inch slips and substitute the 8-inch or 6-inch slips and of course this also applies to slips of other diameters of pipe. The substitution of the interchangeable slips for those already in the jaws can be quickly and expeditiously made by taking out the bolts 24 and 25, removing the slips and substituting other ones.

It will be observed that the jaws are provided with recesses to receive the slips so that when the nuts on the bolts 24 and 25 are tightened, the slips will be securely held in place, the edges of the recesses in the jaws supporting the weight.

Attention is also called to the fact that the central opening in the base or frame 1 is of less diameter than the space between the jaws when the jaws are opened, thus the central opening for the pipe will con-

stitute a guide for guiding the pipe into proper position to be embraced by the jaws.

What I claim and desire to secure by Letters-Patent is:—

1. A clamping device comprising a support, rocking jaw-carrying members on the support, and complementary jaws carried by the rocking members, movable one toward the other for clamping an object between them, the jaws being pivoted to the rocking members below their transverse centers only, so that the upper ends of the complementary jaws will tend to spread apart.
2. A clamping device comprising a support, rocking jaw-carrying members on the support, and complementary jaws carried by the rocking members, movable one toward the other for clamping an object between them, the jaws being pivoted to the rocking members below their transverse centers only, so that the upper ends of the complementary jaws will tend to spread apart, and means for spreading said jaws.
3. A clamping device comprising a support, rocking jaw-carrying members on the support, complementary jaws carried by the rocking members, movable one toward the other for clamping an object between them, the jaws being pivoted below their transverse centers only, so that the upper ends of the complementary jaws will tend to spread apart, and means for opposing the tendency of the jaws to move together, said means, being effective in spreading them.
4. A clamping device comprising a frame, rocking jaw-carrying members on the frame, and two diametrically opposite complementary clamping jaws carried by the rocking members, the jaws being pivoted below their transverse centers only, so that the upper ends of the complementary jaws tend to spread apart, and means for spreading said jaws.
5. A clamping device comprising a frame, rocking jaw-carrying members on the frame, two diametrically opposite clamping jaws carried by the rocking members, the jaws being pivoted below their transverse centers only, so that the upper ends of the complementary jaws tend to spread apart, means for operating said jaws and means carried by the jaws to prevent the article clamped from turning with respect to the jaws, said means comprising lateral teeth and longitudinal teeth, one set of teeth extending inwardly slightly beyond the other set of teeth.
6. A clamping device comprising a frame, two diametrically opposite clamping jaws carried by the frame, the jaws being pivoted below their transverse centers only so that the upper ends of the complementary jaws tend to spread apart, means for operating said jaws and means carried by the jaws to prevent the article clamped from turning with respect to the jaws, said means com-

prising lateral teeth and longitudinal teeth, one set of teeth extending inwardly slightly beyond the other set of teeth.

7. A clamping device comprising a frame, two diametrically opposite complementary clamping jaws carried by the frame, the jaws being pivoted below their transverse centers only so that the upper ends of the complementary jaws will tend to spread apart, means for operating said jaws and means carried by the jaws to prevent the article clamped from turning with respect to the jaws, said means comprising lateral teeth and longitudinal teeth, the longitudinal teeth extending inwardly slightly beyond the other set of teeth.

8. A clamping device comprising a frame, rocking jaw-carrying members on the frame, two diametrically opposite complementary clamping jaws carried by the rocking members, the jaws being pivoted below their transverse centers only, so that the upper ends of the complementary jaws will tend to spread apart and means for operating said jaws, the jaws having outwardly beveled top and bottom edges.

9. A clamping device comprising a frame, rocking jaw-carrying members on the frame, two diametrically opposite complementary clamping jaws carried by the rocking members, the jaws being pivoted below their transverse centers only, so that the upper ends of the complementary jaws will tend to spread apart, means for operating said jaws, lugs on the frame and adjustable fastening devices in the lugs to rigidly secure the clamping device to a support.

10. A clamping device comprising a frame, parallel rock shafts carried by the frame, complementary clamping jaws having supports rigidly secured to the rock shafts, the jaws being movable toward and away one from the other and means for spreading said jaws apart.

11. A clamping device comprising a frame, two parallel rock shafts carried by the frame, jaws having supports rigidly mounted on the rock shafts and having swinging movement toward and away from the center of the frame, the ends of the jaws being beveled outwardly, means in the jaws for preventing the article clamped from turning, said means comprising lateral teeth and longitudinal teeth, one set of teeth extending inwardly slightly beyond the other set of teeth and means for spreading the jaws.

12. A clamping device comprising a frame, two parallel rock shafts carried by the frame, jaws having supports rigidly mounted on the rock shafts and having swinging movement toward and away from the center of the frame, the ends of the jaws being beveled outwardly, means in the jaws for preventing the pipe from turning, said means comprising lateral teeth and longi-

tudinal teeth, one set of teeth extending inwardly slightly beyond the other set of teeth, means for spreading the jaws, and securing means carried by the respective corners of the frame.

13. A clamping device comprising a frame, two parallel rock shafts carried by the frame, jaws having supports rigidly mounted on the rock shafts and having swinging movement toward and away from the center of the frame, the ends of the jaws being beveled outwardly, means in the jaws for preventing the article clamped from turning, said means comprising lateral teeth and longitudinal teeth, one set of teeth extending inwardly slightly beyond the other set of teeth, means for spreading the jaws, and clamping device securing means carried by the respective corners of the frame, said means comprising set screws.

14. A clamping device comprising a frame, complementary jaws carried by the frame, the jaws being pivoted below their transverse centers, a pair of toggle levers connected one to the other and at their ends to the jaws, and an operating lever pivoted to the frame and connected to the toggle levers slightly to one side of a plane passing through the axis of the opening described by the jaws when the jaws are in clamping position.

15. A slip for removable attachment to a recessed clamp jaw of an oil well casing spider and the like, comprising a substantially rectangular body having transverse teeth, and a removable insert having vertical teeth, the vertical teeth of the insert extending slightly beyond the horizontal teeth.

16. A slip for removable attachment to a recessed clamp jaw of an oil well casing spider and the like, comprising a substantially rectangular body having transverse teeth, and a removable insert having vertical teeth, the vertical teeth of the insert extending slightly beyond the horizontal teeth, the insert being receivable in the upper edge of the body.

17. A slip for removable attachment to a recessed clamp jaw of an oil well casing spider and the like, comprising a substantially rectangular body having transverse teeth, and a removable insert having vertical teeth, the vertical teeth of the insert extending slightly beyond the horizontal teeth, the insert being receivable in the upper edge of the body, the slip having an offset opening below its transverse center to receive a bolt passing through the jaw so that when the offset opening in the slip coincides with the bolt the insert must be at the top of the slip.

18. A slip for removable attachment to a recessed clamp jaw of an oil well casing spider and the like, comprising two members, one a main body member and the other

an insert therefor, one of the members having horizontal teeth and the other vertical teeth, the teeth of one member projecting slightly beyond the teeth of the other.

19. A clamping device, comprising a support, jaw carrying rocker arms pivoted to the support, complementary jaws pivoted to the rocker arms below their transverse centers only, jaw operating means comprising a lever pivoted to the support between the pivots of the rocker arms, and operating connections between the lever and the jaws.

20. A clamping device comprising a support, shafts at opposite ends of the support, rocker arms on the shafts, jaws carried by the rocker arms, the jaws being pivoted to the rocker arms below their transverse centers only, jaw operating means comprising links connected one to the other and to the complementary jaws, and a lever connected to the links, the lever being mounted between the shafts.

21. A slip for removable attachment to a recessed clamp jaw of an oil well casing spider and the like, comprising two members, one a main body member and the other an insert therefor, horizontal teeth on the main body member and vertical teeth on the insert, the vertical teeth extending inwardly, slightly beyond the horizontal teeth of the main body member.

22. A clamping device comprising a support having rocking members, complementary jaws, movable one toward the other for clamping an object between them, the jaws being pivoted to the rocking members below their transverse centers only, and to one side of a vertical plane passing through the jaws so that the upper ends of the jaws will tend to spread apart.

23. A clamping device comprising a support having rocking members, complementary jaws, movable one toward the other for clamping an object between them, the jaws being pivoted to the rocking members below their transverse centers only, and to one side of a vertical plane passing through the jaws so that the upper ends of the jaws will tend to spread apart, and means for spreading said jaws.

24. A clamping device comprising a support having rocking members, complementary jaws, movable one toward the other for clamping an object between them, the jaws being pivoted to the rocking members below their transverse centers only, and to one side of a vertical plane passing through the jaws so that the upper ends of the jaws will tend to spread apart, and means for opposing the tendency of the jaws to move together, said means being effective in spreading them.

In testimony whereof I affix my signature.

GEORGE KRELL.