June 29, 1965 R. M. HANULA 3,191,984

LOAD GRIPPING DEVICE FOR HOIST

Filed July 6, 1961 2 Sheets-Sheet 1

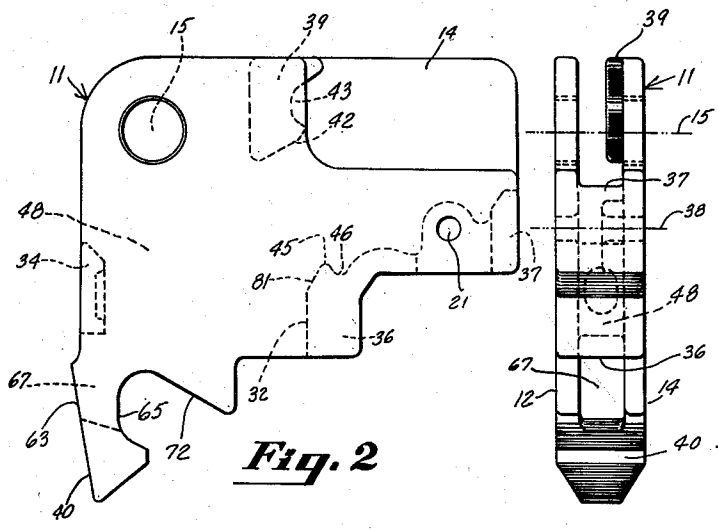


Fig. 2

Fig. 3

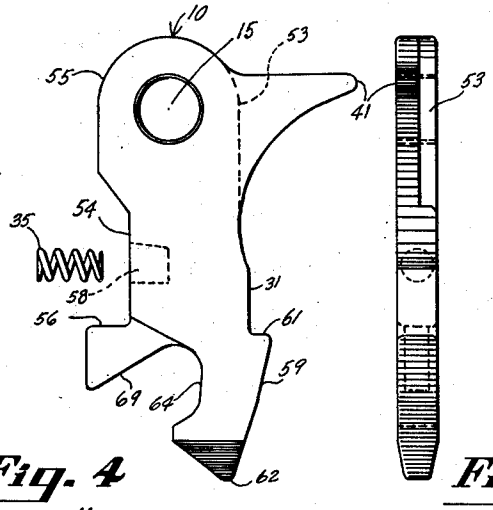


Fig. 4

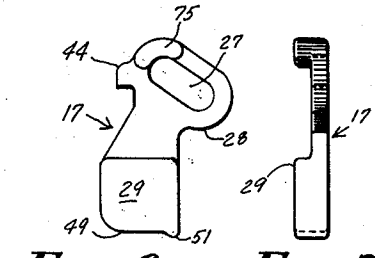


Fig. 6 Fig. 7

Fig. 8 Fig. 9

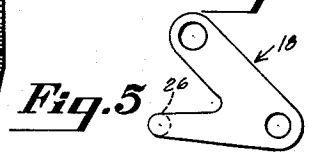


Fig. 5

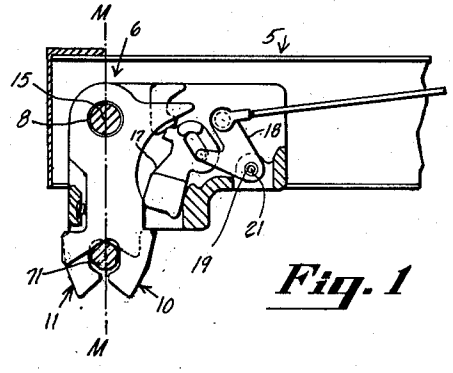
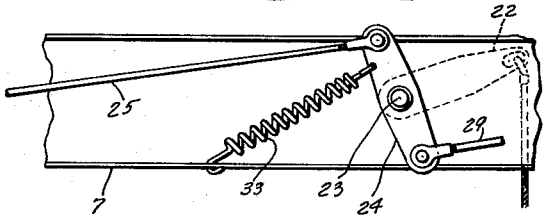


Fig. 1



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LOAD GRIPPING DEVICE FOR HOIST

Filed July 6, 1961 2 Sheets-Sheet 2

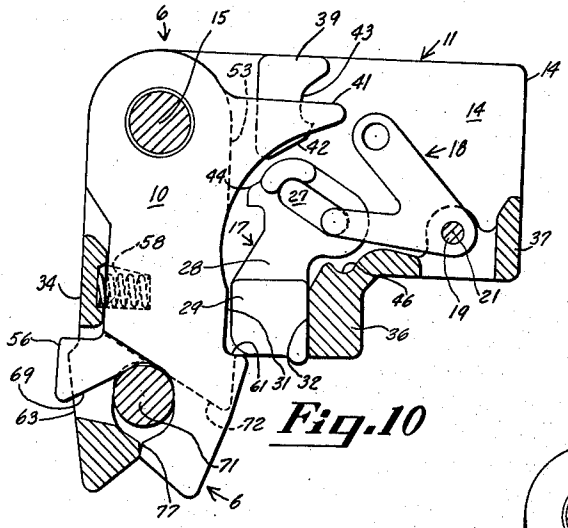

Fig. 10

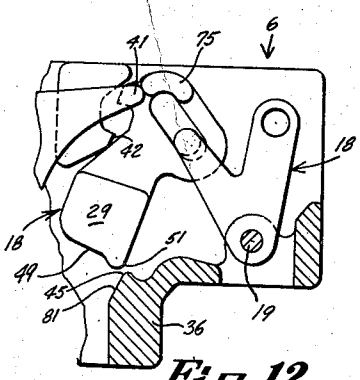

Fig. 12

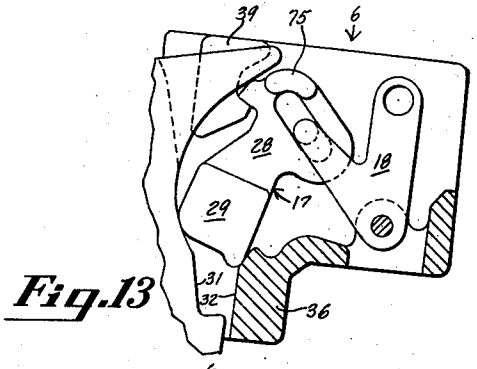

Fig. 13

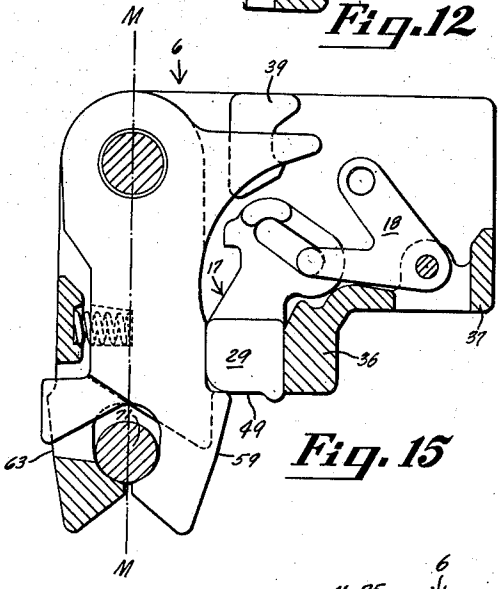

Fig. 15

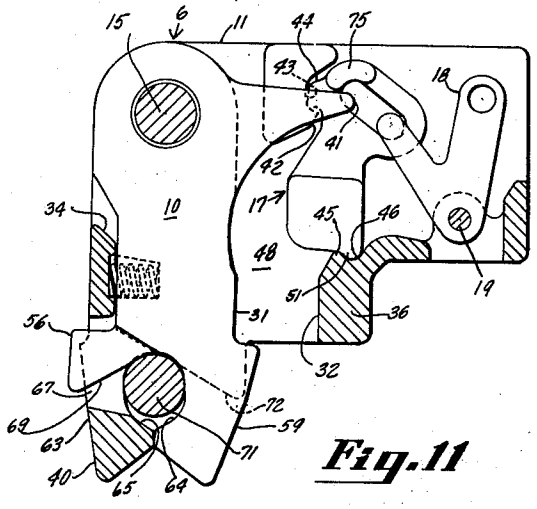

Fig. 11

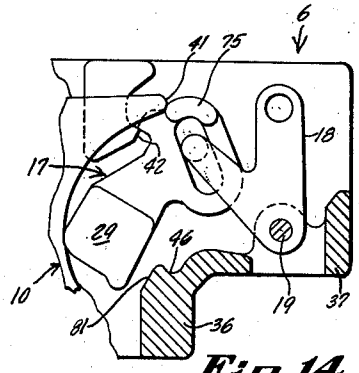

Fig. 14

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United States Patent Office 3,191,984 Patented June 29, 1965

3,191,984

LOAD GRIPPING DEVICE FOR HOIST

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Filed July 6, 1961, Ser. No. 122,247
13 Claims. (Cl. 294—83)

This invention relates to devices carried on a crane or other hoisting machine for connecting the machine with a load article and, particularly, to mechanism including a lock in such devices wherein a lock-set condition may be established to allow separation of a device from its load without concurrent manipulation of the lock by an operator. The invention has particular reference to devices adapted for lifting load articles which comprise a horizontal element of rod-like cross-section for each device carried on the hoisting equipment.

There is currently in marine and military use a large system of standard containers known to the shipping industry as "Conex." A typical container of this system comprises four top corner fixtures, each of which provides an upwardly opening pocket horizontally bridged by a short rod-like element.

The customary way of lifting such containers is by the use of a "four-leg swing" consisting essentially of four equal length cables, each attached at an upper end to a ring common to the three other cables, and supporting a hook at its lower end. In using the "four-leg swing" it is necessary for a workman to manually connect each hook with one of the four fixture elements. In spite of the widespread use of the Conex container no hoisting equipment, capable of automatically coupling therewith, is in use, hence there is a strong inference that prior art does not provide hoisting equipment satisfactory for this purpose.

It is a primary object of this invention to provide load gripping devices adapted for incorporation in a hoisting implement which will automatically connect the implement to a load article of the type providing vertically accessible, horizontally-extending elements such as rod-like struts, rungs, rings, loops, or trunnions in a manner providing a high degree of safety and convenience in crane operation.

In view of the need to minimize the facilities of a crane which must be simultaneously controlled by the operator, it is an object ancillary to the foregoing object to provide lock-setting mechanism in the automatic load-gripping devices of this invention whereby a crane operator may pre-set load-lifting equipment for load-releasing operation thereby permitting the operator to direct his attention to other matters of crane operation at the critical instance of load release.

In effecting the above objects, the invention is concerned essentially with a lock-setting mechanism for connecting a load with a hoisting implement or crane portion. This lifting device which, in its normal use, will be one of a plurality occurring as components of a hoisting frame or "spreader," comprises a pair of jaws in relatively pivotal relationship having opposed, load-gripping portions movable between load-gripping and load-releasing positions by relative pivoting of the jaws. The device further provides an abutment on each jaw which is moved toward the abutment of the other jaw by movement of the jaws to releasing position, and a lock or chock which is received between the jaws at locking position but is movable out of the locking position to lock-set position to lift the jaws to assume their load-releasing position.

This invention is concerned essentially with mechanism for holding the lock out of the range of movement of the abutments to permit relative movement of the jaws in releasing a load. In a preferred embodiment, the lock

is lifted to a shoulder carried on one of the jaws and otherwise placed in a position wherein it may be engaged by a cam of the other jaw during the jaw-opening operation and shifted off the shoulder.

In the drawing in respect to which this invention is described:

FIG. 1 is a horizontally shortened fragmentary view of a spreader incorporating a device in accordance with the invention depicting a frame of the spreader in section and the lifting device in an unlocked load-releasing condition.

FIG. 2 is an elevation of one jaw as viewed in the direction of a pivotal axis thereof.

FIG. 3 is an elevation of the jaw of FIG. 2 as viewed at right-angles with its pivotal axis.

FIG. 4 is an elevation of the other jaw of the device of FIG. 1 as viewed along the same axis of reference as FIG. 2.

FIG. 5 is an end elevation of the jaw of FIG. 4 as viewed at right-angles with its pivotal axis

FIGS. 6 and 7 are elevations as viewed in two horizontal, relatively-perpendicular directions of a lock adapted for lock setting operation in cooperation with the jaws of FIGS. 2 to 5.

FIGS. 8 and 9 are elevations, as viewed in two horizontal, relatively-perpendicular directions of a bell-crank shown in FIG. 1 for lifting the lock of FIGS. 6 and 7 out of locking position.

FIGS. 10–15 illustrate the device in various stages of operation in proceeding from a jaw-closed lock-released condition shown in FIG. 10 to the jaw-closed load-supporting condition shown in FIG. 15. The stages illustrated are progressive in the order of the figure numbers.

FIG. 1 illustrates the device at a condition occurring between the stages of FIGS. 14 and 15. For description in greater detail, and with reference to FIG. 1, a spreader 5 is normally suspended from a crane by a cable system (not shown) for maintaining the spreader in horizontal alignment shown. Such suspension is conventionally obtained by use of a plurality of sheaves on both the spreader and the crane chassis laced with a cable terminating in a windlass on the crane chassis. The spreader 5 is rectangular in a horizontal plane and comprises a lifting device 6 disposed in each of its four corners. Each device is connected to the frame 7 of the spreader in pivotal pendulous relationship. The device 6 comprises a jaw 10 and a double-walled jaw 11 having spaced generally parallel walls 12 and 14 between which the jaw 10 is received in the assembled condition of the device, as shown in FIGS. 10–15. The jaws 10 and 11 are supported in relatively pivotal relationship on a shaft 8 with the pivotal axis 15 of the jaws being the longitudinal axis of the shaft 8. Load-gripping portions thereof are separable with respect to a plane M—M. The device 6 further comprises a lock 17 cooperating with jaws 10 and 11 as hereinafter described to maintain them in load-gripping relationship, and a bell-crank 18 pivoted on a pin 19 supported by the jaw 11 along the pivotal axis 21 in fixed relation with the jaw 11.

The lifting device 6 and spreader 7 are operable by a common control system comprising, for example, a horizontal shaft 23 mounted, and extending transversely, within the frame for operation from a crane-operating station by means of a lever and pull cord 22. A lever 24 fixed to the shaft 23 is connected by a rod 25 to the one leg of the bell-crank 18. The other leg of the bell-crank has a trunnion 26 extending into a slot 27 of the head portion 28 of the lock.

Operation of the device 6 is found to be the most efficient when the lock operating mechanism is urged in a direction tending to seat the lock in its locking position between abutments 31 and 32 of the two jaws. While

this objective may be accomplished in a number of ways, the means used in the present embodiment is a tension spring 33 having one end connected to the lever 24 and the other end to the frame on the side of the shaft 23 tending to traverse the rod 25 and counterpart rods 29 serving other devices toward the device 6 connected therewith. Consequently, pull cord operation results in retraction of the lock from locking position to lock-set position and release of the pull cord allows the control system to automatically return to the condition permitting the load-gripping function of the device upon completion of further stages of its operation, as illustrated in FIGS. 12–15.

FIGS. 10–15 illustrate the device 6 in assembled condition with the wall 12 of the jaw 11 removed. As these figures indicate, the walls 12 and 14 are connected and spaced by transverse walls, i.e., (1) a detent wall 34 which functions as a seat for a spring 35 and may function as a stop for the jaw 10 moving relative to the jaw 11 to load-gripping position; (2) a terminal hook or claw section 40 in which walls 12 and 14 of the jaw 10 merge; (3) a guide wall 36 spaced through an angle about the axis 15 with respect to the wall 34 to enable pivoting of the jaw 10 relative to jaw 11 between a load-releasing position and a load-gripping position wherein the lock 17 is received between the abutment surfaces 31 and 32 of the jaw 10 and the wall 36, respectively; and (4) a reinforcing bridge wall 37 for rigidifying the double wall structure of the jaw 11 adjacent the openings therethrough for the pin 19 along the pivotal axis 21.

Another feature of the jaw 11 is an internal lug 39 protruding laterally inwardly from the wall 14 in partially overlapping relation with the thickness of the jaw 10 and lateral adjacent relationship with a cam tooth 41 thereof. The lower part of the lug 39 extends away from the axis 15 as a tongue 42 which partially defines by its upper surface a notch 43 facing away from the axis 15. At certain stages in the operation of the device 6, the tongue 42 cooperates with a neb 44 on the head portion of the lock 17 to support the lock in lock-set position as shown in FIGS. 11 and 13.

An important structural feature of the jaw 11 is the contour of the guide wall 36, particularly the upper shoulder surface thereof, defining a hump or ridge 45 forming the upper terminus of abutment surface 32 and a notch 46 disposed outwardly from the ridge 45 with respect to the region 48 of jaw 11 within which jaw 10 is received. The shoulder of the wall 36, i.e., the ridge 45 and recess 46, is adapted to receive an area of the undersurface 49 most outward from the region 48. This area is formed by a downward extending ridge 51 adapted to be received in the notch 46 and thus cooperate with the ridge 45 in retaining the lock on the shoulder surface of the wall 36 at lock-set condition of the device.

The overall thickness of the jaw 10 as measured in the plane of the paper in FIG. 5 is such as to permit it to be loosely received between the walls 12 and 14. Evident from FIG. 5 also is that the thickness of the cam tooth 41 does not overlap that of the neb 44 of the lock 17 in a direction parallel to axis 15. In this direction, the neb 44 overlaps surface 53 of the jaw 10 and the lug 39. During operation of the device 6, the tooth 41 and the neb 44 traverse ambits in parallel planes perpendicular to the axis 15 which avoid any substantial frictional engagement of the neb and the tooth. The jaw 10 is further provided with a recessed edge surface 54 extending vertically on the left side of the jaw, as viewed in FIG. 4, from the hub portion 55 of the jaw to the guide lug 56. The jaw 10 has a pocket 58 extending inwardly from its left edge in which the spring 35 is seated and may be compressed in relative movement of the jaws to the load-gripping condition. The right side of the jaw, as viewed in FIG. 4, extends downwardly in a longitudinal direction of the jaw as a terminal load-gripping portion 59 disposed generally between a shoulder surface 61 and the lower tip 62. This portion of the jaw 10 cooperates with a corresponding counterpart, load-engaging portion 63 of the jaw 11 comprising the aforesaid portion 40 and lower extremities of walls 12 and 14 merging therewith. The jaw portions 59 and 63 are to be substantially opposed to each other and define concave load-gripping surfaces 64 and 65 of jaws 10 and 11, respectively.

The guide lug 56 of the jaw 10 is adapted to enter into guide relation with the jaw 11 as it projects through an opening 67 of the latter jaw. The underside cam surface 69 of the lug 56 engages a load element 71 extending horizontally between load-gripping jaw portions 59 and 63 when the element 71 acts on the jaws to force them together. The jaw 11 has a corresponding cam surface 72.

The lock

The lock comprises its lower body portion 29 and a generally thinner upper portion 28 disposed within the plane of the lug 39 to obtain cooperation of its neb 44 with the projection 42. The head portion of the lock 17, however, has a lug 75 extending in a direction parallel to the axis 15 into the plane perpendicular to the axis 15 traversed by the cam tooth 41. Hence, the lug 75 is brought into the ambit traversed by the tooth 41 so that it may be engaged thereby at the stages of operation shown by FIGS. 12 and 14. The body portion 29 has a width substantially the full spacing of walls 12 and 14 of the jaw 11.

The slot 27 extends obliquely relative to the top-to-bottom longitudinal direction of the lock away from the neb 44 and the lug 75 in a downward outward direction at normal locking position shown in FIG. 10. The slot is elongated in the direction just described to enable it to receive the trunnion 26 of the lever 18 and yet execute such toggle movements relative to the shoulder ridge 45 and tilting movements produced by the cam tooth 41 at various stages of operation of the device.

Operation

FIGS. 10 to 15 and FIG. 1 depict the device in various stages in its cycle of operation. FIG. 10 shows the device 6 in a condition of being forced downwardly on a load element 71. Before this condition was reached the element 71 slidably engaged the cam surfaces 69 and 72. Jaws 10 and 11 have reached maximum closing by engagement of opposed hook sections at point 77. The abutment surfaces 31 and 32 are at maximum spacing, thereby releasing the lock 17 from wedged engagement therewith and allowing it to rest loosely on the shoulder 61.

With the device 6 still held firmly downwardly on the element 71 to hold the jaws together, the lock may be easily lifted by clockwise movement of the bell-crank 18 to the position shown in FIG. 11. In moving to this position, the head portion of the lock is carried by the bell-crank to a position considerably rearwardly or outwardly of that shown so that the lug 75 passes around the cam tooth 41 and the ridge 51 is carried outwardly and over the top of the ridge 45 into the recess 46. After this maximum lock-lifting motion preceding the position of FIG. 11, the lock pivots forwardly about the ridge 45 to seat the neb 44 of the lock on the top surface of the tongue 42 within the recess 43. The lock set position thus achieved is maintained as long as the element 71 remains in tight engagement with the cam surfaces 69 and 72.

As the spreader 5 with devices 6 is lifted away from respective elements 71 of a load article, the force holding the jaws 11 and 12 together is released to allow the spring 35 to separate them and assume the position of FIG. 13. In doing so, the parts of the device 6 pass through the stage illustrated in FIG. 12 wherein the jaw 10 is shown in the act of swinging the cam tooth 41 upwardly into

cam engagement with the underside of the lock lug **75**. As the tooth **41** lifts the lock ridge **51** clear of the wall ridge **45**, the bell-crank **18**, urged counterclockwise by the spring **33**, rotates the lock about the tooth **41** as a pivot to shift the lock body portion **29** toward the adjacent edge surface of the jaw **10**. Such pivotal movement also tends to carry the lug **75** away from the tooth and implement its passage around the tip of the tooth to its underside. Following this maneuver, the body portion **29** passes into the space between an upper area **81** of the wall **36** facing the jaw **10** and the opposing side edge of the jaw **10**. Simultaneously, the neb **44** is caught and retained by the tongue **42**. Hence, the lock **17** comes to rest in a suspended position with complete opening of the jaws to effect the normal jaw-opened position of FIG. 13. This is the position or condition of the devices of the spreader when the spreader has separated from its load.

FIG. 14 illustrates a device **6** at an instant in which the previously opened jaws of FIG. 13 have engaged the load element **71** and the jaws **10** and **11** are beginning to close as the element **71** acts on the surfaces **69** and **72**. The cam tooth **41** is rotating clockwise downwardly against the lug **75** to force the lock head **28** outwardly off the tongue **42**. The trunnion **26** of the bell-crank **18** is meanwhile bearing on the lock in a direction toward and downwardly relative to jaw **10**. The jaw **10** at this instant is rotating relative to the jaw **11** to grip the element **31** but also to open the space between the abutments **31** and **32** within which the lock body **29** is received. When the abutments **31** and **32** have parted sufficiently, the lock drops into place as the condition of the device illustrated in FIG. 10 is reached. The next movement of the spreader is normally upward to lift the load and the condition of the device as illustrated in FIG. 15 is obtained with the lock body **79** in wedged relation with portions of both jaws through separating forces imposed on the jaws by the load.

Described above is an efficient mechanism for placing load lifters of a type utilizing the particular jaw closing and locking arrangements herein described in lock-set condition. The lock-set condition which may be achieved thereby is provided essentially for the purpose of permitting a crane operator to turn his attention from the unlocking operation to other controls of the crane necessary for disengaging it from the load.

The terms and expressions which have been employed are used as terms of description and not of limitation and there is no intention of excluding such equivalents of the invention described or of the portions thereof as fall within the scope of the claims.

What is claimed is:

1. A lifting device comprising; as normally oriented for use: a pair of jaws and means connecting the jaws for relative movement about a horizontal axis, said jaws extending in their longitudinal direction downwardly away from the axis to provide substantially opposed load-gripping portions adjacent the lower load-receiving end of the device; means for urging the load gripping portions apart; one of said jaws extending transversely of its length and said axis and then parallel to said axis to circumscribe a lock-transversing region between an outer surface of said other jaw facing away from the axis and an abutment wall of said one jaw, said abutment wall terminating upwardly in a shoulder surface substantially below the axis; cam means on said other jaw projecting horizontally away from said axis in overhanging relation with said lock-traversing region; a lock having a body portion adapted to fit between said abutment wall and said outer surface at the closed position of the jaws, and a head portion providing cam-following means adapted to cooperate with said cam means; means for lifting the lock to a position placing the body portion on said shoulder and the cam-following means suprajacent the upper side of said cam means.

2. A lifting device comprising: a pair of jaws and means connecting the jaws for relative movement about a horizontal axis, said jaws extending in a vertical direction away from the axis to provide substantially opposed load-gripping portions adjacent the load-receiving end of the device; means for urging the load gripping portions apart; one of said jaws extending transversely of its length and said axis beyond the other and parallel to said axis to circumscribe a lock-traversing region between an outer surface of said other jaw and an outboard wall of said one jaw; said other jaw having a cam tooth extending approximately radially away from said axis transversely of said region; a tongue fixed to said one jaw to taper outwardly from said axis and juxtaposed in a direction lengthwise of said axis with a path of movement for said tooth; a lock traversable within said region in a direction generally lengthwise of the jaws having a body portion and a head portion; the head portion comprising a neb pointing toward said other jaw, and a lug projecting in a direction parallel to said axis; with respect to directions parallel to the axis, the neb having a confronting relation with said tongue and a non-confronting relation with the tooth, and the lug having a confronting relation with the tooth and a non-confronting relation with the tongue; said outboard wall terminating in a shoulder facing toward the tooth and the tongue; means for lifting the lock to a position resting said body portion on said shoulder and the neb on the upper side of said tongue with the lug suprajacent said tooth.

3. A lifting device comprising, as normally oriented for use: a pair of jaws and means connecting the jaws for relative movement about a horizontal axis, said jaws extending downwardly in a vertical direction away from the axis to provide substantially opposed load-gripping portions adjacent the lower load-receiving end of the device; means for urging the load gripping portions apart; one of said jaws extending transversely of its length and said axis beyond the other and horizontally lengthwise of said axis to circumscribe a lock-traversing region between an outer surface of said other jaw and an outboard wall of said one jaw; said other jaw having a cam tooth extending approximately radially away from said axis transversely of said region; a tongue fixed to said one jaw to taper outwardly from said axis in approximately horizontal juxtaposition with a path of movement for said tooth; a lock having a lower body portion and an upper head portion supported for movements within said region between said outer surface and the outboard wall; said head portion comprising a neb pointing toward the other jaw, and a lug extending generally parallel to said axis; said neb having a confronting relation with said tongue and a non-confronting relation with said tooth, and the lug having a confronting relation with the tooth and a non-confronting relation with the tongue; said outboard wall terminating upwardly in a shoulder spaced below said tongue a distance approximately equal to that between the neb and undersurface of the lock; said tooth being of sufficient length to extend under said lug when the lock occupies its lock-set position wherein the lower end of the lock rests on said shoulder and the neb rests on the upper side of the tongue; and means for lifting the lock from a locking position between said outer surface and outboard wall to said lock-set position.

4. The lifting device of claim **3** wherein: said head-portion has a slot extending downwardly and away from said other jaw; and said lifting means is a lever having a bearing portion disposed within and traversable lengthwise of said slot in pivotal and slidable relation with the lock; and said lever is pivotally connected to said one jaw along an axis located horizontally outboardly of said lock-traversing region.

5. The lifting device of claim **4** wherein: the slot ex-

tends in downward outward direction from a point of adjacency with said neb and said lug.

6. The lifting device of claim 3 wherein: said one jaw comprises two spaced walls with said axis extending generally perpendicularly therethrough and said other jaw is supported between said walls.

7. The lifting device of claim 6 wherein: said spaced walls are joined by said outboard wall and a bridge wall between which said other jaw is disposed.

8. The lifting device of claim 7 wherein: both spaced walls of said one jaw join and merge in an integral lower extremity of the jaw.

9. The lifting device of claim 3 wherein: said load-gripping portions have generally opposed concave surfaces facing a plane of separation containing said axis; each of said jaw portions having a cam surface contiguous with the end of its concave surface nearer said axis; each cam surface facing toward said load-receiving end and extending from said contiguous concave surface crosswise of, and at an inclination with, said plane toward said load-receiving end at all operative positions of the jaws.

10. The lifting device of claim 9 comprising: a guide on said other jaw having said cam surface on its underside and projecting from the body of said jaw in the direction of its movement relative to said one jaw for effecting said load-gripping position; said one jaw comprising two walls between which a substantial portion of said other jaw including said guide is received.

11. A lifting device comprising: a pair of jaws and means connecting the jaws in relatively pivotal relationship providing movement of substantially opposed load-gripping portions thereof between load-gripping and load-releasing positions; means for urging the load-gripping portions apart; locking means for maintaining said jaws in said load-gripping position; said locking means received in locking position between opposed abutments on both jaws which are moved toward each other by movement of the jaws to said releasing position; said locking means being movable from between said abutments to a lock-set position remote from said abutments to subsequently permit said jaws to assume said load-releasing position; and upwardly facing shoulder means on one of said jaws spaced from said opposed abutments shaped to receive downwardly facing portions of said lock cooperating with said shoulder means for holding said locking means in said lock-set position while said jaws are in the load-gripping position.

12. A lifting device comprising: a pair of jaws and means connecting the jaws in relatively pivotal relationship providing movement of substantially opposed load-gripping portions thereof between load-gripping and load-releasing positions; means for urging the load-gripping portions apart; locking means for maintaining said jaws in ing position between opposed abutments on both jaws which are moved toward each other by movement of the jaws to said releasing position; said locking means being movable out of locking position to a lock-set position from between said abutments which subsequently permits movement of said jaws to said load-releasing positions; and a pair of shoulder means spaced from each other on one of said jaws and spaced means on said lock adapted to engage both shoulder means for holding the lock in said lock-set position while said jaws are in the load-gripping position.

13. A lifting device comprising: a pair of jaws and means connecting the jaws in relatively pivotal relation with an axis providing movement of substantially opposed load-gripping portions thereof between load-gripping and load-releasing positions; means for urging the load-gripping portions apart; locking means for maintaining said jaws in a load-gripping position receivable at said position of the jaws in a locking position between opposed abutments on the jaws which move toward each other with movement of the jaws toward said releasing position; said locking means being movable from between said abutments to a lock-set position which subsequently permits movement of said jaws to said lock-releasing position; the abutment of one jaw terminating in a shoulder surface facing in the direction of movement of the lock from locking position to lock-set position for receiving an oppositely facing surface of the lock; a tongue on said one jaw projecting generally radially away from said axis; a neb on said lock projecting generally toward said other jaw and disposed for engaging said tongue when the lock is retracted from between said abutments; said lock surface and the neb resting on said shoulder and said tongue respectively at lock-set position; and means for lifting the lock from locking to lock-set position.

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