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PLATE CLAMPS

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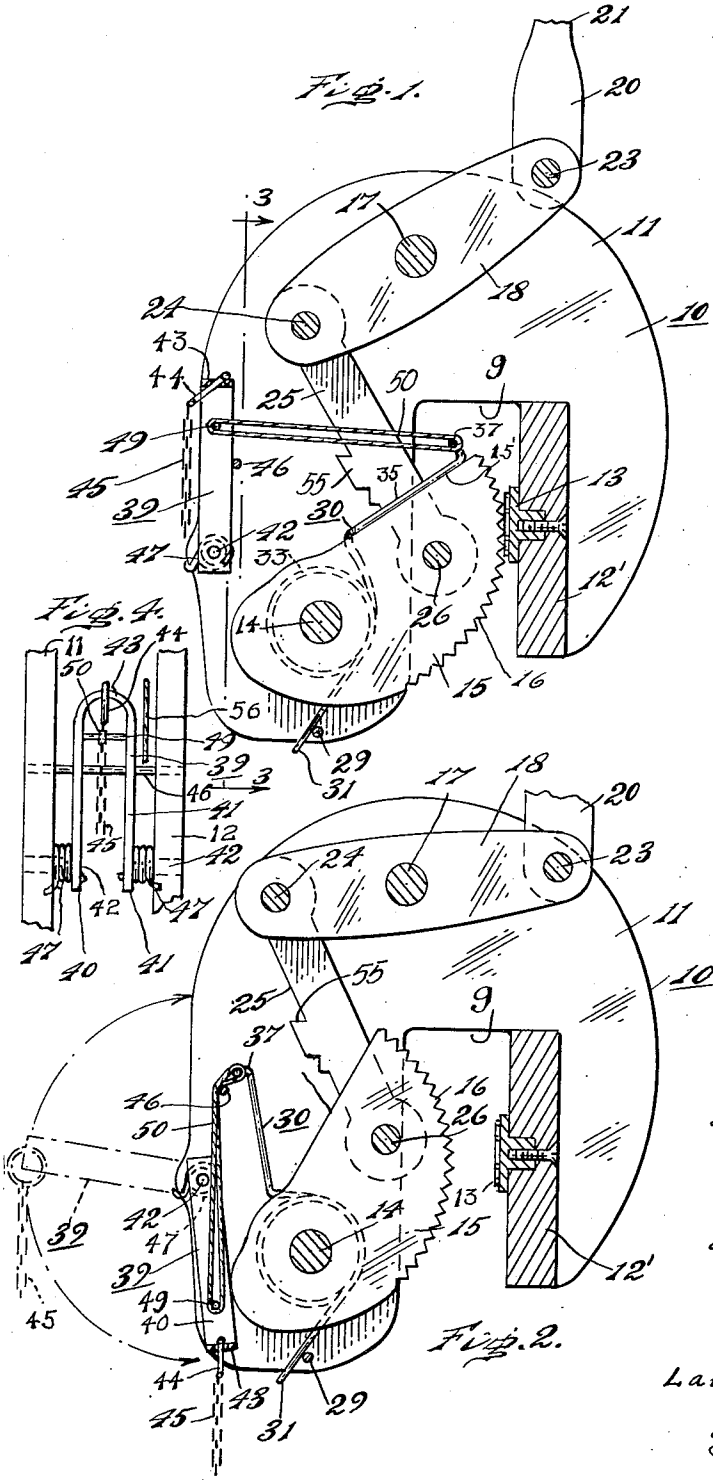

Fig. 1.

Fig. 4.

Fig. 2.

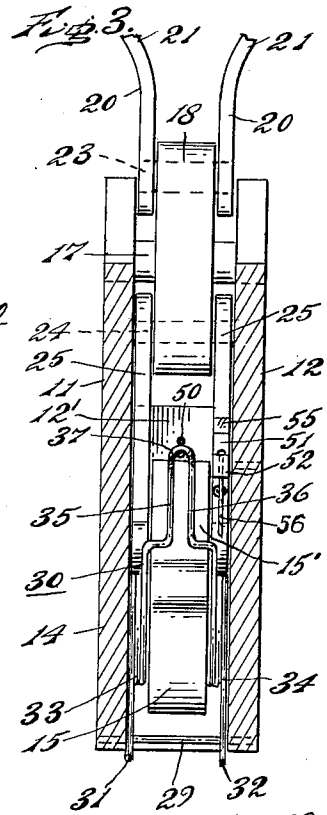

Fig. 3.

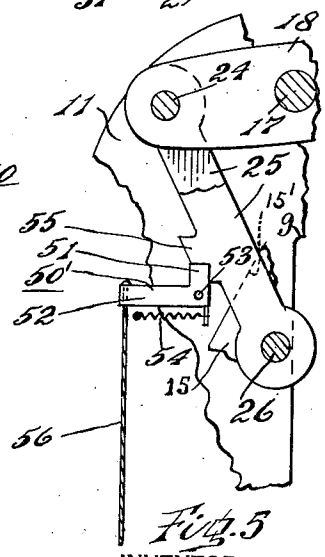

Fig. 5

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PLATE CLAMPS

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This invention relates to plate clamps, and particularly to clamping devices adapted for suspension from a crane or the like for engaging, lifting, manipulating and depositing sheets and plates.

Although in general all approaches to the problem have utilized a self-energizing factor of the applied weight on the relatively movable clamping elements to enhance the frictional grip of the latter, so far as known all previously developed devices were possessed of inherent disadvantages. For instance, some were only able to engage and manipulate initially vertical work, and could not be used on work that was initially horizontal. They were subject to release of the frictional grip on the work when the latter is lowered into contact with the ground or floor relative to which the work was being manipulated. In those cases where the toothed cam engaging one surface of the work had an auxiliary spring bias additive to the linkage, it was of short life because of its nature and disposition and because of the over-stressing thereof necessary in releasing the cam from the bias when depositing the work, leading to fatigue and crystallization. Additionally these required manual manipulation at the clamp to release the grip on the work. Finally, all of such devices, in providing the bias release necessarily had control elements projecting beyond the clamp in such positions as to be susceptible to accidential actuation by contact with other plant equipment during work or clamp manipulation.

It is among the objects of this invention; to obviate the disadvantages of prior art devices; to provide a plate clamp which can safely and expeditiously handle either horizontal or vertical work; to provide an extremely compact tool for clamping plates without hazardous physical protuberances or projecting control elements; to provide a rugged and long-lived plate clamp; to provide a plate clamp with a bias on the movable jaw element thereof which can be applied and released from points remote from the clamp; to provide a plate clamp with a bias applicable to or removable from the movable jaw element of the clamp from points remote thereto, in conjunction with a locking element for locking the movable jaw in its wide open setting, releasable from points remote from the clamp, and other objects and advantage of the invention will become more apparent as the description proceeds.

In the accompanying drawings, forming part of this description:

FIG. 1 represents a longitudinal vertical section through the clamp of this invention in its closed gripping relation, showing the biasing spring in its effective bearing on the cam to enhance the frictional effects of the jaw members, and with the spring release lever in its inoperative position within the peripheral outline of the clamping frame.

FIG. 2 represents a similar view of the clamp in its non-gripping open position with the spring bias released from the cam, and with the spring release lever in its opeartive position within the peripheral outline of the clamping frame.

FIG. 3 represents a transverse vertical longitudinal section taken on line 3—3 of FIG. 1, looking into the clamp and showing the lock-open detent in its inoperative disposition.

FIG. 4 represents a fragmentary side elevational view showing the inoperative disposition of the spring release lever in its FIG. 1 setting.

FIG. 5 represents a fragmentary vertical section through a portion of the clamp, showing the releasable lock-open detent in its operative position holding the clamp open.

The clamp 10 is preferably comprised of a unitary steel frame having spaced parallel cheeks, 11 and 12, connected by an integral heavy anvil plate 12'. The latter mounts the removable rigid clamping pad or fixed jaw 13. The cheeks are recessed to outline a composite plate-receiving slot 9. A cam pivot pin 14 extends between the cheeks in the lower part of the clamp. A movable cam jaw 15 is journalled on pivot pin 14, for operation across the slot 9 and relative to the pad 13. The outer edge of cam 15 is serrated with teeth 16 in a series eccentric to the pivot pin 14. A lever pivot pin 17 extends between the cheeks in the upper part of the clamp. A shackle lever 18 is pivoted on pivot pin 17, and at one end is pivoted to the parallel yoke arms 20 of the shackle 21, broken away in the figures, but of conventional eye construction to receive a hook, as on a crane or the like. The shackle 21 is pivoted to the shackle lever 18 on a transverse pivot pin 23. The other end of the shackle lever is disposed between and pivoted at 24 to a pair of parallel links 25—25. The latter straddle and are pivotally connected to the eccentric clamping cam 15, by a pivot pin 26, in radial spacing from the cam pivot pin 14.

As so far described the clamp is more or less conventional, and it will be understood that with a plate (not shown) in slot 9, between the serrated edge of the cam and the jaw element 13, any upward pull on the shackle, as from such crane, through the leverage effected by the link and lever system described forces the clamping cam compressingly against the work to progressively tighten the grip as the full load is applied to the clamp, to lift and manipulate the work comprised of such plate.

In order to initiate and enhance the biting grip on the work, a spring of unique design is provided for biasing the movable jaw against the work. With this is associated a spring release lever selectively operable for applying or releasing the bias from the movable jaw element, operated from points safely remote from the clamp.

To these joint ends a spring is provided for imposing a bias on the cam, together with a spring release lever, which while moving between positions of full bias on the cam and a release of such bias moves the spring through such a small degree of motion as not to stress the latter beyond safe non-fatiguing limits, while maintaining the lever in both positions within the periphery of the clamp frame to avoid accidental actuations of the lever, and which lever is subject to ready and facile remote actuations from the ground, to avoid the previous necessity for manual actuations at the clamp.

The spring 30 is formed of a single continuous strand of spring wire shaped in a configuration as follows: the two inner free ends of the spring, 31 ad 32, bear against a cross pin 29 between the cheeks and lead respectively into adequately large coils 33 and 34, generally concentric of and surrounding the cam pivot pin 14, beside the cam, on each side respectively of the latter, from which coils the spring straddles the cam and the courses are bent toward each other over the cam and lead outwardly in substantial parallelism in reaches 35 and 36 overlying and bearing resiliently upon the upper surface 15' of the cam, and connected at their outer ends in an integral upstanding loop or eye 37. It will be obvious that cross pin 29 can be positioned at various points angularly of the axis 14 to control the effectiveness of the bias against the cam 15.

A spring release lever 39 is provided comprised of a generally U shaped member having spaced parallel legs 40 and 41 respectively journalled on aligned spaced pivot pins 42—42 to form an open channel between the legs

at the pivot. The legs 40 and 41 are disposed parallel to and substantially within the peripheral outlines of the creeks 11 and 12. At the free end spaced from the pivot 42—42 the legs 40 and 41 are joined by an integral end portion 43, to which a ring or the like 44 is pivoted, from which an actuating flexible connector, such as a chain 45, is suspended. The lever 39 is provided with a transverse cable-connecting pin 49, spaced from the lever pivot 42—42. A transverse snubbing pin or bar 46 extends between the cheeks 11 and 12 forming a stop abutted by the edges of the legs 40 and 41 of the lever 39 in the position thereof indicated in FIGS. 1 and 4. The lever 39 is suitably biased toward the snubbing bar 46, as by one or a pair of torsion springs 47—47 anchored suitably to the creeks of the frame and bearing against the respective legs 40 and 41. By this means the release lever 39 is caused to lie within the periphery of the clamp when the bias of spring 30 is imposed fully against the upper surface 15' of the cam 15.

A flexible metal cable connection 50 is provided, preferably as a loop extending through the eye 37 of the spring 30, at one end, and about the transverse pin 49 of the lever 39, at the other. The loop is of such length as to permit the parts to assume the position shown in FIG. 1, without undue sag in connection 50. In this position preferably the cable 50 passes above the snubbing bar 46.

To operate the spring release lever and remove the bias from the cam, the operator pulls on and manipulates the chain 45. This may be from a position safely remote from the clamp. The pull is outward and downward, and forces the release lever 39 on its pivot toward the intermediate position indicated in dotted lines in FIG. 2. This tightens the cable connection 50 and starts elevation of the spring 30 at its extreme free end 37. As the transverse pin 49, in its arcuate movement with lever 39, moves downwardly the tightened cable connection 50 is forced against and about the snubbing bar 46. Continuation of the pull from the remote source, with easily controlled manipulation, pulls the assembly of spring 30, cable 50 and release lever 39 almost into the positions indicated in FIG. 2. As the tautened cable 50 moves about and slides on the snubbing bar it assumes and maintains a substantially straight line between the latter and the pin 49 on the release lever lying in the open channel between the legs 40 and 41, and as it passes across the axis 42—42 of the lever and goes beyond dead-center, the lever snaps into the ultimate position indicated in FIG. 2, with the lever 39 abutting a stop on the clamp. Preferably the stop is the hub of the cam 15. In pulling up the free outer end of the spring 30, the flexure of the spring is easily consumed in the turns 33 and 34, accompanied by slight sliding of the inner free ends 31 and 32 across the pin 29. This well absorbed flexure precludes crystallizing strains on the spring 30, which is always stressed well within its elastic limits and consequently has a very long life.

After the clamp has been lowered toward the work to permit the relative entry of a plate between the relatively movable jaws in slot 9, still working safely from the ground remote from the clamp, the operator, by pull and manipulation of the flexible chain 45, can release the lever 39 from its toggle-locked position of FIG. 2, to permit it to regain the position of FIG. 1, with imposition of full bias on the cam 15. If there is slack in the cable connection 50, the lever 39 moves into the FIG. 1 position under the rather light bias of springs 47—47.

It is frequently desirable to be able to lock the jaws of the clamp in an open position, and to this end the detent organization shown in FIG. 5 is of importance. One of the cheeks of the clamp, illustratively cheek 12, pivotally mounts a bell crank detent lever 50', comprising legs 51 and 52, on a transverse pivot 53. A spring 54 is provided for biasing the upper detent leg 51 toward

the generally aligned link 25. The latter has a shoulder 55 formed thereon, so disposed that when the cam 15 is fully retracted the detent leg 51 of the bell crank lever under its bias moves under the shoulder to establish a lock precluding linkage movement and thus locking the cam in its retracted position. A flexible connector, such as a cable or chain 56 depends from the arm 52 of the bell crank, and extends over coil 34 of the spring 30, to within grasping distance of the operator on the ground or other clamp-remote point. When so locked the cam is held against movement until the detent is released.

The function of the locking detent lever is particularly important in loading and unloading the clamp. In unloading, for instance, to deposit a plate in a rack, as the work comes to rest on the rack, the shackle is permitted to move downwardly toward the clamp, but linkage movement is opposed by spring 30. The spring bias is then removed by suitable actuation of the spring release lever 39, whereupon the linkage moves the cam 15 to its fully retracted position. This permits the detent lever to move leg 51 under the shoulder to lock the cam open. Raising the shackle then raises the clamp freely up and off of the deposited plate, because of the locked open position of the jaws. The elevated clamp in this locked open condition can then be lowered toward another plate, which enters freely between the locked open jaws. When the clamp and work are properly overlapping the operator first actuates the spring release lever to imposed the bias on the movable cam, and then releases the detent by a tug on cable 56. The cam then snaps against the work in a frictional engagement enhanced by the linkage as the full load is assumed by the shackle.

I claim as my invention:

1. A clamp comprising a slotted wall support, an anvil carried by a wall of the slot and having a work surface extending normal to the support, a clamping cam pivoted to the support on an axis substantially parallel to the surface and having a peripheral portion movable toward said surface, a shackle lever pivoted on an axis intermediate its ends to the support, a link pivotally connected to the cam at a location spaced from its pivot axis and to one end of the shackle lever, a shackle pivoted to the other end of the lever, said shackle upon application of a force thereto, operating to move the cam toward or away from the anvil surface by rotation of the lever, a torsion spring having one end abutting the support and a free end abutting the cam at a location spaced from its pivot to bias the cam toward the anvil surface, and means including a lever mounted on the support and engageable with the free end of the torsion spring for moving it from abutting engagement with the cam to relieve the bias thereon.

2. A clamp as recited in claim 1 including a shoulder on said link, a bell crank lever pivoted on the support having a leg movable under said shoulder as a detent, means biasing the bell crank to urge said detent leg toward said link to engage the shoulder upon full retraction of the cam away from the anvil surface, to hold the cam in such retracted position against the force of the bias of the torsion spring and a flexible member connected to the bell crank to rotate it against its biasing means.

3. A clamp as recited in claim 1, in which a cross pin is mounted on said support, and said torsion spring comprises a single strand of wire having two terminal ends bearing against said cross pin leading into respective coils one on each side of the cam generally concentric with the axis of said cam and leading into courses straddling the cam and bent toward each other over the cam in two generally parallel courses joined together and forming said free end, said free end formed as an eye, and a flexible member extending between said eye and said lever and comprising with said lever said means for moving said free end.

4. A clamp as recited in claim 1, in which said lever comprises a spring release lever pivoted to the support,

a snubbing bar mounted on the support, said means for moving comprising a flexible connector extending between said release lever and the said free end of the torsion spring across said snubbing bar, a flexible actuator engaging said release lever and manually operative to move said release lever angularly to force said flexible connector about said snubbing bar to move said torsion spring out of contact with said cam, and means for locking said spring release lever in the position to which it is moved.

5. A clamp as recited in claim 4 in which the means for locking comprises a stop mounted on the support and abuttable by said lever when the pressure from the torsion spring on the flexible connector incident on the lever passes across the lever pivot.

6. A clamp as recited in claim 4 in which stop means is mounted on the frame in the path of movement of said release lever and said release lever is of generally U-shaped construction having generally parallel spaced legs and a terminal connector, and said pivot thereof is comprised of aligned pivot members individually pivoting the respective legs to provide an open channel through

which the tightened flexible connector may enter the release lever at said pivot to move across the axis of said pivot to abutment against said stop means to effect a lock for said lever.

7. A clamp as recited in claim 4 in which the support is comprised of a pair of parallel interconnected transversely spaced cheeks, and said spring release lever lies between and within the peripheral outline of the cheeks in both of its angularly spaced positions whereby there is substantially no projection of said lever at either of its said angularly spaced positions so as to preclude accidental operations thereof.

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