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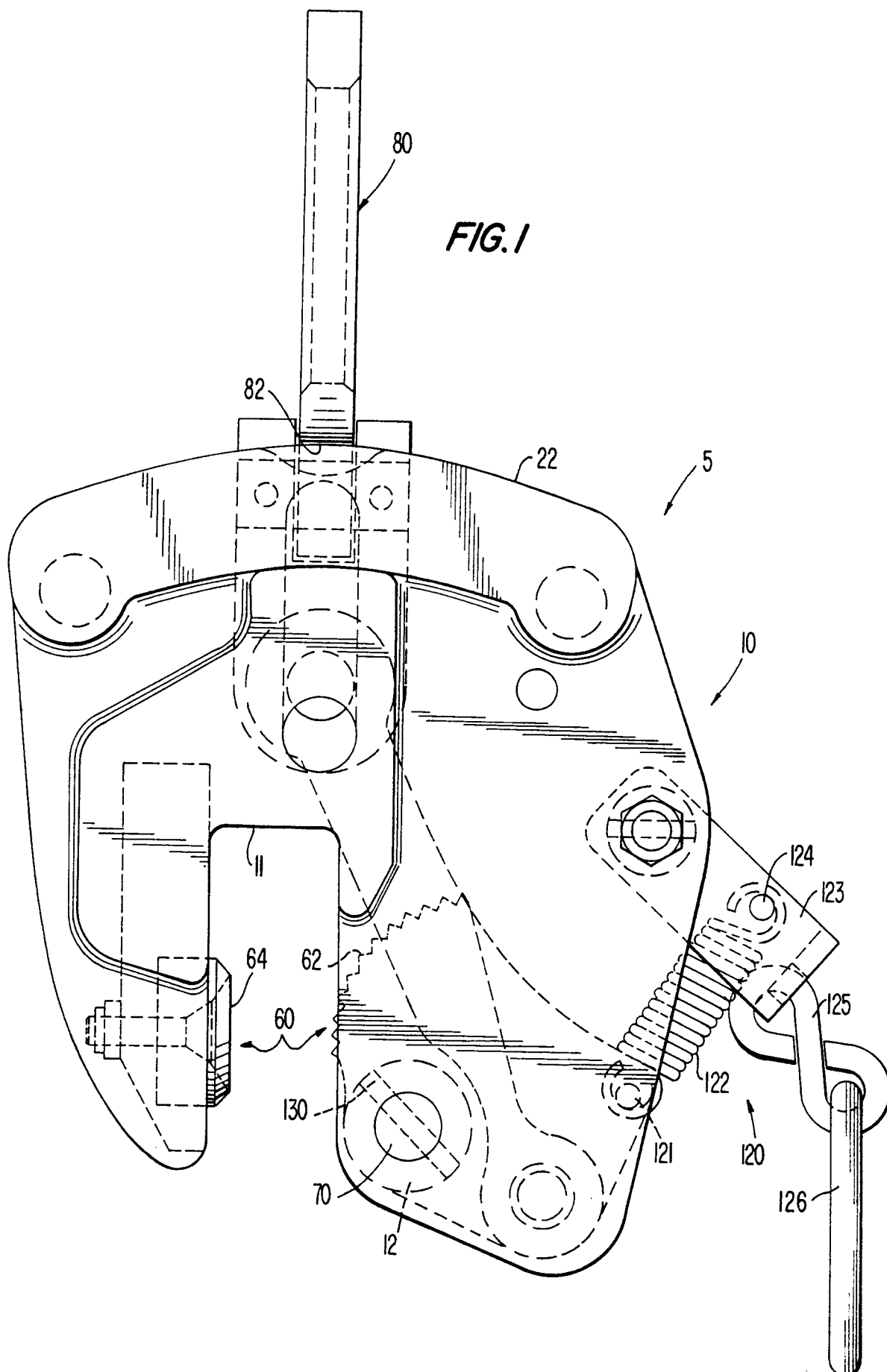
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Lifting clamp.

A clamp (5) for lifting material comprising a casing (10) having a longer length than width and a slot (11), disposed along the length and across the width of the casing (10), for receiving material to be lifted, and a jaw (62), operatively positioned within the casing (10), for releasably holding the material in the slot (11). The clamp (5) also includes an assembly, extending within and outward from the casing (10), for forcing the material holding jaw (62) against the material. This material forcing assembly includes a shackle (80) for engaging a clamp lifting element having surfaces disposed outside of the casing (10) and adjacent end surfaces of the casing (10) which pivot about one of the adjacent end surfaces of the casing when the surfaces of the shackle (80) move along the width of the casing (10) and which slide along the adjacent end surfaces of the casing (10) when the surfaces of the shackle (80) move along the length of the casing; and links, pins and arms, connected to the shackle (80) and primarily disposed within the casing (10), for moving the material holding jaw (62) against the material when the shackle surfaces are pivoting about or sliding along at least one of the end surfaces of the casing (10).



BACKGROUND OF THE INVENTION

This invention relates to lifting clamps. More particularly, it relates to clamps for lifting and turning material such as metal plates.

The prior art contains numerous types of clamps for lifting material such as metal plates. It is generally agreed that most difficulties arise when a clamp is turning a material (moving a shackle parallel to clamp side plates) or side lifting (lifting the shackle perpendicular to clamp side plates) a material from a horizontal to a vertical. The difficulties arise, because the known devices are not flexible enough to exert a sufficient and reliable gripping force when turning or side lifting a material while still quickly releasing the member after it has been moved.

For example, U.S. Patent No. 4,647,098 to Hoyer teaches a shackle parallel to side plates of the clamp which rides considerably up and along the side plates of the clamp during side lifting before a sufficient force is exerted to grip material with the jaw. Also in Hoyer, this shackle can be leveraged about bracing points on the inside of the casing when turning a plate. With a leveraging action, however, it may be difficult to get a reliable tight grip on the material. This is especially true when the plate material is thick and very little leveraging or prying action is obtained. Since turning or lifting of large metal plates requires assurance of sufficient gripping, this structure may not always meet that objective.

An example of a structure which is difficult to release the material from and which is limited in flexibility is shown in U.S. Patent No. 2,543,017 to Hagan. Hagan discloses an upper surface of the casing with a radius of curvature which is relatively longer than the radius of curvature through which a nut swings about the linkage. Hagan, however, does not appear to address gripping when side lifting its ring perpendicular to the casing plates. Also, Hagan teaches the nut being locked firmly in place against the casing. Thus, Hagan locks the jaw before turning so that removing the plate would require an extra step of unscrewing this same nut each time.

Consequently, there is a need for a lifting clamp which overcomes these disadvantages of possibly insufficient gripping force or insufficient flexibility.

SUMMARY OF THE INVENTION

It is an object of the present invention to be able to lift material in the clamp from a horizontal to a vertical when a shackle is moving perpendicular to and pivoting about a side plate of the clamp casing.

It also is an object of the present invention to be able to turn material in the clamp when the same shackle is moving parallel to and sliding against the side plates of the clamp casing.

It is a further object of the present invention to pro-

vide four-way flexibility of the shackle against side plates of the clamp when the clamp is turned and/or lifted.

In an attempt to accomplish one or more of the above-identified objects, the present invention includes a clamp for lifting material comprising a casing having a longer length than width and a slot, disposed along the length and across the width of the casing, for receiving material to be lifted, and means, operatively positioned within the casing, for releasably holding the material in the slot. The clamp also includes means, extending within and outward from the casing, for forcing the material holding means against the material. This forcing means includes means for engaging a clamp lifting element having surfaces disposed outside of the casing and adjacent end surfaces of the casing which pivot about one of the adjacent end surfaces of the casing when the surfaces of the engaging means move along the width of the casing and which slide along the adjacent end surfaces of the casing when the surfaces of the engaging means move along the length of the casing; and means, connected to said engaging means and primarily disposed within the casing, for moving the material holding means against the material when the engaging means surfaces are pivoting about or sliding along at least one of the end surfaces of the casing.

Other objects, features, and characteristics of the present invention, as well as the methods, operations and functions of the related elements of the structure, the combination of parts and the economies of manufacture, will become apparent upon consideration of the following description and the appended claims with reference to the accompanying drawings, all of which form a part of this specification, wherein like reference numerals designate corresponding parts in the various figures.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a side view of a lifting clamp of the present invention in an open position; Figure 2 illustrates an end view of the lifting clamp of Figure 1; Figure 3 illustrates an opposite end view of the lifting clamp of Figure 1; Figure 4 illustrates an exploded perspective view of primarily internal elements of the lifting clamp of Figure 1; Figure 5 illustrates the same side view of the lifting clamp as in Figure 1, but in a fully closed position with the lifting shackle pivoted perpendicularly about a top of a casing side plate. Figure 6 illustrates a sectional view along line 6-6 of Figure 5 with a lower shoulder of the lifting shackle pivoted perpendicularly about a top of a casing side plate.

Figure 7 illustrates the same side view of the lifting clamp as in Figure 1, but in a fully closed position with the lifting shackle having been slid parallel to and along the casing side plates to its maximum position.

Figure 8 illustrates the same side view of the clamp as in Figure 7 with the lifting shackle slid parallel to the casing side plates to a maximum position for that thickness of material.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows four-way fully flexing clamp 5 for perpendicular side lifting and for parallel turning of material such as steel plates. It includes casing 10 having generally an inverted U-shaped configuration when in normal vertical lifting orientation and defining slot 11 open at its lower end.

Disposed within casing 10 is material holding assembly 60. Included in the assembly is stationary holder 64 and movable jaw 62. Jaw 62 is held by cam jaw pivot pin 70 for releasably engaging the material in slot 11. Stationary holder 64 can have a relatively smooth material resting surface as shown or other surfaces such as a toothed surface like jaw 62. Also, the assembly 60 may have two movable jaws and still obtain the advantages described herein.

Also shown in Figure 1 is cam jaw pivot pin 70 extending through jaw 62 and apertures of internal bosses 12 of casing 10. These bosses 12 are on both sides of jaw 62. A pair of holding pins 130 extend through apertures in bosses 12 and pin 70 to strongly secure the jaw 62. Strongly securing jaw 62 and pin 70 is desirable, because jaw 62 and pin 70 will undergo considerable stresses while being required to work reliably to avoid dropping large heavy plates during lifting.

Extending within and outward from casing 10 is another assembly for forcing material holding assembly 60 against the material. Included in this assembly is an element 80 for engaging a clamp lifting mechanism such as an external hook on a crane. This clamp engaging element 80 includes a surface 82 disposed outside of casing 10 and disposed adjacent an end surface 22 of the casing.

Also shown in Figure 1 is an optional lock 120 for locking jaw 62 against material in slot 11. This lock includes a connection 121 to movable jaw 62, a resilient member 122 between connection 121 and connection 124 on arm 123. In addition, engaged to arm 123 are loosely fitting handle elements 125 and 126.

Figures 2 and 3 show spaced plates 20 and 30 of casing 10 and rods 16, 17 and 18 for connecting the spaced plates. Shown in Figure 3 is a planar piece 19 for connecting spaced plates 20 and 30. Plates 20 and 30 and connecting elements 16, 17, 18 and 19 may be integral to each other.

By comparing Figure 1 to Figures 2 and 3, it can be seen that clamp 5 has a longer length along casing 10 of Figure 1 than a width between plates 20 and 30 of figures 2 and 3. Also, it can be appreciated that slot 11 is disposed along the length and across the width of the casing. In addition, it is preferred that top surfaces 22 and 32 of plates 20 and 30 are opposite to the lower end surfaces having slot 11.

The preferred element 80 for engaging a clamp lifting mechanism is a shackle as shown in Figures 1-3. As more clearly seen in Figures 2 and 3, shackle 80 is disposed perpendicular to plates 20 and 30 (i.e., perpendicular to the length of the casing). To facilitate engagement with a clamp lifting mechanism, shackle 80 includes a relatively large eye-ring 81.

Also, surfaces 82 and 84 disposed outside of and adjacent top surfaces 22 and 32 of plates 20 and 30 define lower shoulders of shackle 80. Lower surfaces of shoulders 82 and 84 are defined in the preferred embodiments as under surface portions of shackle 80 beginning along the curve between lowermost projection 86 of the shackle and extending along the underside of the shoulder through where there is a curve leading to the side of the shackle.

Also shown in Figure 3 is a nut 65 for bolting stationary holder 64 to casing plate connecting element 19.

In addition, Figures 2 and 3 show the adjacent, second or top end surfaces 22 and 32 of the plates including grooves 23 and 33. Before hook engaging shackle 80 is moved along the length of the casing (i.e. moved parallel to the plates) or moved along the width of the casing (i.e. moved perpendicular to the plates), lower shoulders 82 and 84 of shackle 80 are advantageously disposed adjacent grooves 23 and 33. More preferably, lower shoulders 82 and 84 are disposed directly adjacent top surfaces 22 and 32 of the spaced plates so that when shackle 80 is moved perpendicular to or parallel to the plates, a lower shoulder of shackle 80 immediately contacts a top end surface of one of the spaced plates. Also, it is preferable that when lower shoulders 82 and 84 move along the length or width of the casing, that they immediately contact adjacent end surfaces of the casing near the end of grooves 23 and 33. One way to accomplish such immediate contact near the end of grooves 23 and 33 is to have lower shoulders 82 and 84 resting (i.e., no activation of jaw 62 against the material) in an area defined by grooves 23 and 33 and below the line of curvature of plate top surfaces 22 and 32. This latter structure also allows the shackle to sit lower in the casing to assure that jaw 62 is moved to its fully open position.

Figure 4 illustrates an exploded perspective view of primarily internal elements of the lifting clamp of Figure 1. In particular, it shows plate 30 of the casing having interior wall 34 with internal recess 36. A central pin 50 is to be slidably disposed in recess 36. This

pin 50 is prevented from lateral movement in the recess. Thus, central pin 50 moves only towards and away from top end surfaces 22 and 32 of the plates.

Also shown in Figure 4 is link 90 for transferring motion of shackle 80 in both a perpendicular and a parallel direction relative to the plates to effectively direct jaw 62 towards the material. Link 90 is connected to shackle 80 and central pin 50 for transferring both the sliding and pivoting motions of shackle lower shoulders 82 and 84 against at least one of top surfaces 22 and 32 of the plates to a pull on central pin 50 towards top surfaces 22 and 32 of the plates. Preferably, link 90 includes lower portion 91 disposed about central pin 50 and upper portion 93 supporting lowermost projection 86 of the shackle.

Although various structures for accomplishing the function of link 90 are anticipated, preferred is a clevis link wherein upper portion 93 of the link includes two projections 94 and 95 extending from lower portion 91 of the link and a shackle pin 100 extending through a lowermost aperture 89 of the shackle and through apertures 96 and 97 of projections 94 and 95. To further secure link 90 to shackle 80, pins 110 and 112 extend through apertures 98 and 99 in link projections 94 and 95 and through shackle pin 100. Also preferred is lower portion 91 having aperture 92, at a right angle to apertures 96 and 97, through which central pin 50 extends.

Figure 4 also shows arms 40 and 42 connected about central pin 50 and rocking pin 74 of the material holding movable jaw 62. These arms are for directing jaw 62 towards the material when central pin 50 within recess 36 is moved towards adjacent top surfaces 22 and 32 of the plates. These jaw directing arms 40 and 42 are preferably disposed about a rocking pin 74 from which an end of movable jaw 62 is pulled upward. O-rings 75 and 76 are disposed between pin 74 and arms 40 and 42.

Figures 5 and 6 illustrate the operation for side lifting material such as a steel plate from a horizontal to a vertical position. In Figures 5 and 6, lifting shackle 80 has been moved perpendicular to side plates 20 and 30 of the casing. As more clearly illustrated in Figure 6, when engaging shackle 80 is moved perpendicular to the plates (i.e. along the width of the casing), a portion of lower shoulder 84 of shackle 80 pivots about adjacent top surface 32 of plate 30 to pull central pin 50, within oppositely facing internal recesses 26 and 36 of plate interior walls 24 and 34, toward top surfaces 22 and 32.

Having lower shoulder 84 of lifting shackle 80 contacting side plate 30 generates a camming effect when lifting shackle 80 is in the centered position and moved (i.e. pivoted) perpendicular to the side plates. Also, the configuration of the top surfaces 22 and 32 of the side plates and lifting shackle lower shoulders 82 and 84 are such that moving the shackle perpendicular to the side plates increases the gripping ratio

of the clamp during this side lifting over clamps where the shackle initially rides considerably up clamp side plates. Pivoting with the lower shoulders 82 and 84 of the perpendicular shackle is especially advantageous for obtaining a quick and tight grip on relatively thin materials.

In addition, as seen in Figure 5, recess 26 for pin 50 is preferably disposed directly above slot 11 of the casing. With this structure, pin 50 is held in a centered position of casing 10.

Figure 7 illustrates the clamp in a fully closed position and Figure 8 illustrates the clamp closed about material 2. Figures 7 and 8 also illustrate lower shoulder 82 of shackle 80 sliding along top surface 22 of plate 20 to pull central pin 50 toward top surface 22 of plate 20. It can be appreciated from Figures 1-8 that during the motions of the shackle shown in Figures 7 and 8, the opposite lower shoulder 84 is sliding along top surface 32 of plate 30 to pull central pin 50 toward top surface 32 of plate 20.

Adjacent top surfaces 22 and 32 of plates 20 and 30 have a first radius of curvature. Lower shoulder 82 and 84 of the engaging shackle 80 have a second radius of curvature which is less than the first radius of curvature of the adjacent top surfaces of the plates. When the shackle lower shoulders move parallel to the plates as in Figures 7 and 8, lower shoulders 82 and 84 of the engaging shackle slide along adjacent top or cam surfaces 22 and 32 of the casing plates to pull pin 50 within recesses 26 and 36 toward the adjacent top end surfaces of the plates. This camming effect along top surfaces of the casing results in a smoother pull on pin 50 than using leverage with the shackle about bracing shafts or the like disposed within the casing. In other words, with the clamp of Figures 7 and 8, the lower shoulders avoid having to be pried or lifted over a shaft or pin at the beginning of a lift. Also, as shackle 80 moves away from the centered position and parallel to the side plates, having shackle lower shoulders 82 and 84 slide along the greater radius 22 and 32 will increase the gripping force.

Note that the shackle link does not come in contact with plate connecting element 18 in Figures 7 and 8. Thus, the above-mentioned advantages are obtained without a leveraging or prying action against the shackle.

Figures 7 and 8 also illustrate link 90, pin 50, arm 40 and locking pin 74, primarily disposed within the casing, for moving material holding jaw 62 against material 2 when the engaging shackle lower shoulder 82 and 84 are pivoting about or sliding along at least one of top surfaces 22 and 32 of the plates.

As seen in figure 1, gripping jaw 62 can preferably only be moved to the full open position when the lifting shackle is in the centered position. Furthermore, except for when optional lock 120 is used, the movable jaw 62 does not hold the material until the engag-

ing shackle lower shoulders are moved either along the length or width of the casing. When the shackle is moved, however, its shoulders 82 and 84, by being adjacent to plate top surfaces 22 and 32, facilitate rapid movement of the jaw towards the material. This speed is especially advantageous when a thin plate in the slot must be held by the jaw before too much lifting or turning of the clamp occurs.

When turning material 2 with the lifting shackle moving parallel to the side plates, the weight of material 2 normally generates a force that is attempting to push the gripping cam jaw 62 toward the open position as in Figure 1. The combination of the two radii of plates 20 and 30 and shackle 80, however, generate a greater gripping force to offset the pushing forces generated by material 2. Also once jaw 62 has seated properly on material 2 and the lifting shackle has been slid as in Figures 7 and 8, the effect of the two radii offers a greater resistance to the material pushing against the gripping cam to the open position than do other known clamps.

If the fully flexing lifting shackle is moved from the centered position and pivoted perpendicularly to side plates 20 and 30, both the pivoting effect on a lower shoulder of the shackle and the camming effect due to the combination of the two radii planes are in effect for even tighter gripping.

Figures 7 and 8 also show elements 121-126 in the locked position. By comparing Figures 7 and 8 to Figure 1, it can be seen that when handle elements 125 and 126 rotate arm 123 upwards, resilient member 122 and its connection 121 pull jaw 62 into its material engaging positions.

Except for the optional lock and shackle, the working parts are preferably disposed inside the body of the casing. In particular, cam jaw pin 70, disposed in the casing for pivotally supporting the cam jaw, does not extend beyond the outer wall of the casing. More preferably, the casing further includes an inwardly directed boss 12 of Figure 1 on one side of the holding jaw 62 and an opposing boss (not shown) on the other side of jaw 62. Each of the bosses include an aperture for receiving cam jaw pivot pin 70 and apertures for receiving holding pins 130. This structure has an advantage of avoiding a lower portion protrusion which can interfere with objects as the clamp is moved.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not to be limited to the disclosed embodiments, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the sphere and scope of the appended claims.

Claims

1. A clamp for lifting material comprising:

a casing having a longer length than width and a slot, disposed along the length and across the width of said casing, for receiving material to be lifted;

means, operatively positioned within said casing, for releasably holding said material in said slot; and

means, extending within and outward from said casing, for forcing said material holding means against the material, said forcing means including

means for engaging a clamp lifting element having surfaces disposed outside of said casing and adjacent end surfaces of said casing which pivot about one of said adjacent end surfaces of said casing when said surfaces of said engaging means move along the width of said casing and which slide along said adjacent end surfaces of said casing when said surfaces of said engaging means move along the length of said casing; and

means, connected to said engaging means and primarily disposed within said casing, for moving said material holding means against the material when said engaging means surfaces are pivoting about or sliding along at least one of said end surfaces of said casing.

2. The clamp as in claim 1, wherein said adjacent end surfaces of said casing include grooves and before said engaging means is moved along the width or length of said casing, said engaging means surfaces are disposed adjacent said grooves.

3. The clamp as in claim 2, wherein when said engaging means surfaces move along the length or width of said casing, said engaging means surfaces first contact said adjacent end surfaces of said casing near the end of said grooves.

4. The clamp as in claim 1, wherein said moving means is disposed entirely within said casing.

5. The clamp as in claim 1, wherein said moving means further comprises a pin disposed in said casing for pivotally supporting said material holding means and said pin does not extend beyond the outer walls of said casing.

6. The clamp as in claim 5, wherein said casing further comprises inwardly directed bosses on either side of said holding means and each of said bosses include means for receiving said pin.

7. The clamp as in claim 1, wherein said engaging means further comprises a shackle and said engaging means surfaces disposed outside of said casing define lower shoulders of said shackle.

8. The clamp as in claim 7, wherein said shackle is perpendicular to the length of said casing and said lower shoulders of said shackle pivot about said end surface of said casing when said shackle moves along the width of said casing.

9. The clamp as in claim 1, wherein said radius of curvature of said surfaces of said engaging means are less than a radius of curvature of said adjacent end surfaces of said casing.

10. The clamp as in claim 1, wherein said moving means further comprises:

a pin slidably disposed in said casing which moves only towards and away from said adjacent end surfaces of said casing;

a link connected to said engaging means and said pin which transfers both of said sliding and pivoting motions of said engaging means surfaces to a pull on said pin toward said adjacent end surfaces of said casing; and

means, connected to said pin and said material holding means, for directing said material holding means against the material when said pin is moved toward said adjacent end surfaces of said casing.

11. A clamp for lifting material comprising:

a casing including a plurality of spaced plates and means for connecting said plates, each of said plates having opposing slots for receiving the material to be lifted;

means, operatively positioned within said casing, for releasably holding said material in said slot including a movable jaw which releasably engages the material; and

means, extending between and outward from said spaced plates, for forcing said movable jaw against the material, said forcing means including

means for engaging a clamp lifting element having surfaces disposed outside of said plates and adjacent end surfaces of said plates which pivot about one of said adjacent end surfaces of one of said plates when said surfaces of said engaging means move perpendicular to said plates and which slide along said adjacent end surfaces of said plates when said surfaces of said engaging means move parallel to said plates; and

means, connected to said engaging means and primarily disposed within said casing, for moving said movable jaw against the material

when said engaging means surfaces are pivoting about or sliding along at least one of said end surfaces of said plates.

12. The clamp as in claim 11, wherein:

said adjacent end surfaces of said plates have a first radius of curvature;

each of said plates of said casing have interior wall with oppositely facing internal recesses ;

said moving means further comprises

a pin disclosed between said spaced plates, slidably disposed in each of said recesses and connected to said engaging means; and

means, connected to said pin and said movable jaw, for directing said jaw against the material when said pin within said recesses is moved towards said adjacent end surfaces of said plates;

wherein when said engaging means surfaces move perpendicular to said plates, said surfaces of said engaging means pivot about one of said adjacent end surfaces of said plates to pull said pin within said recesses towards said adjacent end surfaces of said plates; and

wherein said surfaces of said engaging means have a second radius of curvature which is less than said first radius of curvature of said adjacent end surfaces of said plates so that when said engaging means surfaces move parallel to said plates, said surfaces of said engaging means slide along said adjacent end surfaces of said plates to pull said pin within said recesses towards said adjacent end surfaces of said plates.

13. The clamp as in claim 11, further comprising means for locking said movable jaw against the material.

14. The clamp as in claim 11, wherein said adjacent end surfaces of said plates include grooves and before said engaging means is moved perpendicular to or parallel to said plates, said engaging means surfaces are disposed adjacent said grooves.

15. The clamp as in claim 11, wherein said plates and said plate connecting means are integral to each other.

16. The clamp as in claim 11, wherein said moving means is disposed entirely within said casing.

17. The clamp as in claim 11, wherein said moving means further comprises:

a pin slidably disposed between said

plates which moves only towards and away from said adjacent end surfaces of said plates;

a link connected to said engaging means and said pin which transfers said sliding and said pivoting motion of said engaging means surfaces to a pull on said pin toward said adjacent end surfaces of said plates; and

means, connected to said pin and said material holding means, for directing said movable jaw against the material when said pin is moved toward said adjacent end surfaces of said plates.

18. The clamp as in claim 11, wherein said engaging means further comprises a shackle and said engaging means surfaces disposed outside of said plates define lower shoulders of said shackle.

19. A clamp for lifting material comprising:

a casing including spaced plates and means for connecting said spaced plates, each of said plates having opposing slots in a first end surface for receiving the material to be lifted, said spaced plates including a second end surface generally opposite said first end surface and having a first radius of curvature, and said spaced plates including interior walls having oppositely facing internal recesses;

means, operatively positioned within said casing, for releasably holding said material in said slot including a movable jaw which releasably engages the material;

means, extending within and outward from said spaced plates, for forcing said movable jaw against the material, said forcing means including means for lifting the clamp including a shackle disposed perpendicular to said plates, said shackle including lower shoulders disposed outside of and adjacent said second end surfaces of said spaced plates;

a pin disposed between said spaced plates, slidably disposed in each of said recesses and connected to said lifting means; and

means, connected to said pin and said material holding means, for directing said movable jaw against the material when said pin within said recesses is moved towards said second end surfaces of said plates;

wherein when said shackle is moved perpendicular to said plates, a lower shoulder of said shackle pivots about one of said second end surfaces of said plates to pull said pin within said recesses towards said second end surface of said plates; and

wherein lower shoulders of said shackle have a second radius of curvature which is less than said first radius of curvature of said second

end surfaces of said plates so that when said shackle is moved parallel to said plates, said lower shoulders of said shackle slide along said second end surfaces of said plates to pull said pin in said recesses towards said second end surfaces.

20. The clamp as in claim 19, wherein said shackle lower shoulders are disposed directly adjacent said second end surfaces of said plates so that when said shackle is moved perpendicular to or parallel to said plates, said lower shoulders of said shackle immediately contact said second end surface of one of said spaced plates.

21. The clamp as in claim 19, wherein:

said clamp lifting means further comprises a link, said link including

a lower portion disposed about said pin; and

an upper portion supporting said shackle; and

said link transfers both of said sliding and said pivoting motions of said shackle lower shoulders to a pull on said pin.

22. The clamp as in claim 21, wherein said upper portion of said link further comprises two projections extending from the lower-most portion of said link and a shackle pin extending through a lower-most portion of said shackle and through said projections of said upper portion of said link.

23. The clamp as in claim 19, wherein said casing and said slot define generally an inverted U-shaped configuration when in normal vertical lifting orientation with said recesses for said pin disposed directly above said slot of said casing.

24. The clamp as in claim 23, wherein said recesses on said plates prevent said pin from lateral movement.

25. The clamp as in claim 19, wherein said jaw directing means further comprises:

a rocking pin about which an end of said movable jaw is pulled towards said second end surfaces of said plates; and

an arm connected to both of said pin of said forcing means and said rocking pin.

26. The clamp as in claim 19, further comprising a cam jaw pin about which said movable jaw pivots and said cam jaw pin does not extend outside of said casing.

27. The clamp as in claim 19, wherein said lifting means further comprises means, connected to

said shackle and said pin, for transferring both of said sliding and pivoting motions of said shackle lower shoulders against at least one of said second end surfaces of said plates to a pull on said pin within said recesses towards said second end surfaces of said plates.

28. A clamp for lifting and turning material comprising:

a casing having generally an inverted U-shaped configuration when in normal vertical lifting orientation, defining a slot open at its lower end and including spaced plates and means for connecting said spaced plates, said spaced plates including a top surface generally opposing said lower end surface and having a first radius of curvature, and said spaced plates including interior walls having oppositely facing internal recesses;

means, disposed within said casing, for releasably holding said material in said slot including a movable jaw which releasably engages said material;

means, primarily disposed with said casing, for forcing said jaw towards the material, said forcing means including

means, extending between and outward from said second end surfaces of said spaced plates, for lifting the clamp, said lifting means having

a shackle disposed perpendicular to said spaced plates, said shackle including lower shoulders disposed adjacent said top surfaces of said spaced plates; and

means for transferring motion of said shackle in both a perpendicular and a parallel direction relative to said plates to direct said jaw towards the material;

a pin disposed between said spaced plates, slidably disposed in each of said recesses, prevented from lateral movement in said recesses and connected to said transferring means; and

means, connected to said pin and said material holding means movable jaw, for directing said jaw toward the material when said pin within said recess is moved towards said second end surface of said plates;

wherein when said shackle is moved perpendicular to said plates, a lower shoulder of said shackle pivots about one of said top surfaces of said plates to pull said pin within said recesses towards said top surfaces; and

wherein said lower shoulders of said shackle have a second radius of curvature which is less than said first radius of curvature of said top surfaces of said plates so that when said shackle is moved parallel to said plates, said

lower shoulders of said shackle slide along said top surfaces of said plates to pull said pin in said recesses towards said second end surfaces.

29. The clamp as in claim 28, wherein said top surfaces of said plates include grooves and before said shackle is moved perpendicular to or parallel to said plates, said shackle lower shoulders are disposed adjacent said grooves.

30. The clamp as in claim 28, wherein said shackle lower shoulders are directly adjacent said top surfaces of said plates so that when said shackle is moved perpendicular to or parallel to said plates, said lower shoulders of said shackle immediately contact said top surface of one of said plates.

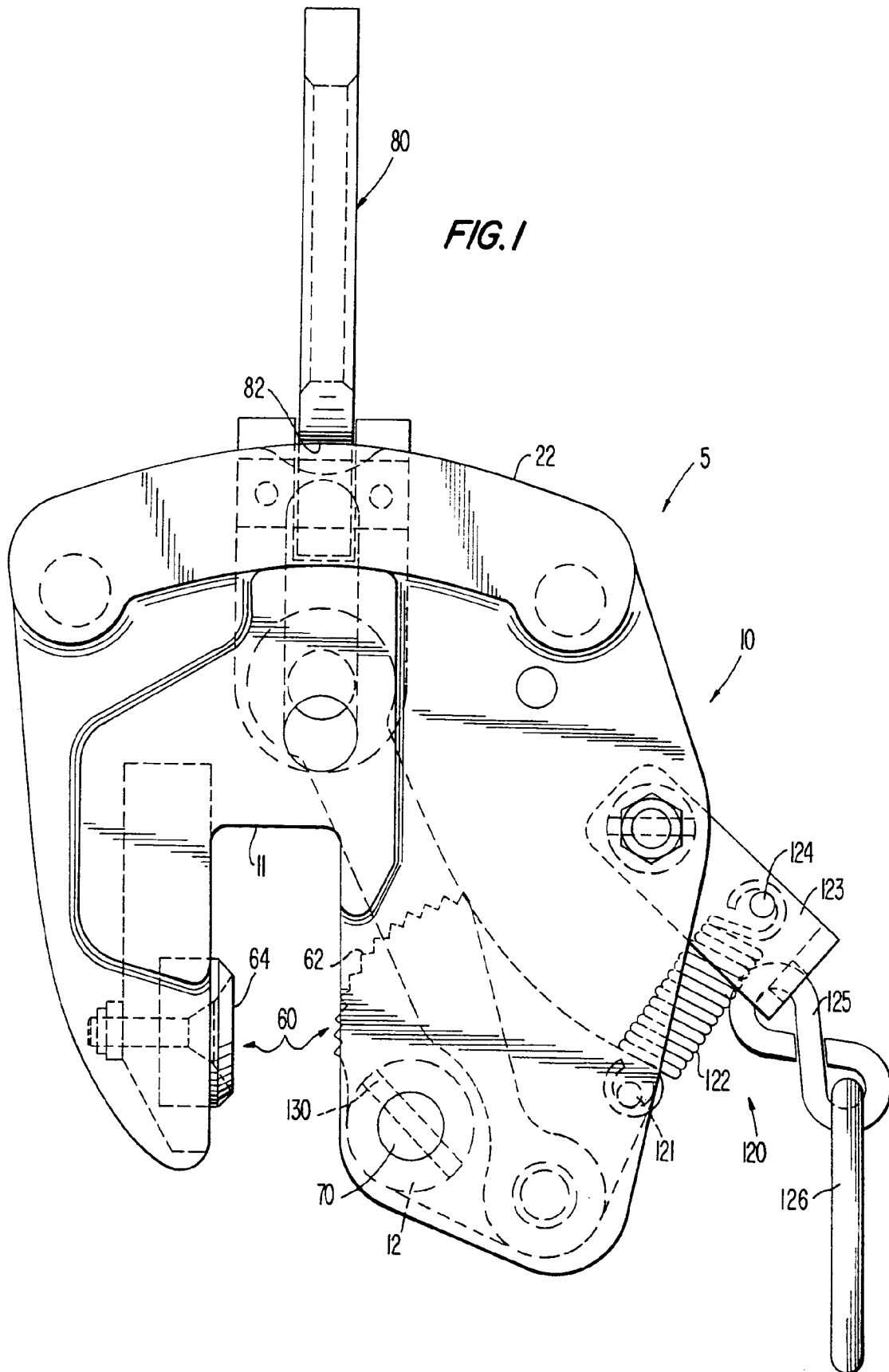


FIG. 2

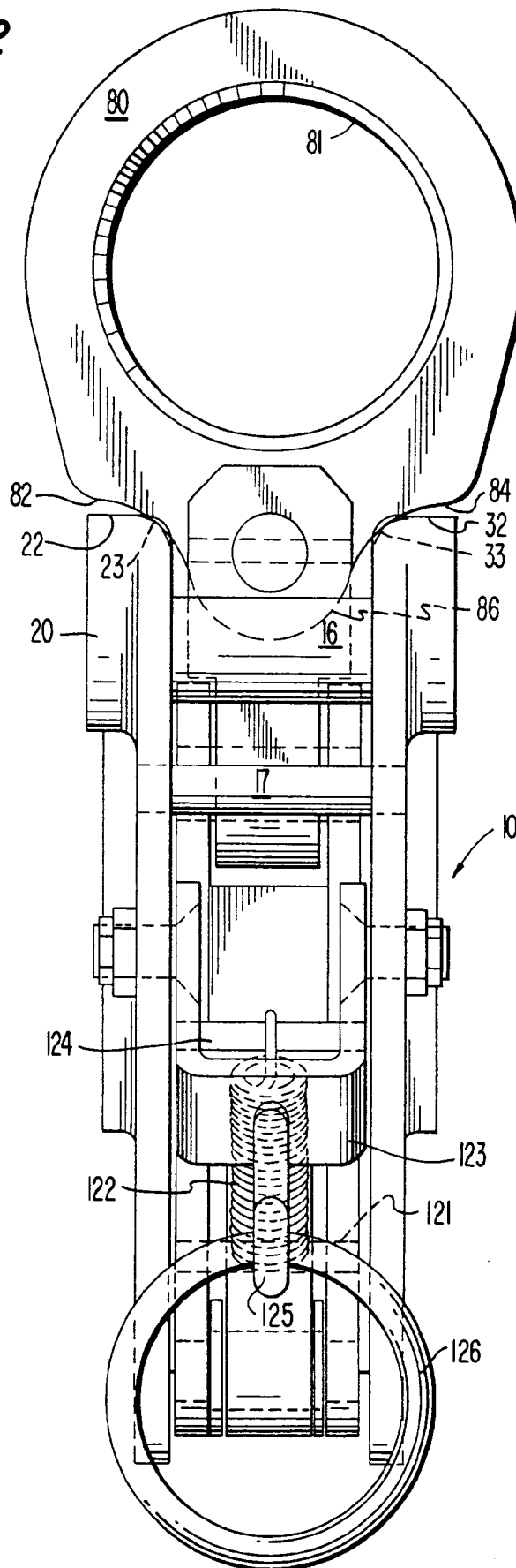
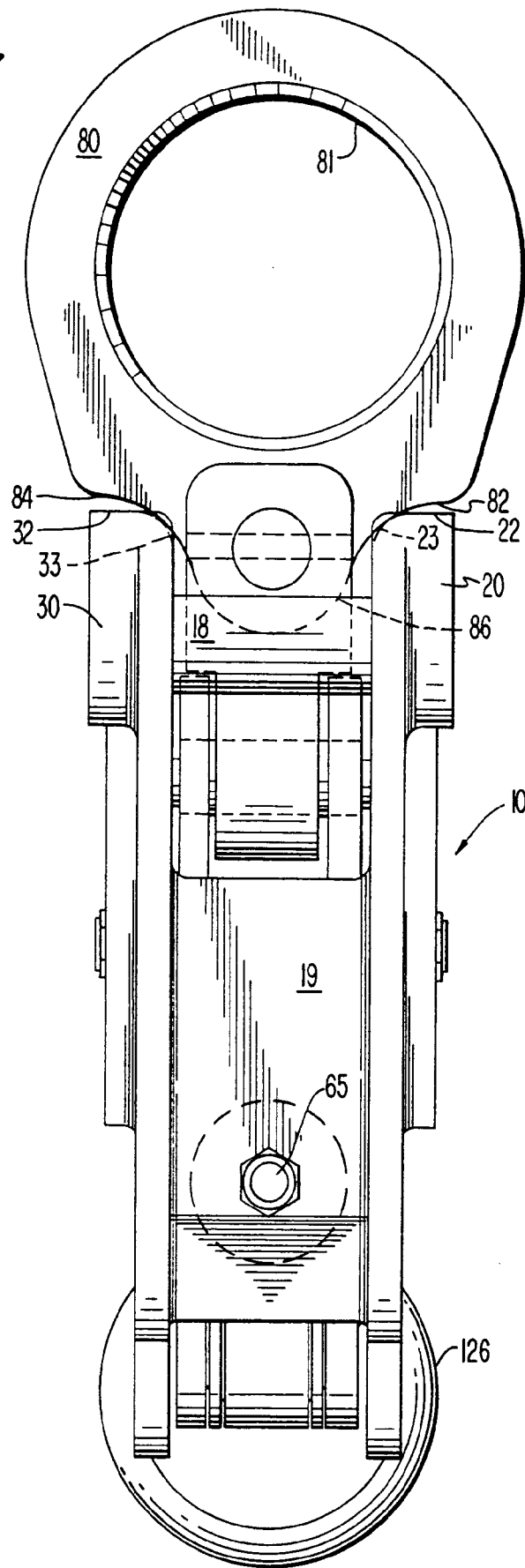
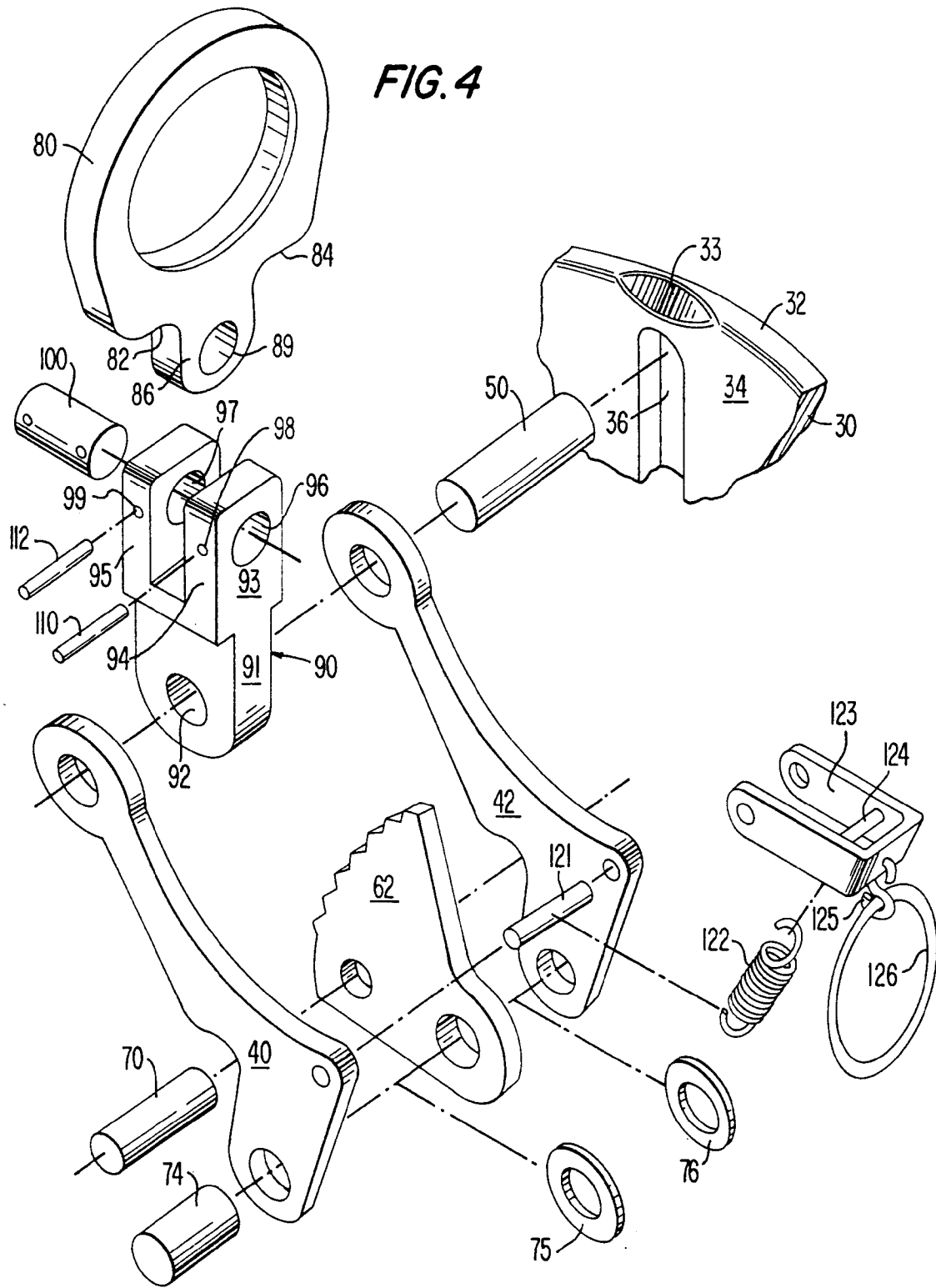


FIG. 3





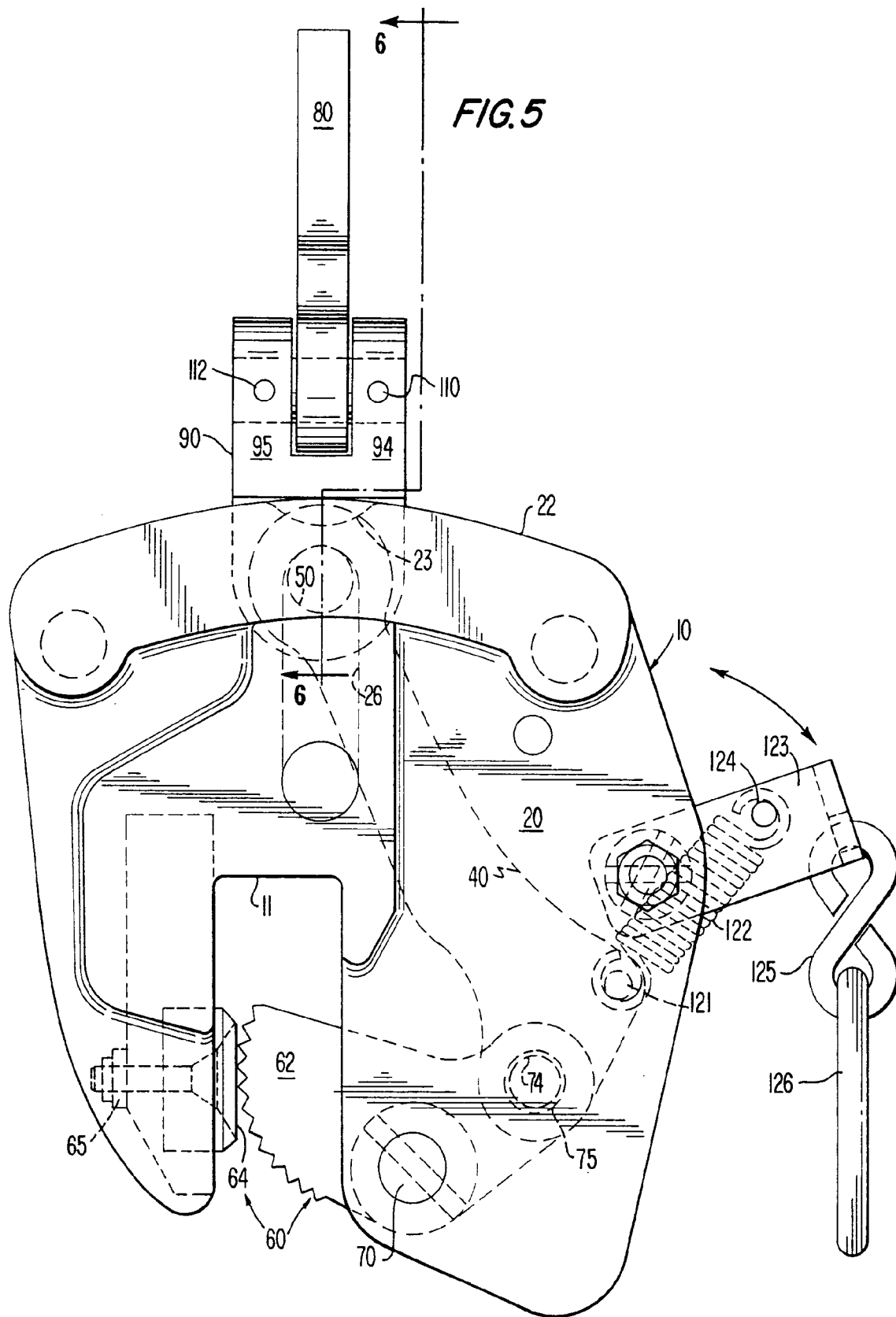


FIG. 6

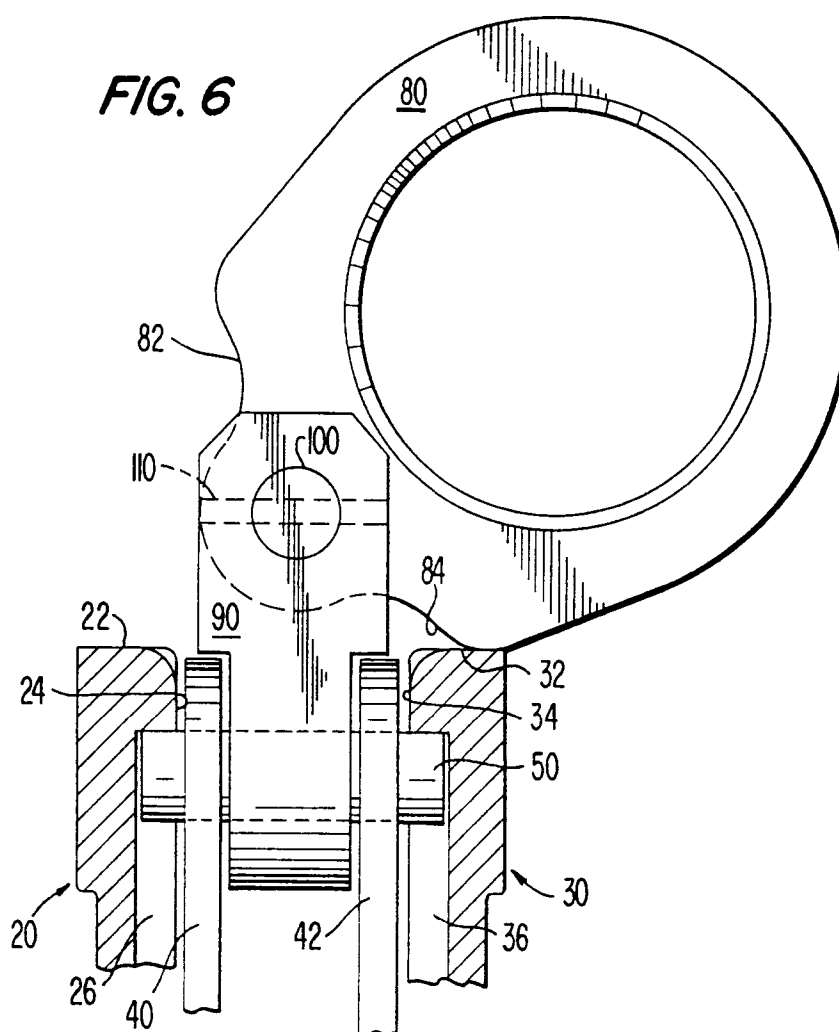
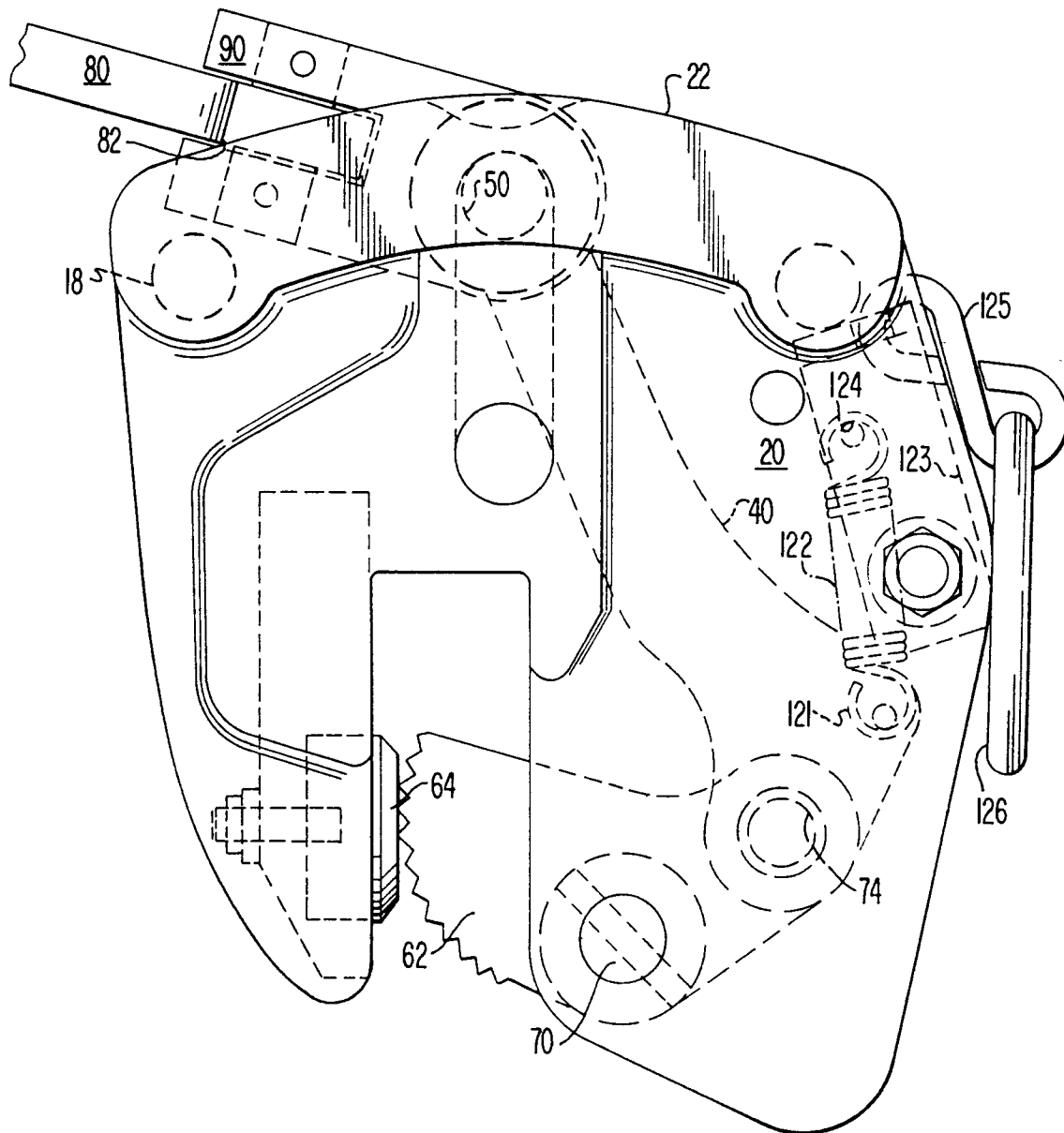
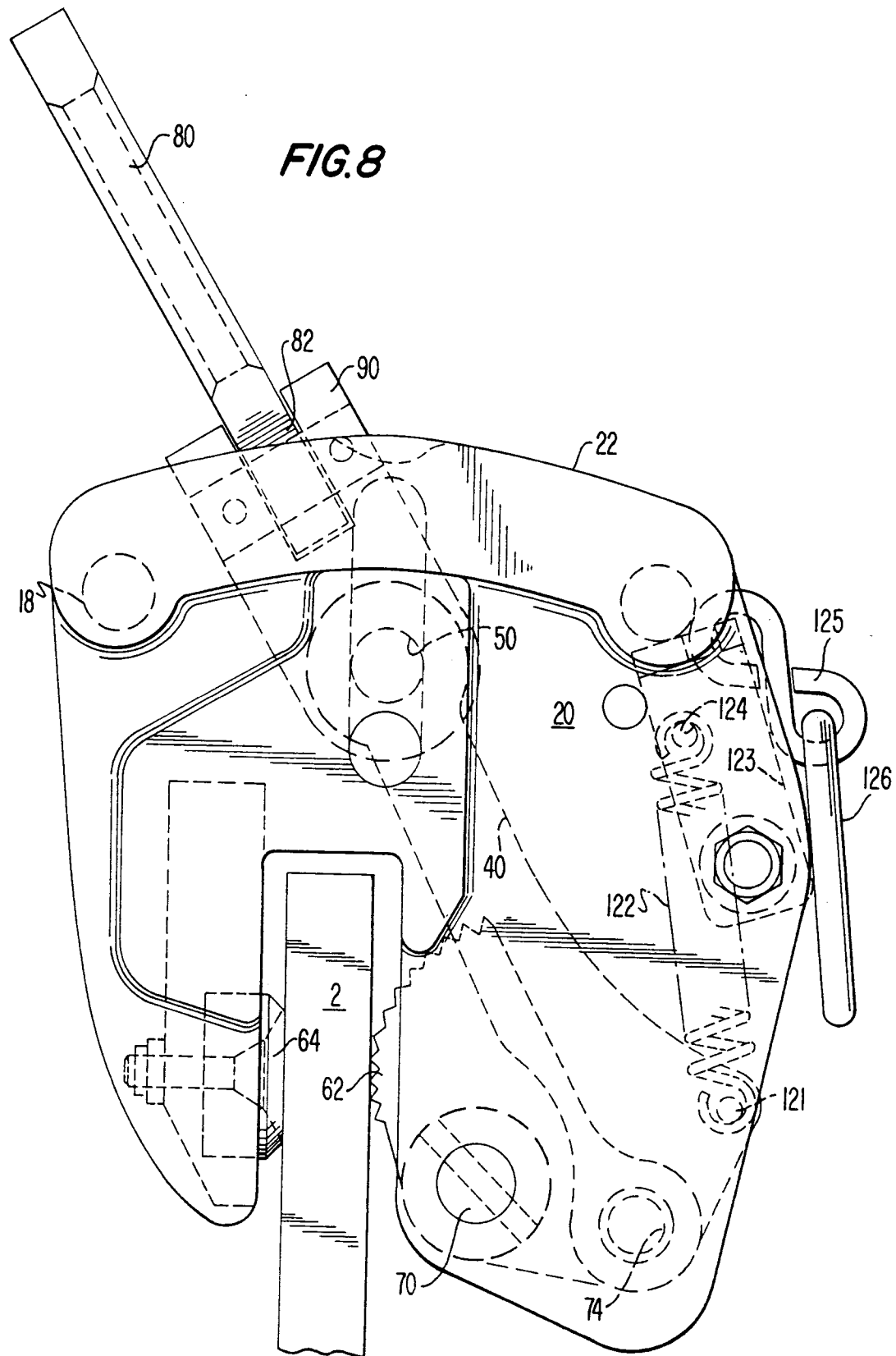


FIG. 7







European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 5682

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-B-2 453 121 (EAGLE CLAMP) * column 3, line 24 - column 4, line 23; figures 1,2 *	1,10,11	B 66 C 1/48
A	---	4-8,12-19,20-28,30	
A	US-A-4 834 442 (M. CHOUNG) * abstract; figures 1,3 *	1,11,19,28	
D,A	US-A-4 647 098 (P. HOYER et al.) * abstract; figures 1,2 *	1,11,19,28	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 66 C
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 25-09-1991	Examiner WESTERMAYER W G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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