

PATENT SPECIFICATION

DRAWINGS ATTACHED



870,866

Date of filing Complete Specification (under Section 3(3) of the Patents Act 1949): April 6, 1959.

Application Date: April 9, 1958.

No. 11139/58.

Application Date: April 21, 1958.

No. 12494/58.

Application Date: April 29, 1958.

No. 13650/58.

Application Date: July 26, 1958.

No. 24133/58.

Complete Specification Published: June 21, 1961.

Index at acceptance:—Classes 78(3), H(4:13); and 78(4), MX.

International Classification:—B66f.

COMPLETE SPECIFICATION

Improvements in or relating to Gripping Means for Lifting Loading or Stacking Equipment

I, GORDON HENRY BENNETT, a British Subject, of "Brooklyn", 37 Cross Park Road, Crownhill, Plymouth, Devonshire, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to gripping means for lifting, loading or stacking equipment, whereby comparatively fragile articles can be securely held for the purpose of lifting, loading or stacking.

The object of the invention is to provide simple and efficient gripping means which, while enabling more articles to be gripped and lifted than by known devices, nevertheless reduces the risk of crushing or other damage to the articles in question. While the invention is suitable for gripping articles of any kind, it has very useful applications in the lifting and stacking of precast concrete blocks which are not fully hardened, and/or comparatively fragile articles such as cartons partly or fully packed with goods.

The invention consists in gripping means for lifting, loading or stacking equipment comprising a main support for attachment to a conventional lifting device and extending therefrom a cantilever arm of channel section and located therein two members also of channel section which are slidable one within the other and the other within the cantilever arm and also located in the cantilever arm two double acting hydraulic or pneumatic rams connected to the two slidable members respectively and a projecting gripper arm rigidly attached to one end of each of the said slidable members, each gripper arm-being provided with a resilient gripping surface and one or more intermediate gripping members each attached to two divergent arms attached to the

said cantilever arm at points between the afore-said projecting gripper arms, each of the intermediate gripping members being provided with two gripping plates and means for forcing these plates apart to provide gripping action.

The invention will be clearly understood from the following description of forms (given, however, merely by way of example) which it may assume, and this description will be more readily followed by reference to the accompanying drawings wherein:—

Figures 1 and 2 represent respectively a side view, and a plan view with cover plate broken away, of gripping means for lifting, loading or stacking equipment according to the invention.

Figure 3 represents a sectional side view of the device shown in Figures 1 and 2.

Figure 4 represents a transverse sectional view along the line IV—IV of Figure 3.

Figures 5 and 6 represent respectively an end view in contracted state, and a transverse section in expanded state, of an intermediate gripping member incorporated in the device shown in Figures 1—3.

Figure 7 is a side view along the line VII—VII of Figure 5.

Figure 8 is a sectional plan view along the line VIII—VIII of Figure 6, and

Figures 9, 10 and 11 represent respectively front view, plan view and a side sectional view of a modified form of gripping device according to the invention, Figure 11 representing a section along the line XI—XI of Figure 9.

In carrying the invention into effect in one convenient manner, as shown in Figures 1—8 of the drawings herewith, a gripping device for use in lifting, loading or stacking articles, e.g., partially hardened pre-cast concrete blocks, or cartons packed with goods, comprises an end plate 1 having reinforcing ribs or plates 2, and ring lugs or brackets 3 whereby

[Price 3s. 6d.]

the plate can be detachably secured to a conventional lifting device, e.g., to the hoist carriage of a fork lift or hoist truck. Secured to and projecting horizontally from the plate 1 is a cantilever arm formed of side plates 4, a base plate 5 extending between the lower edges of the side plates along a substantial mid-portion of the cantilever arm, which is thus substantially of channel form.

In the U-sectioned cantilever arm are mounted, one within the other, for longitudinal movement, two slides 6, 7, each of channel section. The outer end of each slide 6, 7, carries downwardly projecting divergent arms 8, supporting a gripping pad described more fully below.

The cantilever arm is closed by a cover plate 9 between and secured to the side plates 4 by bolts 10 extending through flanges or angle members 11, and in the closed spaces between this cover 9 and the inner slide are located side by side two double acting hydraulic or pneumatic rams 12, 13, operable in opposite directions. Each ram at its rear end is articulated to lugs or brackets 14 beneath the cover 9, and the piston rod of one ram 12 is linked to an end plate of one slide 6, while the piston rod of the other ram 13 is likewise linked to an end plate of the other slide 7.

Each pair of arms 8 terminates in plates 15 to which is rigidly secured a transverse vertical gripping pad formed of a rear plate 16 (Figure 3) in which is mounted a resilient strip 17 i.e., of rubber or the like, faced with a metal or like stiff plate 18 on which a thin surface layer 19 of soft or resilient material e.g., rubber is mounted. The plate may be of a shallow U-section as shown or otherwise.

The rams 12 and 13 are connected by flexible hose to, and serviced by, a hydraulic or pneumatic pressure governable system e.g., of the truck on which the plate 1 is mounted, and it will be apparent that when the rams are retracted the slides 6 and 7 are slidably moved inwards in relation to one another and thereby bring together their respective pairs of arms 8, in order to grip between the pads 19 any article(s) located between them, while on reverse operation the pads are separated to release the article. The metal plates 18 on the resilient buffers 16 of the gripping pads ensure a uniform application of gripping force to the article(s) while the surfacing 19 improves the frictional grip and avoids scratching or damage. The material being thin does not sag and so facilitates gripping at very low pressure.

One or more intermediate gripping members are between the end pads. Each intermediate member is expansible to assist in the gripping action, and enables a plurality of articles, or a plurality of groups of articles to be gripped simultaneously. The form of the invention shown in Figures 1-4 is illustrated as fitted with one intermediate member, of which more

detail is shown in Figures 5-8.

The intermediate member is pivotally suspended by hooked arms 20 engaged on spigots 21 on opposite sides of the cantilever arm and approximately at mid-points along its length, these arms diverging, in a manner similar to the arm 8, in order to carry the intermediate member which is dimensionally similar to the end gripping pads. Near their lower ends the arms 20 may be strengthened by a strut 22 (Figure 7) extending between them, and have pivoted thereto link members 23 to support the intermediate member.

The intermediate member comprises two parallel plates 24, 25, of approximately the same dimensions as the end plates 16, each having externally a resilient facing 26 (which may be the same as the facing 17, 18, 19, fitted to the plates 16). Near to their upper edges the plates 24, 25 are provided with lugs 27 bolted to the links 23, to be supported thereby in a vertically dependent position at approximately the same level as the end plates 16, and parallel thereto. Near to their ends the plates 24, 25 are interconnected by pairs of links 28, and a tension spring 29 acting on the junction of the links 28 tends to fold the links together thus drawing together the plates 24, 25, and the links 28 limit the extent of opening of the plates 24, 25.

Means are provided between the plates 24, 25 for forcing the plates apart to expand the intermediate member. As shown in Figures 5-8 these means comprise co-operating wedge-shaped elements. A rod 30 has mounted thereon in spaced positions a plurality of full-taper wedge-elements 31 adapted to co-operate with pairs of half-taper wedge-elements 32 mounted in facing positions in the inner faces of the plates 24, 25. Two assemblies of a rod 30 with wedges 31 are mounted respectively in guides 33, and in association with fixed wedges 32, respectively near to the upper and lower edges of the plates 24, 25, and corresponding full-taper wedges 31 of the two assemblies are rigidly interconnected by rods 34. It will be apparent that longitudinal movement of the rods 30 causes the wedges 31 and 32, in co-operation, to force the plates 24, 25 apart, thus expanding the intermediate member, or in reverse sense allow them to come together in retraction. In order to effect such movement a ram 35 is pivoted at 36 inside one of the plates 24, and its shaft connected at 37 to a rod 34 of the slidable wedge assembly. The ram 35 may be operated from the same pressure supply, hydraulic or pneumatic, as the rams 12, 13. It will be seen from the drawing that the wedges are tapered to flat. When fully extended the flat of the centre wedge rests against the flat of the half tapers so relieving back pressure on the ram when under full compression for lifting.

A cam-shaped plate 38 may be pivoted between lugs 39 near to the mid-point of one

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of the plates 24 or 25 on its inner surface, and adapted to ride by its free end against the inner surface of the other plate, thereby stabilising the plates as they open and close. The free end of the cam-plate 38 may rise between guide lugs 40 on the other plate. A strip spring 41 may form a loop in the inner surface of one plate, e.g., 25, to steady the slidable wedge assembly by bearing on one of the rods 34 extending through the loop when the assembly is open for maintenance. The half-taper wedges 32 on the inner surface are formed with semi-cylindrical channels 42 to accommodate the rod 30 when the plates 24, 25 are closed together.

In modified forms of the invention the above described wedge-assembly arrangement may be replaced by alternative means for expanding or retracting the plates 24, 25. For example, the plates may be interconnected by pairs of links (similar to links 28) all the link junctions being connected together by a ram-operated rod, so that longitudinal movement of the rod opens and closes the links to provide a toggle action for separating the plates. Alternatively the inner surfaces of the plates 24, 25 may be provided with ribs having inclined ramp edges, and a rod or roller extending between these inclined edges may be moved by a ram in a direction parallel to the ribs, to force the plates apart. In any of the these arrangements it is within the scope of the invention to pivot the lugs 27 of the plates directly to the arms 20, so that, instead of remaining parallel to one another when expanded, the plates open out bookwise about their supporting pivots.

In a modified form of the invention shown in Figures 9—11 of the accompanying drawings the gripper arms, instead of depending from the slides and support extend in a horizontal direction therefrom. The supports 3 whereby the device can be secured to the hoist carriage of a lift truck or the like extend from the side of the main support formed by the side plates 4 and the rear plate 5, and equispaced from the mid-point of the main support. The slides 6, 7 slidably nested in the main support have secured to their outer ends front plates 43 to which are rigidly attached the forwardly projecting gripper arms 8 provided on their inner faces with gripping pads substantially as described above. The front plate 9 of the main support has attached to its inner surface rams 12, 13 which are connected to the outer ends of the slides 6, 7 in order to force them inwards or outwards, as previously described, for gripping and release operations.

An intermediate gripping member is supported by the plate 9 and for this purpose a bracket plate 44 has a boss 45 at its upper inner corner mounted on a rod 46 carried in and between lugs 47 near the upper edge and on the front face of the plate 9. The lugs 47 are equispaced from the centre line of the plate 9, and the bracket 44

is centralised on the rod 46 by springs 48. The bottom rear corner of the bracket 44 is fitted with slide or roller means 49 which bear against the plate 9. The intermediate member may comprise two plates substantially identical with plates 24, 25 described above, slung by pivot plates 50 from spaced lugs 51 on the lower edge of the bracket 44. The intermediate gripper assembly is provided with means for expanding and retracting the plates, and these may be of any of the forms described above.

When a gripping device such as described above is mounted on the hoist carriage of a lift truck or the like the pneumatic or hydraulic rams are connected to the pressure system of the truck by high-pressure flexible hose, preferably by means of a self-sealing detachable union, and is thereupon ready to grip articles for the purpose of lifting, loading or stacking. The truck is advanced towards articles on the ground or on a supporting surface, so that the gripping pads 19 extend beside a group of articles to be gripped, and the retracted intermediate member or members between articles of the group. Owing to its pivotal support and/or mobility the intermediate member can readily move to a position for insertion between the articles. Thereafter the intermediate member is expanded and the rams are operated, the slides and gripping pads being moved inwards to grip the articles for lifting and subsequent disposal and release.

From the above description it will be seen that the invention provides simple, effective and convenient gripping means but it should be understood that the invention is not limited solely to the details of the forms described above, which may be modified, in order to meet various conditions and requirements encountered, without departing from the scope of the invention.

WHAT WE CLAIM IS:—

1. Gripping means for lifting, loading or stacking equipment comprising a main support for attachment to a conventional lifting device and extending therefrom a cantilever arm of channel section and located therein two members also of channel section which are slidable one within the other and the other within the cantilever arm and also located in the cantilever arm two double acting hydraulic or pneumatic rams connected to the two slidable members respectively and a projecting gripper arm rigidly attached to one end of each of the said slidable members, each gripper arm being provided with a resilient gripping surface and one or more intermediate gripping members each attached to two divergent arms attached to the said cantilever arm at points between the aforesaid projecting gripper arms, each of the intermediate gripping members being provided with two gripping plates and means for forcing these plates apart to provide gripping action.

2. Gripping means as claimed in claim 1

of the plates 24 or 25 on its inner surface, and adapted to ride by its free end against the inner surface of the other plate, thereby stabilising the plates as they open and close.

5 The free end of the cam-plate 38 may rise between guide lugs 40 on the other plate. A strip spring 41 may form a loop in the inner surface of one plate, e.g., 25, to steady the slidable wedge assembly by bearing on one of

10 the rods 34 extending through the loop when the assembly is open for maintenance. The half-taper wedges 32 on the inner surface are formed with semi-cylindrical channels 42 to accommodate the rod 30 when the plates 24, 25 are closed together.

15 In modified forms of the invention the above described wedge-assembly arrangement may be replaced by alternative means for expanding or retracting the plates 24, 25. For

20 example, the plates may be interconnected by pairs of links (similar to links 28) all the link junctions being connected together by a ram-operated rod, so that longitudinal movement of the rod opens and closes the links to provide a

25 toggle action for separating the plates. Alternatively the inner surfaces of the plates 24, 25 may be provided with ribs having inclined ramp edges, and a rod or roller extending between these inclined edges may be moved by a

30 ram in a direction parallel to the ribs, to force the plates apart. In any of the these arrangements it is within the scope of the invention to pivot the lugs 27 of the plates directly to the arms 20, so that, instead of remaining parallel

35 to one another when expanded, the plates open out bookwise about their supporting pivots.

In a modified form of the invention shown in Figures 9—11 of the accompanying drawings the gripper arms, instead of depending

40 from the slides and support extend in a horizontal direction therefrom. The supports 3 whereby the device can be secured to the hoist carriage of a lift truck or the like extend from the side of the main support formed by the side

45 plates 4 and the rear plate 5, and equispaced from the mid-point of the main support. The slides 6, 7 slidably nested in the main support have secured to their outer ends front plates 43 to which are rigidly attached the forwardly

50 projecting gripper arms 8 provided on their inner faces with gripping pads substantially as described above. The front plate 9 of the main support has attached to its inner surface rams 12, 13 which are connected to the outer ends

55 of the slides 6, 7 in order to force them inwards or outwards, as previously described, for gripping and release operations.

60 An intermediate gripping member is supported by the plate 9 and for this purpose a bracket plate 44 has a boss 45 at its upper inner corner mounted on a rod 46 carried in and between lugs 47 near the upper edge and on the front face of the plate 9. The lugs 47 are equispaced from the

65 centre line of the plate 9, and the bracket 44

is centralised on the rod 46 by springs 48. The bottom rear corner of the bracket 44 is fitted with slide or roller means 49 which bear against the plate 9. The intermediate member may comprise two

70 plates substantially identical with plates 24, 25 described above, slung by pivot plates 50 from spaced lugs 51 on the lower edge of the bracket 44. The intermediate gripper assembly is provided with means for expanding and

75 retracting the plates, and these may be of any of the forms described above.

When a gripping device such as described above is mounted on the hoist carriage of a lift truck or the like the pneumatic or hydraulic rams are connected to the pressure system of the truck by high-pressure flexible hose, preferably by means of a self-sealing detachable union, and is thereupon ready to grip articles for the purpose of lifting, loading or stacking.

80 The truck is advanced towards articles on the ground or on a supporting surface, so that the gripping pads 19 extend beside a group of articles to be gripped, and the retracted intermediate member or members between articles of the group. Owing to its pivotal support and/or mobility the intermediate member can readily move to a position for insertion

85 between the articles. Thereafter the intermediate member is expanded and the rams are operated, the slides and gripping pads being moved inwards to grip the articles for lifting and subsequent disposal and release.

From the above description it will be seen that the invention provides simple, effective and convenient gripping means but it should be understood that the invention is not limited solely to the details of the forms described above, which may be modified, in order to meet various conditions and requirements encountered, without departing from the scope of the invention.

100

WHAT WE CLAIM IS:—

1. Gripping means for lifting, loading or stacking equipment comprising a main support for attachment to a conventional lifting device and extending therefrom a cantilever arm of channel section and located therein two members also of channel section which are slidable one within the other and the other within the cantilever arm and also located in the cantilever arm two double acting hydraulic or pneumatic rams connected to the two slidable members respectively and a projecting gripper arm rigidly attached to one end of each of the said slidable members, each gripper arm being provided with a resilient gripping surface and one or more intermediate gripping members each attached to two divergent arms attached to the said cantilever arm at points between the aforesaid projecting gripper arms, each of the intermediate gripping members being provided with two gripping plates and means for forcing these plates apart to provide gripping action.

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2. Gripping means as claimed in claim 1

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wherein each resilient gripping surface is mounted on a rigid plate on an undersupport of resilient material secured to the gripper arm.

- 5 3. Gripping means as claimed in claim 1 or 2 wherein the intermediate gripping members are mounted so as to allow self adjustment during location of the gripping members between articles to be gripped.

- 10 4. Gripping means as claimed in any of the preceding claims wherein the means for forcing apart the gripping plates of the intermediate gripping members comprise movable fully tapered wedge-shaped elements co-oper-

ating with fixed half tapered wedge-shaped elements mounted on the interior surface of each plate and hydraulic or pneumatic mechanism for moving the movable wedges longitudinally with respect to the fixed wedges.

5. Gripping means for lifting, loading or stacking equipment substantially as described with reference to and as illustrated in Figures 1 to 8 on Figures 9—11 of the accompanying drawing.

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Agents for the Applicant.

PROVISIONAL SPECIFICATION
No. 11139 A.D. 1958

Improvements in or relating to Gripping Means for
Lifting Loading or Stacking Equipment

- 25 I, GORDON HENRY BENNETT, a British Subject of "Brooklyn," 37 Cross Park Road, Crownhill, Plymouth, Devonshire, do hereby declare the nature of this invention to be as follows:—

- 30 From a main suspended unit which may be so mounted as to allow for mobility and for hoisting and lowering operations, pressure arms extend downwards. To these individually or dually operating fore and back arms are fitted
35 vertically or slightly toed inwards towards the direction of grip with plain or fabricated plates of desired length and height. These plates (later referred to as the main plates) on their face side, that is the side towards their grip
40 action, can be furnished with various forms of cushioning and gripping materials, later referred to under sub headings A, B, and C. Some methods by which some of these materials may be secured, are later referred
45 to under sub headings D, E and F.

- At a desired centre or centres between the main plates and of corresponding length and height may be placed parallel and vertical to these plates, one or more intermediate plates.
50 These plates are later referred to descriptively under the sub headings G, H, and I, but in general they are referred to herein as intermediate plates. The faces of these plates are furnished with cushion grip materials
55 previously described and similarly secured as mentioned previously to the main plates. To the intermediate plate or plates is fitted on their top side or top edge distance links in an upright position holed at each end for hinge-
60 ing, the link or links in turn being hung in a predetermined position or positions from the main suspended unit in such a manner as to allow free travel of the intermediate plate or plates in a direction towards and away from
65 the main plate. Should additional horizontal travel be needed for these intermediate plates when the bulk-loading operation is taking place, this may be obtained where the hinged

linkage is secured at the point of suspension from the main suspended unit, by a form of horizontal sliding low rated compression spring return movement and the like, operating in the direction required according to the number of intermediate plates being used. The linkage to each of the intermediate plates may be controlled at their points of suspension from the main suspended unit by a braking movement capable of holding the linkage at any desired angle when required. This will afford additional ease of entry to the load and ease of withdrawal after having deposited the load. The intermediate plate or plates may be unshipped from or folded up under the main suspended unit permitting the sole use of the main plates should it be so desired.

SUB-HEADINGS

A. For extremely fragile goods, rubber of a suitable density having gripping and wearing properties is bonded at the rear to a plate of a hard substance. On the other side of this plate is rubber of a lesser density.

B. For less fragile goods rubber of a suitable density having gripping and wearing properties is used and is bonded at the rear with rubber of a lesser density.

C. For goods of a more robust nature, hard materials are used, milled or moulded with gripping surfaces. If desired they can be backed by cushioning rubber of suitable density.

In all cases the rubber may be of a solid or of an expanded nature, and the hard plate mentioned under sub heading A may be used. If desired the plates may be curved to permit gripping of circular articles.

D. Where it is advantageous to use the lesser density rubber of considerable thickness in conjunction with the hard plate, to avoid downward sag when under compression and the bulk load is hoisted, the plate may be secured at the top to the main plates, or the intermediate plates, by a fitting furnished with



a movement giving lateral tolerance when being subjected to pressure.

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E. Alternatively each ~~card~~ plate mentioned under sub heading D, may, say from the middle of its height, have secured at right angles or thereabouts a series of confined ball and socket and floating gudgeon systems, the gudgeon being load bearing and operating in a sleeve allowing lateral movement. This system gives vertical and horizontal tolerance when subject to compression.

F. A similar hinged gudgeon system similarly so secured provides for vertical tolerance.

15 G. The intermediate plate or plates may be of single thickness or two plates may be mounted together to provide toe in towards the direction of the articles to be gripped.

20 H. The intermediate plate or plates are each provided at the top with a fitting furnished with a plain or horizontally slotted hole, which is then secured to the suspended linkage earlier mentioned thus giving a hinged lateral or semi-lateral motion. Between the plates an oval rod or rods acting as levered controlled cams can be supported, being turned with their smallest dimension against the sides of the plates prior to the compression and hoisting of goods. The cams are brought into use against the returned sprung plates when the goods having been gripped, hoisted and moved, have been lowered to a surface and the main plates released horizontally, will permit the various grouped articles being so handled to be pushed further apart. The release now of the cams will permit rehoisting of the plates.

35 I. The action of the cams described in sub heading H, may be replaced by a hydraulic piston system, or a hydraulic or compressed air-operating system which may be applied by inserting between the plates a collapsible reinforced bag or pipe permitting similar action of the plates. In this case the returned sprung plates when not being used for pushing articles

apart are brought to rest against spacer stops.

General to sub headings H, and I, some of the devices previously mentioned together with another system of leverage and springing for operating the opening of the plates to permit the pushing of the articles which have been gripped, hoisted, moved and lowered to a surface may in certain cases if so desired be arranged above the plates.

CYCLE OF OPERATIONS OF COMPLETED ASSEMBLY

55 Upon a floor or platform goods are placed in a row and behind them further goods are arranged in rows. The gripping device is now hoisted over a given quantity of goods, the intermediate plate or plates if any having been previously centred to suit. The main arms are now moved laterally to conform with the spacing below and the assembly is lowered permitting the plates to enter into the spaces between the rows of goods. The arms are now moved inwards causing the goods to be brought together by the pressure of the plates. Further compression is now applied and the goods-gripped and held are hoisted and moved. After they have been lowered and deposited where desired, the main plates are moved outwards and when so equipped the expansion movement of the unit assembled plates, is now brought into action pushing the rows of goods apart. At this stage if provided the linkage braking is brought into operation and the expansion movement released. The gripping device now free of the goods is hoisted ready for another cycle of operations.

80 In certain cases the action of the unit assembled intermediate plates may be reversed permitting the goods to be brought together and compression applied and the load hoisted ready for moving when the plates are in their expanded position.

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PROVISIONAL SPECIFICATION

No. 12494 A.D. 1958.

Improvements in or relating to Gripping Means for Lifting Loading or Stacking Equipment

90 I, GORDON HENRY BENNETT, a British Subject of "Brooklyn," 37 Cross Park Road, Crownhill, Plymouth, Devonshire, do hereby declare the nature of this invention to be as follows:—

95 From a main suspended unit which may be so mounted as to allow for mobility and for hoisting and lowering operations, pressure arms extend outwards. To these individually or dually operating inward and backward arms are fitted vertically or slightly toed inwards towards the direction of grip with plain or fabricated plates of desired length and height.

100 These plates (later referred to as the main plates) on their face side, that is the side towards their grip action, can be furnished with various forms of cushioning and gripping materials later referred to under sub headings A, B, and C. Some methods by which some of these materials may be secured, are later referred to under sub headings D, E, and F.

110 At a desired centre or centres between the main plates and of corresponding length and height may be placed parallel and vertical to these plates, one or more intermediate plates. These plates are later referred to descriptively

under the sub headings G, H, and I, but in general they are referred to herein as intermediate plates. The faces of these plates are furnished with cushion-grip materials previously described and similarly secured, as mentioned previously to the main plates. To the top side or edge of each intermediate plate a vertically held cantilevered plate is hinged of a similar length to that of the intermediate plate or plates, the cantilevered plate or plates being held, in a predetermined position or positions from the main suspended unit, by fittings incorporating a form of horizontal sliding low rated compression spring return movement and the like, operating in the direction required according to the number of plates being used. The fitting in this manner provides more or less free travel for the desired distance of the intermediate plates towards and away from the main plates. The cantilevered plate or plates may be unshipped from the main suspended unit permitting the use of the main plates only if desired.

SUB-HEADINGS

A. For extremely fragile goods, rubber of a suitable density having gripping and wearing properties is bonded at the rear to a plate of a hard substance. On the other side of this plate is rubber of a lesser density.

B. For less fragile goods, rubber of a suitable density having gripping and wearing properties is used and is bonded at the rear with rubber of a lesser density.

C. For goods of a more robust nature, hard materials are used milled or moulded with gripping surfaces. If desired they can be backed by cushioning rubber of suitable density.

In all cases the rubber may be of a solid or of an expanded nature, the hard plate mentioned under sub heading A may be used. If desired the plates may be curved to permit gripping of circular articles.

D. Where it is advantageous to use the lesser density rubber of considerable thickness in conjunction with the hard plate, to avoid downward sag when under compression and the bulk load is hoisted, the plate may be secured at the top of the main plates, or the intermediate plates, by a fitting furnished with a movement giving lateral tolerance when being subjected to pressure.

E. Alternatively each hard plate mentioned under sub heading D, may say from the middle of its height, have secured at right angles or thereabouts a series of confined ball and socket and floating gudgeon systems, the gudgeon being load bearing and operating in a sleeve allowing lateral movement. This system gives vertical and horizontal tolerance when subject to compression.

F. A similar hinged gudgeon system similarly so secured provides for vertical tolerance.

G. The intermediate plate or plates may be of single thickness, or two plates may be

mounted together to provide toe in towards the direction of the articles to be gripped.

H. The intermediate plate or plates are each provided at the top with a fitting furnished with a plain or horizontally slotted hole, which is then secured to the suspended cantilevered plate or plates earlier mentioned thus giving a hinged lateral or semi-lateral motion. Between the plates on oval rod or rods acting as levered controlled cams can be supported, being turned with their smallest dimension against the sides of the plates prior to the compression and hoisting of goods. The cams are brought into use against the returned sprung plates when the goods having been gripped, hoisted and moved, have been lowered to a surface and the main plates released horizontally, will permit the various grouped articles being so handled to be pushed further apart. The release now of the cams will permit either the free hoisting or backward withdrawal of the plates.

I. The action of the cams described in sub heading H may be replaced by a hydraulic piston system, or a hydraulic or compressed air operating system which may be applied by inserting between the plates a collapsible reinforced bag or pipe permitting similar action of the plates. In this case the returned sprung plates when not being used for pushing articles apart are brought to rest against spacer stops.

General to sub headings H, and I, some of the devices previously mentioned together with another system of leverage and springing for operating the opening of the plates to permit the pushing of the articles which have been gripped, hoisted, moved and lowered to a surface, may in certain cases if so desired be arranged according to the size of the bulk load either above or at the ends of the plates.

CYCLE OF OPERATIONS OF COMPLETED

ASSEMBLY

Upon a floor or platform goods are placed in a row and behind them further goods are arranged in receding lanes. The gripping device with the arms slightly above the level of the floor or platform is moved up to the goods, the intermediate plate or plates, if used, having been previously centred to suit. The main arms are now moved laterally to clear the overall width of the rows of goods, and the whole device is moved forward permitting the plates to enter horizontally into the spaces between the goods. The arms are now moved inwards, causing the goods to be brought together by the pressure of the plates. Compression is now applied and the goods gripped and held are hoisted and moved. After they have been lowered and deposited where desired, the main plates are moved outwards and when so equipped the expansion movement of the unit assembled plates is now brought into action pushing the rows of goods apart. On completion and release the device now free of the goods is withdrawn ready for another cycle of operations.

5 In certain cases the action of the unit assembled intermediate plates may be reversed permitting the goods to be brought together and compression applied and the load hoisted ready for moving when the plates are in their expanded position.

MARTIN, JACK & CO.,
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PROVISIONAL SPECIFICATION
No. 13650 A.D. 1958.

**Improvements in or relating to Gripping Means for
Lifting Loading or Stacking Equipment**

10 I, GORDON HENRY BENNETT, a British Subject of "Brooklyn," 37 Cross Park Road, Crownhill, Plymouth, Devonshire, do hereby declare the nature of this invention to be as follows:—

15 A member rectangular in section is slotted along its entire length. This member is hereinafter referred to as the parent member. It is bushed internally at the appropriate end to a size which will permit say the insertion of a similar member hereinafter referred to as the final member.

20 A similar slotted member of an overall sectional size slightly less than the internal sectional size of the parent member, and a little less in length, is hereinafter referred to as the intermediate member. From the web of this member and towards one of its ends an anchorage plate is secured for later reception of fittings.

25 The final member is similar to the parent member, but of an overall sectional size slightly less than the internal sectional size of the intermediate member. From the web of this member and towards one of its ends an anchorage plate is secured for later reception of fittings. The slots in the parent, intermediate and final members are of the same width.

30 Upon a plate of the desired length and width two cylindrical cased rams are secured side by side and so placed that when closed they operate outwardly in opposite directions. 35 Each is serviced by pressure feeds to allow the

opening and closing of the rams individually or together.

Alternatively one cylinder equipped with a ram at either end may be employed if desired, it being suitably provided with pressure feeds and by-pass couplings and releases and the like. 45

In assembling the device, the parent member is held horizontally, secured at the rear, that is the wide unslotted face; the end of the intermediate member remote from the anchorage plate is then inserted into the unbushed end of the parent member; next the end of the final member remote from the anchorage plate is now inserted through the bushed end of the parent member and passed into the intermediate member. The rams are then inserted through the slots of the members into the so formed aperture; the plating to which the rams are secured is next fixed and held to the so offered face of the parent member. The individual ram heads are now secured to the respective anchor plates of the intermediate and final members and the intermediate member and the final member are thereby enabled to extend or retract separately or together as desired. 50 55 60 65

The outward ends of the intermediate and final members are furnished with any desired fittings, such as arms and the like. 70

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PROVISIONAL SPECIFICATION
No. 24133 A.D. 1958.

**Improvements in or relating to Gripping Means for
Lifting Loading or Stacking Equipment**

75 I, GORDON HENRY BENNETT, a British Subject of "Brooklyn," 37 Cross Park Road, Crownhill, Plymouth, Devonshire, do hereby declare the nature of this invention to be as follows:—

80 From a main suspended unit which may be so mounted as to allow for mobility and for hoisting and lowering operations, pressure arms extend forwards or downwards. To these individually or dually operating fore and back arms are fitted vertically or slightly toed inwards towards the direction of grip with plain

or fabricated plates of desired length and height. These plates (later referred to as the main plates) are in this example drilled and sleeved for the reception of sliding gudgeons. These gudgeons are secured to sub plates described below. 85

Each sub plate may be of corresponding length and height to the main plates. On one side of each sub plate suitable materials with gripping properties are attached and from the rear face of each plate a support, such as is described under sub heading E and F is 90

attached. Also on the rear faces of these plates is a series of suitably rated compression springs or sprung leaves or the like operating at 90°, which later are anchored to or abut against the faces of the main plates. In cases where the weight of the goods being lifted permits, it may be desirable to let the springs carry out a dual purpose, namely, that of horizontal compression and that of supporting the sub plates.

SUB HEADINGS

E. A sub plate may have secured for instance at the middle of its height and at right angles or thereabouts, a series of confined ball and socket and floating gudgeon systems, these gudgeons being load bearing and operating in the sleeves which are incorporated in the main plates, this system giving vertical and horizontal tolerance when subject to compression.

F. A similar hinged gudgeon system similarly so secured provides for vertical tolerance.

CYCLE OF OPERATIONS OF COMPLETED ASSEMBLY

Goods are placed in a row upon a floor or platform and behind them similar goods are placed. Using the forward extending arms in a free hoisted position, the gripping device is moved up to the goods, and the arms opened far enough to avoid fouling the goods beneath. They are then lowered to the desired position and inward pressure applied so that the arms, the main plates and the sub plates exert a vice like action on the goods. Towards the end of this movement the spring comes into action providing a cushioning effect, whereupon the goods are collectively and individually gripped and can then be hoisted and moved. After being lowered and deposited where desired, the arms are moved outwards and hoisted thus freeing the device for another cycle of operations.

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