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(54) Title: DEVICE AND METHOD FOR THE REMOVAL OF SKATE BEAMS DURING THE INSTALLATION OF A BUILDING

(57) Abstract: A device and method for the removal of skate beams during the installation of a building supported by carrier beams onto a building foundation. In operation, hanging skate beam supports are engaged with the carrier beam supporting the building, hanging skate beam supports having two hangars. Each hangar has a fixed arm which is securely engaged with, and preferably welded to the hangar. The fixed arm has a slot therein, adapted to engage with one side of the lower flange of the carrier beam, and a removable arm, also having a slot therein, which is adapted to engage with the other side of the lower flange of the carrier beam. The removable arm can be temporarily and securely attached to the fixed arm. A roller is then positioned between and attached to and supported by both hangars. The first and second hangars have holes therein adapted to receive a roller axle which passes through the roller and extends beyond both ends thereof, the axle having holes near each end thereof, the holes being positioned so that when the roller is attached to the hangars, the axle and roller may be temporarily and securely engaged by means of a pin which may be inserted into the holes to temporarily prevent the axle or roller from being removed from the hangars.
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
DEVICE AND METHOD FOR THE REMOVAL OF SKATE BEAMS DURING THE INSTALLATION OF A BUILDING

FIELD OF THE INVENTION

The present invention relates to a device and method for the removal of skate beams during the installation of a house or building, and more particularly to a device and method for the removal of skate beams during the installation of a house or building, onto a foundation.

DESCRIPTION OF THE PRIOR ART

The manufacturing of completed or partially completed houses or buildings, within a factory (both of which are referred to herein as "buildings"), for subsequent transport to the installation location of the building, for example in a subdivision, is well-known. During this process it is necessary to support, lift and move the building, for example from the manufacturing factory to the building foundation.

During the installation of the building onto a foundation, the building may be supported in alignment with, and directly above the foundation, the building being supported on carrier beams, which carrier beams are supported by skate beams which may, for example, extend beyond the foundation. In this configuration, the skate beams must be removed to permit the building to be lowered onto the foundation.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a method and device which, when using skate beams to support a building and carrier beams above a foundation, facilitates the removal of the skate beams from above the foundation prior to lowering the building onto the foundation.
Accordingly, the invention relates to a method and device for lifting skate beams supporting carrier beams, and a building positioned thereon, to facilitate the removal of the skate beams from above a foundation comprising, means for engaging the lower flange of at least one carrier beam, means for supporting at least one skate beam, the means for engaging the lower flange of the at least one carrier beam being in engagement with the means for supporting at least one skate beam.

According to a further aspect of the present invention, there is provided a device for lifting skate beams supporting carrier beams and a building to facilitate the removal of the skate beams from above a foundation comprising engagement means for engaging a lower flange of at least one carrier beam; support means for supporting at least one skate beam; the engagement means for engaging the lower flange of the at least one carrier beam being in releasable engagement with the support means for supporting at least one skate beam.

According to a further aspect of the present invention, there is provided a system for lifting skate beams supporting carrier beams and a building to facilitate the removal of the skate beams from above a foundation comprising support means for supporting at least one skate beam; attaching engagement means to a lower flange of at least one carrier beam, the engagement means for engaging the lower flange of the at least one carrier beam being in releasable engagement with the support means for supporting at least one skate beam; movement means for raising the carrier beams and building positioned thereon, whereby, when the carrier beams and building are raised to lift the skate beams off of the foundation, the support means receives a load of the skate beams, allowing the skate beams to be transferred out from under the building, and allowing the building and the carrier beams to be lowered into position on the foundation without interference from the skate beams.

The advantage of the present invention is that it provides a method and device which simplifies and facilitates the removal of skate beams from above the foundation prior to lowering the building onto the foundation.

BRIEF DESCRIPTION OF THE DRAWINGS
A preferred embodiment of the present invention is described below with reference to the accompanying drawings, in which:

Figure 1 is a drawing of one embodiment of carrier beams supporting a building;

Figure 2 is a drawing of one embodiment of carrier beams when the building is positioned above the foundation;

Figure 3 is a drawing of one embodiment of single piece carrier beams when the building is being transported;

Figure 4 is a view of one embodiment of multi-part carrier beams;

Figure 5 is an exploded view of the components of an embodiment of a multi-part carrier beam;

Figure 6 is a cross section view of an embodiment of a two-part carrier beam installed in a building positioned above the foundation;

Figure 7 is a cross section view of an embodiment of a two-part carrier beam installed in a building resting on the foundation;

Figure 8A is a drawing of a multi-part bevelled carrier beam and Figure 8B is an exploded view of an embodiment of the connection between carrier beam segments;

Figure 9 is a three-quarter view of the bevelled end of the multi-part carrier beam;

Figure 10 is an end view of the bevelled end of the multi-part carrier beam in the lowered position;

Figure 11 is a side view of the bevelled end of the multi-part carrier beam in the
lowered position; and

Figure 12A, 12B, 12C, 12D and 12E are elevation, profile, elevation and exploded views of one embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Figure 1, an embodiment of carrier beams 10 which may be used in the support of a building is illustrated, the carrier beams 10 being positioned underneath the building 20 to efficiently distribute and support the load of the building 20.

As shown in Figure 3, when the building is ready for transportation, with the carrier beams positioned beneath the building, the building may then be loaded onto a suitable building transporter 5 for subsequent transportation to the building foundation.

Referring to Figure 2, when a building 20 is being installed onto a foundation 40, skate beams 30 may be used to support the building 20 and carrier beams 10, and to provide a surface upon which the building 20 and carrier beams 10 may be moved into location above the foundation 40. It is preferred to have the carrier beams 10 aligned substantially perpendicularly to the skate beams 30. The carrier beams 10 are positioned in spaced relation to one another, the spacing between the carrier beams being determined by the loading and structural characteristics of the building 20, and the required support of the building 20 at any particular location.

In the embodiment shown in Figure 1, the carrier beams 10 have a substantially horizontal top surface, the top surface engaging the underside of the building, and a substantially horizontal lower surface or lower flange upon which the carrier beams 10 may rest when loaded with a building 20, and providing a surface from which the carrier beams 10 and building 20 may be lifted or lowered and a surface from which the hanging skate beam supports of the present invention may be suspended.

When single piece carrier beams 10 as shown in Figure 1 are utilized, the carrier beams 10 generally span across the bottom of the building and extend beyond the external wall
of the building 20.

When utilizing single piece carrier beams 10 as shown in Figure 1 to move and support a building, the foundation 40 of the building may require alteration to accommodate the passage of the carrier beam 10 below the top of the foundation wall when the building is being lowered onto the foundation, as the foundation wall would otherwise interfere with the carrier beam's movement as the building is being lowered onto the foundation. For example, as shown in Figure 2, the foundation wall may need to be cut, or notched, or formed to a sufficient size 130 to allow the carrier beam to be lowered sufficiently as to allow the building to be placed on the top of the foundation, and to allow for the removal of the carrier beam once the building is securely positioned on the foundation 40.

In one embodiment, as an alternative to the solid single piece carrier beams illustrated in Figure 1, multi-part carrier beams 60, as shown in Figures 4, 5 and 8 may be constructed of two or more components which may be separated for easy disassembly after the building is positioned and lowered onto the foundation. As shown in Figure 5, this embodiment of the multi-part carrier beam includes parts 62, 64 and 66.

As illustrated in Figure 6, in the case of one embodiment of the two part carrier beams 50, the combined length of the two part carrier beam is long enough that it extends to within a short distance of the inside surface of both of the foundation walls 80 and 82 at which the carrier beam will be positioned. Similarly, in the case of another embodiment where three part carrier beams are used, the combined length of the three part carrier beam is long enough that it extends to within a short distance of both of the inside surfaces of the foundation walls at which the beam will be positioned.

The multi-part carrier beams are joined securely and temporarily in a manner known to a worker skilled in the art. In one embodiment, face plates 55, as shown in Figure 5, are securely welded to those ends of the carrier beam sections which are to be joined to other carrier beam sections. Holes are drilled in the face plates 55 to receive bolts 59, as shown in Figure 5, the holes being positioned to ensure that when the two face plates of two carrier beam sections are in alignment with and abutting one another, the holes in the face plates are aligned to receive the bolts 59, which may then be inserted in the
holes, and nuts threaded thereon

In one embodiment, inverted "L" shaped ears 70, as shown in Figures 4, 5, and 6 are securely affixed, or welded to those ends of the multi-part carrier beams on which no face plate has been welded so that when a multi-part carrier beam is assembled, it has ears 70 extending outwardly on both ends thereof. In this embodiment, the ears 70 are made of steel, having a thickness generally of between 3/4" and 1 1/2", the horizontal surface measuring approximately 12 inches by 12 inches. These ears 70 effectively extend the lifting length of the carrier beams, permitting the carrier beams, by means of the ears, to receive a significant portion of the load of the building through the rim joist 75 which rests upon the ear, as shown in Figure 6.

Figure 8A illustrates an embodiment of a multi-part carrier beam 60 with beveled ends 90 and 92. Figures 8A and 8B also illustrates an alternative embodiment of the face plates 55 (in the embodiment shown in Figures 8A and 8B, the face plates are plate steel, having a thickness of greater than 3/8", with 16 holes bored therethrough, it being understood that a worker skilled in the art would be aware of alternative configurations for connecting multi-part carrier beams) which securely and temporarily engage one carrier beam to another. The face plates extend across the ends of two carrier beams, and, when the holes in the face plates align with holes in the carrier beams, the face plates are bolted 59 to the carrier beams, thereby securely engaging the two carrier beams to each other. Multiple face plates may be utilized as shown in Figures 8A and 8B for additional strength. Figure 9 illustrates the bevel 90 at the end of the multi-part carrier beam and support flange 150 extending from the lower flange 160 to the upper flange 170, said support flange 150 being proximate to the bevel 90.

Whether the carrier beams are of the single piece type as shown in Figure 1, or the multi-piece types of Figures 4, 5, 6, 7, 8, 9 or 11 in one embodiment, the building 20 and carrier beams 50 are unloaded from the transporter 5 in close proximity to the foundation 40 and thereafter positioned on and supported by skate beams 30 while the building and carrier beams are being positioned above the foundation 40.

When the building is properly positioned above the foundation, the device and method of
the present invention may be utilized as described herein so that when the jacks 100 installed within the basement of the building 20 are used to raise the carrier beams and the building 20, the skate beams 30 are also supported and raised on rollers as described herein, facilitating the removal of the skate beams as described herein, whereupon the building and carrier beams can be lowered.

In the preferred embodiment, once the building and carrier beams are positioned above and in proper alignment in relation to the foundation upon which the building is to be lowered, to assist in the removal of the skate beams from their position on top of the foundation (the skate beams supporting the carrier beams and building), hanging skate beams supports 310 are temporarily attached to the underside of the carrier beams to securely support the skate beams on rollers when the carrier beams and the building are lifted using the hydraulic jacks as described herein.

It is understood that one, or more than one, hanging skate beam supports 310 may be utilized as described herein to facilitate the removal of the skate beams from their position atop the foundation of the building.

In the preferred embodiment, and with reference to Figure 12, the hanging skate beam supports have two hangars 320, each hangar 320 having a fixed arm 330 (as shown in Figure 12B) which is securely engaged with, and preferably welded 340 to the hangar 320 and having a slot 350 therein adapted to engage with one side of the lower flange of the carrier beam, and a removable arm 360, also having a slot 370 therein adapted to engage with the other side of the lower flange of the carrier beam.

In the preferred embodiment, in operation, the slot 350 of the fixed arm of the first hangar is engaged with one side of the lower flange of a carrier beam, the hangar being positioned near and on one side of the skate beam 30 which is to be thereby supported, the slot 370 of the removable arm 360 thereafter being engaged with the other side of the lower flange of the carrier beam, the removable arm 360 then temporarily and securely being attached to the fixed arm, for example by means of a bolt or threaded rod welded or otherwise secured to the hangar, and a nut 385 (a wing nut being illustrated for example only), or other device known to a person skilled in the art. Similarly the second hangar is engaged with the carrier beam on the other side of the runner beam to be
supported. A roller 390 may then be positioned between and attached to and supported by both hangars.

In the preferred embodiment, the first and second hangars have holes 400 therein adapted to receive a roller axle 410 which passes through the roller 390 and extends beyond both ends thereof (as shown in Figures 12C and 12D), the axle 410 having holes 420 near each end thereof, the holes 420 being positioned so that when the roller is attached to the hangars, the axle 410 and roller 390 may be temporarily and securely engaged with hangars, by means of, for example a pin 430 which may be inserted into the holes to temporarily prevent the axle or roller from being removed from the hangars, as illustrated in Figure 12E. Other methods of securing the roller and axle are known to persons skilled in this art.

With the hangars and rollers positioned to support the skate beams, the hydraulic jacks may be extended to raise the carrier beams and building, and in so doing, the rollers receive the load of the runner beams, lifting the runner beams off of the foundation and any additional supports 35, allowing the runner beams to be rolled by means of the rollers out from under the building, allowing the building and carrier beams to be lowered into position without interference from the skate beams.

It is understood that the hanging skate beam supports of the present invention may take a variety of forms and may be temporarily and securely attached to the carrier beams in a variety of manners known to a person skilled in the art. For example, in one embodiment, the top of the hanging skate beam support may be temporarily connected or bolted to the carrier beam in a conventional manner. In another embodiment, a metal or fabric sling may be utilized, extending over both sides of the carrier beam and both sides of the skate beam, the sling extending beyond the lower surface of the skate beam on both sides, the sling having a hole on either end thereof, such that when the sling is positioned over the carrier beam and skate beam, the holes extend below the skate beam, each being adapted to temporarily and securely receive an end of the roller axle, whereby when the roller axles are inserted into their respective holes in the sling, the roller is positioned beneath the skate beam and may be oriented so that when the carrier beam is lifted as described herein, the roller engages with and lifts the skate beam. Furthermore,
rather than utilizing a roller, a Teflon or similarly lubricated bar may be utilized to lift and support the skate beam.

Figure 6 shows a two-part carrier beam 50 supporting a portion of a building 20 in a position directly above the foundation 40 and suitably aligned so as to allow the building to be lowered onto the foundation 40. Figure 6 shows a two part carrier beam 50 the ears 70 loaded with exterior walls 80 and 82 of a building 20. The building 20 may additionally be reinforced and supported by a channel 110 fixedly engaged to the ears 70, the channel abutting the exterior surface of the rim joist of the building for additional support. As shown in Figure 6, hydraulic or other suitable jacks 100 are positioned on the basement floor and suitably arranged to engage with and to support in order to lift or lower the two part carrier beam 50 and the building 20.

Figure 7 shows, in one embodiment, the building 20 in the lowered position, having been suitably lowered from the raised position illustrated in Figure 6, by means of hydraulic or other suitable jacks 100, until the building rests securely on the sill plate 120 (the sill plates having been suitably notched to accommodate and receive the ears 70).

Figure 10 illustrates an embodiment of a multi-part carrier beam with said beam in the lowered position, a cut in the sill plate 120 being marginally greater than the width of the upper flange 170 of the carrier beam 60 and a cut in the foundation 40 being marginally greater than the width of the vertical webbing 180 of said carrier beam 60.

As illustrated in Figure 10 and Figure 11, the lower flange 160 of the multi-part carrier beam 60 does not interfere with the foundation 40 when the carrier beam 60 is in the lowered position. As illustrated in Figure 11, the building 20 has been installed upon the foundation 80, the rim joist 75 and floor joist 190 and resting upon the sill plate 120, the rim joist 75 and floor joist 190 supporting the floor material 200, and the exterior walls 210 (supported by the floor material 200) being ready for the application of exterior finishing, such as brick (which will rest on the brick ledge 220), siding or other suitable material, it being understood that the builder may alternatively apply the exterior finish in the factory, except where to do so would make the building prohibitively heavy or difficult to transport or manipulate.
In the case of the multi-part carrier beams, once the building is securely positioned on the foundation, the components of the multi-part carrier beam may then be disassembled one from the other at the face plates and removed in components from the basement, by the window 130, as shown in Figure 2, or in any other suitable manner. In the case of the single piece carrier beam, it may be removed through the sufficiently sized cut or notch 120, as shown in Figure 2, in the foundation wall. The removed carrier beams may then be reused as needed.

The device of the present invention may be utilized for single piece or multi-part carrier beams as described herein, and may be modified to accommodate a variety of different carrier beams without departing from the scope of the present invention. The present invention has been described herein with regard to preferred embodiments. However, it will be obvious to persons skilled in the art that a number of variations and modifications can be made without departing from the scope of the invention as described herein.

INDUSTRIAL APPLICABILITY

The invention provides an provide a method and device which, when using skate beams to support a building and carrier beams above a foundation, simplifies and facilitates the removal of the skate beams from above the foundation prior to lowering the building onto the foundation.
THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A device for lifting skate beams supporting carrier beams and a building to facilitate the removal of the skate beams from above a foundation comprising:
   a. means for engaging a lower flange of at least one carrier beam;
   b. means for supporting at least one skate beam;
   c. the means for engaging the lower flange of the at least one carrier beam being in releasable engagement with the means for supporting at least one skate beam.

2. A device for lifting skate beams supporting carrier beams and a building to facilitate the removal of the skate beams from above a foundation comprising:
   - engagement means for engaging a lower flange of at least one carrier beam;
   - support means for supporting at least one skate beam;
   - the engagement means for engaging the lower flange of the at least one carrier beam being in releasable engagement with the support means for supporting at least one skate beam.

3. The device of claim 2, wherein, once the building and carrier beams are positioned above and in alignment with the foundation upon which the building is to be lowered, hanging skate beam supports are attached to a lower flange of each of the carrier beams.

4. The device of claim 3, wherein each of the hanging skate beam supports attached to the underside of each of the carrier beams supports the skate beams on rollers when the carrier beams and the building are lifted.
5. The device of claim 4, wherein hanging skate beam supports are temporarily attached to the lower flange of the carrier beams.

6. The device of any one of claims 3 to 5, wherein the hanging skate beam supports have two hangars, each of the hangars having a fixed arm and a removable arm, the fixed arm being adapted to engage a first side of the lower flange of the carrier beam and the removable arm adapted to engage with a second side of the lower flange of the carrier beam.

7. The device of claim 6, wherein the fixed arm is welded to the hangar.

8. The device of claim 7, wherein the fixed arm defines a slotted portion therein, whereby when the hanging skate beam supports are attached to the lower flanges of each of the carrier beams, the slotted portion engages the first side of the lower flange of the carrier beam.

9. The device of claim 8, wherein the removable arm defines a slot therein, whereby when the hangars are attached to the lower flanges of each of the carrier beams and the slotted portion of the fixed arm has engaged the first side of the lower flange of the carrier beam, the slot of the removable arm thereafter engages the second side of the lower flange of the carrier beam, thereby securing the hangars of the hanging skate beam supports to the lower flanges of each of the carrier beams.

10. The device of claim 9, wherein a lower portion of a first hangar is positioned near and on a first side of the skate beam which is to be supported, and a lower portion of a second hangar is positioned near and on a second side of the skate beam to be supported.

11. The device of claim 10, wherein the removable arm is temporarily secured to the hangar, the removable arm being in opposed relation to the fixed arm.

12. The device of claim 11, wherein the removable arm is secured to the hangar by a bolt or threaded rod, and a roller is positioned between the lower portion of the first hangar
and the lower portion of the second hangar.

13. The device of claim 12, wherein each of the lower portions of the first and the second hangars have holes therein adapted to receive a roller axle, the roller axle adapted to pass through the roller and extend beyond both ends of the roller,

14. The device of claim 13, wherein the roller axle has attachment holes at each end thereof, the attachment holes being positioned so that when the roller is attached to the lower portions of the first and the second hangars, the roller axle and the roller can be temporarily and securely engaged with the lower portions of the first and the second hangars by a pin, the pin being inserted into the attachment holes to prevent the axle or roller from being removed from the lower portions of the first and the second hangars.

15. A system for lifting skate beams supporting carrier beams and a building to facilitate the removal of the skate beams from above a foundation comprising:

support means for supporting at least one skate beam;

attaching engagement means to a lower flange of at least one carrier beam, the engagement means for engaging the lower flange of the at least one carrier beam being in releasable engagement with the support means for supporting at least one skate beam;

movement means for raising the carrier beams and building positioned thereon, whereby, when the carrier beams and building are raised to lift the skate beams off of the foundation, the support means receives a load of the skate beams, allowing the skate beams to be transferred out from under the building, and allowing the building and the carrier beams to be lowered into position on the foundation without interference from the skate beams.
# INTERNATIONAL SEARCH REPORT

**A. CLASSIFICATION OF SUBJECT MATTER**

| IPC  | E04G21/16 | B60P1/64 |

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

| IPC  | B60P | E04B | B65G | E04G |

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>X</td>
<td>US 3 599 808 A (Bisson Roger) 17 August 1971 (1971-08-17) column 3, line 15 - line 35; figures 3.4.22-25 column 4, line 40 - line 59 column 7, line 45 - column 8, line 54</td>
<td>1, 2</td>
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<tr>
<td>A</td>
<td>US 3 958 705 A (Baxter Bobby G) 25 May 1976 (1976-05-25) column 2, line 49 - column 4, line 41; figures 1, 3, 9, 10</td>
<td>1-15</td>
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<tr>
<td>A</td>
<td>US 6 027 295 A (Geppert Carl ET AL) 22 February 2000 (2000-02-22) column 2, line 66 - column 6, line 31; figures 1-4</td>
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**Date of the actual completion of the international search**

8 June 2004

**Date of mailing of the international search report**

16/06/2004

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<td>US 6027295 A</td>
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