A combined lifting and cutting device for use in the handling of still unhardened cellular concrete bodies comprises, in addition to a horizontal carrier frame including body-gripping clamping jaws and a transversally reciprocatable, vertical cutting frame, a pair of comblike supporting elements adapted to be moved into a position, in which they take over the weight of the body during the cutting thereof.

6 Claims, 8 Drawing Figures
COMBINED LIFTING AND CUTTING MEANS FOR UNHARDENED CELLULAR CONCRETE BODIES

This invention is concerned with the manufacture of blocks, slabs and similar products from lightweight cellular concrete. Such manufacture commonly includes three main steps, viz. molding a large, generally parallelepipedic body of a concrete mass that is capable of congealing when being in a cellular state, cutting said body into a plurality of smaller pieces corresponding to the desired products while the concrete mass is still plastic, and finally steamhardening the cut body in an autoclave. Usually the molding of the body takes place on a bed or truck, from which the body is removed as soon as the concrete mass becomes self-supporting, and the cutting of the body is most frequently accomplished in two steps, at least when both longitudinal and transverse cuts are required.

More specifically the invention relates to an improved device useful in such a manufacture of cellular concrete products and by means of which a substantially parallelepipedic, still unhardened cellular concrete body having a large horizontal extent but a considerably smaller height than width may not only be gripped and transferred from a first to a second support, but in which the body, while being thus transferred, may also be cut in its transverse direction.

The improved device embodying the invention is of the kind comprising, on the one hand, a horizontal and generally rectangular carrier frame that is supported in a manner permitting at least vertical movements thereof, is large enough to encircle the body, and is provided on the inner sides of its longitudinal side members with clamping jaws adapted to be pressed against the longitudinal side surfaces of the body and having its body-engaging faces divided into a plurality of sections separated by vertical slots, and, on the other hand, a vertical cutting frame that extends in the longitudinal direction of the carrier frame, is guided to move in the transverse direction of the latter between opposite end positions located outside the body-engaging faces of the clamping jaws, and has a number of vertically extending cutting members therein in a manner to enter corresponding slots in the clamping jaws, and is in its end positions.

A combined lifting and cutting device of the general class just referred to is previously known from the U.S. Pat. No. 3,792,635, in which it is also suggested that the carrier frame should be swung up into an edgewise, vertical position during the accomplishment of the transverse cutting operation in order to reduce the strains on the plastic body. This, however, involves several undesirable complications.

It has also been previously suggested that a still unhardened cellular concrete body should be cut in its transverse direction while being held fast between clamping jaws engaging the longitudinal side surfaces of the body only and leaving the bottom surface thereof entirely free, but experience has proved that this is a rather unsafe and unsatisfactory method, at least when the body has a considerably smaller height than width, and, particularly, when the body is still very soft and weak when handled.

The primary object of this invention is to provide an improved device of the kind mentioned hereinbefore, by means of which a substantially parallelepipedic body of still unhardened lightweight cellular concrete mass can be safely handled and, in particular, be safely cut during its transfer, even when the body has a considerably smaller height than width and even when the cellular concrete mass forming the body is still very fresh and, hence, rather soft and weak. Another object of the invention is to provide a device of the kind referred to that uses heavy clamping pressure on the body only temporarily and not during the accomplishment of the cutting operation, whereby the strains on the body are minimized and deformation of the body is avoided.

In order to achieve these objects the invention suggests the improvement of the previously known devices referred to which consists in the provision on the lower side of the carrier frame of two transversely spaced and longitudinally extending comb-like supporting elements, both of which are connected to the carrier frame to be supported thereby and each of which has a plurality of free fingers projecting inwardly towards the opposite supporting element and thus in the transverse direction of the carrier frame, said supporting elements being movable relative to the carrier frame not only horizontally in the transverse direction thereof between widely spaced, inoperative positions, in which the supporting elements are located entirely outside the body-engaging faces of the clamping jaws, and more closely spaced, operative positions, in which the fingers of the supporting elements extend from either side in under a substantial part of the bottom of the body, but also vertically between a first position, in which the upper sides of the fingers are spaced from the bottom of the body, and a second position, in which the upper sides of the fingers supportingly engage the bottom of the body, said supporting elements being adapted to carry the entire weight of the body all by themselves during the transverse cutting operation.

With such an improved device it becomes possible to carry out the transverse cutting operation while the body is entirely and solely supported by the fingers of the supporting elements and while the clamping jaws are only exerting a very moderate counterholding pressure, if any at all, on the body. Consequently, no harmful body-deforming pressure will be combined with the agitation exerted by the cutting members moving through the body and probably changing and weakening the plastic cellular concrete mass, which is believed to be more or less thixotropic in character.

For further elucidation of the invention a preferred form of the device embodying the same will now be described with reference made to the accompanying drawings.

In the drawings:

FIG. 1 is a simplified end view of the device and also illustrates, how the latter is preferably used in practice,

FIG. 2 is a top view of the device showing the same in operation,

FIG. 3 is a shortened longitudinal sectional elevation of the device, the cellular concrete body carried by the same being partly removed,

FIG. 4 is an enlarged cross-sectional elevation taken substantially along the line A—A in FIG. 2 and illustrating a first step in the operation of the device,

FIG. 5 is a similar cross-sectional elevation illustrating a second step in the operation of the device,

FIG. 6 is a similar cross-sectional elevation illustrating a third step in the operation of the device,
FIG. 7 is a similar cross-sectional elevation illustrating a fourth step in the operation of the device and, in fact, the operational step illustrated in FIG. 2, and FIG. 8 is an enlarged sectional elevation taken along the line VIII—VIII in FIG. 3.

As appears from FIG. 1, the device embodying the invention and generally designated by 1 is by means of ropes 3 running over sheaves 2 vertically adjustably suspended from a travelling crane 4 that is movable along rails 5. The primary task of the device 1 is to lift a substantially parallelepipedic, still unhardened cellular concrete body 7 from a first support 6, for instance a platform truck that has served as a molding bed for the body, and to later on deposit the body on a second support 8, for instance a conveyor belt, from where it can be forwarded for further treatment in the manufacturing plant. Obviously it is essential that nothing prevents the device from gripping the body 7 on the first support 6 or from depositing the body on the second support 8 and to this end the bearing surfaces of those supports must have a certain height and a width that only very slightly exceeds the width of the body 7. On the other hand the supports may have any suitable length at least corresponding to that of the body. Usually the very fresh and weak cellular concrete bodies 7 to be handled by the device 1 have a length of between 5.0 and 8.0 meters, a width of between 1.2 and 1.8 meters, and a height of between 0.5 and 0.8 meters. Accordingly, the body 7 commonly has a large horizontal extent also in its transverse direction but a height that is considerably smaller than the width, which fact makes the handling of the body rather delicate and difficult.

As best appears from FIG. 2, the device 1 comprises as a first and main component a horizontal and generally rectangular carrier frame 9 composed of two longitudinal side members 10 and two transverse end members 11. The previously mentioned sheaves 2 are mounted on the upper sides of the side members 10 and between the latter extend also a pair of arched reinforcing girders 12. Inside of each side member 10 there is provided a clamping jaw 13 extending along the whole length of the body 7 and having a body-engaging inner face that is adapted to be pressed against the longitudinal side surface of the body. Each such body-engaging jaw face is divided by vertical slots 14 into a plurality of sections 15 which are thus forming a kind of projections or abutments on the clamping jaw and the end surfaces of which may suitably be covered with rubber, foam rubber or similar material (not shown). Each clamping jaw 13 has a pair of upstanding horns 16, one for each reinforcing girder 12, and each horn has a pair of wheels 17 running along the related girder 12 in order to movably support the related clamping jaw. The clamping jaws 13 are movable towards and away from each other under the actuation of hydraulic jacks 18, which are located straight below the reinforcing girders 12 and partially hidden within the side members 10 of the carrier frame and within the clamping jaws 13, respectively, in order to reduce the total width of the device 1.

As best appears from FIG. 3, guides 19 and driving screws 20 for a pair of slides 21 are arranged inside of the respective end members 11 of the carrier frame 9. The slides 21 are thus movable in the transverse direction of the carrier frame 9 and they carry between them a vertical cutting frame 22, which extends in the longitudinal direction of the carrier frame and in which a plurality of vertically extending cutting members 23 in the form of steel wires are stretched. As is best seen from FIGS. 4–7, the cutting frame 22 is reciprocably between end positions located outside the body-engaging faces of the clamping jaws 13. When the cutting frame is in either one of its two end positions, the cutting members 23 are received in the corresponding vertical slots 14 between the body-engaging jaw face sections 15. During each cutting operation the cutting frame 22 moves only in one direction from one end position to the other. If needed, also the cutting frame 22 may be provided with horns and supporting wheels cooperating with the reinforcing girders 12 (not shown). The driving screws 20 for the slides 21 of the cutting frame 22 are driven by motors (not shown) accommodated in the side members 10 of the carrier frame.

The carrier frame 9 has attached to its lower side two supporting elements generally designated by 25 and extending in the longitudinal direction of the carrier frame generally below each one of the clamping jaws 13 and the related frame side member 10. Each supporting element 25 comprises a torque-resistant beam structure 26 of substantially L-shaped cross-section, from the upper part of which a series of fingers 27 extend freely in a cantilever fashion towards the opposite supporting element and thus in the transverse direction of the carrier frame 9. The width of the fingers 27 is preferably the same as that of the sections 15 into which the body-engaging inner faces of the clamping jaws 13 are divided (see FIG. 3), and the thickness or height of the fingers is sufficient to allow them to carry the entire weight of the body, as will appear from the following. The fingers 27 are rigidly connected to the related beam structure 26, and the ends of the latter are rigidly connected to end pieces 28, which are located under each one of the two end members 11 of the carrier frame 9. The end pieces 28 are made as very rigid boxtype structures of approximately the same extent in the transverse direction of the carrier frame as that of the fingers 27.

Connected to each end piece 28 are two uprights 29 having wheels 30 co-operating with a runway 31 arranged in the lower part of the related frame end member 11 (see FIGS. 3 and 8). The upper end of each upright 29 has a bifurcated head 32, which is directed inwardly towards the longitudinal centre line of the carrier frame 9, and within each frame end member 11 are secured two pairs of jacks 33, one pair for each supporting element. Each jack 33 comprises a hydraulic cylinder having a downwardly directed piston rod and a head at the lower end of the latter. As best appears from FIG. 8, the bifurcated heads 32 of the uprights 29 on each end piece 28 are arranged to engage with these piston rod heads of the jacks to allow lifting of the supporting elements when the latter are in a certain position, in which they have been moved towards each other. It should be noted that, in order to illustrate the engaging and lifting operation just mentioned, FIG. 8 shows the left-hand supporting elements in another position than the right-hand one, although in practice the supporting elements are always moved synchronously towards and away from each other. When the supporting elements are lifted by means of the jacks 33, the upper sides of the end pieces 28 will come into contact with the bottom side of the end members 11 of the carrier frame, whereby the position of the supporting ele-
ments relative to the carrier frame will be reliably defined.

The wheeled end pieces 28 of the supporting elements are movable relatively to the carrier frame 9 between widely spaced, inoperative positions, shown in FIGS. 4 and 5, in which the supporting elements, including their fingers 27, are entirely outside the body-engaging faces of the clamping jaws 13, and more closely spaced, operative positions, shown in FIGS. 6 and 7, in which the fingers 27 of the supporting elements extend from either side in under the body 7 to a substantial part of the width thereof, or more specifically to about one third of said width. It is in the latter positions where the supporting elements are liftable by means of the jacks 33. When the supporting elements are in their elevated positions, their fingers 27 supportingly engage the bottom of the body 7 (FIG. 7), but when the supporting elements are lowered and their supporting wheels 30 are operative, the upper sides of the fingers 27 are somewhat below the bottom of the body 7 (FIGS. 4-6). It should be particularly noted that the supporting elements are of such a design that the cutting frame 22 is entirely free to move its full stroke between its end positions, even when the supporting elements are in their operative positions. This is achieved by making the fingers 27 longer than just the desired part of the width of the body 7 which they have to support in the operative positions of the supporting elements. In addition, the fingers are always at a level above the lower frame member of the cutting frame 22 (see FIGS. 4-7).

The operation of the described device is as follows: First the device is lowered, as illustrated to the left in FIG. 1, down over the body 7 resting on the first support 6, while the clamping jaws 13 and the supporting elements 25 are in their widely spaced apart positions, until the device assumes the position relative to the body as is shown in FIG. 4. In this position the clamping jaws 13 are applied from either side against the longitudinal side surfaces of the body under a considerable pressure, whereupon the device is elevated to lift the body 7 from the support 6 as illustrated in FIG. 5. When the body support 6 has been removed, or the device has been further elevated, the supporting elements 25 are moved towards each other into their operative positions as in FIG. 6. The powerful clamping pressure of the clamping jaws 13 is still maintained and the cutting frame 22 still remains in its inoperative end position. When the supporting elements have been brought together, they are lifted as in FIG. 7 so that the upper sides of the fingers 27 are brought into engagement with the bottom of the body 7. When this has been done, the heavy clamping pressure on the clamping jaws 13 is relieved, but the jaws are allowed to remain in contact with the longitudinal side surfaces of the body 7 to serve as counter-holders during the cutting. Now the entire weight of the body 7 is resting on the fingers 27 of the supporting elements, and the cutting frame 22 is moved from its one end position to the other (FIG. 7) so that the body 7 is cut in its transverse direction by the cutting members 23. When the cutting frame has reached its position 22, the clamping jaws 13 are again applied with a heavy pressure against the longitudinal side surfaces of the cut body. The supporting elements 25 are lowered and restored to their inoperative positions, and the whole device, which has moved to the left in FIG. 1 during the described procedure, is lowered in order to deliver the cut body 7 on the second support 8. Only when the body 7 has been properly deposited on this second support, the heavy pressure on the clamping jaws 13 is again relieved and the jaws are retracted to completely release the body. Now the device is returned to fetch another body.

Because of the fact that the heavy clamping pressure, which the clamping jaws 13 must exert on the body 7 when lifting the same from or depositing the same on a support, is relieved or at least considerably reduced during the cutting operation, the risk of uncontrollable deformations of the body is eliminated. During cutting the body 7 is resting on the fingers 27 of the supporting elements 25, which cover so large a part of the whole bottom area of the body that the body will not be subjected to any detrimental combination of stresses during the cutting operation. Through the symmetrical design of the device a simplified construction is achieved, and the fact that the cutting frame has to move only in one direction at a time during each cutting operation expedites the cutting procedure.

I claim:

1. A device for gripping and transferring a substantially parallelepipedic, still unhardened cellular concrete body from a first to a second support and for simultaneously cutting the body in the transverse direction thereof, said device comprising, for the first, a horizontal and generally rectangular carrier frame that is supported in a manner permitting at least vertical movement thereof, large enough to encircle the body, and is provided on the inner sides of its longitudinal side members with clamping jaws adapted to be pressed against the longitudinal side surfaces of the body and having its body-engaging faces divided into a plurality of sections separated by vertical slots; for the second, a vertical cutting frame that extends in the longitudinal direction of said carrier frame, is guided to move in the transverse direction of the latter between opposite end positions located outside the body-engaging faces of the clamping jaws, and has a number of vertically extending cutting members stretched therein in a manner to enter corresponding slots in the clamping jaws, when the cutting frame is in its end positions; and, for the third, the lower sides of said carrier frame, two transversely spaced and longitudinally extending comb-like supporting elements, both of which are connected to said carrier frame to be supported thereby and each of which has a plurality of free fingers projecting inwardly towards the opposite supporting element and thus in the transverse direction of said carrier frame, said supporting elements being movable relative to the carrier frame not only horizontally in the transverse direction thereof between widely spaced, inoperative positions, in which the supporting elements are located entirely outside the body-engaging faces of the clamping jaws, and more closely spaced, operative positions, in which said fingers of said supporting elements extend from either side in under a substantial part of the bottom of the body, but also vertically between a first position, in which the upper sides of said fingers are spaced from the bottom of the body, and a second position, in which the upper sides of said fingers supportingly engage the bottom of the body, said supporting elements being adapted to carry the entire weight of the body all by themselves during the transverse cutting operation.
2. A device according to claim 1, wherein each supporting element comprises a torque-resistant beam structure, from the upper part of which said fingers project horizontally in a cantilever fashion, said beam structure having its ends rigidly connected to end pieces formed as carriages movable along related, transversally extending runways in the carrier frame.

3. A device according to claim 2, wherein said end pieces of the beam structures are arranged, when the supporting elements are in their operative positions, to engage with lifting jacks supported by the carrier frame and operative to lift the supporting elements to thereby cause said fingers to supportingly engage the bottom of the body, the lifted position of the supporting elements being defined by engagement between said end pieces and the carrier frame.

4. A device according to claim 1, wherein said fingers of each supporting element have a free length that is sufficient to let them extend in under about one third of the width of the body, when the supporting elements are in their operative positions.

5. A device according to claim 1, wherein the cutting frame is free to move the full stroke between its opposite end positions also when the supporting elements are in their operative positions.

6. A device according to claim 1, wherein said carrier frame intermediate its ends and on its upper side has a number of arched reinforcing girders extending between the longitudinal frame side members and serving as runways for wheels supporting the clamping jaws.