United States Patent

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[73] Assignee **Hilfiker Pipe Co. Eureka, Calif.**

[54] **REINFORCED CONCRETE CRIBBING**
7 Claims, 10 Drawing Figs.

[52] U.S. Cl. **61/47**
[51] Int. Cl. **E02d 17/00,** E02d 17/04
[50] Field of Search 61/47, 39, 49, 35; 52/56

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ABSTRACT: A reinforced concrete cribbing comprised of a stacked plurality of headers and stretchers. The stretchers are chamfered along the edges thereof to be disposed outwardly and incorporate primary steel reinforcing rods only on the outwardly disposed sides thereof. The headers are necked down intermediate their ends and are provided with integral middle supports. Additionally, the headers are chamfered in such a manner as to cooperate with the chamfered edges of the stretchers. Load distributing means is provided between the headers and stretchers.

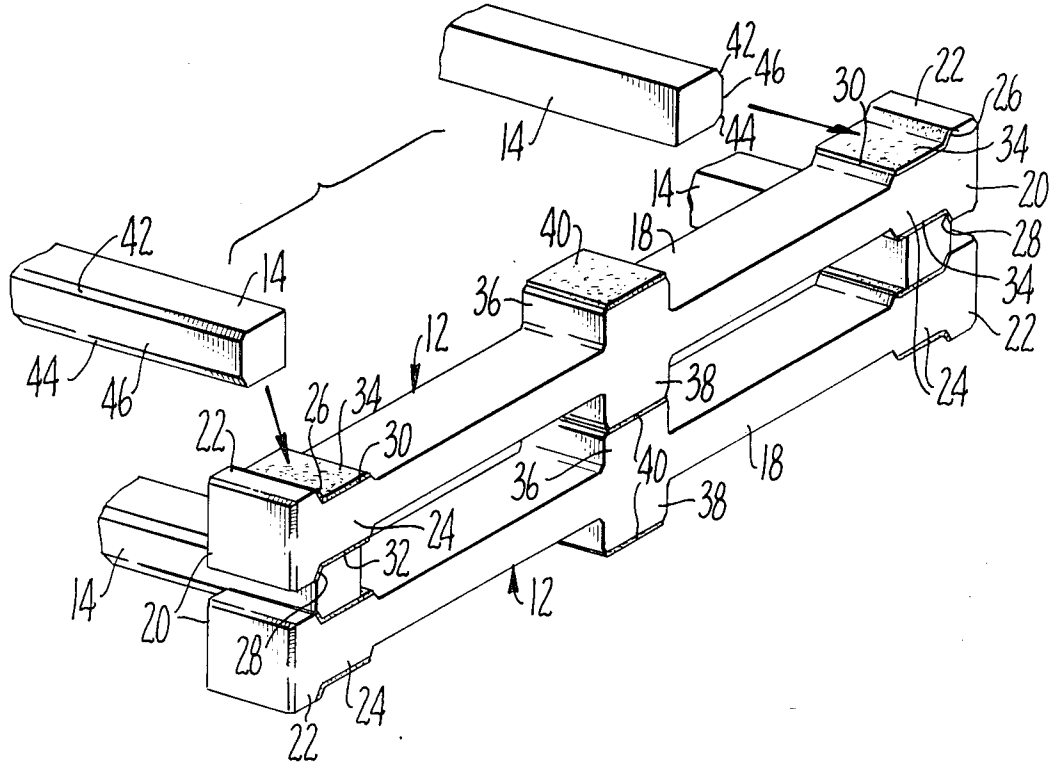


FIG. 1.

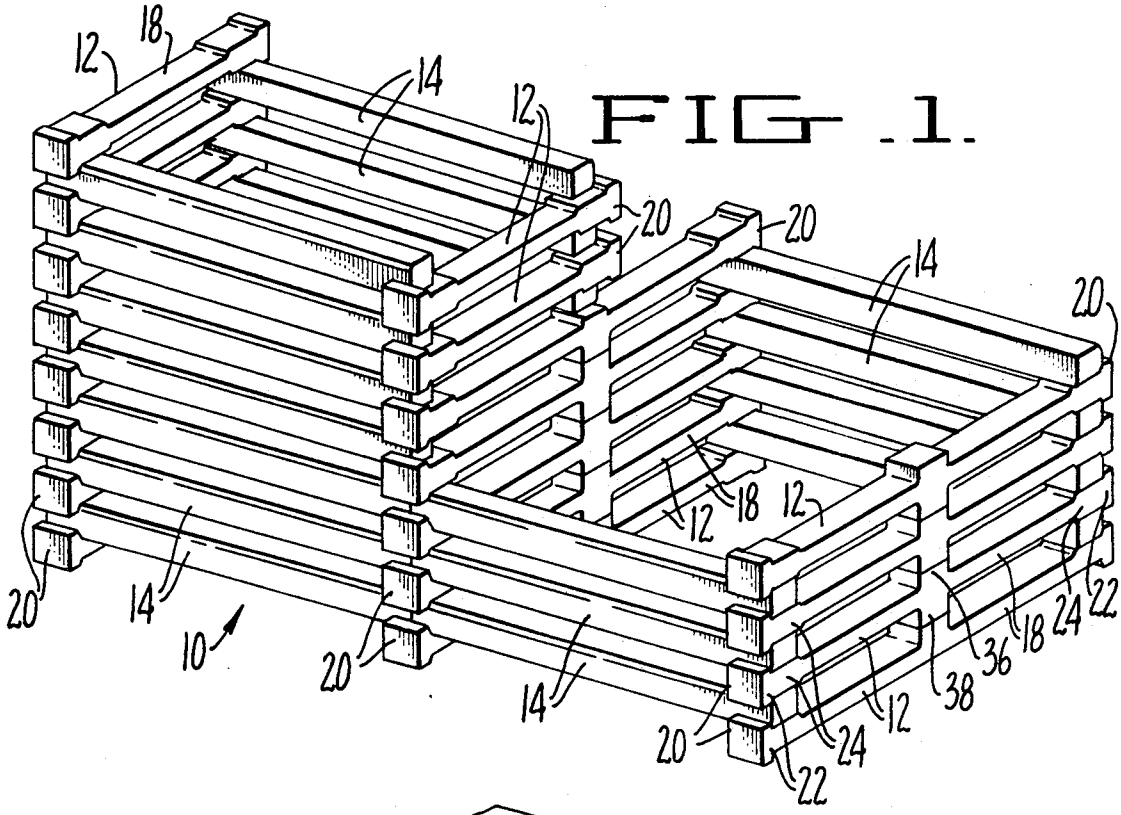
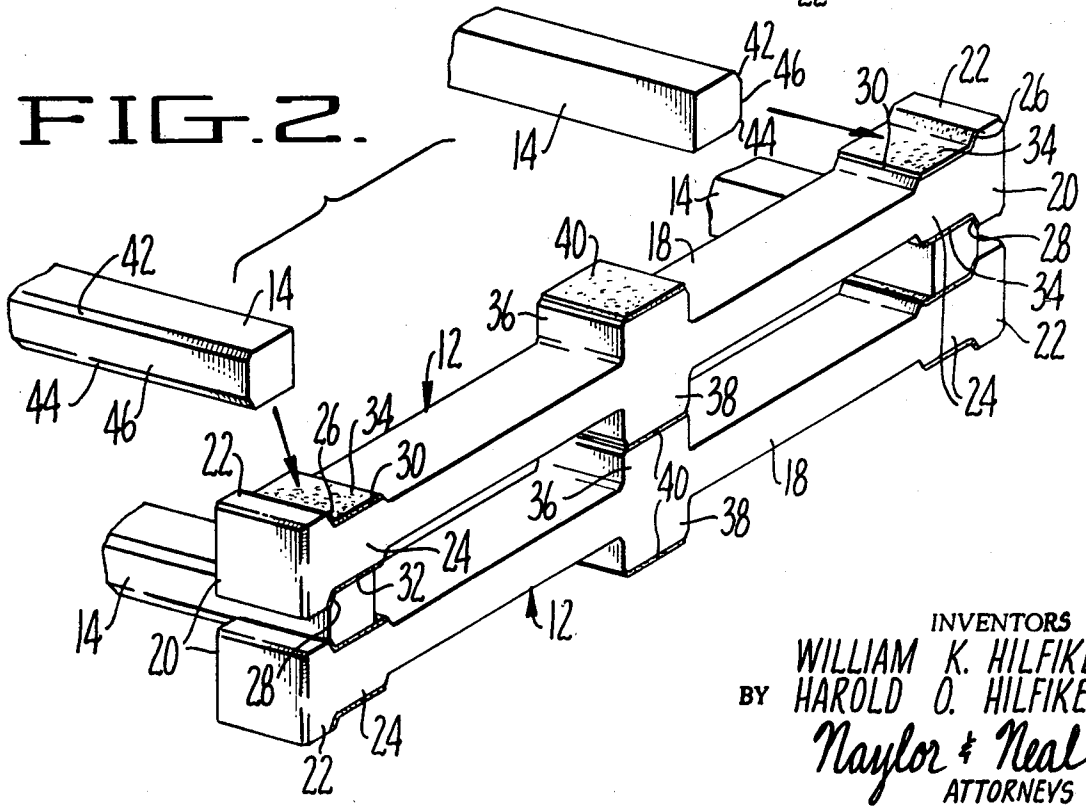


FIG. 2.



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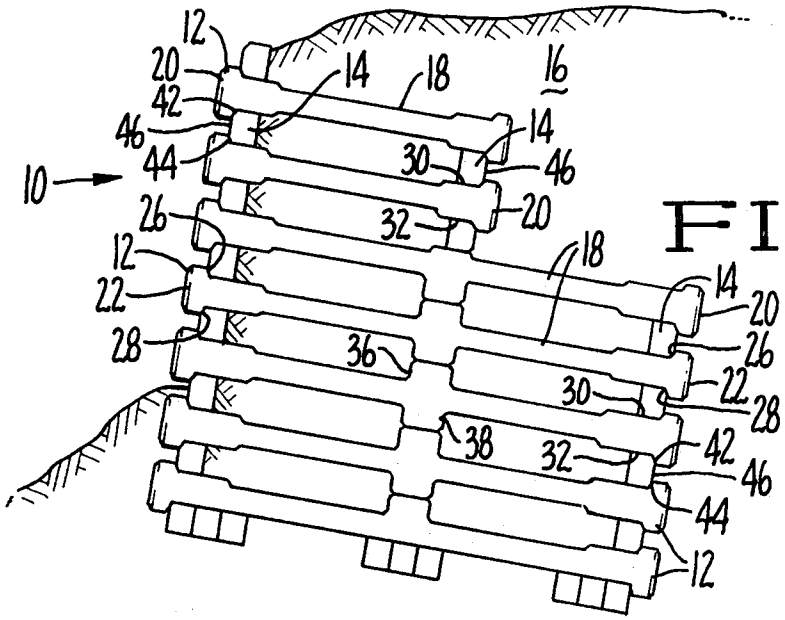

FIG. 3.

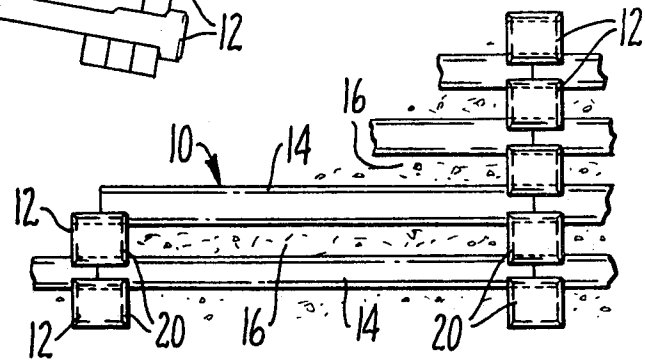

FIG. 4.

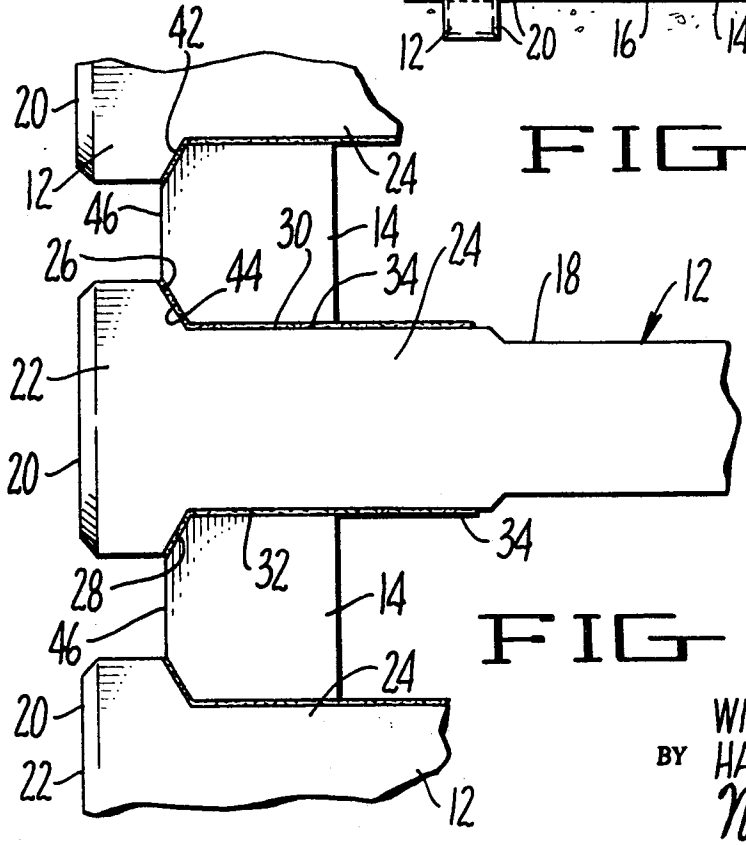

FIG. 5.

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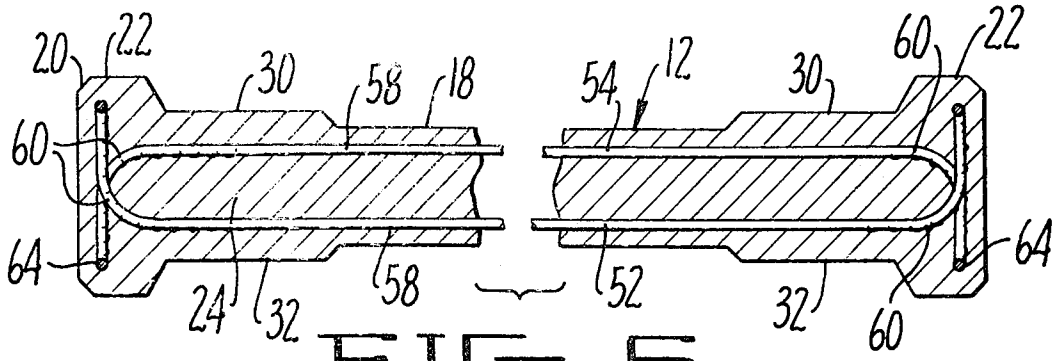

FIG. 6.

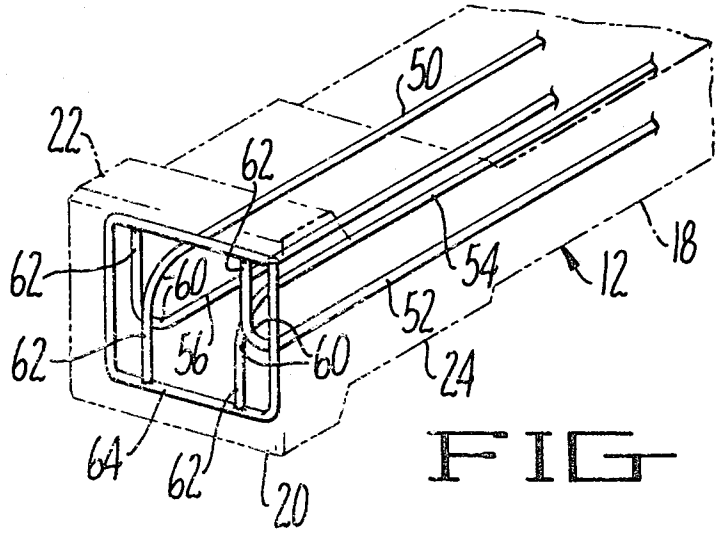

FIG. 7.

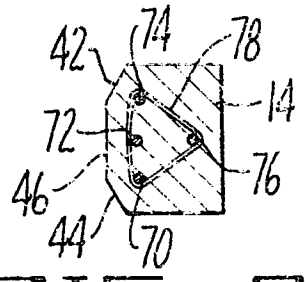

FIG. 8.

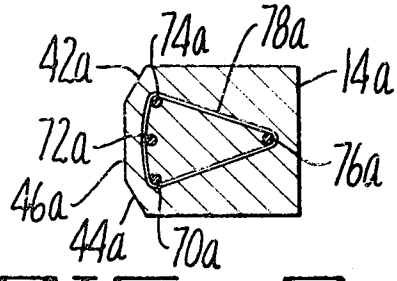

FIG. 9.

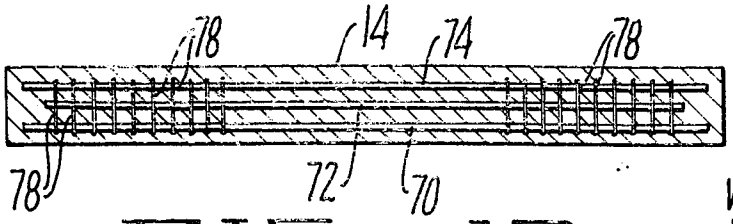

FIG. 10.

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REINFORCED CONCRETE CRIBBING

BACKGROUND OF THE INVENTION

The present invention relates to reinforced concrete cribbing utilized for earth retention.

Prior art cribbing is characterized by its relatively high cost of manufacture and installation. This is due to the fact that the headers and stretchers comprising such cribbing are constructed in such a manner as to use rather large amounts of concrete and reinforcement material. Insofar as the actual assembly of such prior art cribbing is concerned, headers and stretchers employed do not readily lend themselves to ease of assembly at the construction site. In addition, the weight of the headers and stretchers utilized in prior art cribbing precludes the use thereof in certain work situations such as those requiring relatively high-retention walls.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide reinforced concrete cribbing including headers and stretchers which are economical to manufacture and readily lend themselves to quick and efficient assembly at the work site.

It is a further object of the present invention to provide reinforced concrete cribbing comprising headers and stretchers which are relatively simple in construction and yet are capable of withstanding operating pressures of high magnitude.

It is still another object of the present invention to provide reinforced concrete cribbing comprising headers and stretchers which are of relatively lightweight construction and have a high degree of structural strength and stability.

DESCRIPTION OF THE DRAWINGS

The above noted and other objects of this invention will be understood from the following description taken with reference to the drawings wherein:

FIG. 1 is a perspective view illustrating reinforced concrete cribbing incorporating the teachings of the present invention.

FIG. 2 is a perspective view illustrating details of the headers and stretchers utilized in the cribbing of FIG. 1 and showing two such stretchers just prior to the positioning thereof on header bearing surfaces.

FIG. 3 is a side elevational view of a portion of the reinforced concrete cribbing constructed according to the present invention operating to retain earth in position.

FIG. 4 is a sectional side elevational view illustrating the manner in which individual structures cooperate with the header ends.

FIG. 5 is an enlarged elevational view illustrating bearing surface details of the headers and stretchers of the cribbing incorporating the teachings of the present invention.

FIG. 6 is an enlarged cross-sectional elevational view illustrating the header of the present invention and showing details of the header reinforcement means.

FIG. 7 is an enlarged perspective view illustrating details of the header reinforcement means.

FIGS. 8 and 9 are enlarged cross-sectional side elevational views illustrating alternative embodiments of stretchers constructed in accordance with the teachings of the present invention and showing the manner in which reinforcement rods are disposed.

FIG. 10 is a cross-sectional elevational view illustrating details of the stretcher reinforcement means.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

In FIG. 1 reinforced concrete cribbing constructed in accordance with the teachings of the present invention is designated generally by means of reference numeral **10**. The cribbing comprises a plurality of headers **12** and a plurality of stretchers **14**. The cribbing is assembled at the work site by stacking the headers and stretchers in alternating tiers in the manner which may best be seen with reference to FIG. **2** wherein two stretchers **14** are shown just prior to having the respective ends thereof positioned on the topmost header **12**.

FIG. **3** illustrates the assembled reinforced concrete cribbing of the present invention installed at a work site so that it functions as a retaining wall. As with respect to more conventional prior art cribbing, reinforced concrete cribbing **10** is assembled at the work site and then filled with earth **16** to anchor the cribbing in position. As may most readily be seen with reference to that figure and to FIG. **4**, earth **16** is prevented from spilling outwardly of cribbing **10** due to the restraining influence of the outermost tier of stretchers **14**. Although voids exist between the stretchers **14** in the outermost tier, the earth **16** will not readily move outwardly therethrough due to the compacting thereof which occurs during the backfill operation. On the other hand, the slots formed between the assembled stretchers permit desired drainage of the backfilled earth **16**.

Returning once again to FIG. **2**, it may be seen that the headers **12** are each of unitary construction and include an elongated section **18** having a pair of enlarged end portions **20** integrally formed therewith. Each of the enlarged end portions **20** includes a head **22** and a bearing section **24**. Bearing section **24** has a greater thickness than does elongated section **18** and a lesser thickness than does head **22**. Each of the heads **22** is chamfered at the top and bottom thereof to form chamfered bearing surfaces **26** and **28**, respectively. Chamfered bearing surfaces **26** and **28** communicate respectively with upper and lower primary bearing surfaces **30** and **32** formed by bearing section **24** of each enlarged end portion **20**. In the illustrated preferred cribbing embodiment felt pads **34** are adhesively or otherwise secured to the header enlarged end portions **20** so that they cover chamfered bearing surfaces **26** and **28** and primary bearing surfaces **30** and **32**. Intermediate the two enlarged end portions **20** of each header **12** enlarged support members **36** and **38** are integrally formed with elongated section **18** to extend from the top and bottom thereof, respectively, as viewed in FIG. **2**. An additional set of felt pads **40** are applied to the top and bottom surfaces of these centrally disposed enlarged support members.

Referring now to FIGS. **2** and **5**, it may readily be seen that stretchers **14** are also each provided with a pair of chamfered bearing surfaces. The stretcher chamfered bearing surfaces, which have been designated by means of reference numerals **42** and **44**, are positioned so that they communicate with only one common side **46** of each stretcher. In the assembled cribbing the headers **12** and stretchers **14** are relatively positioned so that the respective chamfered bearing surfaces thereof are adjacent to one another in the manner which may best be seen with reference to FIG. **5**. Felt pads **34**, in addition to being disposed between the header and stretcher chamfered bearing surfaces **26** and **42**, respectively, are positioned between the header primary bearing surfaces **30**, **32** and the top and bottom sides of the associated stretchers. The felt pads **34** assist in distributing the load more evenly along the header bearing surfaces thereby preventing the buildup of undesirable stress concentrations in the structure.

As may best be seen with reference to FIG. **4**, in the assembled cribbing **10** stretchers **14** are positioned so that they extend between adjacent headers **12** with the ends of the stretchers **14** terminating substantially midway across the width of each associated header. The ends of each stretcher communicate with ends of adjacent stretchers lying along the same horizontal plane so that each header **12** serves to support at one end thereof adjacent ends of two stretchers **14**.

Enlarged support members **36** and **38** serve to increase the stability of assembled cribbing **10**. When assembled, the felt pads **40** positioned on the enlarged support members bear against the felt pads of the two vertically adjacent headers. This feature allows higher concrete cribs to be constructed than do the known prior art designs which do not incorporate centrally disposed enlarged support members. Felt pads **40** assist in the even distribution of the load over the entire associated enlarged support member. In the headers utilized near the top of the cribbing it is not necessary to incorporate thereon enlarged support members **36** and **38** since such headers may be of a relatively shorter construction than those

employed near the bottom of the cribbing and are not subjected to the same magnitude of stresses.

FIGS. 6 and 7 illustrate the placement of reinforcement means employed in the header construction according to the present invention. A plurality of reinforcing rods 50, 52, 54 and 56 are embedded within the header concrete and extend along substantially the full length thereof. Each of the rods includes a straight section 58 which extends between the two heads 22 of the header. At that point, the rods are bent to form bight portions 60 so that each rod terminates in a laterally extending straight portion 62 (FIG. 7). With reference to this latter figure, it should be noted that some of straight portions 62 extend laterally in an upper direction and some extend laterally in a downward direction. The laterally extending straight portions 62 of the reinforcing rods are welded or otherwise secured to rectangular-shaped anchor members 64 which are embedded within the concrete of heads 22. Rectangular-shaped anchor members 64 are also constructed of reinforcement rod material and lie in a substantially vertical plane, as may best be seen in FIG. 6. Rectangular-shaped anchor members 64 occupy a considerable amount of the cross-sectional area of the associated heads 22 and at their upper and lower extremities thereof preferably extend beyond upper primary bearing surface 30 and lower primary bearing surface 32, respectively.

FIGS. 8, 9 and 10 illustrate the positioning of the reinforcement means within the cribbing stretcher. Referring specifically to FIGS. 8 and 10, it may be seen that the reinforcement means of stretcher 14 comprises a plurality of reinforcement rods 70, 72, 74 and 76, which are embedded within the stretcher concrete and extend along substantially the full length of the stretcher. It should be noted that three of the reinforcement rods 70, 72 and 74 are disposed adjacent to the side 46 of the stretcher which is common to the stretcher chamfered bearing surfaces 42 and 44. Reinforcement rods 70, 72 and 74 may collectively be considered the primary stretcher reinforcement means. In the preferred embodiment of the stretcher wires 78 are preferably looped about reinforcement rods 70, 72, 74 and 76 to contribute to the overall strength of the stretcher. Wires 78 and reinforcement rod 76, which is offset with respect to reinforcement rods 70, 72 and 74, may be considered as comprising the secondary stretcher reinforcement means. Rather than employ two separate wires, as shown in FIG. 10, for example, one such wire may be looped about the reinforcement rods along substantially the full length thereof.

FIG. 9 illustrates an alternative form of stretcher 14*a* which has greater cross-sectional dimensions than does stretcher 14 illustrated in FIGS. 8 and 10. A stretcher similar to stretcher 14*a* would be utilized in the lower portions of cribbing 10 where greater working forces are encountered. However, it should be noted that the stretcher reinforcement means of the alternative form of stretcher 14*a* has substantially the same configuration as the reinforcement means employed in stretcher 14. In other words, the primary stretcher reinforcement means is disposed near the side of the stretcher which is common to the stretcher chamfered bearing surfaces. Reinforcement rod 76*a*, on the other hand, is disposed a somewhat greater distance away from the associated primary stretcher reinforcement means than is reinforcement rod 76 in the embodiment of FIG. 8. Consequently, the wire loops employed in the alternative form of stretcher are somewhat larger than the wire loops shown in FIG. 8. Although two stretcher sizes are illustrated in FIGS. 8 and 9, it is to be understood that the teachings of the present invention may be employed on stretchers having other dimensional characteristics in accordance with the requirements of a work situation. In all cases, however, the primary stretcher reinforcement means will be disposed on that side of the stretcher which is common to the two stretcher chamfered bearing surfaces.

As will now be explained in detail the positioning of the reinforcement means in both the headers and stretchers employed in cribbing 10 has been carefully planned to make the most effective utilization thereof in accordance with the tensile and compressive forces to which the headers and stretchers are subjected during use. Returning once again to FIGS. 6 and 7, the header 12 when assembled in a cribbing is subjected to oppositely directed tensile forces which are directed to heads 22. This is due to the fact that the associated stretchers are pushed outwardly against the heads by the earth retained in the cribbing with relative movement between the headers and stretchers being prevented through the cooperative association of their respective chamfered bearing surfaces. The combined interaction of the header rectangular-shaped anchor members 64 and the associated reinforcement rods 50, 52, 54 and 56 substantially contributes to the ability of the header to resist these tensile forces. In addition, the headers 12 are subjected to compressive forces which are directed to the primary bearing surfaces 30 and 32 thereof by the weight of the above-disposed remaining cribbing structure. Since the headers are enlarged at bearing sections 24, they have a greater capacity to handle these compressive loads. The elongated sections 18 thereof, on the other hand, need not be unduly thick since the headers along this segment thereof are subjected principally to tensile forces which are in large measure taken up by the reinforcement rod straight sections 58. As stated above, the felt pads employed on the headers assist in the distribution of compressive loads thereon.

With respect to the cribbing stretchers, it should be noted that they are always disposed with the chamfered bearing surfaces thereof directed toward the chamfered bearing surfaces of their respective associated headers. Due to the outwardly directed forces which are exerted on these stretchers by means of the retained earth, the stretchers will have a tendency to bow outwardly except where restrained by the heads 22 of the headers 12. It is obvious that an excessive amount of bowing will cause the stretcher to fail. The outwardly directed forces exerted by the retained earth will create tensile stresses along the side of the stretcher which is common to the two stretcher chamfered bearing surfaces. For this reason, the reinforcement rods comprising the primary stretcher reinforcement means are positioned near this outwardly disposed side. The secondary stretcher reinforcement means comprising the rearwardly disposed rod and associated wire will further assist in resisting these retained earth induced forces. In addition, the combined primary and secondary stretcher reinforcement means will also assist the stretcher in structurally resisting the compressive forces exerted thereon by means of the rest of the cribbing which is disposed thereabove.

With reference to the aforegoing description, it may be seen that the cribbing stretchers are chamfered only along the edges thereof to be disposed outwardly when assembled and the primary stretcher reinforcement means is provided only on one side of the stretchers. The chamfered bearing surfaces of these stretchers will communicate only with the side of the stretcher on which the primary stretcher reinforcement means is provided and this serves as a marking means to indicate the manner in which the stretchers should be placed. When assembling the cribbing, the stretchers must be placed so that the side on which the primary reinforcing means is provided is disposed outwardly, since the side is under tension. One purpose of this overall arrangement is to conserve the amount of steel reinforcing which is required for each stretcher. Another purpose is to provide a wedging effect on the associated header that has a matching slope (in the order of 45° in the disclosed embodiment) on the back of the head. This cooperation between the header and stretcher chamfered bearing surfaces assists in the proper positioning thereof with respect to one another.

From the foregoing detailed description, it is believed apparent that the present invention enables the attainment of the objects initially set forth herein. It should be understood, however, that the invention is not intended to be limited to the specifics of the illustrated embodiment, but rather is defined by the accompanying claims. In this regard, it is noted that while the pads 34 and 40 have been defined as being felt, other suitable yieldable materials might be employed.

We claim as our invention:

1. A cribbing comprising a plurality of headers and stretchers disposed in stacked relationship;

each of said headers comprising an elongated portion and at least one enlarged end portion connected to said elongated portion and including a bearing section having primary bearing surfaces and a head, said head having chamfered bearing surfaces formed thereon communicating with said primary bearing surfaces; and

each of said stretchers comprising an elongated member having a plurality of sides and chamfered bearing surfaces with each of said stretchers being positioned with respect to associated headers when in stacked relationship in engagement with said enlarged end portion and with at least one of said stretcher sides matingly disposed in bearing engagement with respect to at least one of said header primary bearing surfaces and with at least one of said stretcher chamfered bearing surfaces matingly disposed in abutting engagement with respect to at least one of said header chamfered bearing surfaces.

2. The cribbing of claim 1 wherein load distributing padding material is disposed between said headers and stretchers in the vicinity of said header primary bearing surfaces and chamfered bearing surfaces.

3. The cribbing of claim 1 wherein said headers each further comprise support means disposed along said elongated portion engaging cooperating support means formed on relatively vertically disposed adjacent headers.

4. The cribbing of claim 1 wherein each of said stretchers has two chamfered bearing surfaces, both of said chamfered bearing surfaces communicating with a common stretcher side, and wherein primary reinforcement means is disposed in close proximity to said common side of the stretcher.

5. The cribbing of claim 4 wherein said primary reinforcement means comprises a plurality of elongated reinforcement rods extending substantially the full length of each stretcher.

6. The cribbing of claim 5 wherein each of said stretchers incorporates secondary reinforcement means comprising at least one additional elongated reinforcement rod disposed offset with respect to said rods comprising said primary reinforcement means and wire looped about all of said rods.

7. The cribbing of claim 1 wherein each of said headers includes unitary reinforcement means extending through said elongated portion and into said enlarged end portion and including at least one laterally extending reinforcement portion positioned in said head.

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