United States Patent [19]

Jay

[11] 3,844,600

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[54] **MODULAR STORAGE RACK FOR CYLINDRICAL LOADS**

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[73] Assignee: **Jarke Corporation,** Chicago, Ill.

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[52] **U.S. Cl.** ..... **294/67 D,** 108/53, 211/49 R, 214/10.5 R, 294/67 R

[51] **Int. Cl.** **B66c 1/00,** B65d 21/00

[58] **Field of Search** ..... 294/67 R, 67 D, 67 DA, 294/67 DB, 67 E, 67 EA, 81 R; 108/51, 53, 58; 211/13, 49 R, 60 R, 60 S, 71, 126, 148; 214/8, 10.5 R, 10.5 S, 15 R; 220/1.5

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2,801,752	8/1957	Jakubowski	211/49
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Assistant Examiner—Johnny D. Cherry
Attorney, Agent, or Firm—Dominik, Knechtel, Godula & Demeur

[57] **ABSTRACT**

An improved modular storage rack formed by a series of four corner support posts, each of a pair of corner support posts being interconnected by opposed parallel bottom nesting rails, a pair of square support tubes, angularly mounted on and interconnecting opposed pairs of support post members and disposed in cross orientation with respect to the parallel bottom nesting rails, the square support tubes being angularly inclined to present inclined flat support surfaces, thereby to carry cylindrical loads therebetween, wherein the improvement comprises a plurality of carrying bars, one of each of the carrying bars being mounted on the top of a corresponding corner support post and disposed in parallel orientation with respect to the bottom nesting rails and extending outwardly for a distance with respect to the corresponding support post and each of the carrying bars presenting a non-flat nestable surface along both the top and bottom post surfaces thereof, the top surface of each of the carrying bars having a mating nesting configuration of a corresponding bottom nesting rail.

5 Claims, 7 Drawing Figures

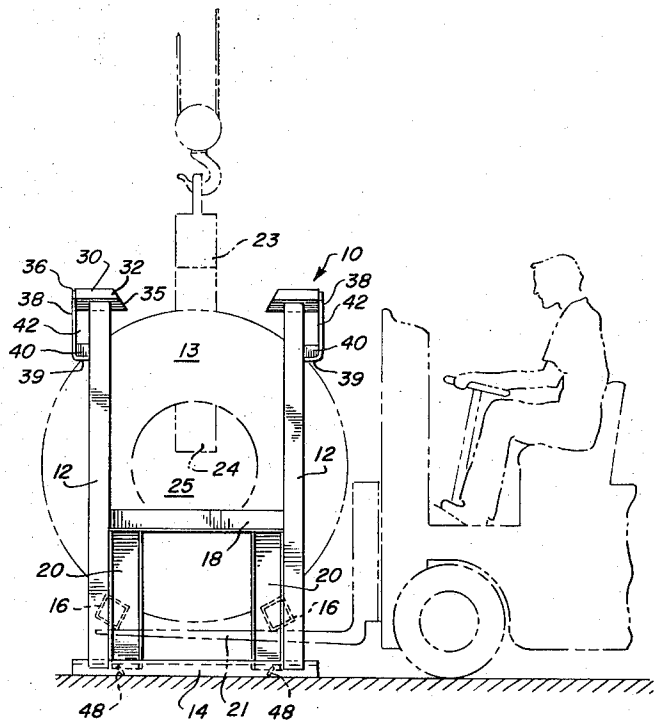


FIG. 1

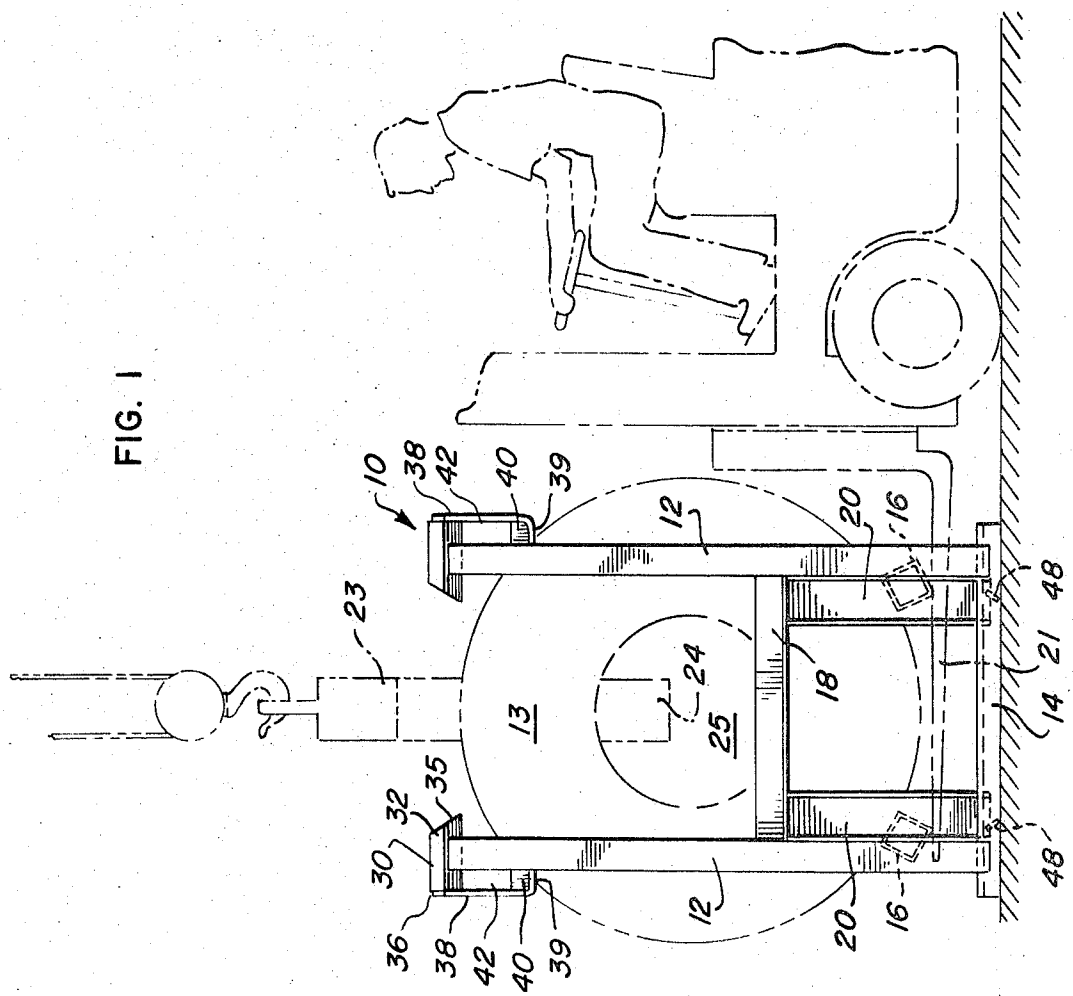

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FIG. 2

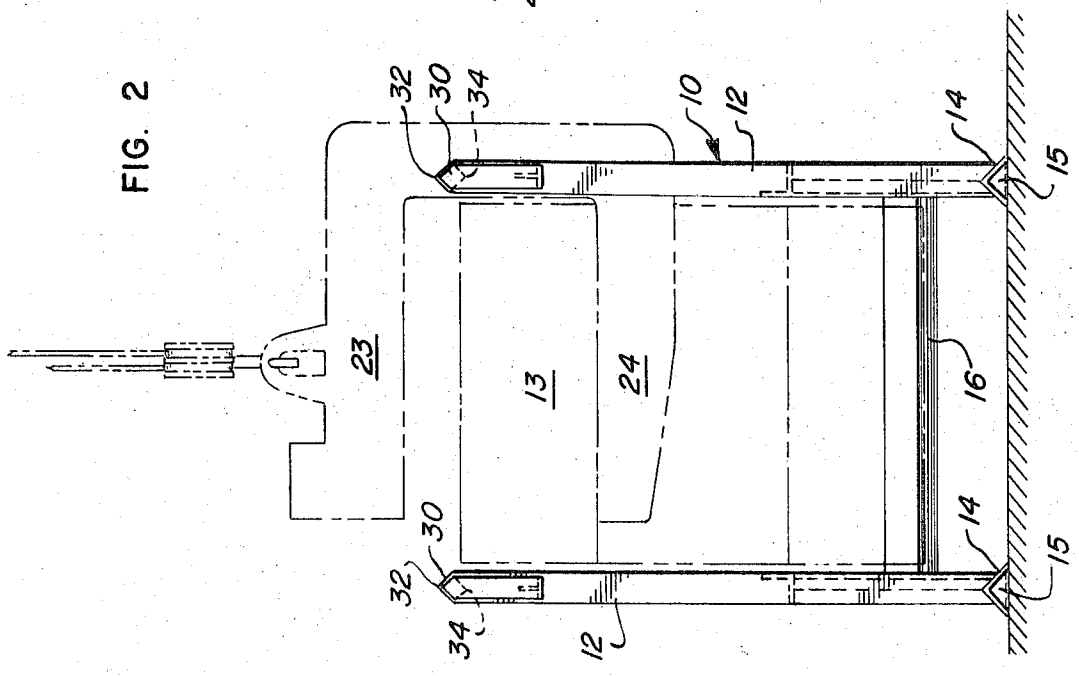

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FIG. 3

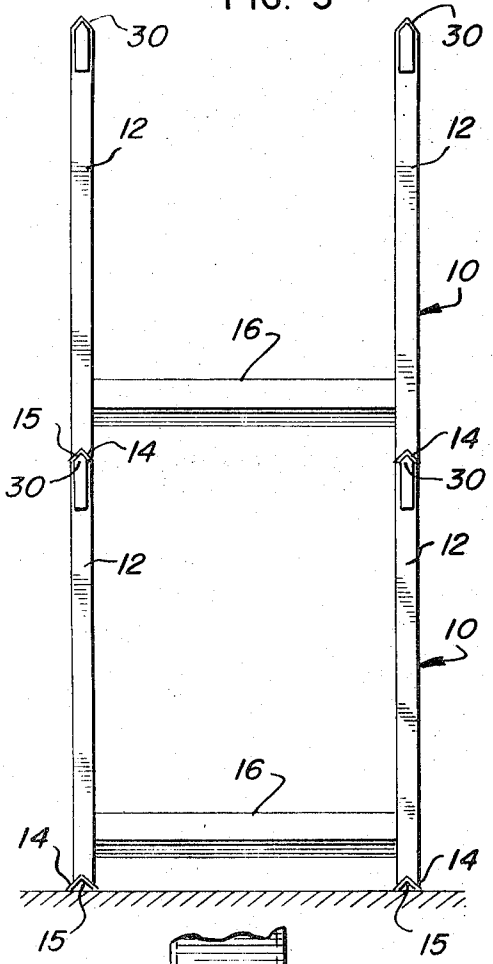


FIG. 4

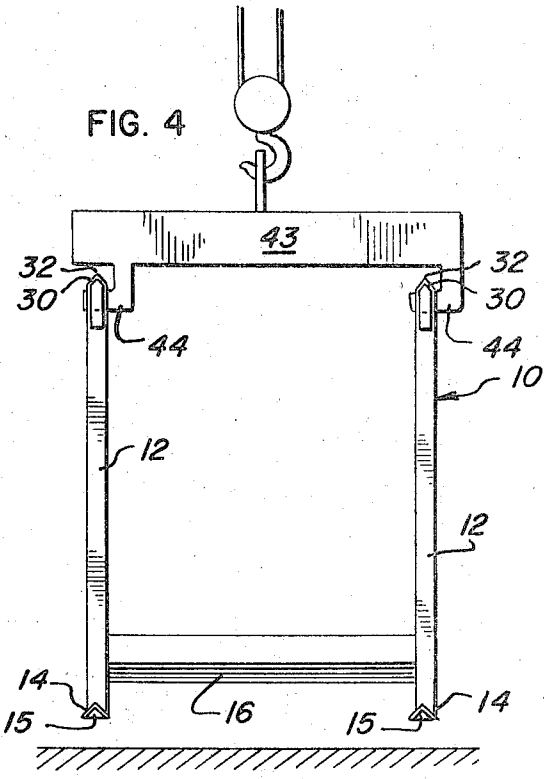


FIG. 5

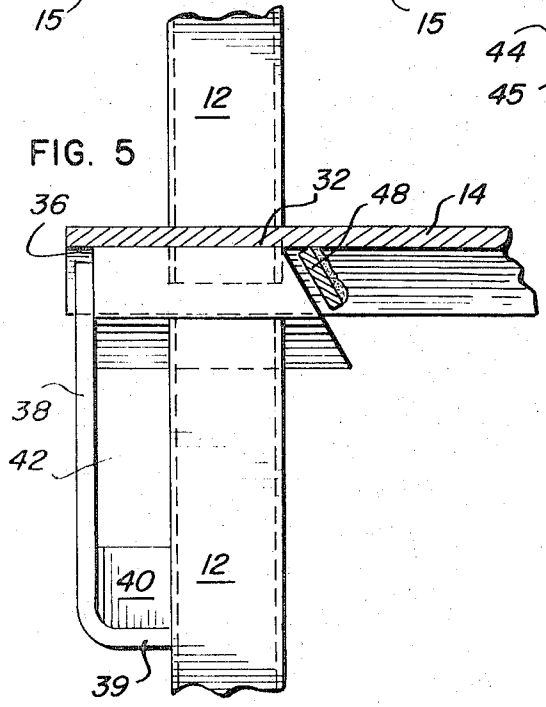


FIG. 6

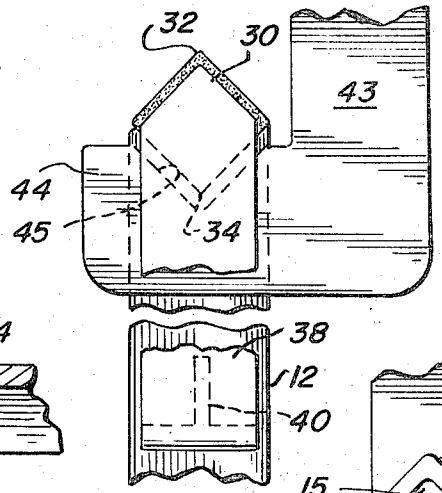
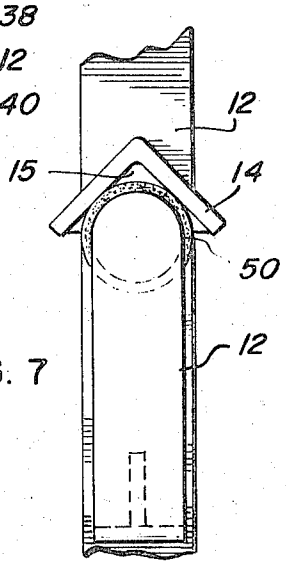


FIG. 7



MODULAR STORAGE RACK FOR CYLINDRICAL LOADS

BACKGROUND OF THE INVENTION

It has become quite prevalent in the warehousing industry to ascertain means of conserving warehousing space, since floor space is generally at a premium and usually quite expensive. In this connection, it has become advisable to employ the use of modular storage racks of a wide variety of types, which function to store a plurality of given items, as well as to permit vertical stacking of one storage rack upon another. The advantages provided by such modular racks are usually associated with rigid configurations, while at the same time permitting the storage of a number of otherwise cumbersome items and in addition, providing the ability to vertically stack a plurality of such racks with the items to be stored contained therein such that a minimum of floor space is utilized when a series of such racks are in vertical orientation.

Exemplary of a variety of such modular storage racks include the units shown in U.S. Pat. No. 2,801,752 which shows a modular stacking unit which accommodates the storage of bar stock and other similar elongated materials. Similarly U.S. Pat. No. 2,357,157, shows a material handling and storage hopper which facilitates the storage and handling of small parts. Still another example of such units is shown in U.S. Pat. No. 3,503,519, which again represents a structure for storing and handling elongated flexible stock and permitting the vertical storage of a plurality of bins containing such materials. U.S. Pat. No. 3,565,018 shows a modular storage rack which accommodates vertical stacking of a plurality of racks with each of the racks having a full complement of the units or items to be stored thereon while still permitting vertical stacking thereof. Each of these patents are assigned to the assignee of the present invention.

With respect to cylindrical loads, various attempts have been made to develop modular storage racks, which not ony permit ease of storage of the cylindrical loads, but also facilitate the vertical stacking and orientation thereof. For example, the rack shown in U.S. Pat. No. 3,476,260 assigned to the assignee of the present invention, is directed to a pallet type storage rack which accommodates a pair of cylindrical drums positioned thereon, and due to the configuration of the top and bottom surfaces thereof, the storage racks may be vertically stacked and oriented in order to maximize the volume of items to be stored within a given unit of floor space. However, in order to develop a modular storage rack capable of accommodating a very cylindrical load, such as a cylindrical core of rolled steel, a wire, paper, or the like, it has become necessary to develop alternate forms of modular storage racks. In this connection, it is known that such storage racks must permit the use of fork lift trucks as well as C-shaped crane hooks, for the purpose of either removing the cylindrical load from the track, or transporting the rack from one location to another. It has also been deemed important to construct such racks in order to permit, once again, the vertical stacking and orientation of one rack upon another, when fully loaded with a large cylindrical load, thereby to maximize the warehousing space for such items.

OBJECTS AND ADVANTAGES

The principal object of the invention is therefore to provide an improved modular storage rack of the type which accommodates a large cylindrical load while at the same time being rigid in construction and stable when fully loaded and when vertically stacked.

A further object is to provide an improved modular storage rack which accommodates ease of transport by the use of either a fork lift truck or a four hook crane hitch wherein a great degree of stability is achieved when the hitch engages the modular rack for transport.

In connection with the foregoing object, it is yet another object of this invention to provide a modular storage rack of the type described which is improved by th use of a plurality of carrying bars each of which is mounted on the top end of a corresponding corner support post and positioned in parallel orientation with regard to the bottom nesting rails and which extend outwardly for a distance with respect to the corresponding corner support post, and each of the carrying bars presenting a non-flat nestable surface along the top and bottom exposed surfaces thereof, the top surface of each of the carrying bars having the mating nesting configuration of the corresponding bottom nexting rail, thereby to permit both the vertical nesting and stacking of a plurality of such modular storage racks as well as to accommodate a stable engagement of a crane hitch accordingly modified when positioned in grasping and engaging relation with the bottom portion of each of the carrying bars on a given modular storage rack.

Still a further object of this invention is to provide a modular storage rack of the type described wherein the bottom nesting rails are each provided with a spaced guide plates and wherein the top carrying bars are provided with angularly inclined interior side edges whereby adjacent modular storage racks may be cross-stacked by positioning the inclined guide plates along the bottom portion of the bottom nesting rails of one storage rack against the angularly inclined side edges of the carrying bars of an adjacent modular storage rack.

Further features of the invention pertain to the particular arrangement of the elements and parts whereby the above-outlined and additional operating features are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof will best be understood by reference to the following specification, taken in connection with the accompanying drawings in which:

FIG. 1 is a side elevational view showing the positioning of a fork lift truck relative to the modular storage rack of the present invention, as well as the positioning of an industrial C-shaped hook and having a cylindrical load supported thereon;

FIG. 2 is a front elevational view of the modular storage rack of the present invention, having a cylindrical load in place and the industrial C-shaped hook positioned within the load;

FIG. 3 is a side elevational view showing two modular storage racks of the present invention in vertically stacked orientation;

FIG. 4 is a side elevational view of a modular storage rack of the present invention having a lifting four hook

crane hitch under the carrying bars thereof, and showing the rack in lifted orientation;

FIG. 5 is a side elevational view, partly in cross-section showing the nesting elements adjacent the top portion of one modular storage rack of the present invention and the lower end of an adjacent rack, as contemplated by the present invention;

FIG. 6 is a side elevational view, partly in cross-section showing the manner in which the lifting four hook crane hitch engages the lower portion of the carrying bar to achieve a stable engagement and lift the racks;

FIG. 7 is a side elevational view, partly in cross-section, showing an alternate embodiment of the present invention, wherein the carrying bar is of a circular configuration.

With specific reference to FIGS. 1 and 2 of the drawings, the basic overall details of construction of the modular storage rack of the present invention are illustrated. The modular storage rack, generally referred to by the number **10,** includes a series of four corner support posts **12,** which are arranged in substantially rectangular orientation one with respect to the other. A pair of bottom nesting rails **14** are mounted on and interconnect a corresponding pair of opposed corner support posts, the bottom nesting rails **14** providing the bottom support surface for the modular storage rack **10.** As will be noted with respect to the embodiment of the invention as shown in FIGS. **1** and **2** of the drawings, the bottom nexting rail **14** is shown to be formed in the configuration of a right angle bar with an open channel **15** defined along the length thereof. A pair of square load bearing tubes **16** are mounted between opposed pairs of corner support posts **12,** each of the load bearing tubes **16** being positioned in cross orientation with respect to the bottom nesting rail **14.** It will therefore be apparent that the bottom nexting rails **14** also provide rigidifying support for one pair of corner support posts **12** while the load bearing tubes **16** provide rigififying support for opposed pairs of the corner support posts **12.**

As viewed in FIG. **1** of the drawings, each of the pair of side corner support posts **12** are further rigidified by an angle brace **18,** mounted on and extending between opposed corner support posts **12,** while further structure rigidity is provided by a pair of structural channels **20** mounted on and extending between the angle brace **18** and the bottom nesting rails **14.** It will also be noted that each of the load bearing tubes **16** is mounted in part on a corresponding structural channel **20** such that the complete lower section of each of the modular storage racks **10** is rigidly and securely interconnected to provide a very firm structure for bearing the load of a cylindrical member **13.**

As further shown in FIG. **1** of the drawings, each of the load bearing tubes **16** is mounted in an angularly inclined disposition in order to permit tangential contact as between the cylindrical load **13** and the support surfaces of the load bearing tubes **16.** It has been found from experience that by providing such a tangential contact as between the cylindrical load **13** and the support surfaces of the load bearing tubes **16,** the possibility of marring the surfaces of the cylindrical load **13** or otherwise damaging the materials carried on the cylindrical load **13** is minimized. In addition, a more stable positioning of the cylindrical load **13** on the rack **10** is also achieved.

It will further be noted by viewing FIG. **1** of the drawings that the pair of load bearing tubes **16** provide a convenient support surface for the use of the forks **21** of a fork lift truck, thereby permitting the rack **10** to be transported from one location to another by the use of a fork lift truck. Also illustrated in FIGS. **1** and **2** of the drawings is the manner in which the cylindrical load **13,** may be loaded and unloaded from the rack **10** by means of an industrial C-shaped crane hook **23,** wherein the load bearing arm **24** may be easily positioned into the central core **25** of the cylindrical load **13** and the cylindrical load **13** thereafter being easily withdrawn from the rack **10.** It is clearly apparent that in order to effect ease of operation, the modular storage rack **10** must be so constructed as to eliminate any side cross rail which would interfere with the operation of the C-shaped hook member **23,** during the loading and unloading pressure. Hence, by providing the angle brace **18** between opposed corner support posts **12,** along the lower portion of the rack **10,** this difficulty is obviated.

In FIGS. **2, 4, 5** and **6** of the drawings, the details of construction of the carrying bars associated with the modular storage rack **10** of the present invention are illustrated. It will be observed that each of the corner support posts **12** is provided with a carrying bar **30,** mounted thereon, and oriented in parallel configuration with respect to the bottom nesting rail **14.** Each of the carrying bars **30** is shown to be formed in a configuration of a square tube and fixedly secured to the top of each of the corner support posts **12** by any suitable means such as a weldment or the like. Furthermore, each carrying bar **30** in this particular embodiment is shown to be oriented such that the top surface of each carrying bar **30** forms an apex **32** while the lower surface thereof forms lower apex **34.** Each carrying bar **30** extends both inwardly and outwardly beyond the corresponding corner support post **12** for a distance, for a purpose to be more fully defined hereinafter. The inner side edge **35** of each of the carrying bars **30** is shown to be angularly inclined downwardly while each of the outer side edges **36** is shown to be substantially vertical in orientation. A side closure plate **38** is mounted on the outer side edge **36** of the carrying bar **30** and extends downwardly therefrom for a distance having the lower edge **39** thereof, turned inwardly and mounted on the outside surface thereof of the corresponding corner support post **12.** A reinforcing bar **40** is mounted on and fixedly secured as between the interior surfaces of the side closure plate **38,** the lower edge **39** thereof, and the outside surface of the corner support post **12** to provide additional reinforcement during the lifting operation as against tensile forces which are operative during the lifting and carrying procedure. Hence, as between the lower surface of the carrying bar **30** and the side closure plate **38** and the reinforcing bar **40,** there is defined a lifting aperture **42** which accommodates the insertion of a specially designed lifting four hook crane hitch **43,** as is more fully shown in FIGS. **4** and **6** of the drawings.

It will be observed from FIG. **3** of the drawings that due to the configuration of the bottom nesting rail **14,** and the top apex **32** of the carrying bar **30,** nesting surfaces are created, thereby to provide a very stable orientation of modular racks, when vertical stacking one atop another is desired. It will be appreciated that the open channel **15** of the bottom nesting rail **14,** matingly

nests with the top apex 32 of the carrying bar 30, such that one rack 12, may be vertically stacked upon another rack 10 while fully loaded with a cylindrical load 13.

As more fully shown in FIG. 6 of the drawings, a lifting four hook crane hitch 43 is provided which is specially adapted by having carrying arms 44 having a V-shaped channel 45 provided therein, the V-shaped channel 45 providing a mating surface for the lower apex 34 of the carrying bar 30. The manner in which the lifting crane hitch 43 matingly engages the modular storage rack 10 is more particularly shown in FIGS. 4 and 6 of the drawings, where it is illustrated that each of the carrying arms 44 of the lifting four hook crane hitch 43 may be inserted within a corresponding lifting aperture 42 until the V-shaped channel 45 nestingly engages the lower apex 34 of the corresponding carrying bar 30. It will be appreciated that this mating engagement provides a positive interlock as between the lifting four hook crane hitch 43 and the rack 10, such that the lifting and transporting operation is facilitated with a minimum of danger to personnel working in and about the general area where transport is occurring.

As mentioned previously, and as shown in FIG. 3 of the drawings, the modular storage rack 10 of the present invention may be conveniently stacked in vertical orientation by merely nesting the bottom nesting rail 14 of one rack 10 on top of the carrying bars 30 of an adjacent rack 10. However, where it is deemed desirable to cross-stack the racks, the construction of the rack 10 of the present invention permits such cross-stacking in a convenient, efficient, and stable manner. With reference to FIGS. 1 and 5 of the drawings, it will be observed that the bottom nesting rails 14 are each provided with a pair of guide plates 48 which are angularly mounted thereon, at an angle complementary to the angular incline of the inner edge 35 of the carrying bar 30. As shown in FIG. 5 of the drawings, where cross-stacking is desired, the bottom nesting rails 14 of one rack 10 are cross-oriented with respect to the carrying bars 30 of an adjacent rack 10, such that the guide plates 48 rest against the inclined inner edge 35 of the carrying bar 30 of an adjacent rack 10. It will be appreciated that a very stable and firm interlock is achieved whereby the cross-stacking of adjacent racks 10 may be accomplished.

It will now become clear that the modular storage racks 10 of the present invention are suitable for accommodating the storage of any type of coiled metal rolls, coiled plastic, paper, coiled tubing, wire, rods, or any other fabricated or machined objects of a generally cylindrical shape, and which are substantially large in configuration. A firm and stable nesting of the circular load 13 within the rack 10 is accomplished as mentioned previously by the angular orientation of the load bearing tubes 16, mounted within the rack 10. In this manner, tangential support surfaces are presented for supporting the cylindrical load 13, thereby maximizing the security of the load 13 once stored in the rack 10, while at the same time minimizing the possibility of damaging the materials of the cylindrical load 13 during storage or transport.

It will also be apparent that the nesting features of the present invention may be accomplished with shapes other than square tubing, such as the configuration set forth above with respect to the carrying bars 30. As shown in FIG. 7 of the drawings, the carrying bars 30 may be formed of circular tubes 50 thereby presenting a top apex which is circular in configuration as well as a lower apex which is circular in configuration. In such an event, it may be desirable to adapt the V-shaped channel 45 of the carrying arm 44 to a circular configuration, although it should be clear that a V-shaped channel 45 will still achieve tangential contact with a circular configuration in order to provide a firm and stable interlock. Similarly, the bottom nesting rails 14 may be adapted to semicircular rails, although the 90° angle shown in connection with the bottom nesting rails 14 of the preferred embodiment will similarly achieve tangential contact with a circular shape, and hence, neither the bottom nesting rails 14 nor the V-shaped channel 45 of the lifting arm 44 of the lifting crane hook 43, need be altered in configuration where the carrying bars 30 are formed by circular tubes. It will also be appreciated that other shapes may similarly be employed for the carrying bars 30, in which event, adaptation must be made to the bottom nesting rails 14, and the V-shaped channel 45 of the carrying arms 44, in order to achieve a matingly nesting interlock as between the bottom nesting rails 14 and channel 45 of the carrying arms 44, with respect to the particular configuration employed for the carrying bar 30. As shown in FIG. 7 the carrying bar 50 is circular in configuration and in this embodiment, it is contemplated that the bottom nesting rail 14, and the V-shaped channel 45 of the carrying arm 44 need not be changed in configuration in order to provide a film and secure interlock with the carrying bar 50, due to the tangential contact achieved between the elements.

It is clear from the above description that the invention thereby provides a very convenient and rigid modular storage rack for accommodating the storage and transport of large cylindrical loads while at the same time permitting the stacking in a vertical orientation of such racks when fully loaded. In this manner, in spite of the fact that significantly large loads may be carried by the racks, the vertical storage of such racks permits maximum use of warehousing space while also maximizing the stability achieved during the storage and stacking operation.

While there has been described what is at present considered to be the preferred embodiments of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims, all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a modular storage rack for cylindrical loads of the type formed by a plurality of corner support post members, a pair of opposed parallel bottom nesting rails mounted on and interconnecting opposed pairs of corner support post members, a pair of square support tubes angularly mounted on and interconnecting opposed pairs of support post members and disposed in cross orientation with respect to the parallel bottom angles, the square support tubes being angularly inclined to present inclined flat support surfaces thereby to carry a cylindrical load therebetween, and further including structural channels to rigidify and strengthen the storage rack the improvement comprising in combination,

a plurality of carrying bars, each of said carrying bars being mounted on the top of a corresponding corner support post in parallel orientation with respect

to the bottom nesting rails and extending outwardly for a distance with respect to each of the corner support posts, and

each of said carrying bars presenting a non-flat nestable surface along the top and bottom exposed surfaces thereof, said top surface of each of said carrying bars having the matingly nesting configuration of a corresponding bottom nesting rail,

whereby a series of modular storage racks may be vertically stacked by positioning the bottom nesting rails of one rack on the top surface of the carrying bars of an adjacent rack, such that the carrying bars nest within a corresponding bottom nesting rail, while at the same time presenting a lower surface for said carrying bars which matingly nest with independent carrying hooks to provide a stable and positive engagement of the carrying hook with said carrying bars to facilitate the lifting and transport of said modular storage rack.

2. The improved modular storage rack as set forth in claim **1** above, which further includes a closure plate mounted on the outside terminal edge of each of said carrying bars and extending downwardly therefrom and having the lower edge thereof turned inwardly and mounted on a corresponding corner support post, thereby to define a hook lifting aperture.

3. The improved modular storage rack as set forth in claim **2** above which further includes a reinforcing bar mounted along the interior surface of each of said closure plates and along the inturned lower edges thereof, thereby to reinforce the hook lifting apertures against tensile forces during the lift procedure.

4. The improved modular storage rack as set forth in claim **1** above, wherein each of said bottom nesting rails includes a pair of spaced guide plates angularly mounted thereon and the interior edge of each of said carrying bars is angularly inclined downwardly, whereby a pair of adjacent racks may be cross-stacked by nesting said guide plates against the angularly inclined interior edges of said carrying bars.

5. The improved modular storage rack as set forth in claim **1** above, wherein said carrying bars are each square in external configuration and having opposed apexes forming the top and bottom exposed surfaces of said carrying bars.

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