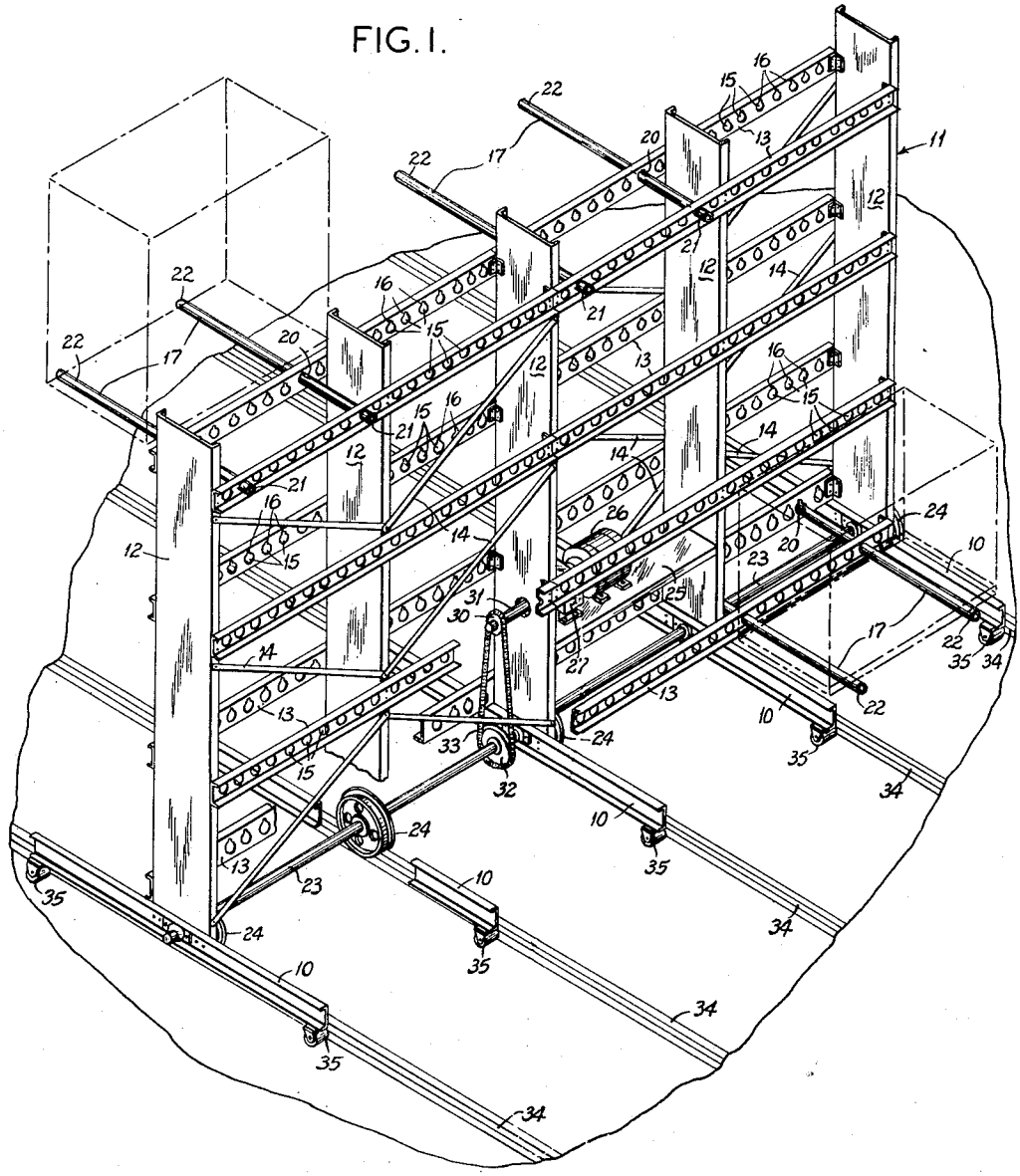
Nov. 5, 1957 E. M. TRAMMELL 2,812,069

RACK ASSEMBLY

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FIG. 1.



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FIG. 2.

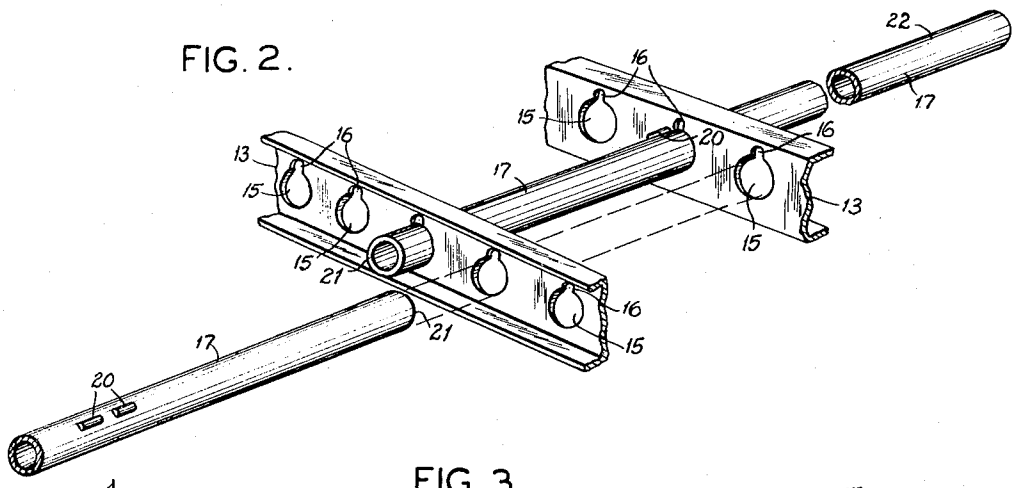
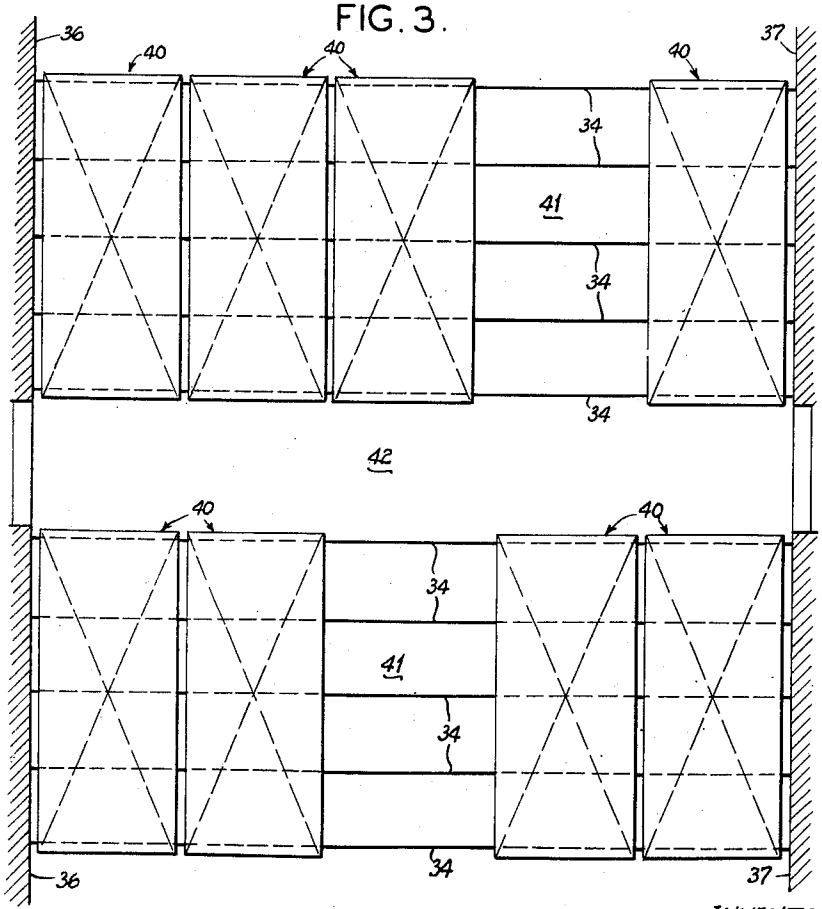


FIG. 3.



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RACK ASSEMBLY

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Application November 24, 1954, Serial No. 470,876

1 Claim. (Cl. 211—162)

This invention relates to improvements in a rack assembly, to improved rack installations, and to improved methods of arranging such racks so as to realize a saving in warehouse floor space.

It is an important objective of the present improvements to provide a rack which will permit stacking of a plurality of pallet loads, one above the other, without one pallet load resting on or supported by the other, which will produce an economy of floor space, and which will afford economies that result from the use of fork-lift operation.

In the racks heretofore used, there is a considerable waste in stacking space because of the different widths of pallet loads. Most materials when loaded on a pallet weigh a great deal, and hence the supporting shelves must have considerable strength. In such prior storage racks, columns or posts are located between the space adapted to receive the pallet loads to support this weight. However, it is obvious, that these column supports are permanently spaced, and thus as a result of the inconsistent widths of pallet loads, considerable stacking space is wasted. It is accordingly an important objective of this invention to realize a rack assembly that does not have supports of any kind at the front of the shelves, and hence to realize a rack assembly that provides a continuous storage space adapted to receive laterally adjacent pallet loads of any widths without the loss of any storage space.

Another object is realized by the provision of a cantilever type of support extending laterally outward from a center load-carrying structure of the rack assembly, the cantilever support consisting of elongate rods carried by the center structure and adapted to be selectively located and mounted in a plurality of positions on cross beams or stringers of such structure, whereby to realize the above noted advantages and functional results.

Still other important advantages and objects are realized by the utilization of a cantilever type of load support. For example, it is possible to use flat boards as pallets that can be handled by fork-lift operation, the spacing below and between the cantilever type of supporting rods permitting insertion of truck forks. As a result of affording the use of flat pallets, there is a substantial economy in the cost and maintenance of such pallets as compared to the usual relatively thick, built-up pallets, and a considerable conservation of space in storing and stacking such flat pallets.

Another important object is realized in providing an interlocking feature between the supporting rods and the stringers of the center load-carrying structure, which prevents any unintentional withdrawal or axial displacement of such rods.

Another important objective is realized in the provision of means in a rack assembly which renders the rack movable laterally in either direction. An arrangement of a plurality of such movable racks in a predetermined space, and method of manipulating the racks permits more floor space to be utilized for storage than would be permitted by the conventional, laterally spaced arrangement of stationary racks in the same predetermined space, and permits access to both sides of each rack.

The foregoing and numerous other objects of the invention will more clearly appear from the following detailed description of a rack assembly, and the installation of a plurality of movable racks in a predetermined space, particularly when considered in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view of a rack assembly showing the rack mounted on a track, and including a power means adapted to move the rack along such track;

Fig. 2 is a fragmentary perspective view of a pair of horizontally disposed ocooperating stringers, and of several supporting rods, Fig. 2 showing the interconnection and interlocking feature of the rods with the stringers, and

Fig. 3 is a diagrammatic top plan view of a rack installation showing a plurality of movable racks within a predetermined space.

Referring now by characters of reference to the drawings, and first to Fig. 1, the rack assembly includes a base structure that consists of a plurality of horizontally disposed braces referred to at **10**, the braces **10** being located in spaced, substantially parallel relation. Carried by and located medially of the base is a center load-carrying structure referred to generally at **11**. This center load-carrying structure **11** includes a plurality of upright elements **12** which constitute vertical standards. The lower ends of upright elements **12** are fastened to the center portion of braces **10**. It will be noted that braces **10** and upright elements **12** are preferably formed of channels having a U-shaped cross section. For uniformity in construction, the braces **10** are placed on their sides so that the channels open to the same end of the rack assembly. Similarly, the upright elements **12** have their channels all opening to the opposite end of the assembly, thus enabling the flat base of the channels constituting upright elements **12** to lie flat against the base of the channels constituting braces **10**.

The center load-carrying structure also includes a plurality of stringers **13** attached to each side of the vertical upright elements **12**. Each of the stringers **13** located at one side of vertical elements **12** is horizontally disposed, and is arranged in vertically spaced relation with each adjacent stringer **13**. Each stringer **13** at one side of upright elements **12** is arranged directly opposite a corresponding and cooperating stringer **13** located at the other side of vertical upright elements **12**. Each pair of directly opposed, horizontally spaced stringers **13** serves as a mounting for a load-supporting means later fully described. These stringers **13** are also preferably formed of channels having a U-shaped cross section, and are arranged so that the channels open laterally outwardly on each side of center load-carrying structure **11**. Several diagonally arranged strips **14** are attached to and interconnect adjacent vertical upright elements **12**, and serve generally to reinforce the center load-carrying structure **11**.

Provided in stringers **13** are a plurality of regularly spaced apertures generally indicated at **15** in Figs. 1 and 2, the apertures **15** in stringers **13** being arranged closely adjacent one another, and extending the entire length of the rack assembly. In addition, the apertures **15** of each pair of directly opposed stringers **13** are similarly arranged in directly opposed relation, and hence are disposed in registered alignment, the purpose of which will be subsequently explained. As more clearly appears from Fig. 2, the apertures **15** are substantially

circular in configuration, except for a small projecting recess **16**.

The load-supporting means consists of a plurality of selectively movable supporting rods **17** of circular cross section, the rods **17** being adapted to interfit any of the registered apertures **15** of directly opposed stringers **13**, and hence being adapted for mounting in the center load-carrying structure **11**. It appears in Fig. 2 that elongate supporting rods **17** are adapted to closely interfit any of the aligned apertures **15** in any pair of opposed cooperating stringers **13**. When inserted into apertures **15**, the supporting rods **17** extend laterally outwardly from the center load-carrying structure **11**, and hence form a cantilever type of support.

In Fig. 1, it is shown how supporting rods **17** may be utilized to support pallet loads. Usually, for the average width of pallet loads having normal weight, only two supporting rods **17** are used. But if such pallet loads are excessive in weight, or if weight has been increased due to extra wide pallets, then additional supporting rods **17** may be inserted into apertures **15** below the pallet to carry this additional weight. It is apparent that the pallet loads may be arranged in closely adjacent relation for the entire length of the rack assembly regardless of the widths of such loads. Furthermore, it is seen that pallet loads may be supported by rods **17** immediately above or below another pallet load supported by similar supporting rods **17**.

In this particular cantilever type of rack assembly, a flat board may be utilized as a pallet, which results in substantial economies in cost and maintenance than that attained by the thicker built-up pallets now in extensive use. Because the supporting rods **17** under a flat pallet are horizontally spaced apart, and provide a space underneath such pallet, truck forks may be accommodated incident to either placing pallets in the rack or removing them from the rack. Obviously, considerable economies are realized by handling materials by fork-lift operation.

Each of supporting rods **17** is provided with a pair of abutments **20**, the abutments **20** being longitudinally spaced a distance substantially equal to the thickness of the base of the channel comprising a stringer **13**. When a supporting rod **17** is inserted into aligned apertures **15** of a pair of opposed stringers **13**, one end **21** of rod **17** extends through and is received in aperture **15** of one stringer **13**, while the opposite end **22** extends laterally outwardly from the other stringer **13**, and hence extends laterally outwardly of the center load-carrying structure **11**. As the supporting rod **17** is inserted into place, one of the abutments **20** passes through recess **16** of aperture **15** in one of the stringers **13**. In position, the abutments **20** are located on opposite sides of stringer **13**. After the supporting rod **17** is properly located, it is angularly twisted or rotated slightly so that the abutments **20** on opposite sides of the stringer **13** are placed out of register with recess **16** of aperture **15**. Thus it is seen that abutments **20** are adapted to engage opposite sides of one stringer **13** to prevent any unintentional axial displacement of rod **17**.

The rack assembly, as has been described, may be stationary in character, with bases **10** of the base structure being disposed on and supported by the subjacent floor. However, certain important advantages and functional results, such as a considerable saving in warehouse floor space, may be attained by rendering such rack assemblies movable.

As is more clearly shown in Fig. 1, a drive shaft **23** is journalled by each of braces **10** and upright elements **12**, the drive shaft **23** extending the entire length of the rack assembly. Connected to drive shaft **23** are a plurality of drive wheels **24**, one of the wheels **24** being located closely adjacent each of the braces **10**. A platform **25** is connected to and between a pair of upright elements **12** of the center load-carrying structure **11**, and is adapted to carry an electric motor **26** constituting a power device, and

to carry a gear reduction unit **27**. A power transmission means is utilized to connect operatively the drive shaft **23** with the electric motor **26**. This transmission means consists of a sprocket **30** carried on shaft **31** connected to motor **26** through reduction unit **27**, a second sprocket **32** mounted on drive shaft **23**, and a connecting link chain **33** extending over and engaging sprockets **30** and **32**.

Located in the subjacent floor are a plurality of tracks **34**, the tracks **34** being arranged in spaced, parallel relation. The drive wheels **24** constitute track followers, and are adapted to ride on tracks **34**. At each end of each brace **10** is a roller **35** adapted to engage the subjacent floor. The wheels **24** and rollers **35** hold the braces **10** off the floor. Upon actuation of motor **26**, the wheels **24** are driven by shaft **23** through the interconnection of power transmission means **30**, **32** and **33**, and hence the rack assembly can be transported along the floor laterally in either direction, the wheels **24** riding on tracks **34**, and rollers **35** riding on the floor.

These movable rack assemblies may be arranged and manipulated within a predetermined space allotted for warehouse storage so that a greater percentage of such space will be used for actual storage purposes than would be normally realized by the conventional, spaced arrangement of stationary racks in the same predetermined storage space. For example, such an installation is clearly shown by the diagrammatic top plan view of Fig. 3. It is assumed for purpose of illustration, that the predetermined space allotted for storage is represented by the distance between two fixed walls **36** and **37**.

In the installations of stationary racks, it is necessary that an aisle be provided between the wall and each end rack, and that an aisle be provided between each adjacent pair of racks, so as to permit access to both sides of each rack. Thus it is seen that a considerable portion of this predetermined floor space is taken up by aisles.

In Fig. 3 there is shown a diagrammatic arrangement of movable racks which will result in a substantial saving in this otherwise wasted storage space taken up by aisles. Located in this predetermined space between walls **36** and **37** are a number of movable racks illustrated diagrammatically by rectangular blocks generally referred to at **40** in Fig. 3. It is only necessary to provide enough space between walls **36** and **37** which will provide a single aisle as indicated at **41**, sufficient in width to permit access to adjacent racks **40**. The remaining space may be completely occupied and utilized for storage by the rack assemblies **40**. Since each of the racks **40** is movable along tracks **34**, the aisle space **41** may be conveniently located in different positions within the predetermined space so that access may be had to either side of any rack assembly **40**. For this purpose, each of the racks **40** need only be moved a distance equal to the width of aisle **41**. This particular type of rack installation and method of movement is clearly illustrated by the two rows shown in Fig. 3. In this first or upper row, the aisle **41** is located between the first and second racks at the right of Fig. 3, while the same aisle space **41** is located between the second and third racks in the second or lower row. Of course, an aisle **42** is required between the adjacent rows of racks.

Although the improvements have been described by making particularized reference to a preferred embodiment of a rack assembly, and to a preferred installation and method of moving such rack assemblies, the detail of description is not to be understood as restrictive, numerous variants being possible within the principles disclosed and within the fair scope of the claim hereunto appended.

I claim as my invention:

In a rack assembly for pallet loads, a base consisting of a plurality of spaced laterally extending braces, a standard connected medially to each brace, a plurality of stringers carried on opposite sides of said standards, said stringers at each side of said standards being hori-

zontally disposed, and being vertically spaced from adjacent stringers, each stringer at one side of said standards being arranged directly opposite, and horizontally spaced from a correspondingly located stringer at the opposite side of said standards, said stringers being provided with a plurality of apertures, the apertures of each stringer being aligned with the apertures of the opposed stringer, a plurality of supporting rods carried by said opposed stringers, said rods being adapted for insertion into any of said aligned apertures of any pair of opposed stringers to accommodate the size and weight of each particular pallet load, said rods extending laterally outwardly from said stringers to support such loads, the rods and cooperating pairs of stringers being adapted to support one pallet load immediately above another such load, yet independent therefrom, an abutment on each of said rods, at least one of said aligned apertures being provided with a recess to permit passage of said abutment upon insertion of a rod into aligned apertures of opposed stringers, said abutment being adapted to engage one of said opposed stringers in a rotative position of said rod to prevent unintentional axial displacement of said rod.

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