March 23, 1937. D. E. HUMPHREY 2,074,548

DERRICK

Filed Nov. 5, 1934 3 Sheets-Sheet 1

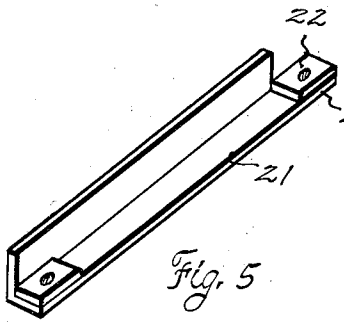


Fig. 5

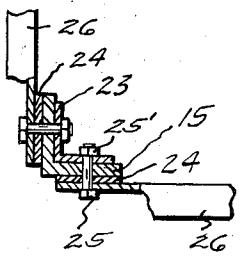


Fig. 6

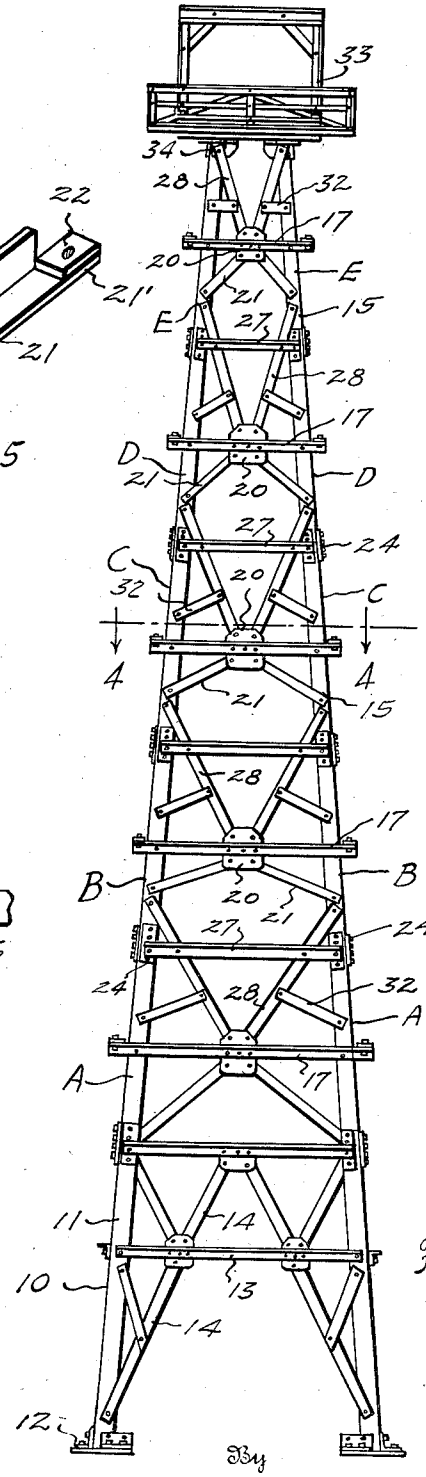


Fig. 1

Inventor
Dee E. Humphrey

By Jack Ashley

Attorney

March 23, 1937. D. E. HUMPHREY 2,074,548

DERRICK

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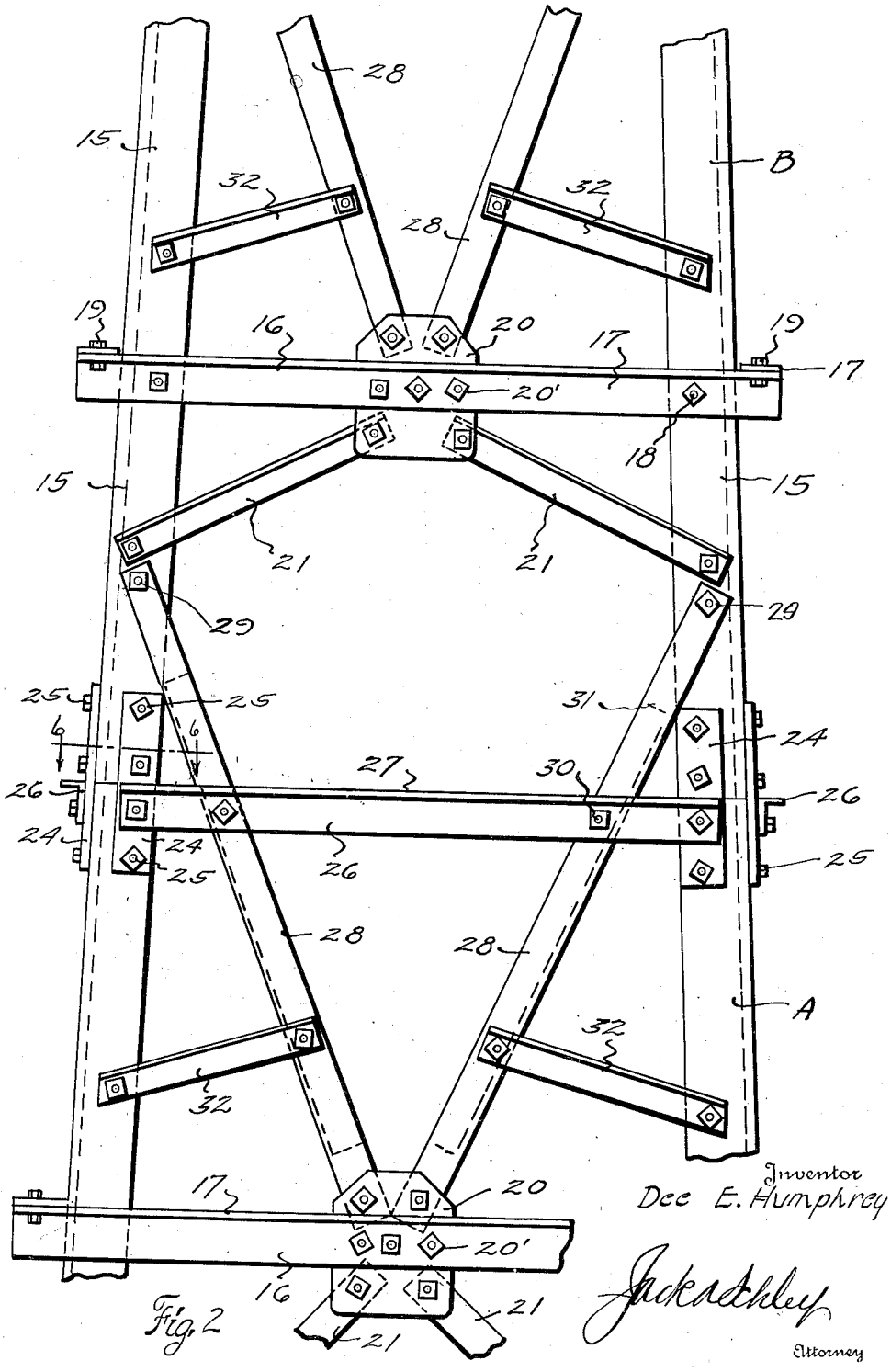


Fig. 2

Inventor
Dee E. Humphrey

Jack Athley

Attorney

March 23, 1937. D. E. HUMPHREY 2,074,548

DERRICK

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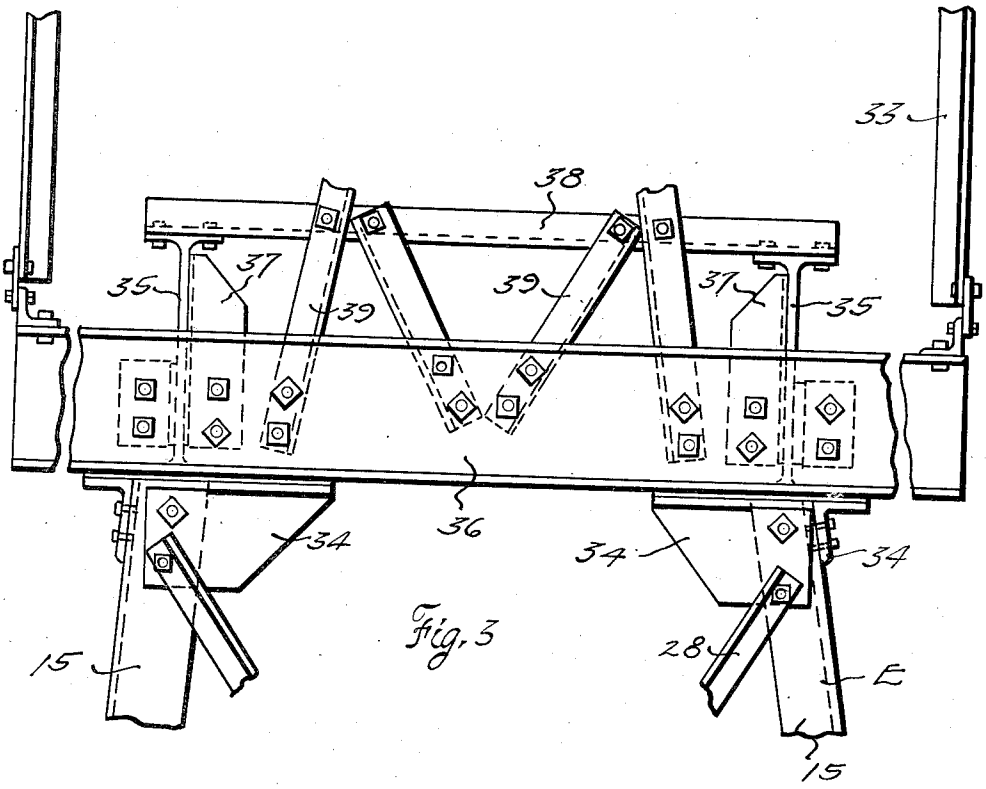


Fig. 3

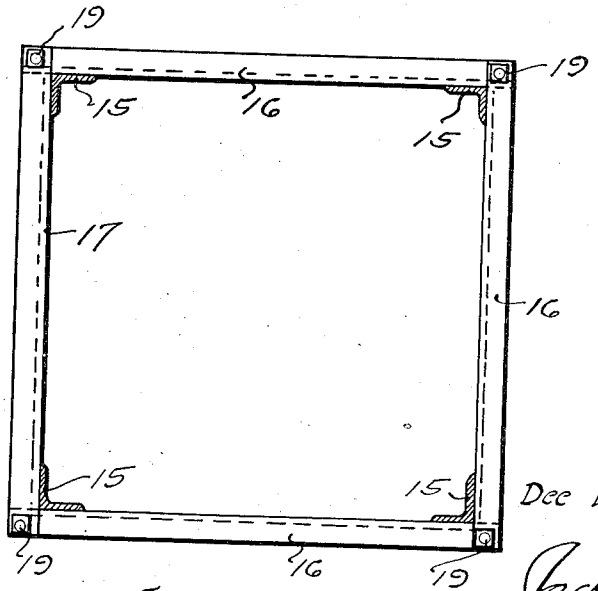


Fig. 4

Inventor
Dee E. Humphrey

By Jack Ashley

Attorney

Patented Mar. 23, 1937 2,074,548

UNITED STATES PATENT OFFICE

2,074,548

DERRICK

Dee E. Humphrey, Dallas, Tex., assignor to Welded Tank and Steel Company, Dallas, Tex.

Application November 5, 1934, Serial No. 751,559

10 Claims. (Cl. 189—13)

This invention relates to new and useful improvements in derricks.

One object of the invention is to provide an improved derrick structure for oil, gas or artesian wells.

An important object of the invention is to provide an improved derrick structure which is so arranged as to reinforce the legs of the derrick at a point between the girts which space and connect the legs, whereby a more substantial structure having greater rigidity and increased carrying capacity is had.

Another object of the invention is to provide an improved derrick structure which comprises the usual supporting legs which are braced by a plurality of bracing members connected thereto, said members being of a uniform size and shape, whereby the necessity of marking the pieces is eliminated and the complexity of assembling the structure is decreased, since the bracing members are interchangeable and convertible throughout.

A further object of the invention is to provide an improved derrick structure, wherein the supporting legs and girts connecting the same, together with the bracing members, form an open structural gusset, whereby the derrick is greatly strengthened throughout its entire length.

Still another object of the invention is to provide a derrick structure which is designed so as to be readily assembled with a minimum of danger to the workmen.

A still further object of the invention is to provide an improved derrick which is constructed of a minimum number of parts, whereby the weight of the derrick is reduced, without sacrificing the rigidity or strength of said derrick.

Still another object of the invention is to provide an improved derrick structure comprising a plurality of supporting legs connected and braced by cross members and having upright divergent braces extending upwardly from one cross member, across the next above cross member, and having its upper end secured to the legs, and also being fastened to the upper cross member, whereby a most substantial reinforcing structure is had.

A further object of the invention is to provide an improved derrick structure having a plurality of supporting legs connected and braced by cross members and having web plates secured to the cross members for fastening inclined reinforcing members between the legs and cross members, whereby erection of the derrick is simplified.

A still further object of the invention is to provide an improved derrick structure including a plurality of angular bracing members which have reinforcing plates secured to their ends, whereby said ends are strengthened and are capable of carrying increased loads without increasing the weight of said members.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Figure 1 is an elevation of a derrick, constructed in accordance with the invention,

Figure 2 is an enlarged detail, showing portion of the derrick structure,

Figure 3 is an enlarged detail of the crow's nest mounting,

Figure 4 is an enlarged horizontal cross sectional view, taken on the line **4—4** of Figure 1.

Figure 5 is an isometric view of one of the reinforcing bars, and

Figure 6 is a horizontal cross-sectional view, taken on the line **6—6** of Figure 2.

In the drawings, the numeral **10** designates a base or support for a derrick which may be of any suitable structure. I have shown the base as comprising four angular corner members or legs **11** which have their lower ends secured to suitable supporting base plates **12** which may be fastened on concrete or other piers to support the derrick structure. The members are connected to each other at their mid-portions by girts **13** and the entire base is strengthened and reinforced by suitable angular brace members **14** which are positioned advantageously around the base. The base is not to be limited to the particular structure shown, as any desired base may be employed to support my improved structure.

In carrying out my improved structure, the derrick comprises a plurality of sections or stages A, B, C, D and E. Although I have shown five sections, the invention is not to be limited to any particular number, as this depends entirely on the height of the derrick. Each section is constructed so as to taper inwardly toward its upper end and by observing Figure 1, it is obvious that when the sections are superimposed and secured together they form the derrick. Since all the sections are substantially alike, a description of one will suffice.

As clearly shown in Figure 2, each section comprises four angular legs **15** which are positioned to form the corners of the derrick. These leg

members are preferably of structural steel, or other suitable metal, and may be of any suitable length, the usual length being about fourteen feet. The members are connected at their midportion by a square girt 16 formed of horizontally extending angle bars 17 which extend from one leg to the next leg and are secured thereto by bolts 18, or other suitable means. At the corners, two of the bars have a portion of their aprons cut off, so that the opposite two bars may be overlapped by the web or top flange of the bars, whereby an overlapping intersection of the bars is provided (Figures 2 and 4). The bars 17 are secured together by bolts 19. The overlapping of the bars is an important feature in forming the girt 16 for it provides a positive reinforcing and strengthening of the legs, and prevents the legs bowing outwardly under strain, as well as providing a connection between said legs.

A web plate 20 is secured to each angle bar 17 at its central portion by bolts 20', and is positioned so as to extend above and below said bar. To brace and strengthen the lower portion of each leg 15, a pair of angular brace bars 21 have their upper ends fastened to the lower end of each plate 20 and depend at an inclination therefrom. It is obvious that the plate provides a positive connecting means for the bars. The lower ends of said bars are bolted, or otherwise secured, to the legs. The particular inclination of the bars 21 is optional as they may be secured at any point on the leg members 15 intermediate the lower end of said members and the girt 16, but it is preferable to secure them near the lower ends of the members. For example, if the distance between the lower ends of the members and the girt is seven feet, it is preferable to fasten the bars 21 about two feet from the lower ends of the member, but it is to be understood that the invention is not to be limited to any particular dimension, as a very strong structure may be obtained by securing the bars at any point intermediate the girt 16 and lower end of the leg members 15.

It is advantageous to reinforce the ends of the brace bars 21 at the point where they are fastened to the plate and leg members. The usual practice in reinforcing angle bars at their ends has been to crimp the ends of the flanges so that said flanges form a double-thickness flattened end. I prefer, however, to cut off the end portion of one of the legs of the bar, whereby one leg extends beyond the other leg, as shown in Figure 5, and weld, or otherwise secure, a flat reinforcing plate 22 to the remaining flange 21' which extends beyond the cut-off flange. This provides a double thickness of metal at the end of the bar 21 and it is this reinforced portion, through which the bolt, or rivet, passes to secure the bars to the leg members 15 and plates 20. With this arrangement, the ends of the bars are capable of withstanding additional strain, without any substantial increase in weight.

From the foregoing, it is obvious that each section, or stage is strengthened and braced at its mid-portion by the girt 16 and the lower end of the section reinforced by the inclined bars 21. In assembling the sections, the lower end of the section B is placed on the upper end of the section A and an angular connecting bar 23 (Figure 6) is disposed along the inner side of each of the angular legs 15 of the two sections. Connecting straps 24 are positioned on the outer sides of the leg members and bolts 25 pass through the strap, legs, and inner connecting bars, and receive nuts 25' to hold the sections rigidly together. At the upper portion of each section, angular horizontally disposed bars 26 connect each leg with the next leg and these bars may be secured to each leg by the bolts 25. It is pointed out that four bars 26 are provided and these bars, being in the same horizontal plane, extend entirely around the leg members to form a girt 27.

For reinforcing the upper end of each section as well as to strengthen the connection between each two sections, a pair of elongated angular brace bars 28 are provided. Two of these bars are provided for each side of the derrick, thereby making eight bars necessary for each section. The lower ends of each pair of bars 28 are secured to the upper end of the plate 20 of one section and extend upwardly at an inclination. The upper end of the bars are secured to the legs 15 of the next section above by bolts 29, or other means. It is pointed out that the upper end of each elongated brace bar 28 is secured to the legs 15 at a point just below where the lower end of each bar 21 is fastened to said member.

Each elongated angular bar 28 passes adjacent to the angular bar 26 at the upper end of the section and is secured thereto by a bolt 30. The ends of the bars 28 are provided with reinforcing plates 31 similar to the plates 22 on the brace bars 21. To further brace the upper portion of the leg members, a short angular member 32 is inclined between each elongated bar 28 and the adjacent leg 15, connecting the same. Since each elongated bar 28 is secured to the girt 27 as well as to the leg 15, the portion of the bar 28 between the bolts 29 and 30, together with the portion of the girt 27 between the bolt 30 and the bolt 25 and the portion of the leg member between the bolt 29 and bolt 25, form an open structural gusset which greatly strengthens the derrick at this point which is the point of connection between each two sections. The elongated bars 28 and 21 form a kite-shape design between the leg members, and not only enhance the appearance but provide a most substantial structure with a minimum number of parts.

The bars 21 and the girt 16 serve to strengthen the midportion of the legs of each section, while the elongated bars 28 strengthen the lower portion of one section as well as the upper portion of the section therebelow. It is the particular position of the bars 28 which permits them to connect the central girt of one section with the leg members of the above section, said member being secured to the top girt of the lower section as it passes adjacent thereto. This is an important feature of the structure.

It is pointed out that all the bars 21 and 28 of each section are exactly alike and are, therefore, interchangeable and convertible to any side of that section. This eliminates the necessity of marking each brace and speeds up the assembly, as well as making it simpler and easier for the workmen.

A crow's nest 33 of any suitable structure is mounted on the top section E of the derrick; it has always been dangerous to the workmen in erecting the crow's nest, because the support on which the workmen stand has been too low with relation to the upper edge of the top section E, thereby causing the workman to reach over his head. This support usually comprises a plurality of boards which are stretched across and supported on the girt 16 of the top section E, which is usually some seven feet from the upper end of the legs 15 to which the crow's nest is secured.

By disposing the short angular members **32** of this section horizontally instead of at an inclination, it is possible to lay boards across these members, whereby the workman is raised from two to three feet and can more easily handle the members to assemble the crow's nest.

Although any suitable structure may be employed in mounting the crow's nest, I prefer to employ angular supports **34** a pair of which are secured to the upper end of each leg member **15**. The supports have a pair of I beams **35** secured thereto and these I beams extend parallel along two sides of the derrick, as shown in Figure 3. A pair of channel bars **36** extend parallel along the other two sides of the structure, and are secured to the supports **34**. Vertically extending angular braces **37** are provided at each corner of the structure and connect the I beams and channel bars. A pair of horizontally extending angle bars **38** connect the two I beams and inclined brace bars **39** fasten the angle bars **38** to the back of the channel bars. The crow's nest **33**, which is usually built square, is then secured to the I beams and channel bars in any suitable manner, as by riveting, or otherwise.

The structure is simple in erection, and the weight greatly reduced due to the minimum number of parts, and with the particular disposition of the angular bars **21**, **28** and the members **32** and their points of connection to the angular legs **15**, the legs of said derrick are positively braced intermediate the girts **16** and **27**. This is an important feature of the invention, for it is obvious that by bracing between the girts, the structure is greatly strengthened because of additional reinforcement. The formation of the open structural gussets by the upper ends of the elongated bars **28**, together with the girts **27** and legs **15**, not only strengthens the structure, but also provides a positive reinforced connection between the sections. The ease of erection is greatly increased by the interchangeability of the parts in each section. Since these part are all alike, it is clear that time is not wasted in determining whether or not one of the bars fits a particular side of the structure. By reducing the number of parts, the erection is not only simplified, but the weight and the cost of manufacturing are greatly reduced. Further, with the structure shown, the number of bolt holes necessary in the legs **15** are reduced to a minimum, whereby the legs are not greatly weakened due to the removal of the area by drilling said holes. Although I have shown and described a derrick having four supporting legs **15**, it is to be understood that the structure is not to be so limited as it would be possible to erect a three or five legged structure employing my improved bracing.

What I claim and desire to secure by Letters Patent is:

1. A derrick structure comprising, a base, a plurality of superimposed sections, each section including legs, girts connecting the midportion and also the upper ends of the legs of each section, and inclined brace members having their lower ends secured to the girt at the midportion of one section and extending upwardly past the upper girt of that section and secured at its upper end to the legs of the section thereabove, said members also being fastened to the upper girt of the lower section.

2. A derrick structure comprising, a base, a plurality of superimposed sections, each section including upright legs, a girt connecting and bracing the upper portion of each section, braces extending from each girt to the legs to reinforce the same, and a girt at the midportion of each section formed of a plurality of angular bars secured to each other at their ends in overlapping relation.

3. A derrick structure comprising, a base, a plurality of superimposed sections, each section including upright legs, a girt connecting and bracing the upper portion of each section, braces extending from each girt to the legs to reinforce the same, a girt at the midportion of each section formed of a plurality of angular bars secured to each other at their ends in overlapping relation, and inclined brace bars connecting the central girt of one section with the legs of the next section thereabove, each bar being secured to the upper girt of the lower section.

4. A derrick structure comprising, a base, elongated leg members forming the corners of the structure, equally spaced girts connecting and bracing the legs, and inclined brace members extending upwardly from one girt beyond the next girt thereabove and secured to the legs above said girt and below the next above girt, each member also being fastened to the girt past which it extends.

5. A derrick structure comprising, a base, a plurality of superimposed sections, each section including supporting legs, a girt connecting the upper ends of the legs of each section, a second girt bracing and connecting the central portion of each section, web plates secured to the latter girt, inclined brace bars connecting the lower end of each web plate with the leg members, and elongated inclined brace members having their lower ends secured to the upper ends of the web plate extending upwardly beyond the girt at the upper end of that section and having their upper ends secured to the legs of the next section thereabove.

6. A derrick structure comprising, a base, a plurality of structural sections, means for securing the sections one above the other, each section including a girt bracing its midportion, a second girt secured to the upper end of the legs of each section for connecting the same, and inclined elongated brace members connecting the central girt of one section with the legs of the section next above and being secured to the girt at the upper end of the lower section, whereby the upper end of each member between its point of fastening to the leg and upper girt, together with a portion of the girt and a portion of the leg form an open structural gusset.

7. A derrick structure comprising, a base, a plurality of superimposed sections, each section including upright legs, a girt connecting and bracing the upper portion of each section, braces extending from each girt to the legs to reinforce the same, a girt at the midportion of each section formed of a plurality of angular bars secured to each other at their ends in overlapping relation, inclined brace bars connecting the central girt of one section with the legs of the next section thereabove, each bar being secured to the upper girt of the lower section, and short angular bars secured to the legs and to the elongated members nearer their lower end, whereby a brace or reinforcing is provided between the girts of each section.

8. A derrick structure including, a base, a plurality of superimposed sections, each section including legs, girts connecting the midportion and

also the upper ends of the legs of each section, and inclined brace members, each having its lower end secured to one of the girts and extending upwardly past the next above girt, the upper end of the member being fastened to a leg of the section at a point intermediate the last named girt and the girt next thereabove.

9. A derrick including, upright legs, horizontal girts secured to said legs at spaced elevations to form stages, and inclined bracing members extending from one stage to the next stage and having their lower ends secured to the girt of the lower stage and extending upwardly past the next above girt being secured to this last named girt, the extreme upper end of said member being fastened to the leg of the superposed stage to form open structural gussets at the corners of the superposed stage.

10. A derrick including, upright legs, horizontal girts secured to said legs at spaced elevations to form stages, inclined bracing members extending from one stage to the next stage and having their lower ends secured to the girt of the lower stage and extending upwardly past the next above girt being secured to this last named girt, the extreme upper end of said member being fastened to the leg of the superposed stage to form open structural gussets at the corners of the superposed stage, and short inclined brace bars connecting the bracing members with the legs intermediate the girts.

DEE E. HUMPHREY.