Oct. 7, 1930. R. W. LUIPPOLD ET AL 1,777,469

TOWER ANCHORAGE

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Fig. 1.

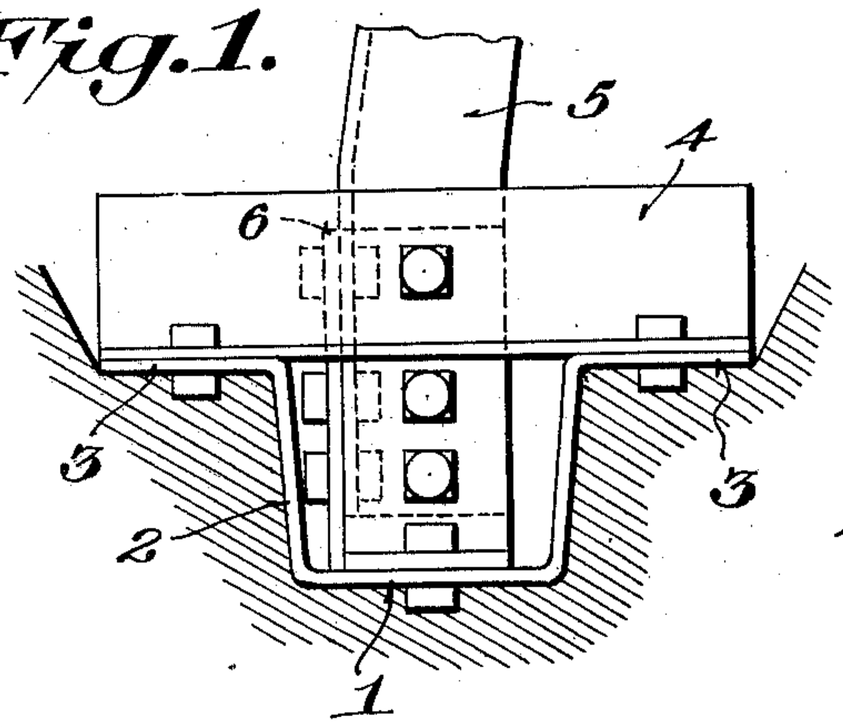

Fig. 2.

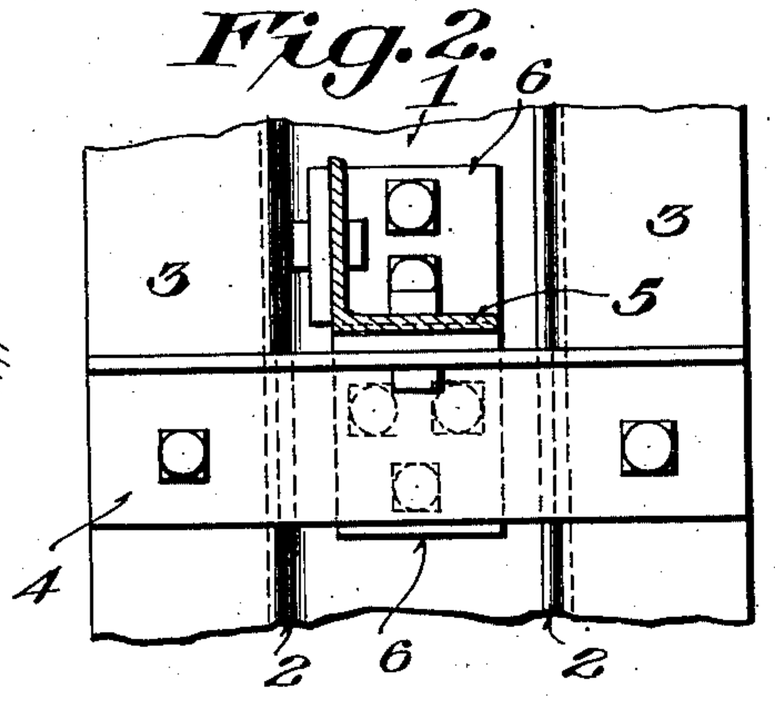

Fig. 3.

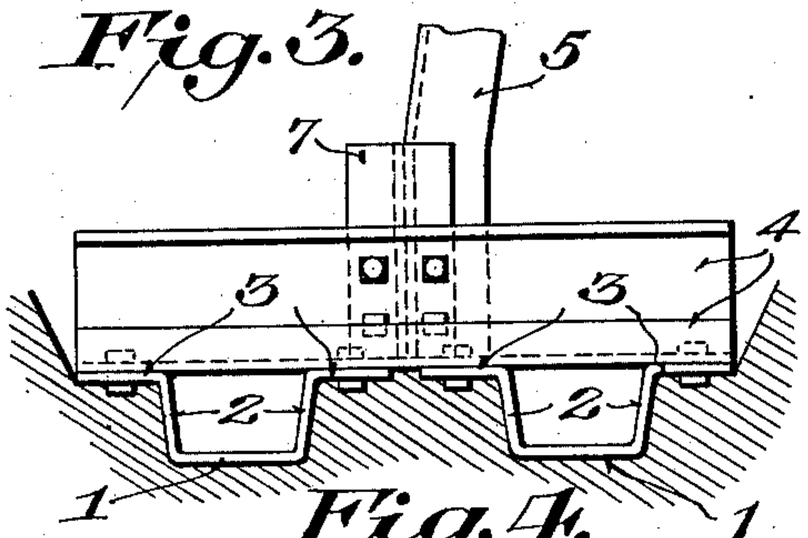

Fig. 5.

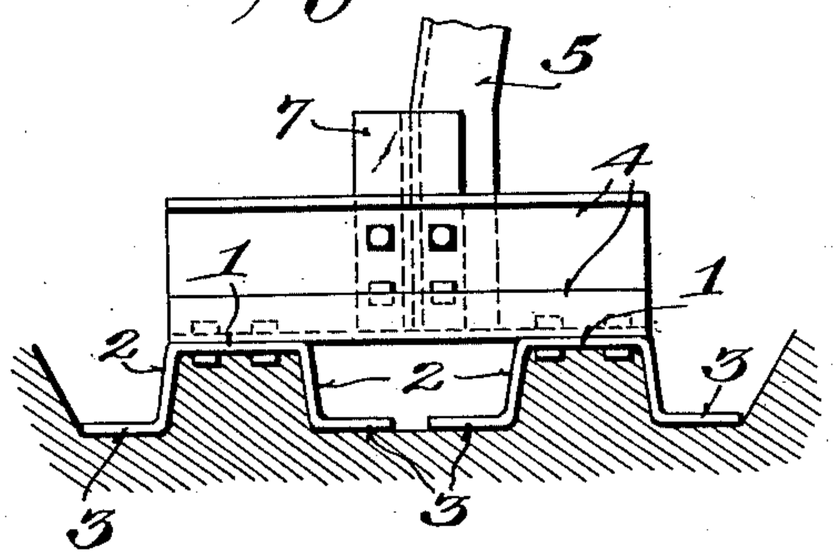

Fig. 4.

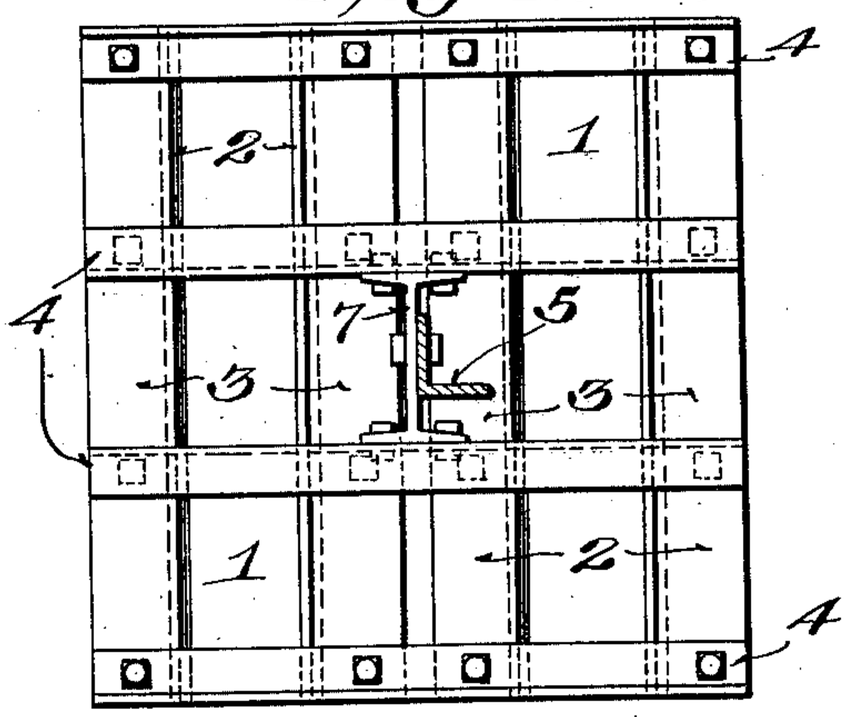

Fig. 6.

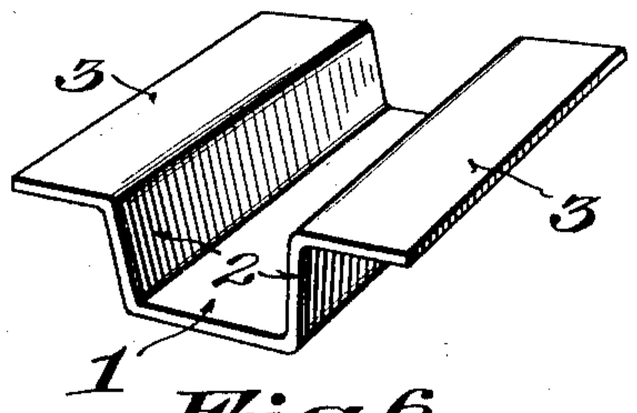

Fig. 11.

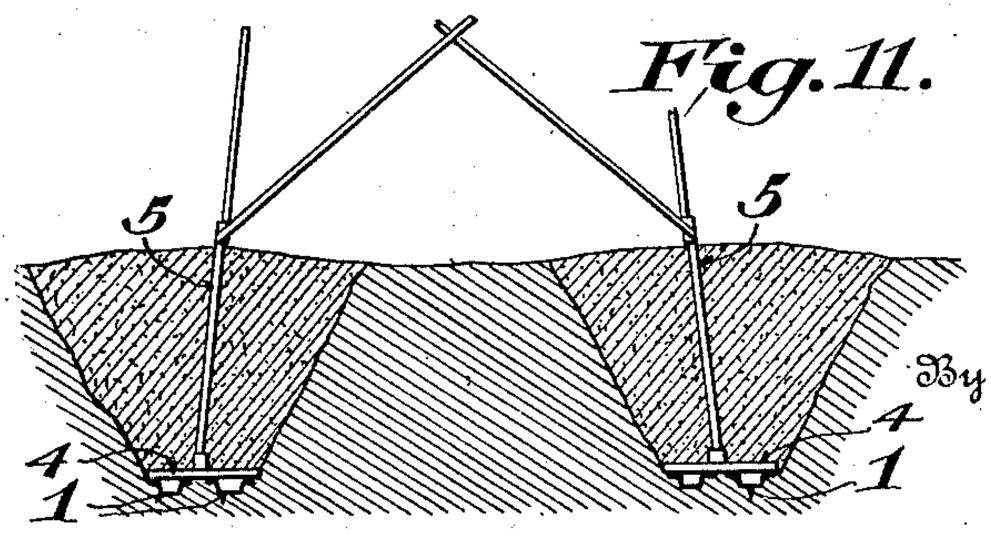

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Fig. 7.

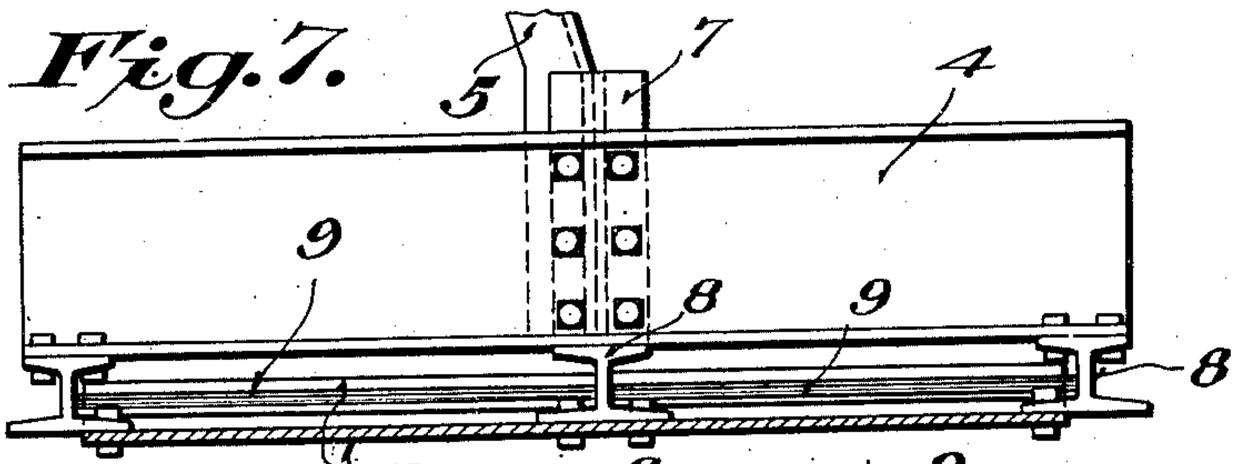


Fig. 8.

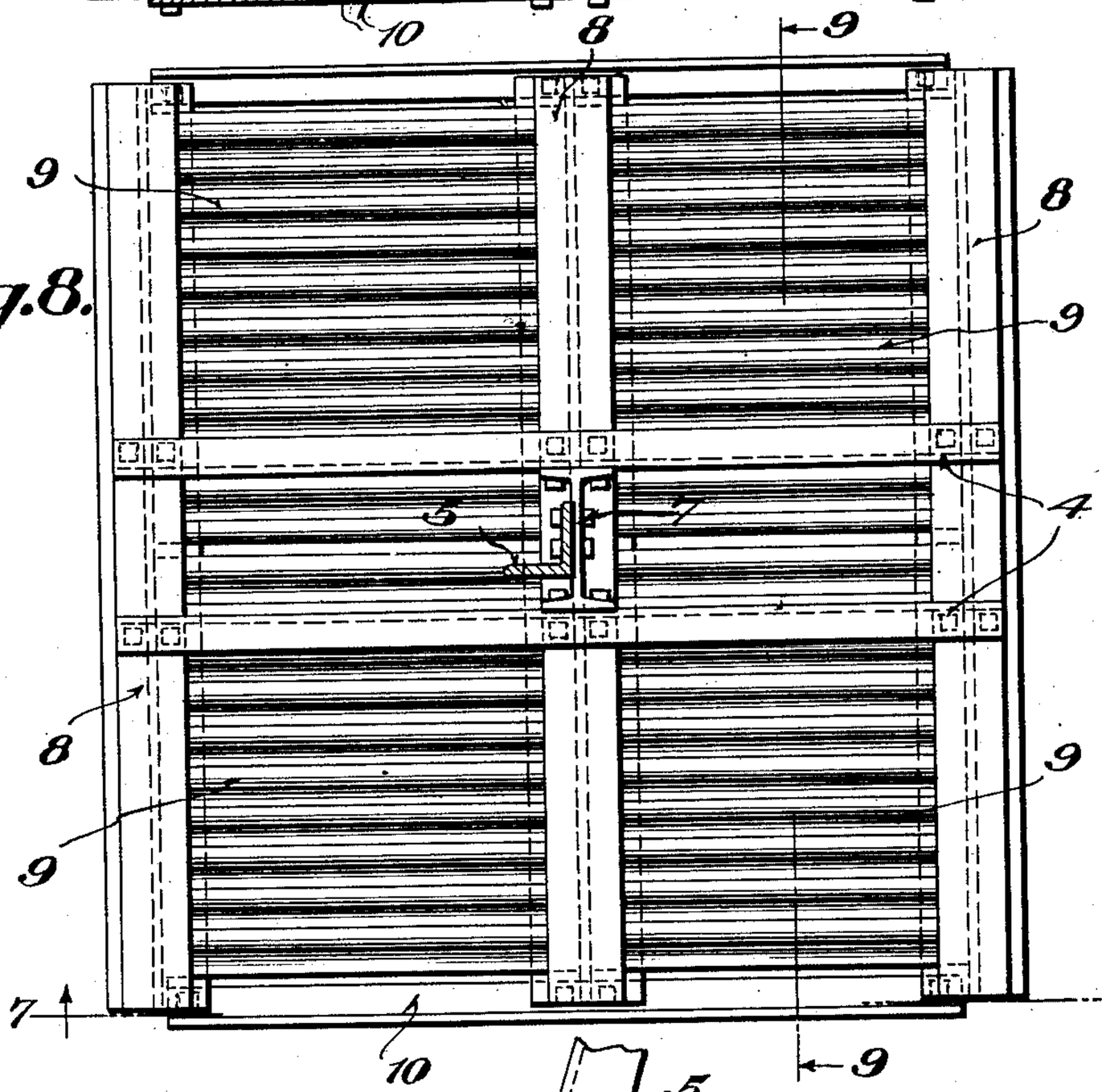


Fig. 9.

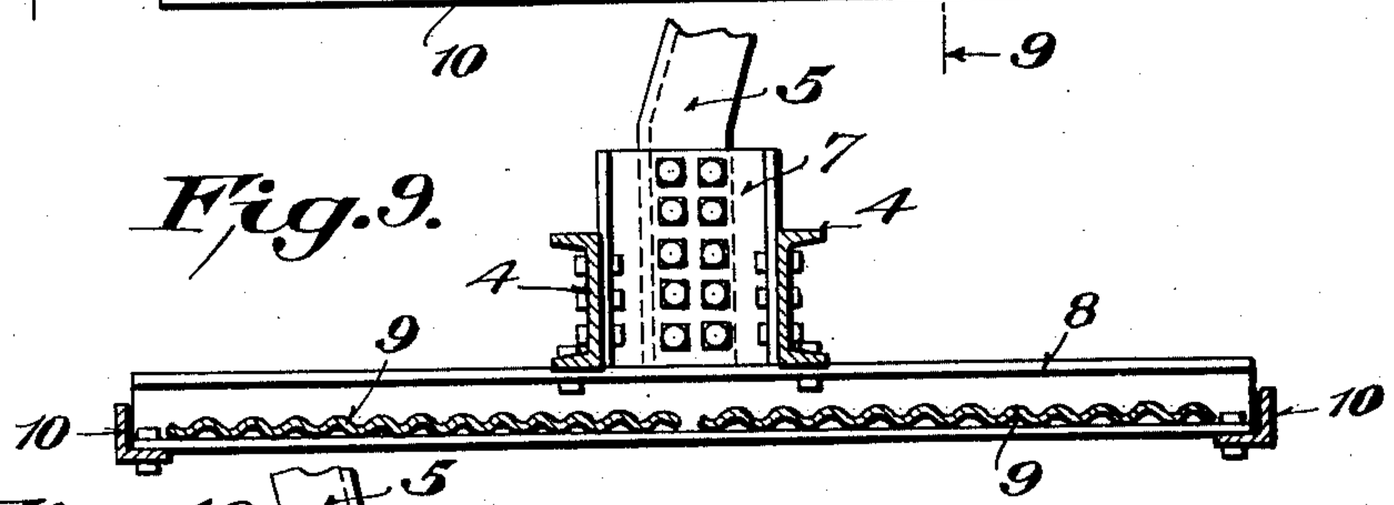
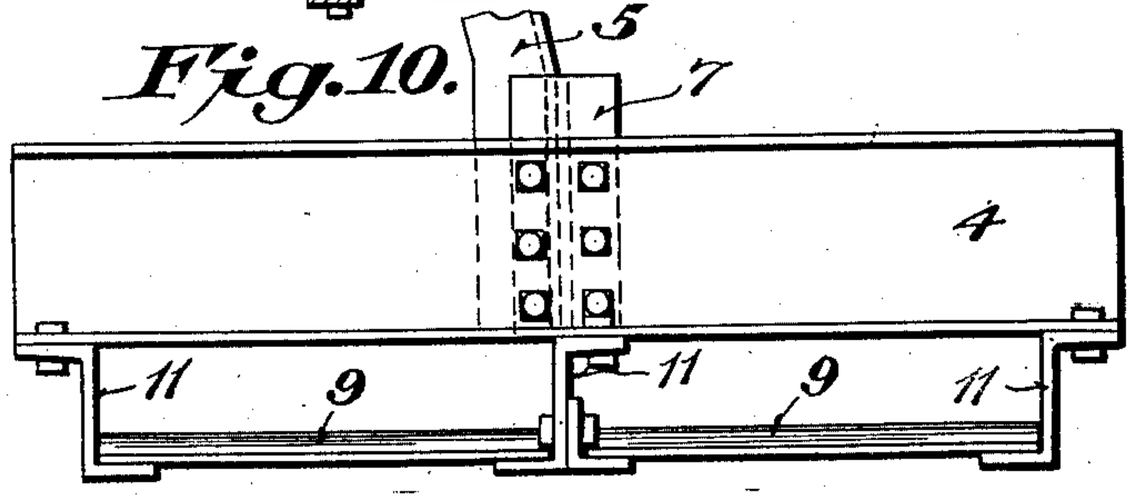


Fig. 10.



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Patented Oct. 7, 1930 1,777,469

UNITED STATES PATENT OFFICE

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TOWER ANCHORAGE

Application filed November 19, 1926. Serial No. 149,478.

This invention relates to improvements in means for supporting towers, columns and the like, and more particularly to anchorages or footings for skeleton towers, such as are used in transmission lines.

It is known that such towers are subjected to considerable loads, due to the weight of the towers themselves, and the weight of the wires, ice loads, etc.; and must be supported on secure footings to resist any tendency of the tower toward displacement. Likewise considerable overturning forces are set up by the force of the wind, unbalanced line pulls and similar lateral forces, which must also be taken up by the footings in order to prevent any movement of the tower leg and consequent tower distortion or deflection. Where such towers are built on ground of rocky or unyielding character, the anchorages are simple in construction and light in weight; but where the ground is of a granular nature, such as sand, it is necessary to distribute the thrusts resulting from the above loads over considerable areas and to dispose the anchoring members so as to assure a sufficient weight of superimposed earth to resist the uplift forces.

Furthermore, the location of the towers is often removed from transportation facilities and may be comparatively inaccessible. This requires an anchorage which is light in weight, compact and capable of ready assembly and installation with a minimum of labor and equipment. The design of anchorage must likewise be such as to be readily variable in dimensions and proportions of the parts, in order to meet the widely varying conditions of load with the most efficient and economical distribution of material, and at the same time it is desirable to employ materials in a form which is readily available commercially in all required sizes and weights.

Various types of anchorages have heretofore been used for this purpose, including principally, interconnected grillage elements such as angle irons, **Z**-bars, **I**-beams and the like. These anchorages are unsatisfactory in practice, particularly where the soil is light, for many reasons. Their surface area is small and an excessive amount and weight of material is required in order to obtain sufficient bearing surfaces. Moreover, the design of such anchorages is such that an efficient distribution of material is impossible and the available commercial sizes and weights of the elements are limited so as to result frequently in uneconomical use of material.

One of the objects of the present invention is to provide a novel form of anchorage which will provide a large surface area with the minimum amount of material.

Another object is to provide an anchorage in which the dimensions and proportions are readily variable to suit particular conditions in order to promote economy through the use of the minimum size and weight of anchorage permissible.

A further object is to employ materials in a form readily available commercially in all required sizes and weights.

A still further object is to provide a novel form of anchorage which will minimize the cost of labor of transportation, assembly and installation.

Other objects will appear more fully hereinafter.

With the above objects in view, the present invention employs base members substantially trough-shaped in cross-section and possessing a large horizontal area whereby the load is distributed to the supporting medium. Either one or a plurality of interconnected base members may be employed, as described more fully hereinafter. These members are preferably prepared by pressing, rolling or stamping into trough-like form rolled sheets of metal, which may be obtained commercially in practically all thicknesses and sizes; or they may be built up from suitable units. The walls of the trough are preferably formed with a slight flare, which facilitates the forming of the member and likewise permits of a variation in the effective area of the member. Dimensions such as thickness and size of plate, size and depth of trough, and amount of flare are determined for the particular conditions encountered and may be readily calculated by well known engineering formulæ.

These members are buried in the earth at a depth determined by calculation to give the required weight of soil, and the legs of the towers are attached thereto in any suitable manner. Preferably the members are stiffened by means such as cross-girders secured thereto. The number of members to be employed is likewise determined by calculation, and where a plurality is required, they are connected together by suitable means such as cross-girders so as to provide a unitary supporting structure, to which a tower leg or the like is attached.

For the purposes of exemplification, several forms of the invention have been illustrated in the accompanying drawings, but it is to be expressly understood that the invention is not limited thereto and that reference is to be had to the appended claims for a definition of the limits of the invention.

In the drawings—

Fig. 1 is an elevation of one form of anchorage;

Fig. 2 is a plan view of Fig. 1;

Fig. 3 is an elevation of an anchorage employing a plurality of base members;

Fig. 4 is a plan view of Fig. 3;

Fig. 5 shows a further arrangement of the base members;

Fig. 6 is a perspective view of a single base member;

Fig. 7 is an elevation of an anchorage employing a built-up form of base member;

Fig. 8 is a plan view of Fig. 7;

Fig. 9 is a section taken on the line 9—9 of Fig. 8;

Fig. 10 is an elevation of a still further form of base member; and

Fig. 11 is a diagrammatic elevation of the base section of a tower or the like, showing its anchorage in place.

Referring now to the drawings, wherein like reference numerals indicate like parts, Fig. 1 shows a simple form of anchorage employing a trough-shaped base member which is illustrated in perspective in Fig. 6. This member is here formed from a unitary sheet of metal of the required thickness, preferably by stamping, rolling or pressing the same so as to form a trough 1 having outwardly flaring walls 2 which connect with flange-like faces 3. The base member is set in the ground at the required depth and may be stiffened when necessary by means such as a cross-girder 4 secured to the faces 3 of the base member by any suitable means as by bolting. This base member serves as a support for a tower leg 5 which may be attached thereto in any suitable manner. In the form shown, the tower leg is in the form of an angle iron which extends into the trough 1 of the base member, and is secured thereto by means of angle clips 6 which are suitably secured as by bolting to the base member, tower leg and cross-girder so as to form a unitary supporting structure. This form of anchorage is designed for use when the loads are comparatively small.

Where the loads to be supported are larger and require a greater supporting surface area, a plurality of base members may be employed, as illustrated in Figs. 3 to 5. The number, grouping and arrangement of these members depends in each case on the particular conditions encountered and is capable of considerable variation, only two forms being shown for purposes of illustration.

In Fig. 3, two trough-shaped members are placed parallel to one another in the position shown in Fig. 1, and are preferably connected together and at the same time strengthened by means of a plurality of cross-girders 4. In the form shown, the two center cross-girders are connected together by a section of I-beam 7 to which the tower leg 5 is secured by any suitable means. Where desired the tower leg may also be secured to the base members themselves by suitable angle clips as illustrated in Fig. 1.

Fig. 5 shows a slightly different form of anchorage employing a plurality of trough-shaped plates placed in an inverted position. The cross-girders 4 in this case are connected to the bottoms of the troughs 1 instead of to the faces 3 as in the preceding illustration. The tower leg 5 may be secured to the assembly by means of a section of I-beam 7 disposed similarly to the arrangement shown in Fig. 4. In this construction the horizontal area covered by the trough plates or covered by the anchorage is the same as in Figs. 3 and 4, but the construction is lighter and less rigid and requires less material.

Figures 7 to 9 show an anchorage in which the trough sections are disposed in a continuous series instead of the unitary elements shown in Figures 3 to 5. In this construction a plurality of parallel cross ties 8 are employed between which are inserted the metal trough-shaped sheets 9. When these sheets are designed to take a proportional part of the compressive load they are suitably secured to the cross tie members, as by bolting, but when designed to aid in resisting the uplift forces only, they are simply inserted between said members. The cross ties 8 are connected at each end by means of angle irons 10 which also serve to retain the metal sheets 9 in place. As in the preceding examples, stiffening members or cross girders 4 are preferably employed and the tower leg is connected to the assembly in a manner similar to that illustrated in Fig. 4. In some instances the sheets 9 may be flat.

In Fig. 10, the construction is similar to that shown in Figs. 7 to 9 except that Z-bars 11 are employed in place of the cross ties 8, between which the metal sheets are inserted.

It will be readily understood that this sys-

tem is capable of expansion to any number of members which may be required to meet the load and soil conditions encountered. Thus, for given conditions, the surface area or footing required becomes fixed and is determined by calculation, and this area may be made up by combining into one unit the necessary number of trough-shaped base members. The flexibility of the arrangement permits of obtaining the required supporting area with the most economical distribution of material, resulting in considerable economy in the amount of material employed. Furthermore, owing to the simplicity of form of the trough-shaped members the dimensions of the same may be varied at will without changing the cost of labor, and the sheets of metal employed may be obtained commercially in practically all thicknesses and sizes at the same cost per pound. The design is moreover simple in construction and installation and the ease of manufacture and of variation of proportion permits of varying the design to meet any given set of conditions.

While several embodiments of the invention have been illustrated in the drawings, it is to be expressly understood that the invention is not limited to these embodiments, but is capable of wide variation in the number and arrangement of parts and in their relative dimensions and proportions, without departing from the spirit of the invention. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. Means for supporting a tower leg or the like, constituting a substantially trough-like metal member provided with a flange along each side thereof, means for stiffening said member including a plurality of girders attached to said flanges to prevent distortion, and means for attaching a tower leg or the like to said member and to said girders.

2. In means of the class described for supporting a tower leg or the like, a trough-like metal member opening toward the tower to be supported and having flanges extending from the walls of said trough and means for attaching a tower leg or the like to said flanges, said flanges and bottom of the trough resisting displacements of the tower and being connected by said walls to prevent spreading.

3. A trough-shaped metal footing for tower legs and the like having substantially horizontal bottom and flange portions connected by upright side portions, and means for securing a tower leg or the like both to said flange portions and to said bottom portion.

4. In means of the class described for supporting a tower leg or the like, a plurality of metal members opening toward the tower to be supported, each shaped substantially in the form of a trough having flanges at each side thereof, cross girders connected to said flanges to prevent distortion of said members and uniting the same to constitute a unitary supporting structure, and means for securing a tower leg or the like to said cross-girders.

5. A footing for a tower or the like, including an anchorage member made of a plate provided with a trough-shaped depression, a series of beams extending crosswise of said anchorage member and said trough-shaped depression therein and secured to the upper face of said anchorage member at opposite sides of said depression, and means connecting said beams to said structural elements.

6. A footing for a tower or the like comprising an anchorage member of plate material with reinforcing undulations formed therein, and a rigid foot connecting element engaging a plurality of the undulations of said member to prevent flexure of said member along the undulations.

7. A footing for a tower or the like, including an anchorage structure having a plurality of trough-shaped depressions opening upwardly and provided with substantially flat surfaces at the upper edges of said depressions, and structural members connected with said tower or the like and to which said flat surfaces are secured.

8. In a footing for a tower or the like, the combination of an anchorage structure provided with a plurality of undulations extending lengthwise of said anchorage structure to resist bending of said base structure in the direction of the length of said undulations and which anchorage structure extends substantially throughout the area of said footing, frame members which extends transversely of said undulations and which are secured to portions of said anchorage structure between said undulations, and means secured to said frame members for attaching a part of a tower to said footing.

9. A footing for a tower or the like, including an anchorage structure formed with undulations for reenforcing said structure, the surface of said anchorage structure available to resist displacement of said structure in the ground being substantially coextensive with the horizontal space occupied by said anchorage structure, and structural members cooperating with said anchorage structure and extending transversely of said undulations.

10. A footing for a tower or the like, including an anchorage structure made of plate material provided with a plurality of trough-shaped portions formed therein and extending in one direction, and structural members engaging said anchorage structure between said trough-shaped portions, and extending

transversely of the length of the trough-shaped portions thereof.

11. A footing for a tower or the like, including an anchorage structure made of plate material provided with a plurality of trough-shaped depressions, a pair of beams secured to the middle portion of said anchorage structure and extending transversely of the depressions therein, means for connecting said tower or the like to said beams, and a structural member secured near each end of said anchorage structure and extending crosswise of said depressions.

12. A footing for a tower or the like, including an anchorage structure having a plurality of trough-shaped portions, each including a base and upwardly extending side portions terminating in substantially horizontal flat portions, and structural members extending transversely of said trough-shaped portions and arranged to exert downward pressure against said horizontal flat portions.

In testimony whereof we have signed this specification.

ROBERT W. LUIPPOLD.
WILLIAM T. SPARROW.