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[54] **COLUMN BASE ASSEMBLY**

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[51] **Int. Cl.**[2] **E02D 27/42**

[58] **Field of Search** 52/294, 296, 295, 297, 52/334, 733, 403

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[57] **ABSTRACT**

A column baseplate assembly utilizing dowel members to absorb concentric loading as well as shear or moment. The dowel members transfer the stresses along substantially their entire length permitting the use of a much smaller baseplate.

6 Claims, 2 Drawing Figures

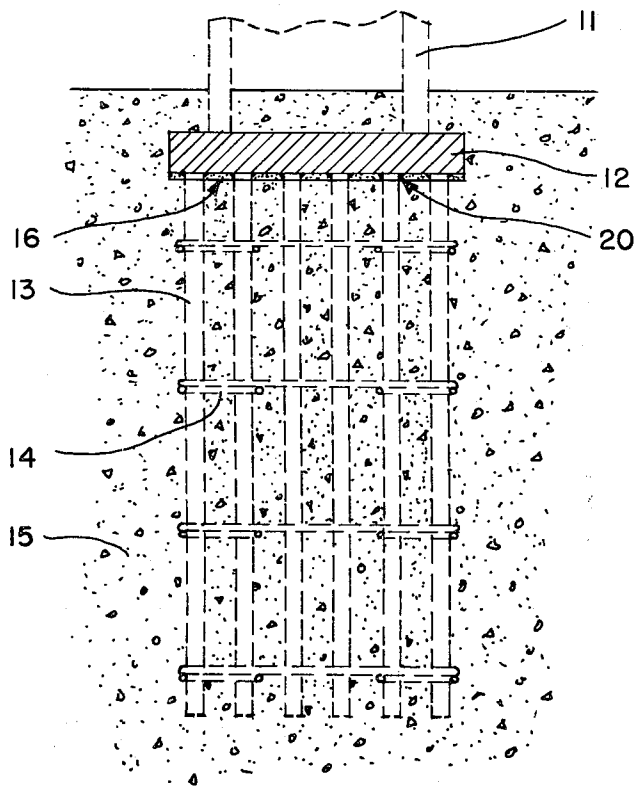


Fig. 1

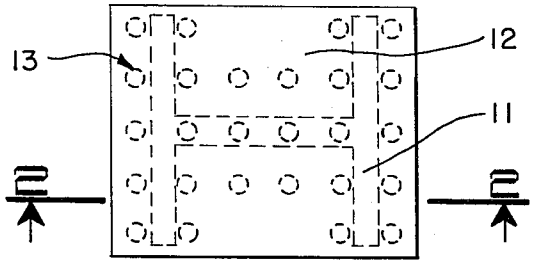
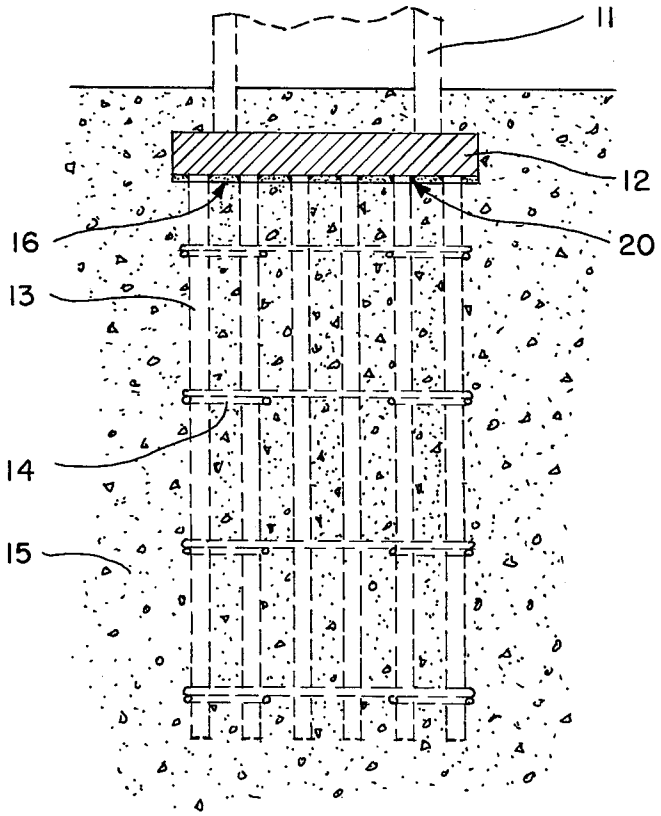


Fig. 2



COLUMN BASE ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates to a baseplate assembly which affects transfer of axial loads, shear forces and bending moments from a metal column or other structural member to the supporting concrete structure, caisson or footing with substantially greater reliability and efficiency than the conventional baseplate with anchor bolts can achieve.

The concentration of stresses into a smaller area results in a more economical baseplate of high strength steel and savings in the immediately adjacent parts of the structure. This is especially true for heavy loads, such as accumulate in columns of high rise buildings, industrial structures, supports of bridges and equipment or the like.

The capability of the baseplate assembly to transfer forces induced by earthquake or wind to the supporting concrete structure, footing or caisson is an attribute which lately has received increased recognition as to its importance by the niform Building Code, published by the International Conference of Building Officials and is a factor considered critical by insurance underwriters.

Outstanding features of this invention in comparison to the conventional baseplate with anchor bolts are, that this assembly is completely shop fabricated, designed to accommodate a desired load, shear and moment capacity and can be installed in one simple operation.

The adaptability of the assembly to special column shapes and restricted conditions is a valuable cost saving and convenient aspect distinguishing the assembly from prior art structures. Rigid frame structures benefit substantially from this very effective way of tying the framework to the concrete base structure or foundation.

With reference to the accompanying description and drawing it becomes apparent, that a great variety of arrangements are possible within the scope of the present invention enabling the designer to achieve the most effective and suitable assembly for any particular local requirement with relative ease and economy. A listing of baseplate assemblies for use with standard rolled column sections and the most common load ranges can be prepared for easy selection, ordering and fabrication. A computer program can also be made available to cover all general and special conditions for quick and accurate design and detailing of baseplate assemblies.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of the inventive baseplate assembly.

FIG. 2 is a vertical section taken along line 2—2 in FIG. 1.

DETAILED DESCRIPTION OF THE DRAWINGS

As seen in the FIGS., the inventive baseplate assembly includes a generally horizontal baseplate **12** upon the top of which is welded a vertical column **11** or other structurally equivalent member. A plurality of reinforcing bar dowels **13** have one end welded to the bottom of baseplate **12** by a fillet weld **20** and extend vertically downward therefrom. The bar dowels **13** are encased in concrete **15** and may further include bar ties **14** as required by the building code or alternatively spiral reinforcing to retard the possibility of breakage of the concrete envelope **15** in the event of a predicted bending moment or shear force. A membrane **16** is is placed below the baseplate **12** to allow vertical compression of the reinforcing bars **13** without over stressing the concrete caused by differential shortening of the dowels **13.**

The column **11** or any member supported by, but not part of the baseplate assembly becomes an integral part of the assembly, when field welded or otherwise joined to the top of the baseplate **12.** In FIGS. **1** and **2** the column **11** is indicated in phantom, not being a part of the present invention, and is shown as, but not limited to a standard rolled steel section. Any shape or size of metal column or other member may be accommodated, however, and it is important to choose the most appropriate shape for the baseplate **12** and to determine the best arrangement and placement of the reinforcing bar dowels **13** below the baseplate **12.** The dowels will be placed to take advantage of the stiffening effect this member or column **11** has on the baseplate **12.**

The use of high strength steel for the baseplate **12,** up to four inches in thickness is made possible by closely spaced reinforcing bar dowels **13** of at least **60,000** pounds per square inch yield strength and with a length necessary to transmit their design load capacity through bond to the supporting concrete **15** along substantially the entire length. The relatively large portion of load that transfers from the baseplate **12** to the dowels **13** directly is gradually dissipated to the supporting concrete **15** below and thereby avoids a concentration of stress immediately under the baseplate **12.** It is critical that this load not be in excess of that permitted by code.

The number of reinforcing bar dowels **13** required is determined by ultimate strength design method for short columns for the portion of load not transferred to the supporting concrete **15** by direct bearing under the baseplate **12.** Alternate to reinforcing bar dowels **13,** steel bars or metal shapes with bond and stress qualities equal or superior to those of the reinforcing bar dowels **13** mentioned above, capable of being attached to the baseplate **12** in a manner similar to the studweld method, will greatly facilitate manufacture of the assembly. When required by building codes closely spaced reinforcing bar ties **14** or spirals for the portion of concrete **15** enveloping said dowels **13** assure ductility of the concrete especially when large bending moments are to be accommodated.

The need for ties **14** or spirals are only nominal if ductility is assured through adequate reinforcing of the supporting concrete structure **15** in compliance with the requirements of the building code.

In applying these assumptions to the design of the assembly it becomes of greatest importance to avoid stress concentrations in the concrete **15** immediately beneath the baseplate **12.** A thin membrane **16** of low compressible strength is attached to the entire underside of the baseplate **12,** except where the reinforcing bar dowels **13** are welded. The thickness of this membrane **16** is determined by the amount of differential shortening taking place in the reinforcing bar dowels **13** and the enveloping concrete **15** as loads are applied to the assembly. All values necessary for establishing the membrane thickness are readily available. Bond length requirements for the reinforcing bar dowels **13**

and the modulus of the elasticity for the various strengths concrete **15** are available from any one of a number of publications by the American Concrete Institute. The modulus of elasticity for a typical reinforcing bar dowel is 29×10^6 psi. The load applied to the dowel **13** dissipates through uniform bond stresses along their entire length to the enveloping concrete.

This method of calculation makes certain that the reinforcing bar dowels **13** are loaded to their design capacity and that the membrane **16** compresses before the portion of load that transfers from the baseplate **12** to the concrete **15** directly, does not exceed stress limitations required by code. In order to meet the code required stress limitations the membrane must satisfy two requirements. First it must permit the reinforcing bar dowels to fully develop their compressive stress capacity and the accompanying elastic shortening. Secondly the membrane, while undergoing a thickness change equal to the elastic shortening of the rebar dowels, must develop compression stresses no greater than those permitted by code for the adjacent concrete. Many available materials such as styrofoam, paper, rubber and cloth of predictable consistency, thickness and performance when subjected to compressive forces can be used to adequately fulfill the requirements for the aforementioned membrane. As a general statement of the requirements of the membrane are that it passes the quality or characteristics of having less compression resistance and more elasticity than the supporting concrete upon which the membrane is positioned between the baseplate.

The **4** inch maximum thickness requirement for high strength steel baseplates **12** may in some instances also necessitate welding on of stiffener plates or the use of a baseplate built up from a combination of plates and/or rolled shapes to satisfy stress limitations. The stiffener plates may be welded to the top side of the baseplate **12** in combination with the column **11** unless the dual purpose of transmitting shear can be better served by welding the stiffener plates to the bottom side.

The hereinabove mentioned method of design and installation of the assembly avoids overstressing the concrete **15** or metal parts beyond values permitted by applicable codes or substantiated by test results. Development of a computer analysis in connection with a test program may result in a more economical baseplate assembly than can be realized within the present code limitations.

The use of this baseplate assembly offers considerable advantages over the conventional baseplate with anchor bolts. For heavily loaded columns a drastic reduction in steel tonnage can be realized. The top of the baseplate can be placed very close to the floor, thus shortening the column length. The assembly is relatively small in plan area and can be placed directly into the top of a caisson, concrete members or piers, eliminating the need for a concrete cap and anchor bolts. Uplift, shear and moment capacity as desired can be accommodated at little or no extra cost, a very important attribute for the frame structures, bridge and column supports, etc., in earthquake areas and high wind zones.

It is to be understood that although the present invention has been particularly described with reference to a vertical column, the principles are equally applicable to the securement of any elongated member subject to analogous stresses.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A column supporting assembly adapted to support a structural load bearing column or the like capable of withstanding vertical loads, shear forces and moment, said column supporting assembly comprising a flat relatively thick steel baseplate, said baseplate including a top, column supporting surface and a bottom surface, a plurality of steel reinforcing rods of substantial length rigidly connected in fixed position to said bottom surface and extending downwardly from said bottom surface substantially normal to said bottom surface of said baseplate, a concrete mass having a top surface area at least equal to the area of said baseplate surrounding said rods and extending below the lower ends of said rods, a relatively thin compressible membrane positioned between the bottom surface of said baseplate and the top surface of said concrete mass whereby forces exerted on said column are transmitted through said baseplate to said rods and the membrane is compressed prior to the forces being exerted on said concrete and a substantial portion of the initial force that transfers through said baseplate is gradually dissipated to the supporting concrete adjacent said rods thereby avoiding a concentration of the initial force on the concrete immediately underlying said baseplate and said membrane being formed from substances having a property of being less compression resistant and greater elasticity than the supporting concrete upon which the membrane is positioned.

2. A column assembly as in claim **1** wherein said membrane is formed from styrofoam.

3. A column assembly as in claim **1** wherein said membrane is formed from paper.

4. A column assembly as in claim **1** wherein said membrane is formed from rubber.

5. A column assembly as in claim **1** wherein said membrane is formed from cloth.

6. A column supporting assembly as in claim **1** wherein said steel reinforcing rods are interconnected by steel tie members at vertically spaced positions along the length of said reinforcing rods.

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