

H. FLAD.

Improvement in Bridges.

No. 132,271.

Patented Oct. 15, 1872.

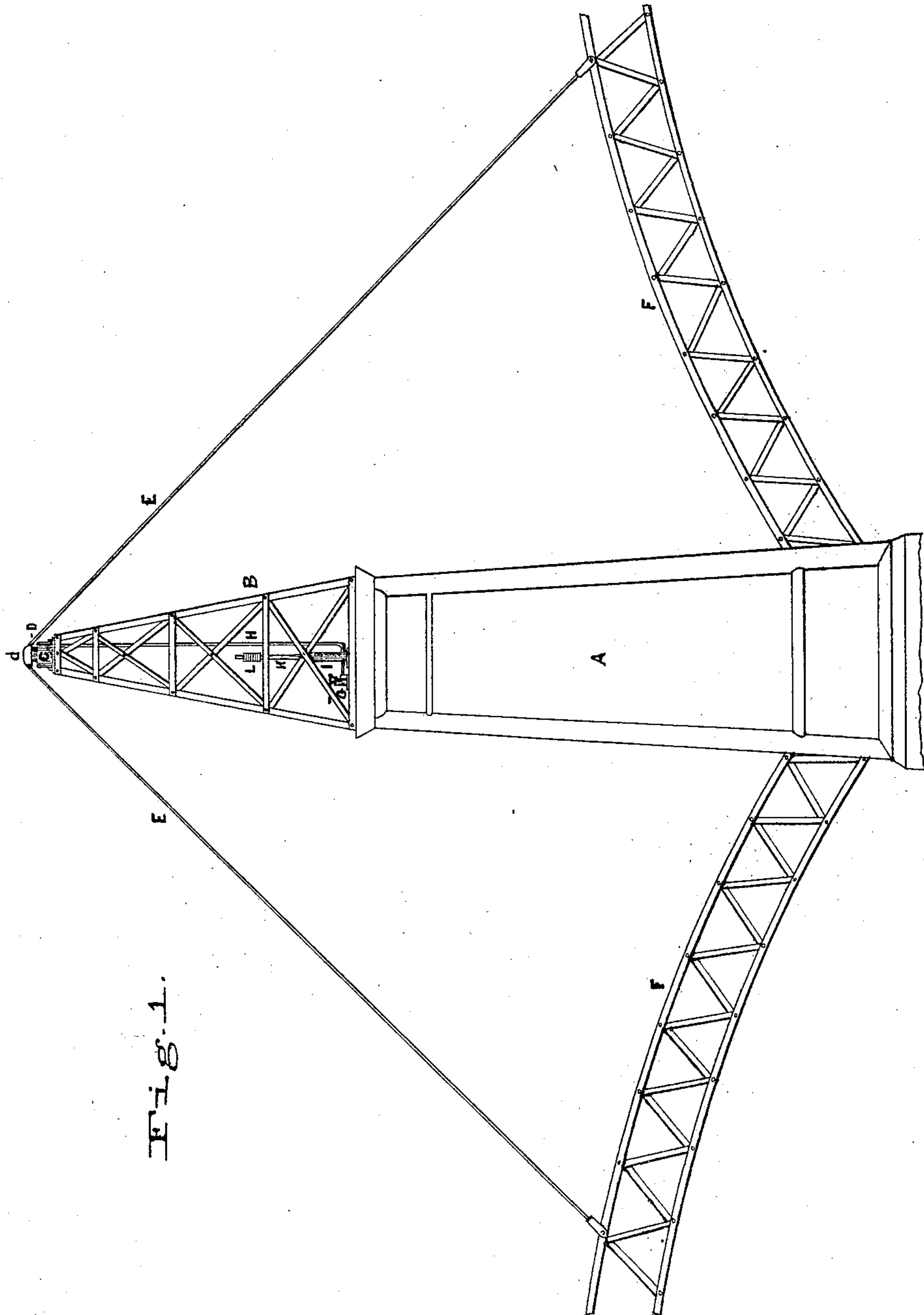


Fig. 1.

ATTEST.

Walter Allen  
W. H. Pearce

INVENTOR.

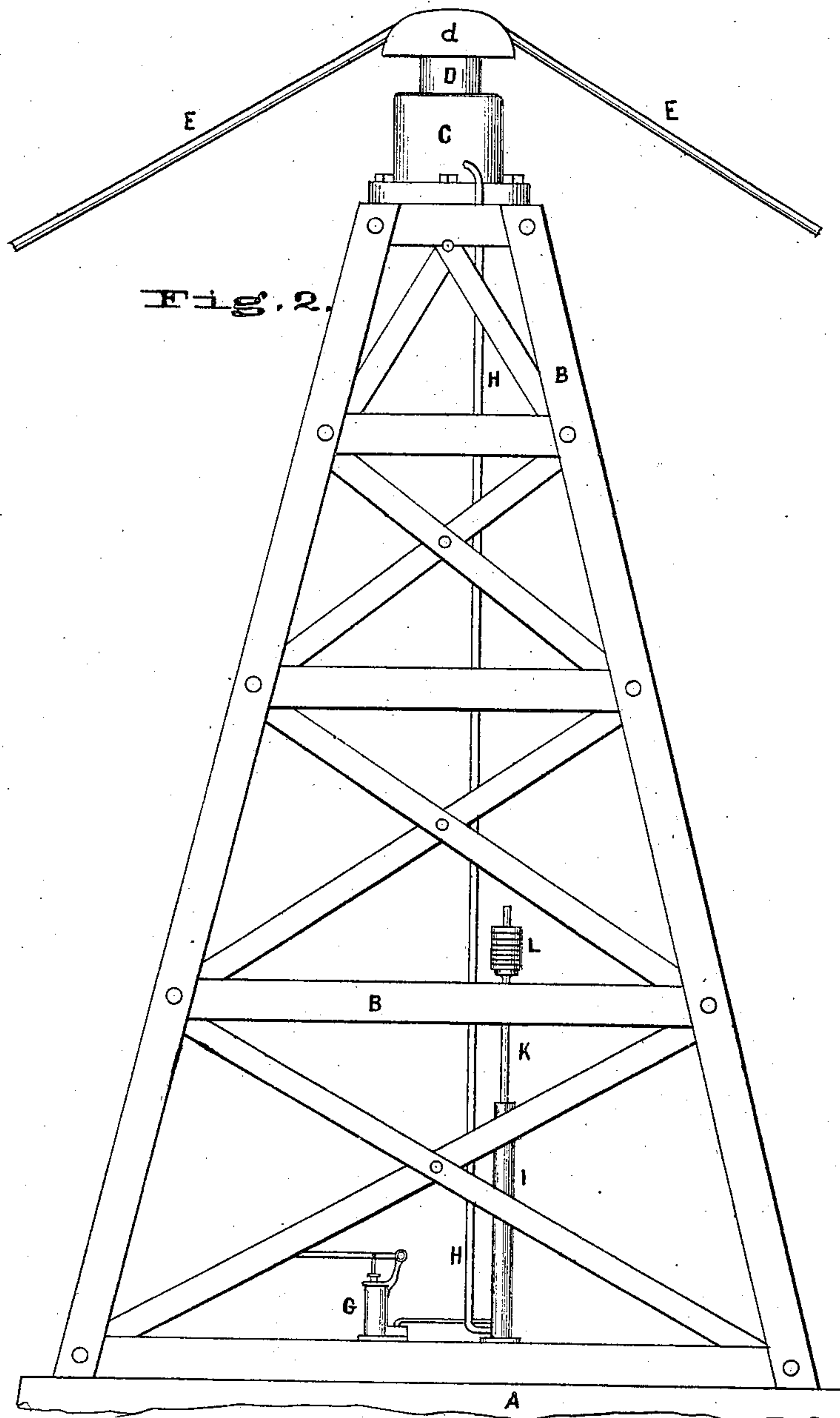
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# UNITED STATES PATENT OFFICE.

HENRY FLAD, OF ST. LOUIS, MISSOURI.

## IMPROVEMENT IN BRIDGES.

Specification forming part of Letters Patent No. 132,271, dated October 15, 1872.

*To all whom it may concern:*

Be it known that I, HENRY FLAD, of the city and county of St. Louis and State of Missouri, have invented a certain Improvement in Bridges, of which the following is a specification:

My invention consists in the combination, with a hydraulic jack or jacks, of a smaller jack or ram whose cylinder is in communication with the cylinder of the larger jacks and whose plunger is weighted so as to keep a regular pressure beneath the plungers of the principal jacks during changes in elevation of the same, resulting from the expansion and contraction of metallic parts of the bridge and guys from changes of temperature.

Figure 1 illustrates, in side elevation, my improvement. Fig. 2 is an enlarged side view of the hydraulic jacks or rams and supporting tower or frame.

A is the upper part of a bridge-pier, on which is erected a frame or tower, B. C is a hydraulic jack, of which there may be one or more, according to the width of the bridge; but in most cases several jacks would be used, connected by a small pipe, to equalize the pressure in the cylinders. The rams may be placed beneath the frame B, instead of upon the same. The heads *d* of the plungers D, when in the position shown, are formed to support the guys E without injury to the latter. The ends of the guys are attached to the portions F of the arches. G is a force-pump, forcing the liquid (which may be water, glycerine, oil, or other suitable material) into the cylinders of the jacks through a pipe, H. I is a hydraulic ram whose cylinder is in communication with the cylinder C, and whose plunger K has a very small diameter compared to the plungers D of the jacks C, so that a small weight, L, placed upon the plunger K counterbalances a great weight upon the plungers D. Supposing the diameter of the plunger D to be twenty times that of the plunger K, then one hundred pounds on the plunger K would balance a downward strain of forty thousand pounds on the plunger D. The relative vertical movements of the plungers D and K would be in inverse ratio to their sectional areas, so that, although the movement of the plungers D would not be great, the movement or play of the plunger K should be several feet, and it should be kept near mid-stroke by the use of the force-pump and waste-cock. By making the liquid-chambers of the jacks C of a certain capacity, de-

termined by the proportion and material of the parts of the bridge, frame, and guys, the displacement of parts from changes of temperature may be counteracted. Supposing the pier to be of stone and the frame or tower B of wood, the expansion and contraction of these parts from changes of temperature would be very small in comparison with that of the metallic guys; but, as the expansibility of the liquid under heat is many times as great as that of metal, then by making the liquid-chamber of the proper capacity (compared with the other parts) the unequal expansion of the parts would be counteracted, the greater expansion and contraction of the liquid making up for the lesser expansion and contraction of the stone and wood. Of course in positions where the liquid would be reduced to a temperature below a certain point—say 45° or 50°—the temperature of greatest density of water being 30°, water could not be used in the jacks and depended on to counteract the unequal expansion and contraction in the manner last described; and in such cases oil, glycerine, &c., may be used.

Any number of guys may be used, extending to different points of the arch, and posts may be erected at the points of attachment of any of the guys, over which pass secondary guys from a point near or at the skew-back to a point beyond the post.

The main object of my improvement is to keep the strain or lifting force of the jacks equal under all changes of temperature.

The orifice by which the pipe H communicates with the chambers of the jacks C would be small in size, to prevent vibration extending from the liquid in the chambers to the liquid outside the same.

My improvement is applicable in a permanent form to suspension and compound suspension and truss bridges where the truss or carriage-way is of less thermo-expansible material than the cables.

I claim as my invention—

1. In combination with the portions F of a bridge, the guys E and hydraulic jacks C D, arranged substantially as and for the purpose set forth.

2. In combination with a principal jack, C D, the counterpoise jack I K, substantially as and for the purpose described.

HENRY FLAD.

Witnesses:

SAML. KNIGHT,  
OSCAR SCHULZ.