No. 659,967. Patented Oct. 16, 1900.

L. G. HALLBERG.

FOUNDATION.

(Application filed Dec. 14, 1896.)

(No Model.) 2 Sheets—Sheet 1.

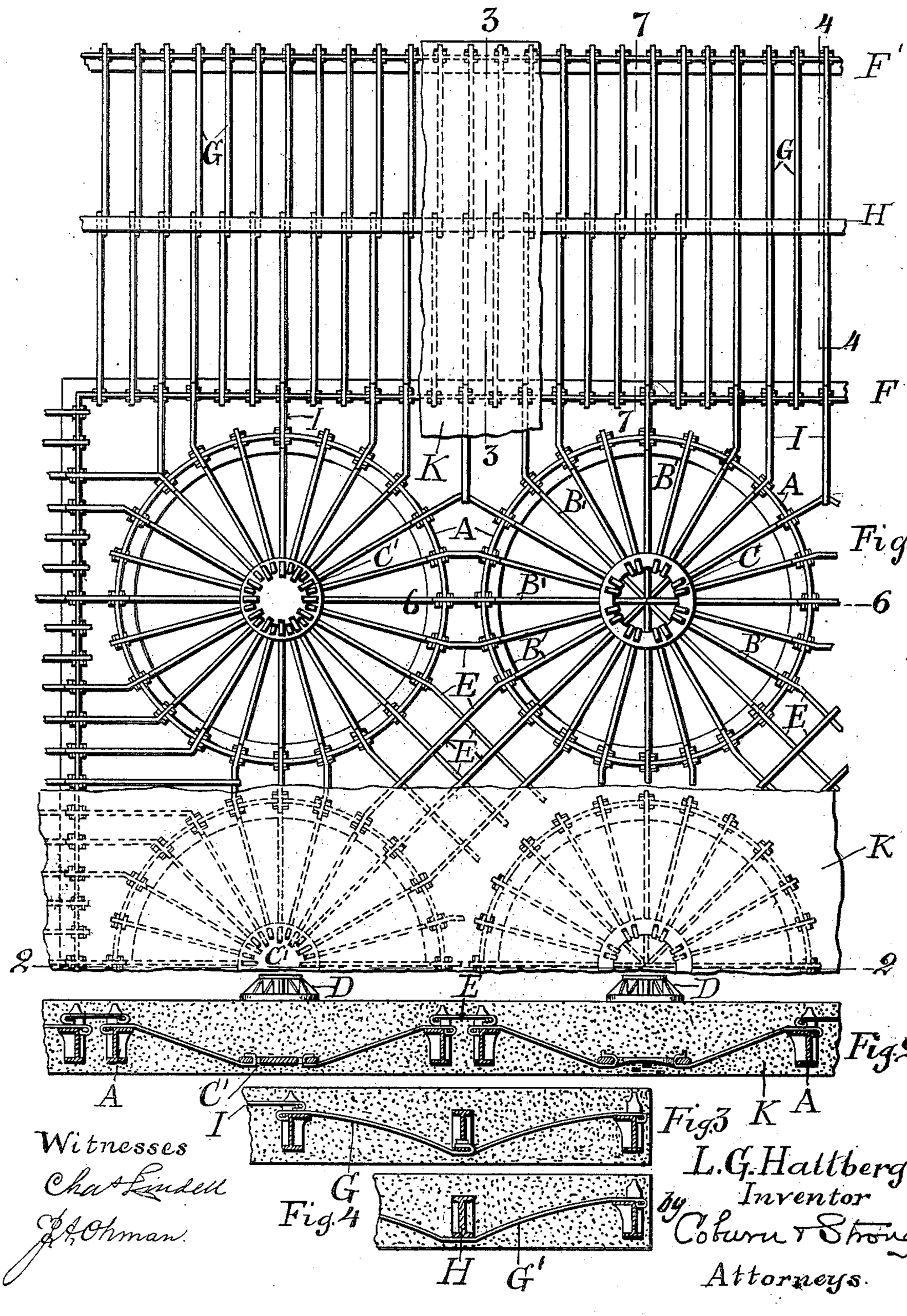

Fig. 1

Fig. 2

Fig. 3

Fig. 4

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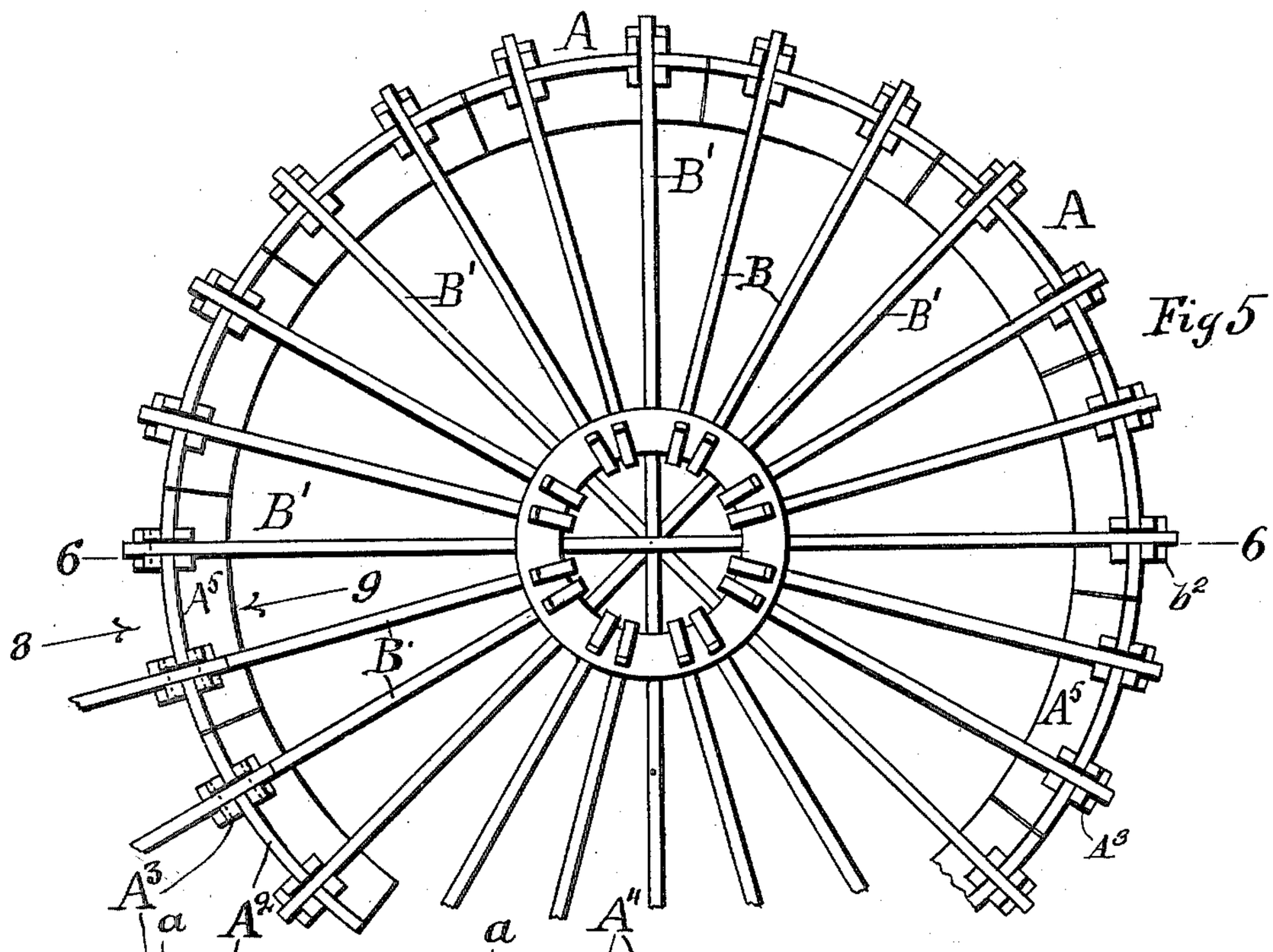

Fig 5

Fig 8

Fig 9

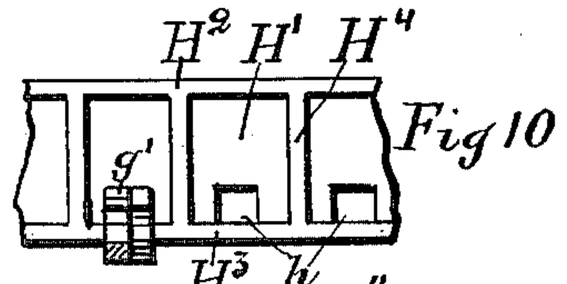

Fig 10

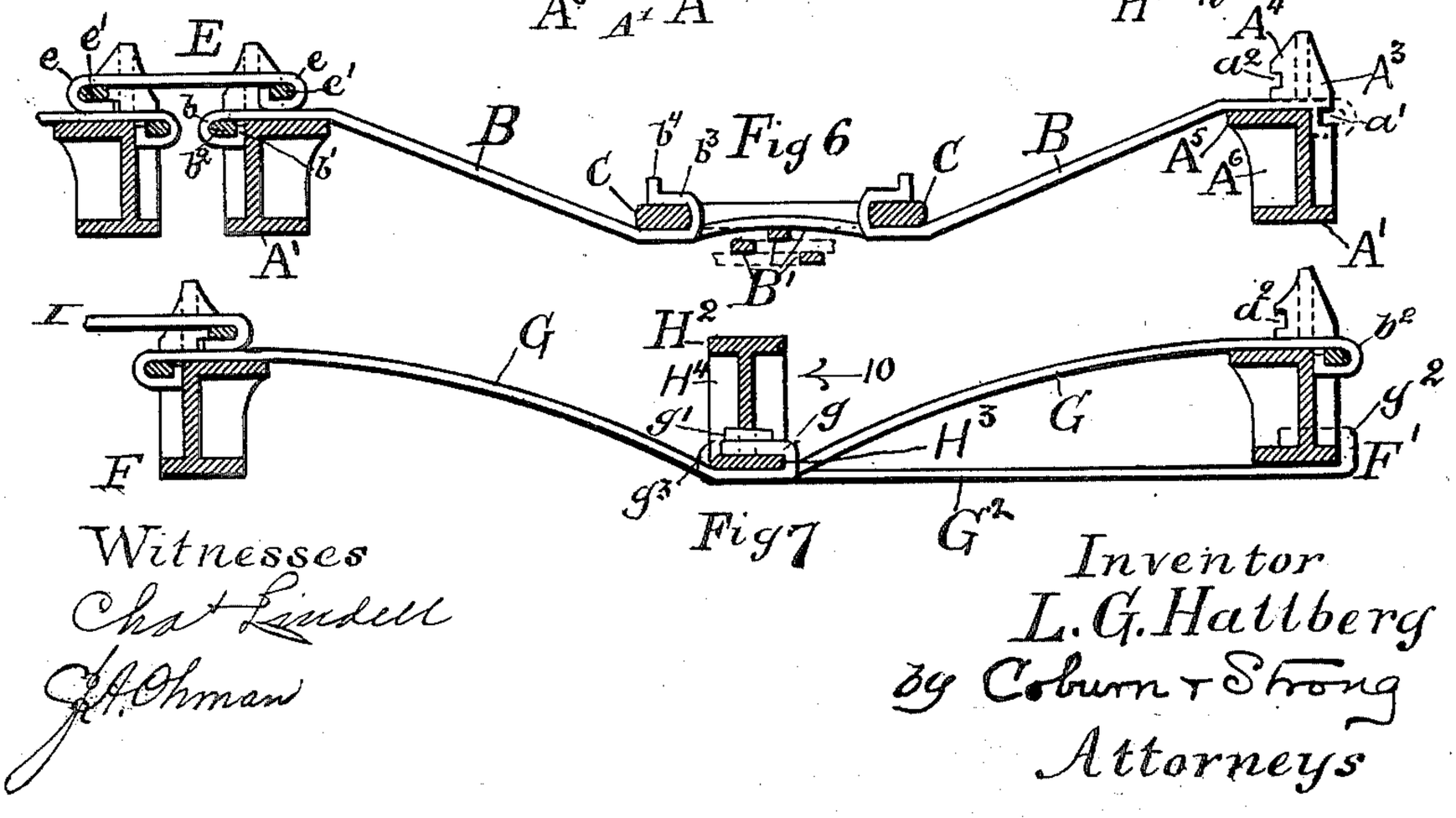

Fig 6

Fig 7

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UNITED STATES PATENT OFFICE.

LAWRENCE GUSTAV HALLBERG, OF CHICAGO, ILLINOIS.

FOUNDATION.

SPECIFICATION forming part of Letters Patent No. 659,967, dated October 16, 1900.

Application filed December 14, 1896. Serial No. 615,701. (No model.)

To all whom it may concern:

Be it known that I, LAWRENCE GUSTAV HALLBERG, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Foundations, which is fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of a part of a foundation structure, showing the metal framework of the foundations for two columns and portions thereof for two other columns and for a portion of a wall, parts of said framework being shown filled in with concrete. Fig. 2 is a vertical section on the line 2 2 of Fig. 1. Fig. 3 is a vertical section on the line 3 3 of Fig. 1. Fig. 4 is a vertical section on the line 4 4 of Fig. 1. Fig. 5 is an enlarged plan view of the metal framework of a foundation for a column. Fig. 6 is a vertical section on the line 6 6 of Fig. 5. Fig. 7 is a vertical section on the line 7 7 of Fig. 1 enlarged. Fig. 8 is an outside elevation of a circular anchor-section in the direction of the arrow 8 in Fig. 5. Fig. 9 is an inside elevation of a circular anchor-section in the direction of the arrow 9 in Fig. 5. Fig. 10 is a side elevation of a portion of the central base shown in section in Fig. 7 in the direction of the arrow 10 in said figure.

My invention relates to foundation structures, and has for its object to form piers adapted to support the columns and side walls of buildings, particularly in the case of office buildings and the like. Hitherto such piers have been, according to the present most approved form of construction, made by superimposing several layers of steel rails, I-beams, or other equivalent metal parts, the rails of each layer being disposed transversely to those below, and by embedding this metal framework in a mass of concrete. This construction has proved an exceedingly-expensive one from the amount of metal required, and the concrete mass is to such an extent divided up by the several layers of rails as to diminish greatly its resistance to downward pressure at any one point on the pier. According to my invention the rails, beams, &c., of the foundation structures above described are replaced by a system of suspension-rods, which extend outward and upward from the point of load and the ends of which are secured to suitable anchors. This metal framework is then embedded in a mass of concrete. By this construction, which utilizes the tensile strength of the metal in the suspension-rods as a substitute for the resistance to transverse strain of the rails previously used, the same load-carrying capacity may be obtained by the employment of a small fraction of the amount of metal heretofore requisite.

My invention further consists in more or less specific constructions by which the said invention is adapted to the support of walls and of columns.

Referring to the drawings by letter, A represents a circular sectional anchor for the attachment of the outer and upper ends of the suspension-rods of one of the column-piers. This anchor A, I have shown to consist of a series of curved sections A^0. Each such section comprises, in the main, a bottom horizontal flange A′ and an upright body or web A^2, the said web being provided with vertical slots *a*, extending part way down from the upper edge thereof. On each side of each slot *a* there is formed on the outer surface of the web a rib or flange A^3, extending downward to the bottom flange. On the inner side of the web A^2, and on each side of each of the slots *a* is formed a rib or flange A^4, similar to A^3, but extending downward only to the bottom of the slot *a*. Each anchor-section is further provided with a horizontal flange A^5 upon its inner side about midway thereof and below the slots *a*, and this flange A^5 is strengthened and supported by the brackets A^6 from the body of the anchor. The ribs A^3 are provided with the notches *a*′ and the ribs A^4 with the notches a^2.

As hereinabove stated, the anchor A is intended for the attachment and support of the outer ends of the suspension-rods of a column-pier. The suspension-rods B are secured to anchor-sections, as particularly illustrated in Fig. 6, by forming on the end of such suspension-rod a hook *b*, the extreme end of which is further bent, as at *b*′. The outer portion of the suspension-rod extends across the flange A^5 of the anchor and outward through the slot *a*. A pin b^2 is inserted through the hook or loop *b* in the end of the

suspension-rod and is itself caught and held from turning by the notches a'. When the suspension-rod is under stress, the pin b^2 is drawn the more tightly against the turned-up ends b' of the said rod, pressing the same against the body of the anchor and the more firmly binding the rod and preventing its disengagement from its anchor by anything short of fracture under tensile strain.

At the center of the circular space inclosed by the anchor is placed a base, to which the inner and lower ends of some or of all of the suspension-rods are secured. In the construction particularly illustrated in Figs. 5 and 6 I show such base to consist of a metal ring or collar C. The inner ends of the suspension-rods are hooked, as at b^3, about the collar, and thereby secured thereto. The extreme inner ends may be turned upwardly, as at b^4, these projecting tips engaging with the surrounding concrete and further binding the ends of the rods with the collars.

In place of the collar C, I may use a flat plate C', provided with perforations adapted to receive the inner ends of the suspension-rods in a similar manner. Furthermore, instead of hooking all of the suspension-rods at their inner and lower ends to such central base I may extend certain ones of the said rods diametrically across from the surrounding anchor upon one side to that on the other, as in the case of the rods B'. These rods will at their point of crossing be superimposed one upon another and will be all beneath the central base. Finally, the suspension-rods B may extend in a straight line from the inner base to the outer anchor, as shown in Figs. 2 and 6, or the said rods may be disposed to take a catenary upward curve as they extend outward and upward from the base, as in the case of the similar rods G and G'. (Shown in Figs. 3, 4, and 7.) This curve should be upward from the base, since for purposes of calculation the building and its supports are considered reversed, the earth is reckoned as the uniform load, and the points at which the weight of the structure bears upon the foundation are considered as the points of support. This form and arrangement of the suspension-rods will thus give the maximum carrying capacity to the piers.

I have thus described a complete metal framework or skeleton for the pier of a single column. In laying the foundations for a building numerous such piers will of course be employed, one for each principal supporting-column, the shoe D of each such column being placed vertically above the central base of each such pier skeleton. These several skeletons may be preferably, though not necessarily, joined together by tie-rods E, each such tie-rod being hooked at its ends, as at e, and secured to the anchor portions of the said skeletons by being passed through the slots a and held by a pin e' engaging with the hook e and with the notches a^2. Each of the skeletons is thus by this cross-bracing connected with and receives support from all of the surrounding skeletons. Each completed pier for one column is strengthened by those of the columns adjacent.

I shall now describe the adaptation of my invention to a foundation for a wall of the building.

A suitable distance apart I arrange two parallel anchors F and F', which may be either integral throughout their length or made up of sections, the said anchors being substantially similar to those shown in connection with the column-piers, except that in that case they are circular, whereas in the wall-piers they are preferably straight and extend the length of the wall. A cross-section of the wall-pier anchor, as shown in Fig. 7, is substantially identical with that of the column-pier anchor, as shown in Fig. 6. The suspension-rods G, the outer and upper ends of which are supported from the said anchors F and F', are secured thereto in the same manner as are the suspension-rods B to their respective anchors. As a central base, to which the inner and lower ends of a portion or all of the rods G are secured, I preferably employ a casting H, disposed midway between the two anchors F and F' and parallel thereto, the said casting comprising a central vertical web H', upper and lower horizontal flanges H^2 and H^3, and vertical ribs H^4, arranged at intervals. The web H' is provided at intervals near its lower edge with perforations h immediately above the flange H^3. The inner and lower ends of the suspension-rods are secured to this central base by forming them into hooks g, the extreme ends of which after passing under the lower flange H^3 extend through the perforations h and are held fast therein by wedges g'. Instead of securing the inner and lower ends of the suspension-rods to such a base I may merely pass the rods underneath such a base, securing the two opposite ends to opposite anchors F and F', respectively, this construction being particularly illustrated in the case of the rods G' in Fig. 4. Again, the rods may either extend in a straight line from the base to the anchor on either side, as in the case of the similar rods B, (shown in Fig. 6,) or may take the inverted catenary curve, as shown in Figs. 3, 4, and 7, the latter form giving a maximum of carrying capacity to the said rods, as before stated. In order to prevent the lower end of such anchor as F' from being thrown outward by the inward tension upon the upper portion of said anchor, and thus to enable me to employ a less depth of cement, I may employ tie-rods, such as G^2, (shown in Fig. 7,) which are hooked, as at g^2, or otherwise adapted to be secured to the lower portion of the anchor F' and are similarly hooked at g^3 or otherwise secured to the central base H. These brace-rods G^2 are more particularly adapted for anchors which lie near to the outer edge of the cement mass. When one pier is inclosed by

and integral with the surrounding piers, there is the less necessity for such brace-rods. Finally, such brace-rods are equally adapted to a column-pier, such as shown in Fig. 5, or to a wall-pier, as shown in Fig. 4. The metal framework or skeleton for the wall-piers may preferably be connected with the skeletons of the column-piers by tie-rods I, similar to the tie-rods E, such tie-rods I being secured to the anchors of the wall and column piers in the manner described with respect of the tie-rods E. The entire metal framework is now filled in with concrete K of a suitable depth. The concrete having hardened, the shoes D of the columns are placed thereon vertically over the bases C or C′ of the column-pier. The walls are built directly upon the concrete vertically above the central base H of the wall-pier.

I have shown the several column-piers and a portion of a wall-pier all united and together forming a single foundation structure. It is obvious, however, that such a column-pier or such a wall-pier may be used separately wherever desirable, and even when several of either one or both are employed for the foundations of a single building they need not necessarily be interconnected in the manner shown.

It will further be obvious that many changes in detail may be made without departing from the spirit of my invention, as hereinabove stated, the arrangement of the suspension-rods may vary, and so may the form of the anchors and bases. As one particularly obvious change, the base C of the column-pier may be made of the same form in cross-section as the base H of the wall-pier. I do not limit myself, therefore, to the particular form shown and specifically described; but

What I claim, and desire to secure by Letters Patent, is—

1. In a foundation, a framework comprising a series of suspension-rods, extending outwardly from the point of load; a central base supported by said framework; and anchors to which the outer ends of said suspension-rods are secured; in combination with a cementitious mass in which the said framework is embedded.

2. In a foundation, a framework comprising a series of suspension-rods, extending outwardly from the point of load; a central base at the said point of load to which the inner ends of a portion of said suspension-rods are secured; and anchors to which the outer ends of the said suspension-rods are secured; in combination with a cementitious mass in which the said framework is embedded.

3. In a foundation, a framework comprising a series of sagged suspension-rods extending outwardly and upwardly from the point of load; a central base located at the said point of load to which the inner ends of the said suspension-rods are secured; and anchors to which the outer ends of the said suspension-rods are secured; in combination with a cementitious mass in which the said framework is embedded.

4. In a foundation, a framework comprising a series of suspension-rods radiating outwardly from the point of load; a central base; and anchors to which the outer ends of said suspension-rods are secured; in combination with a cementitious mass in which the said framework is embedded.

5. In a foundation, a framework comprising a series of suspension-rods, radiating outwardly from the point of load; a central base at the said point of load to which the inner ends of a portion of said suspension-rods are secured; and anchors to which the outer ends of the said suspension-rods are secured; in combination with a cementitious mass in which the said framework is embedded.

6. In a foundation, a framework comprising a series of sagged suspension-rods radiating outwardly and upwardly from the point of load; a central base located at the said point of load to which the inner ends of the said suspension-rods are secured; and anchors to which the outer ends of the said suspension-rods are secured; in combination with a cementitious mass in which the said framework is embedded.

7. In a foundation, a framework comprising a series of sagged suspension-rods B B′; a central base C to which the inner ends of a portion of the said rods are secured; and a surrounding anchor A to which the outer ends of the suspension-rods are secured.

8. In a foundation, a framework comprising a central base C; suspension-rods B B′; and a surrounding circular anchor A, consisting of the segmental parts A^0.

9. In a foundation, an anchor A comprising a series of segmental parts A^0, each consisting of flanges A′, A^2, A^5 and provided with ribs A^3 and slots *a* adapted to receive the ends of suspension-rods B.

10. In a foundation, an anchor A comprising the flanges A′, A^2, A^5 and provided with the slots *a* and the ribs A^3 formed with notches *a′*; in combination with a suspension-rod B, looped as at *b*, and held by the pin b^2 seated in the notches *a′*.

11. In a foundation, piers for column-supports each comprising a series of suspension-rods radiating outwardly from the point of load, and inclosing anchors to which the outer ends of the suspension-rods are secured; in combination with the piers for the walls each comprising a series of suspension-rods disposed in parallel order, extending outwardly and upwardly from the point of load, and anchors to which the outer ends of the said suspension-rods are secured.

12. In a foundation, piers for column-supports each comprising a series of suspension-rods radiating outwardly from the point of load, and inclosing anchors to which the outer ends of the suspension-rods are secured; in combination with the piers for the walls each comprising a series of suspension-rods

disposed in parallel order, extending outwardly and upwardly from the point of load, and anchors to which the outer ends of the said suspension-rods are secured; tie-rods interconnecting the several pier frameworks; and a cementitious mass in which the entire foundation is embedded.

13. In a foundation, a framework comprising a series of suspension-rods extending outwardly from the point of load; a central base located at the said point of load, to which the inner ends of the said suspension-rods are secured; anchors to which the outer ends of the said suspension-rods are secured; and horizontally-disposed brace-rods connecting the base with the lower edges of the anchors, in combination with a cementitious mass in which the said framework is embedded.

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