P. HOLMBERG.

REINFORCED CONCRETE STRUCTURE.

APPLICATION FILED NOV. 23, 1908.

1,024,852.

Patented Apr. 30, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

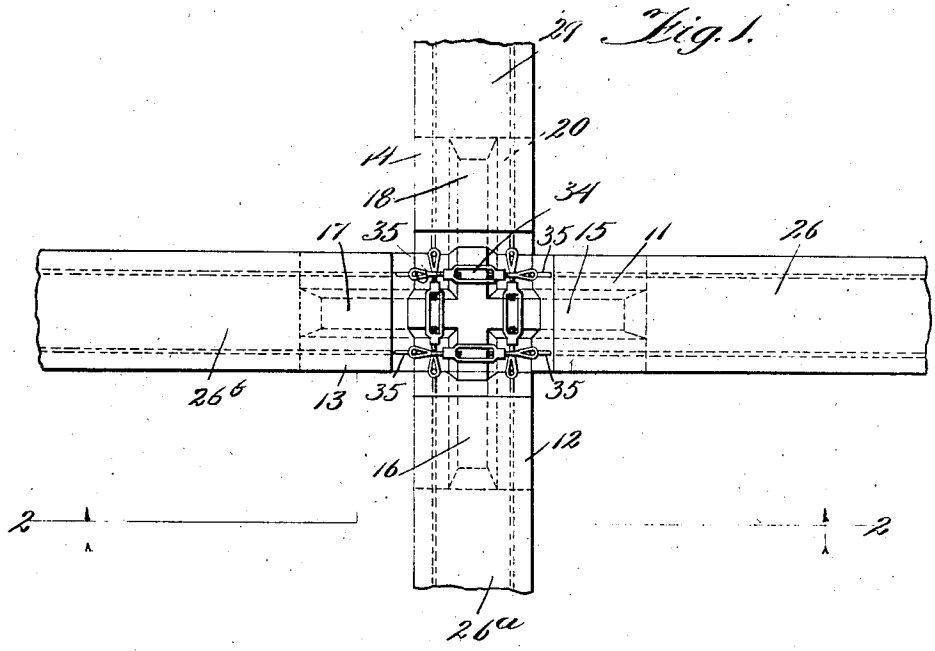
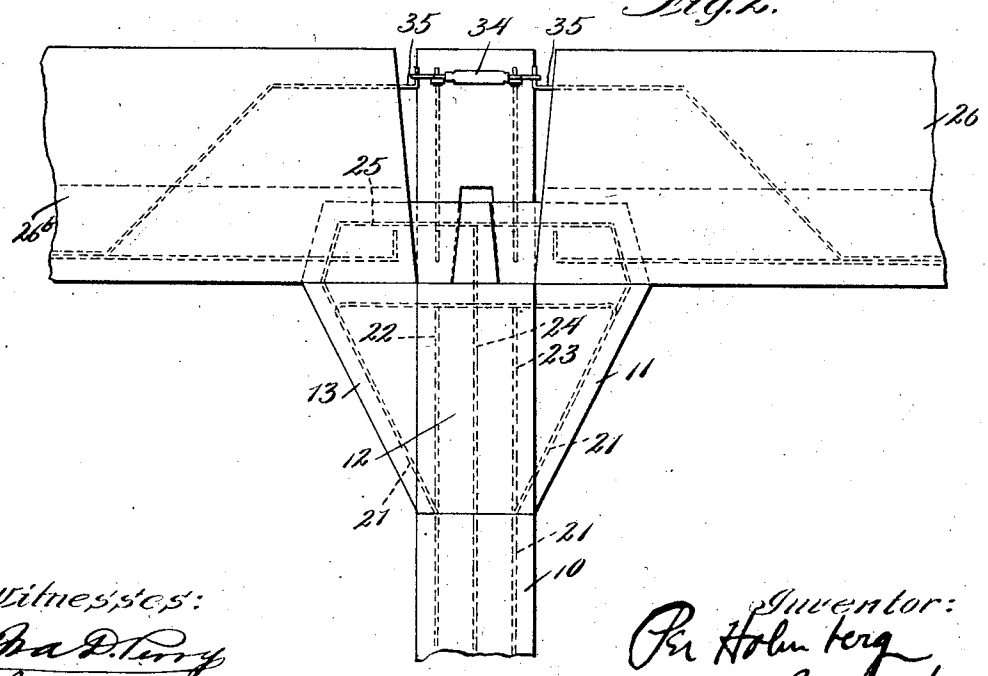


Fig. 2.



Witnesses:

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2 SHEETS—SHEET 2.

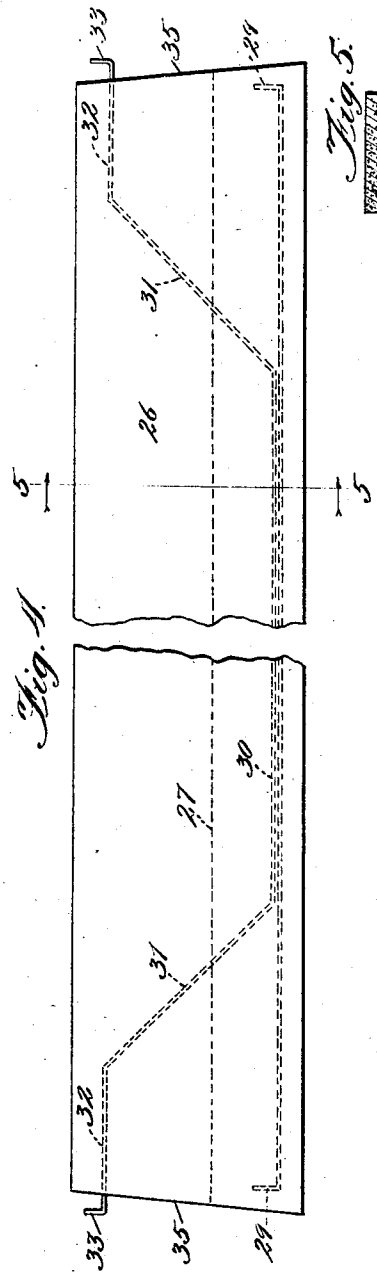

Fig. 4.

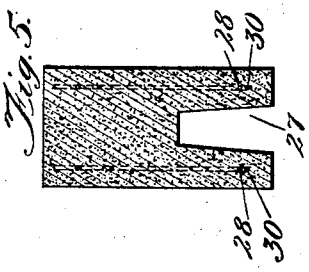

Fig. 5.

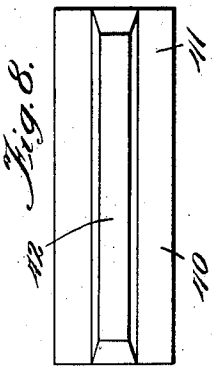

Fig. 8.

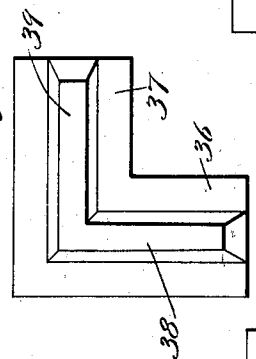

Fig. 7.

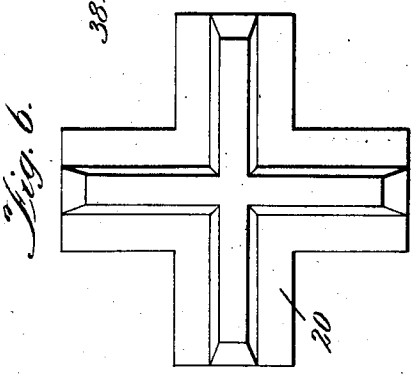

Fig. 6.

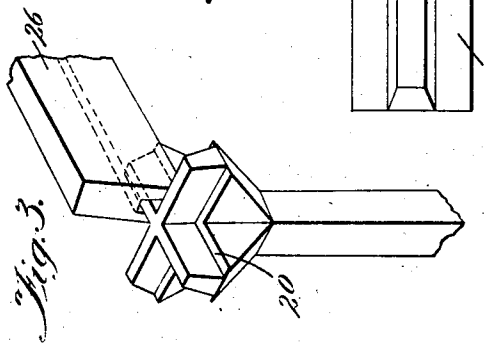

Fig. 3.

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REINFORCED CONCRETE STRUCTURE.

1,024,852. Specification of Letters Patent. Patented Apr. 30, 1912.

Application filed November 23, 1908. Serial No. 464,079.

To all whom it may concern:

Be it known that I, PER HOLMBERG, a subject of the King of Sweden, residing at Glencoe, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Reinforced Concrete Structures, of which the following is a specification.

My invention relates to reinforced concrete construction, comprising upright and transverse members, and has for its object to provide a novel and useful improvement in the forms and constructions of such members, in the arrangements of the metal reinforcements and in the means for securing the parts of the structure together.

More particularly, the invention has for one of its principal objects to provide an upright support or pillar, having an upstanding rib or ribs on the top, which ribs are carried by corbels or the like; the ribs and corbels affording means for securely seating the supported member or members on the top of the pillar.

Another object of the invention is to provide a new and improved construction in reinforced concrete beams, constructed in such form and with the reinforcements arranged in such a manner as to obtain a maximum of strength with a minimum of weight and bulk; and which, if desired, will fit over the ribs on pillars of the sort above-mentioned.

The invention has for another object to provide means for securing beams, of the character described, together upon a pillar of the character described, so that these parts of the structure are held against displacement and so that the strains of the structure are properly distributed; and the transverse members may be adjusted as may be desired with relation to each other, and then united in an integral structure.

These and such other objects as will be described in the specification and particularly set forth in the claims are attained by the constructions constituting typical embodiments of my invention, which are illustrated in the accompanying drawings, wherein—

Figure 1 is a plan view of a construction in which four beams are seated upon a four-way pillar. Fig. 2 is a sectional elevation taken on line 2—2 of Fig. 1, looking in the direction of the arrows. Fig. 3 is a detail of this construction in perspective and on a smaller scale. Fig. 4 is a side elevation of a beam, illustrating one of the features of my invention. Fig. 5 is a section taken on line 5—5 of Fig. 4, looking in the direction of the arrows. Fig. 6 is a plan view of the pillar shown in the preceding figures; and Figs. 7 and 8 are plan views of pillars of modified construction.

Like characters of reference indicate like parts throughout the several figures of the drawings.

Referring to Figs. 1 to 6 inclusive, 10 represents a pillar made of concrete and of any desired dimensions and cross section. The pillar is provided at the top with the corbels 11, 12, 13 and 14, arranged at right angles. These corbels are provided with ribs 15, 16, 17 and 18 respectively, which are preferably in the form of truncated pyramids or wedges, the bases of which are narrower than the tops of the corbels, so as to leave ledges 20 at each side of the ribs. The pillar is preferably reinforced by metal rods or the like, which extend up through the corbels and ribs. For example, in Fig. 2 I have shown a rod 21 which extends up through the pillar on one side through corbel 13, the top of pillar 10, through corbel 11, and down on the other side of the pillar. A similar reinforcing rod runs through the other side of the pillar and these corbels, the corresponding rods for corbel 12 being shown at 22 and 23. Up the middle of the sides of the pillar are reinforcing rods which run through the corbels between the other pair of rods and through the corresponding ribs. 24 represents the rod running through ribs 16 and 18, and 25 represents the rod running through ribs 15 and 17. Other means of reinforcing the pillar might be employed.

The beam constructed in accordance with my invention is shown at 26, in Figs. 4 and 5. The beam consists of a body part 26, recessed or channeled, as at 27, on its lower face. The channel preferably corresponds generally in shape to the ribs on the pillar, so that the beam may seat on the pillar over one of its ribs. The beam is reinforced by the rods 28, the ends of which are preferably bent at 29 so as to anchor in the cement; and by the rods 30 which run along close to rods 29 through the greater part of the length of the beam, but which at the

ends are bent so as to form the diagonally disposed parts 31 and the horizontal parts 32, the latter preferably projecting from the ends of the beam and being so formed at 33 as to permit of connection with the corresponding reinforcements of adjacent beams, preferably by means of turn buckles or other tension adjusting means. The channeling of the beam permits it to seat over the ribs on the pillar or similar supporting devices. The principal object, however, of the channeling or other recessing of the beam is to lighten the same by dispensing with as much of the bulk of the beam as possible without impairing its strength. Concrete has comparatively little tensile strength, but great strength to resist compression. When the beam is supported at each end, it is obvious that the weight of the beam and of any load which it may carry tends to compress longitudinally the upper part of the beam and to pull apart the material in the lower part, the strain being, of course, greatest at the center of the beam. A line could be plotted in accordance with the particular dimensions of the beam made up of points above which the strains are strains of compression and below which the strains are such as to pull the material of the beam apart. A straight line run parallel to the top and bottom of the beam and approximating the curved line as nearly as possible will represent the neutral axis of the beam above which it may be said, though not with perfect accuracy, that the strains are of compression and below which they are strains of tension. Concrete having very little tensile strength, it is clear that the concrete forming the lower part of the beam is of very little use. For this reason the reinforcing rods which have great tensile strength are run through the lower part of the beam as near to the bottom as possible. These reinforcements take care of the tensile strains and the concrete in the lower part of the beam being practically useless in resisting tension, my invention contemplates dispensing with as much of the concrete in the lower part of the beam as is possible. I, therefore, recess the under side of the beam, as, for example, by the channel 27, which channel preferably extends to the neutral axis of the beam, or substantially so, leaving just enough concrete on the sides to cover and anchor the reinforcing rods in and to form a reliable seat for the beam on its supporting devices, or to properly protect the reinforcing rods from fire. The recess I have shown has a straight channel with somewhat sloping sides. Any other method of recessing of the beam might be employed.

The ends of four beams 26, 27, 28 and 29, similar to the beam above described, are shown in Figs. 1 and 2 as supported upon a pillar and secured together. I have used for this purpose ordinary turn buckles 34, provided with loops 35 which extend over the bent ends 33 of reinforcing rods 31, so as to secure together the corresponding reinforcing rods of diametrically arranged beams. Other tension adjusting devices may be used. When the turn buckles are turned up to a proper tension, the space between the ends of the beams may be filled with grout or other cementitious filler.

The tension strains on the beam are greatest at the center and diminish gradually toward the ends of the beams. Where these tensional strains are greatest I preferably have two or more pairs of reinforcing rods which lie close together and preferably close to the lower edges of the beams.

When a beam is supported as above described, there will also be strains diagonally downward and inward from the upper corners of the beams. These strains will tend to displace the upper corners of the beam. It is to take care of this that one or more pairs of reinforcing rods 30 is run up diagonally through the ends of the beam and provided with means by which they can be anchored. When two beams are placed end to end, this anchoring may be accomplished by connecting together reinforcing rods in the diametrically arranged beams in the manner described. Preferably the ends of the beams are oblique to their upper and lower surfaces, as shown at 35. The lower edges of the ends of the beam will, therefore, abut against the beams standing at right angles in the four-way construction shown in the first two figures. The beams at the top will stand apart so as to permit the turn buckles to be manipulated and the reinforcing rods 30 to be put under such tension as is necessary.

In Fig. 7 I have shown a pillar provided with two corbels 36 and 37 at right angles to each other and provided with the two ribs 38 and 39, respectively. A different form of two-way pillars is shown in Fig. 8, in which the corbels 41 are diametrically arranged and support the single rib 42.

It will be observed that in erecting a building embodying my invention the beams will be supported on the pillars and held against transverse displacement by the ribs, as described. The corbels will take the place of the ordinary knee bracing in the other forms of construction, and the channels in the beams will, in the aggregate, reduce the weight of the structure by many tons, thereby lessening the weight on the foundations and the strains on the structure itself. When one course of beams has been laid in position on the pillars and bedded in fresh grout or concrete, which is spread over the ribs and which fills the space left between the tops of the ribs and the bottoms of the channels in the beams, turn buckles,

or other tension adjusting devices, which connect the ends of the beams to each other will be tightened until each of the beams is under the desired tension and at the desired level. The space between the adjacent ends of beams will then be filled with concrete or grout, with the result that the beams will become so connected with each other and with the pillars as to form an integral structure. It will be observed that the ribs not only hold the beams against transverse displacement, but aid in forming a solid, integral connection between the beams and the pillars, while the corbels not only serve all the functions of knee bracing, but they permit such elongation of the ribs as to make a more secure, integral connection between the different members of the structure. In this manner I am enabled to erect an integral, reinforced, concrete structure or frame-work, as may be desired, while at the same time, providing tension adjusting means whereby the strains may be properly distributed and adjusted before the different members of the structure are united in one integral whole. Incidentally the channeled structure of beam may be utilized in upright position to receive slabs of concrete or the like, which will be slid into the channels, the channels in the opposite upright beams being arranged to face each other, thereby forming a wall, fencing or the like. When so used, the channels may desirably be formed on opposite faces of the upright members, so that the wall or fence may be continued indefinitely.

I do not limit myself to the particular construction and device arranged as shown, as modifications might be devised which would come within my invention as defined by the claims. Neither do I limit myself to the use of all of the above described improvements and devices in any single construction, as such devices might obviously be separately employed.

I claim:

1. A concrete pillar formed with a corbel on the upper end thereof and with a rib extending along the upper face of said corbel and the top of said pillar, and shoulders adjacent to said rib and parallel with the longitudinal axis thereof, said pillar being provided with metal reinforcement extending into said corbel and said rib.

2. In a concrete construction the combination with a concrete supporting device provided with integral ribs, said ribs having reinforcing rods embedded therein, of concrete beams which are channeled on their under surfaces so as to fit over said ribs, said beams provided with longitudinal reinforcing rods sagged in the center and projecting from the ends of said beams near the top and means within the space between the ends of opposed beams for connecting together the corresponding rods of said beams.

3. In a concrete construction the combination with a concrete pillar provided on top with integral intersecting concrete ribs, of metal reinforcements in said pillar and ribs, concrete beams channeled and supported end to end on said pillar over said ribs so as to abut said intersecting ribs, reinforcing rods which run longitudinally through said beams and project from the ends of the same near the top, and means arranged in the space between said beams for connecting together corresponding rods of opposed beams.

4. In a concrete construction the combination with a concrete pillar provided at its upper end with integral corbels and integral ribs on said corbels, of reinforcing rods which run through said pillar, corbels and ribs, concrete beams which are channeled so as to be supported on said corbels over said ribs, reinforcing rods running longitudinally through said beams and projecting from the ends thereof, and means for connecting together corresponding rods of opposed beams.

5. In a concrete construction the combination with a concrete pillar provided at its upper end with integral corbels and integral ribs on said corbels, of reinforcing rods which run through said pillar, corbels and ribs, concrete beams which are channeled so as to be supported on said corbels over said ribs, reinforcing rods running longitudinally through said beams, projecting therefrom near the top and provided with engaging hooks, and turn buckles arranged in the space between the ends of the beams which connect together corresponding rods of opposed beams.

6. In a concrete construction the combination with a concrete pillar provided with integral corbels and integral ribs on the upper surface of said corbels, of metal reinforcements which extend through said pillar, corbels and ribs, concrete beams which are channeled substantially to the neutral axes of the beam, said beams extending over said ribs so as to be supported upon said corbels, reinforcing rods in the beams which run longitudinally through the tension sections of the beams on each side of the channel and extend upwardly through the ends of the beams and project therefrom, and adjustable tension devices for connecting corresponding rods of opposed beams.

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Witnesses:
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