(No Model.)

# P. M. BRUNER.

## ARCH OR BEAM.

No. 356,703. Patented Jan. 25, 1887.

Fig. 1.

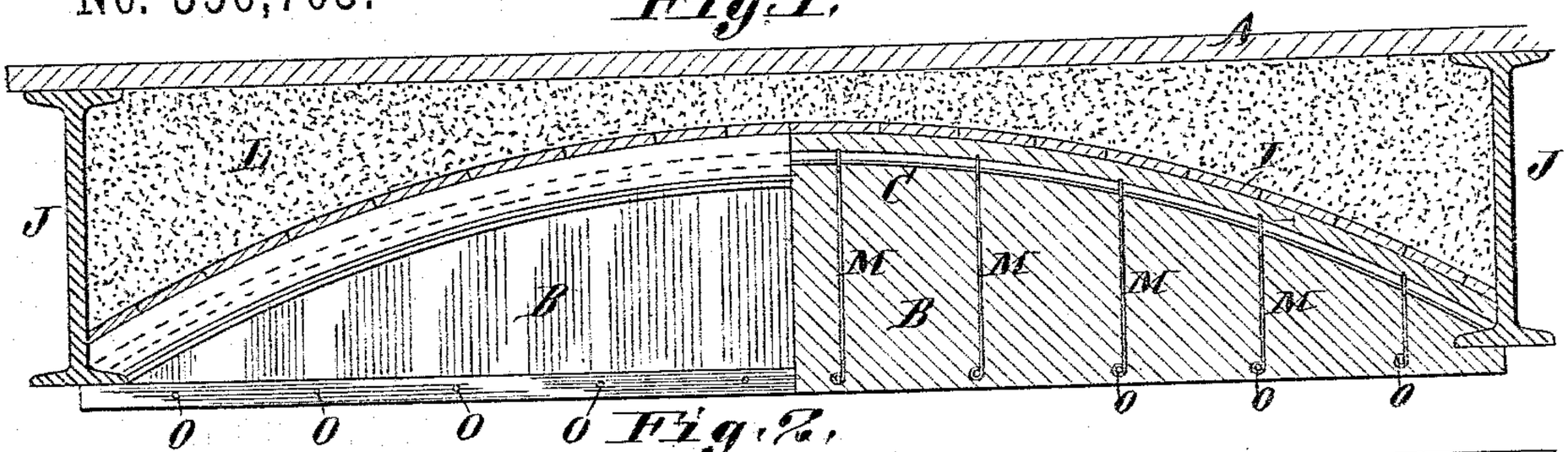



Fig. 2.

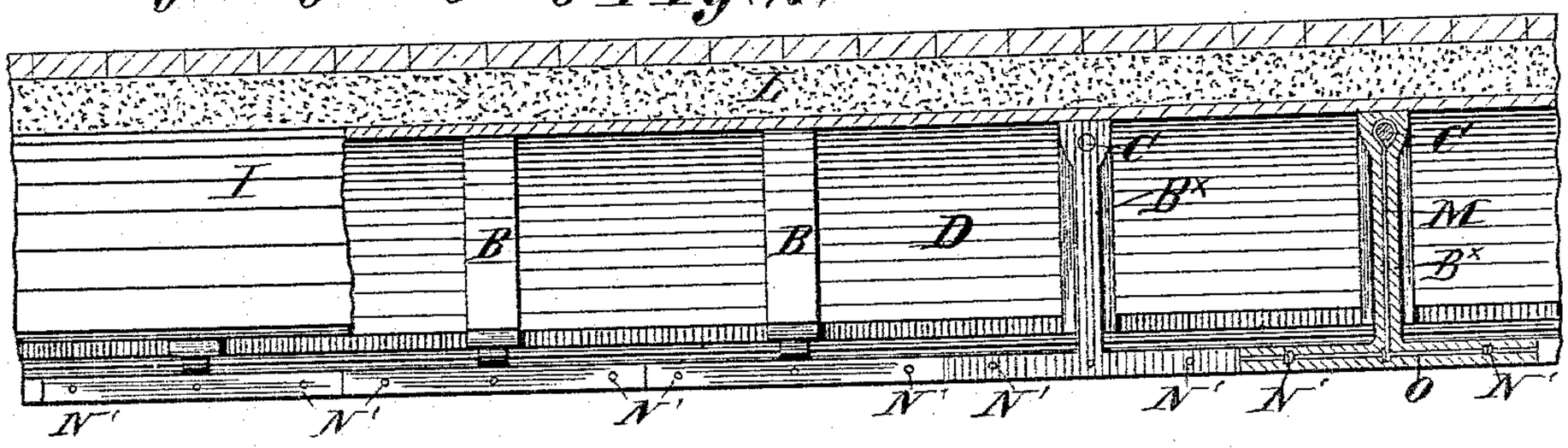



Fig. 3.

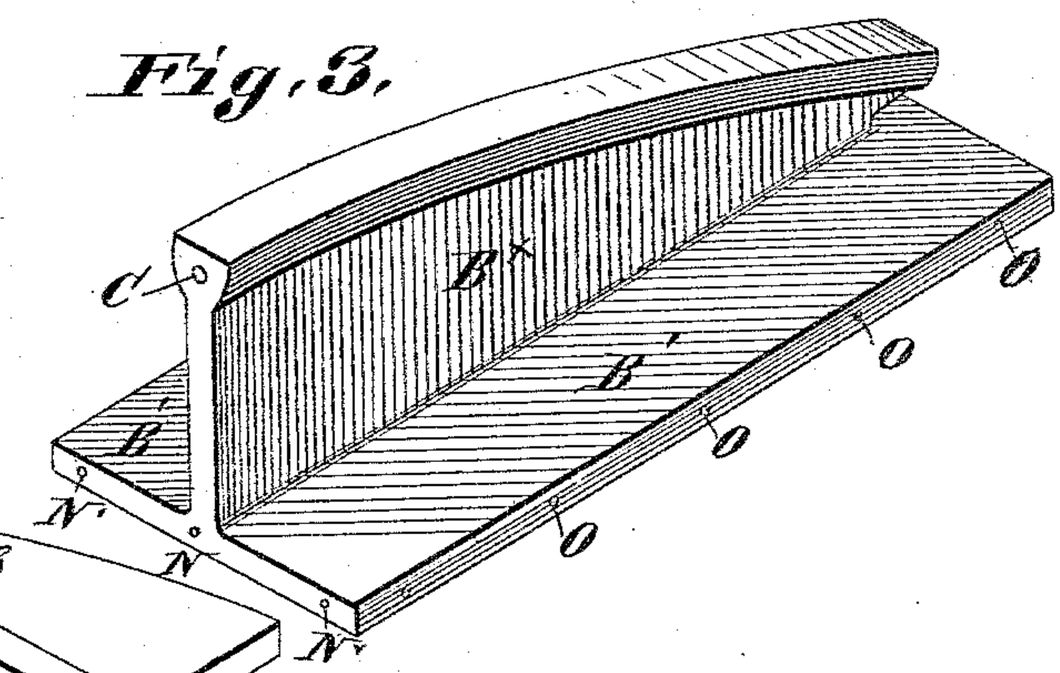



Fig. 4.

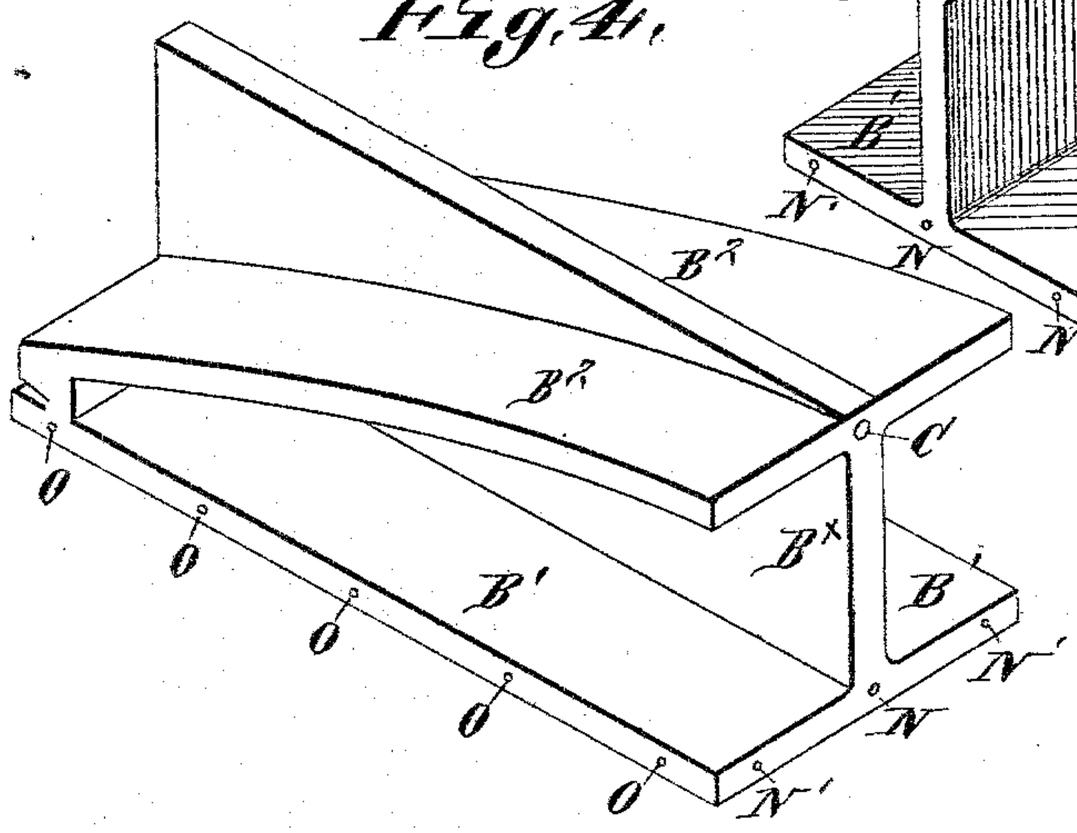
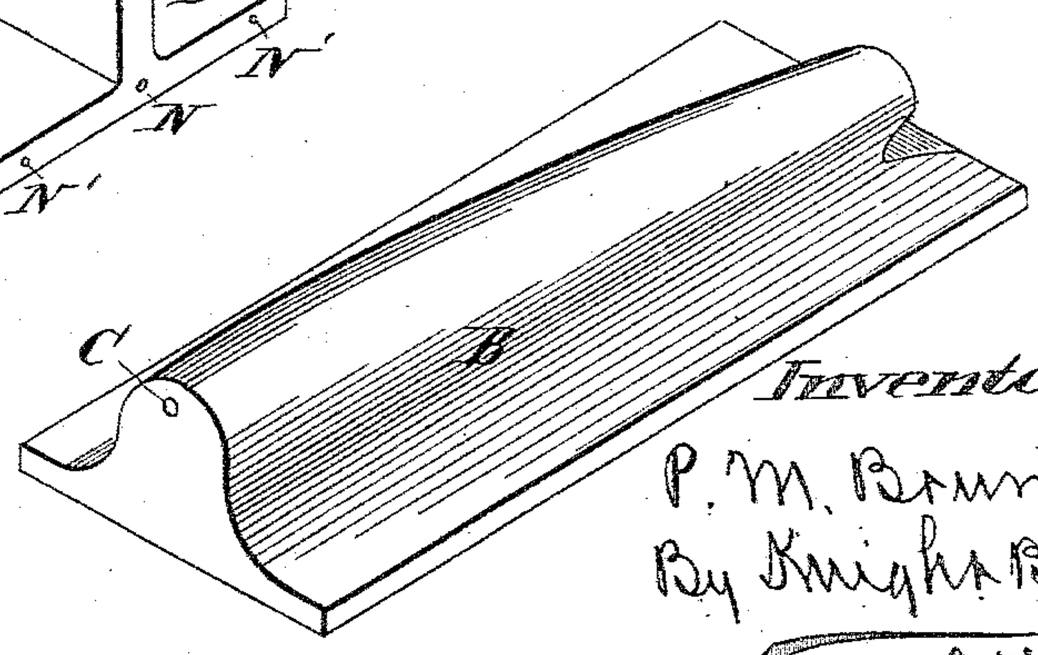



Fig. 5.




Attest:
F. A. Hopkins.
Geo. L. Wheelock.

Inventor:
P. M. Bruner
By Knights Bros
Attys

# UNITED STATES PATENT OFFICE.

PRESTON M. BRUNER, OF ST. LOUIS, MISSOURI.

## ARCH OR BEAM.

SPECIFICATION forming part of Letters Patent No. 356,703, dated January 25, 1887.

Application filed January 12, 1886. Serial No. 188,280. (No model.)

*To all whom it may concern:*

Be it known that I, PRESTON M. BRUNER, of the city of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Arches or Beams, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a detail vertical section through the floor and ceiling of a building or other structure. Fig. 2 is a similar view taken crosswise of the arches. Fig. 3 is a detail perspective view of part of one of the arches. Figs. 4 and 5 are similar views, showing modified forms.

My invention relates to an improved arch or beam, intended more particularly for use in fire-proof buildings, but which may be used in other buildings and in the constructions of bridges, &c.; and my invention consists in features of novelty hereinafter fully described, and pointed out in the claims.

Referring to the drawings, A represents the floor of a building, and B represents my improved arch or beam. This arch or beam is made of concrete cast with an iron rod, C, in its upper part, as shown. This arch or beam may be made of a single part or member extending from one to the other of the two adjacent I-beams J; but I prefer to form it of two sections, such as represented in the drawings, each bearing at one end against the other and at the other end against one of the beams J. The extremities of the rods C are exposed, so that in case the arch is formed in two sections the rods of the two sections will come end to end and form practically a single compression member bearing at its extremities against the beams J.

The arches are put in place between the I-beams J with their base-flanges B′ touching, as shown in Fig. 2, thin boards or strips I being then placed from one to the other, so as to bridge over the spaces D between the vertical portions or webs $B^{\times}$ and form a support for the concrete L, which is placed over the arches, thus forming a continuous even surface for the flooring A; or, instead of these boards or strips being used, the part B of the arch could be formed, as shown in Fig. 4, with wings or extensions $B^{2}$, that would bridge the space D between the vertical parts $B^{\times}$ of the arches in the same manner as the boards, and which would form a base or support for the concrete.

The spaces D, which extend transversely to the length of the beams J, are very important, as they effect a saving of material and a reduction in the weight of the structure.

The action of the rod C is to aid in sustaining by its resistance to endwise compression the strains to which the arch is subjected.

I am aware that it has been proposed to cast within the lower part of the arch a rod which is designed to aid in sustaining by its tensile strength the loads to which the arch is subjected. There are, however, certain objections to this latter arrangement, owing, principally, to the rod becoming heated in cases of fire and expanding or stretching, thus weakening the arch; but these objections are entirely overcome where the rod is placed in the upper part of the arch, as I have shown.

It is well known, of course, that the resistance of concrete to strains of compression is many times greater than its resistance to strains of tension, and therefore it has been the practice, as above stated, to place these rods in the lower parts of the arch to add to the tensile strength of the arch. With my arrangement, however, I accomplish this by placing the rod in the upper part of the arch, for it will be understood that in order for the arch to expand at bottom the rod will first have to be compressed lengthwise, it being held from bending laterally by the concrete in which it is embedded.

The cement adheres to the rod, and for the arch to be compressed the iron itself would have to be compressed lengthwise, and this is as practically impossible as it is to elongate or stretch the rod lengthwise. Therefore I claim that the rod placed in the upper part of the arch adds as much to the strength of the arch by its resistance to endwise compression as it would were it placed in the bottom of the arch, where it would add to the tensile strain.

When a strain is brought upon the arch, there might be a tendency for the rod C to break upward through the cement, as it is located near the top of the arch, as shown. To avoid all danger of this, I suspend from the rod C vertical wires M, that are cast in the

concrete, and around which the concrete will cling and prevent any upward movement of the rod, as stated. These wires M may be connected at their lower ends, if desired, by a longitudinal wire, N, as shown in Figs. 2, 3, and 4, and this wire N and wires N′, cast in the part B′ of the arch, may be connected by transverse wires O, as shown. The object of this is to hold the arch together in case the concrete should become cracked or broken, so that if the arch should be cracked it will be held together by these wires or rods.

The base-flanges B′ could be dispensed with, and then a beam would be formed having all the qualities of the arch, as described.

In the modification shown in Fig. 5 the vertical part of the arch is made rounding on top, so that there are no corners to be broken off before the floor is put down, which makes this form of an arch particularly useful in certain instances.

I claim as my invention—

1. An arch formed of concrete with a vertical part or web, B×, and a base-flange, B′, and having embedded therein a rod, C, at the upper part of the web B, rods O in the base running transversely to the rod C, and wires M, connecting the rods C and O, substantially as and for the purpose set forth.

2. An arch formed of concrete with a vertical part or web, B×, and a base-flange, B′, and having embedded therein rods C and N, located, respectively, at the upper and lower part of the web B, wires M, connecting the rods C and N, rods N′, running through the base parallel with the rod N, and rods O, extending through the base transversely to the rods N and N′ and connected therewith, substantially as set forth.

3. A ceiling formed of concrete arches, with boards or strips between the vertical parts of the arches, and cement over the arches, as specified.

4. The combination, with the beams J, of the arches or beams B, supported at their ends by said beams J, and having the base-flanges B′, and the boards or strips for bridging the spaces D between the beams B, substantially as set forth.

PRESTON M. BRUNER.

In presence of—
GEO. H. KNIGHT,
J. E. KNIGHT.