Jan. 21, 1936. R. K. O. SAHLBERG 2,028,169

COMPOSITE BEAM

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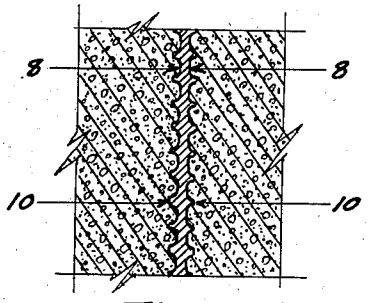


Fig. 2

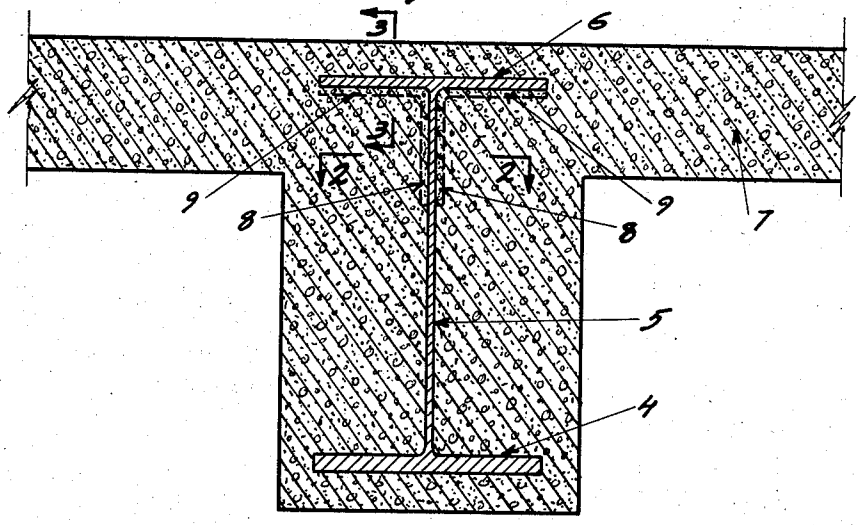


Fig. 1

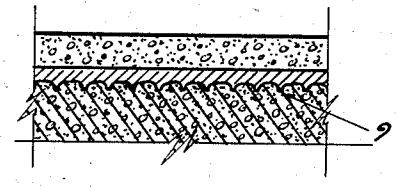


Fig. 3

INVENTOR.
Rolf K. O. Sahlberg
BY
Franz L. Ager
ATTORNEY

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COMPOSITE BEAM

Rolf K. O. Sahlberg, New York, N. Y.

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7 Claims. (Cl. 72—61)

This invention relates to a beam construction composed of a steel beam roller or otherwise fabricated, acting, together with a concrete or other slab resting on the steel beam and bonded to the same, with sufficient rigidity as to restrain the shear stresses developed from the load. The concrete or other slab together with the steel area above the neutral axis of the composite beam forms the zone of compression of the composite beam.

More especially, my invention relates to beams in which the concrete or other slab constitutes the floor when the composite members are spaced in accordance with load and span.

My improved composite beam is not limited to the use of a concrete slab carried by the steel beam, but may be used in connection with slabs or plates or other materials capable of restraining compressive stresses. Therefore, in referring in the following description to concrete slabs, I intend to include in that expression slabs of other material which may be used in place of concrete.

Floor constructions having steel beams as load bearing members and a concrete slab transmitting the load to said beams are at the present time designed in such a manner that the stresses in the steel beams shall balance the bending moment without any helpful effect from the concrete slab between the beams. No helpful effect can be secured, because no provision is made to secure a sufficiently rigid connection between the steel beams and the concrete slab as is the case with my improved beam.

By sufficiently bonding the concrete slab to the steel beam so that the slab will be forced to deform in the same proportion as the top flange, as I will hereinafter describe, considerable saving in steel can be obtained. In this way the zone of compression will be composed of the steel area above the neutral axis of the composite beam, in addition to the area of the concrete slab between the steel beams, as compared to only the steel area alone, as with present constructions.

The main object of my improved composite beam is to secure the connection between the concrete slab and the top part of the steel beam with sufficient rigidity as to develop the same deformation in the concrete slab as in the steel in compression.

In order that my invention may be better understood, attention is directed to the accompanying drawing forming a part hereof, and in which

Figure 1 is a cross section of one form of my composite beam illustrating one arrangement by which the concrete slab and the top part of the steel beam are connected together;

Figure 2 is a horizontal cross sectional view on the line 2—2 on Figure 1;

Figure 3 is a vertical cross sectional view on the line 3—3 of Figure 1.

The composite beam shown in Figure 1 consists of a rolled steel I-beam with upper and lower flanges, 6 and 4 respectively, of unequal area and with a continuous integral web 5 and a concrete slab 7. On both sides of the upper part of the web 5 are a series of parallel grooves 8, and on the lower surface of the top flange 6 are a series of parallel grooves 9. These grooves are separated by intermediate projections 10 integral with the steel beam. In Figure 1, the series of grooves are shown on the top part of the steel beam, which I consider to be the preferred arrangement but these grooves can be placed also on the lower part of the steel beam. The size and construction form of the grooves 8 and 9 can be varied and is not confined to the type shown in Figures 2 and 3. The concrete slab 7 is shown broken, the actual width of the slab taking part in the composite section is wider. The steel beams are spaced apart sufficient distance to carry the load, such spacing depending on the size of the beam, the span, and the load to be carried.

With the arrangement of the composite beam above illustrated, I make use of the concrete slab as part of the zone in compression for resisting bending moments. By doing this, a considerable saving in steel is effected because the steel area in the top flange has only to be designed to carry the weight of the concrete slab. In consequence, the saving of steel in this part of the composite beam, as compared to a regular beam, is in the same proportion as the weight of the concrete slab to the total load.

Furthermore, an additional saving of steel in the bottom flange is obtained, owing to the fact that the level arm between the tension member and the neutral axis of my improved composite beam is in percentage considerably greater than with the regular steel beam. The saving of steel in the bottom flange is in proportion to these level arms.

My improved beams may be manufactured in such a manner that the steel beam comprising the top and bottom flanges with a connecting web is provided with a camber. By that I mean that the beam is slightly curved and when the beam is placed on the job, the apex of the curve extends upward. This precamber is very small, only a

fraction of an inch, and is so chosen that the weight of the concrete slab and beam will develop a deflection of the steel beam equal to the precamber. In this manner the steel beam will be straight and even when the concrete slab has hardened.

It is understood that the forms of my invention herein shown and described are merely representative, and that the various changes in the shape and arrangement of parts may be resorted to without departing from the spirit of the invention and the scope of the case.

Having now described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

1. An improved composite beam supported at its ends and comprising a steel member with tension and compression members, an intermediate web for resisting vertical bending moments, and a slab for resisting compressive stresses, embedding the steel member in compression and anchored to the steel member by means of a series of projections integral with the steel member, with sufficient rigidity as to form, in cooperation with said compression member, the zone in compression of the composite beam.

2. An improved composite beam as recited in claim 1, the slab referred to being composed of concrete.

3. An improved beam as recited in claim 1, the series of projections referred to running on each side of the upper part of the web.

4. An improved composite beam as recited in claim 1, the series of projections referred to running on the under side of the top flange.

5. An improved composite beam as recited in claim 1, the series of projections referred to running on each side of the upper part of the web and on the under side of the top flange.

6. An improved composite beam as recited in claim 1, the steel member referred to having an I-section.

7. An improved composite beam as recited in claim 1, the steel member referred to having an I-section with the area of the tension flange bigger than the area of the compression flange.

ROLF K. O. SAHLBERG.