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R. L. MILK

2,680,259

SELF-LUBRICATING BEARING FOR HEAVY LOADS

Filed June 4, 1951

Fig. 1.

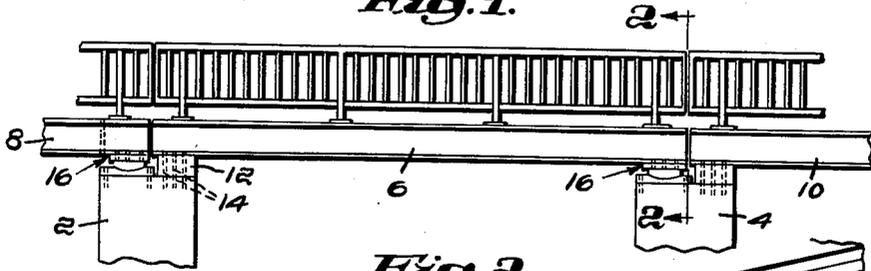


Fig. 2.

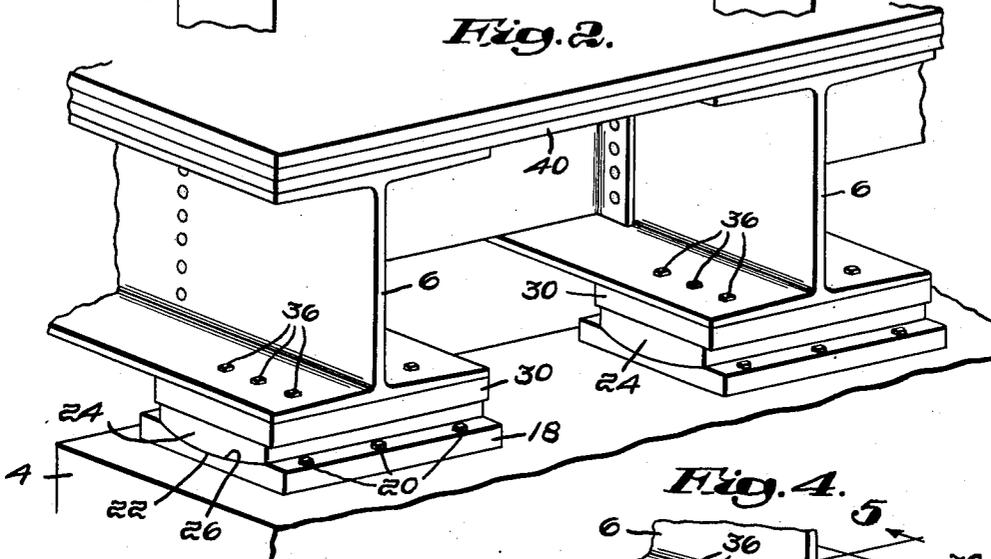


Fig. 3.

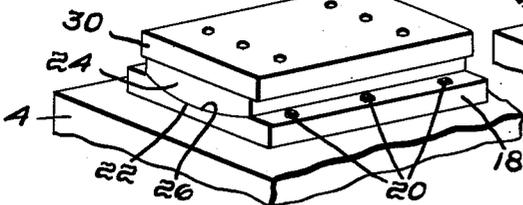


Fig. 4.

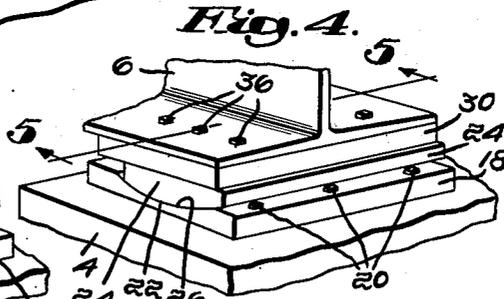


Fig. 5.

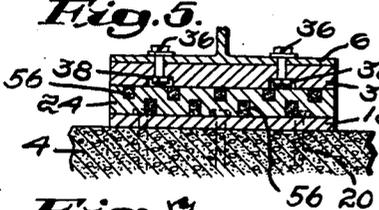
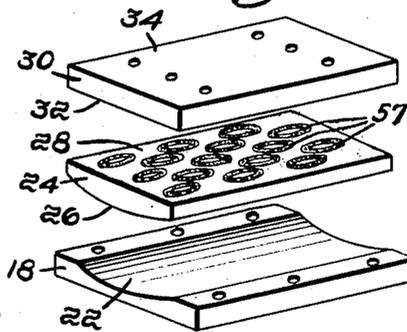
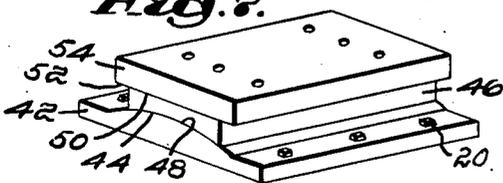


Fig. 6.



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# UNITED STATES PATENT OFFICE

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## SELF-LUBRICATING BEARING FOR HEAVY LOADS

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4 Claims. (Cl. 14—16)

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This invention relates to a new and novel construction devised for the purpose of supporting heavy loads in situations where there will be some horizontal and turning movement of the member being supported.

The invention has been found particularly useful in connection with bridges and other structures of the type in which long horizontal members are carried by spaced piers or other fixed supports.

The invention will be explained in connection with its use in a bridge type of structure but it is to be understood that it is applicable for use in any situation where the conditions presented could make effective use of the novel load supporting arrangement disclosed and claimed herein.

It is well understood that where long horizontal beams, such as I-beams, for example, are used in bridge or elevated roadway construction, there is appreciable longitudinal movement of the ends of the beams under normal temperature changes. Some provision is therefore commonly made to permit at least one end of the beam to move longitudinally with respect to its support through a limited distance. It is also well understood that when a heavy load is applied to the unsupported middle portion of a beam, bending occurs which results in a slight upward tilt of the free ends of the supporting beams.

Thus, since the unsecured end of a beam of the type in question may be turning repeatedly through a slight angle as loads pass along the roadway, and there is a slower elongation and contraction of the beam as the temperature changes, it is an object of the present invention to provide a support fully adequate to carry the vertical loads of the structure while at the same time permitting free and unrestricted movement of the end of the beam as load and temperature conditions vary.

Numerous expedients have been used in the prior practice. One construction has been the provision of a supporting member having a curved under surface resting on a flat plate and forming a rocking line of contact therewith. This arrangement has permitted the end of the beam to turn when the beam is deflected but has had the disadvantage of a concentrated load on a very small area of engagement. Another expedient permitting longitudinal movement of the end of the beam under temperature changes has been to provide a self-lubricated bearing plate of the type shown in the patent to Merri-

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man No. 2,187,626. The use of such self-lubricated bearing plate has permitted the supported beam to move freely in a horizontal or longitudinal direction with respect to the pier as temperature changes occur.

The present invention, therefore, is directed toward the provision of a special type of self-lubricated plate which will carry the load over a large area and at the same time accommodate itself to any movement of the beam end whether that movement be a turning movement due to bending of the beam or longitudinal movement due to expansion and contraction.

The invention will be more clearly understood as the description proceeds with the aid of the accompanying drawings in which

Fig. 1 is a side elevation of a bridge or elevated roadway formed of a plurality of beams supported on piers.

Fig. 2 is an enlarged perspective view of the ends of two I-beams resting on their supporting plates, taken on the line 2—2 of Fig. 1.

Fig. 3 is a perspective view of the supporting plates shown in Fig. 2 with the I-beam removed therefrom, and with the plates in normal position.

Fig. 4 is a perspective view of the supporting plates shown in Fig. 3 with an I-beam affixed to the top plate and in which the I-beam has been contracted and deflected to cause relative movement between the several supporting plates.

Fig. 5 is a section on the line 5—5 of Fig. 4.

Fig. 6 is an exploded view of the three supporting plates.

Fig. 7 is a perspective view similar to Fig. 3 but in which the middle self-lubricated plates has its under side concave instead of convex.

The general nature of the location in which the invention is ordinarily used is shown in Fig. 1. Here the piers or other fixed supports 2, 4 of any height and width carry an I-beam 6. There may be as many additional I-beams across the width of the piers as are needed to support the roadway or other structure. There will be, of course, additional piers to the left and right which will support the other ends of I-beams 8 and 10.

It is customary in structures of this sort to anchor one end of the beam to one pier as shown at 12 in which bolts 14 extend through the flanges of the I-beam down into the pier 2. The right hand end of beam 6 is carried by the structure of the present invention in a manner which permits free bending and expansion and contraction by virtue of the inclusion in the support of a

self-lubricated bearing plate of novel formation, all in combination with the other supporting plates. This construction is generally referred to at 16 and is shown in greater detail in Figs. 2 to 6.

Referring to these Figs. 2 to 6, the pier 4 has horizontally positioned thereon a base plate 18 bolted thereto by bolts 20. The upper surface of this plate is concave as at 22 with the concavity being a segment of a cylinder, the longitudinal axis of which runs transversely of the beams to be supported. Resting on this concave surface is a self-lubricating plate 24 having its bottom surface 26 of the same curvature as the top surface 22 of plate 18 and having its top or upper surface 28 flat.

On surface 28 is positioned a top plate 30 having a flat under surface 32 and a flat top surface 34 on which rests the end of I-beam 6. The I-beam is bolted to plate 30 by a series of bolts 36, the under heads of which are sunk in plate 30 in suitable cavities 38 as shown in Fig. 5. The complete assembly in normal position is shown in Fig. 2 in which there is shown, in addition, a second I-beam and a second set of supporting plates identical with those already referred to and to which the same numbers have been applied. A roadway or other supporting surface is indicated at 40.

In Fig. 2, it will be assumed that there is no load on the beams 6 and the temperature is normal. If the temperature rises, beams 6 being anchored at 12 will expand so that the plates 30 will move to the right with respect to plates 24. This will occur easily and with minimum friction because of the self-lubricating character of the face 28 of plate 24. There will be no horizontal movement between plate 24 and plate 18 due to the interengaging character of surfaces 22 and 26. Conversely, if the temperature falls so that beams 6 contract, then, as viewed in Fig. 2, plates 30 will move horizontally to the left with respect to the upper surface of plate 24. This characteristic motion is well understood and, in a span of fifty feet, for example, elongation of the beam for a rise in temperature of 100° F. will be almost one-half inch. Thus, the sliding relation between the under side 32 of plate 30 and the top face 28 of plate 24 fully meets this changing condition.

If a heavy load is applied to the center of I-beam 6 to cause deflection thereof, the right hand end of the beam will slope slightly in an upward direction to the right. To accommodate this turning movement of the beam end, the bottom 26 of the self-lubricating plate 24 rotates with respect to bottom plate 18 with the surface 26 sliding on surface 22. This condition is illustrated in Fig. 4 in which the movement of plate 24 to the right with respect to plate 18 is plainly shown. It might be mentioned at this point that the location of the bolt heads 20 will be arranged to avoid interference with the side of plate 24 as it may be moved, as shown in Fig. 4. It will also be noted in Fig. 4 that plate 30 has shifted to the left with respect to plate 24 indicating that a drop in temperature has occurred, thus causing contraction of beam 6.

Inasmuch as the beam 6 is anchored at its left end at 12 and each of the aligned beams 6 and 10 are also anchored at their left ends, it is apparent the beams cannot move laterally from their proper positions on the foundations. If deemed necessary, however, provision could be made adjacent the free ends of the beams to secure them against lateral displacement.

The specific construction of the self-lubricating plate 24, shown in the several drawings and particularly in the exploded view in Fig. 6, is preferably according to the disclosure in the previously referred to patent to Merriman No. 2,187,626. The plugs of solid lubricant 56 shown in plate 24 in Fig. 5 are intended to represent any type of lubricant arrangement whether it be the annular form of the Merriman patent as shown at 57 in Fig. 6 or the circular hole type shown in Fig. 5. It will therefore be understood that when reference in this specification and the following claims is made to a self-lubricating plate it is intended to refer to a plate made according to the Merriman disclosure and also to all other types of self-lubricating plates whether the holes in the plate surface be circular or annular or otherwise. It will be further understood, of course, that the lubricant containing holes in the under surface 26 of plate 24 are similar to the holes in the top surface 28. In all cases the principle involved is to have a plate with holes in the top and bottom surfaces containing a solid lubricant and preferably so arranged that there is overlapping of the holes in the direction of the sliding movement so that as movement occurs lubrication will take place over the entire cross section.

A modified construction is shown in Fig. 7. In this arrangement the base plate, which is numbered 42, has a convex upper surface 44 as distinguished from the concave surface 22 of plate 18. Resting on surface 44 is a self-lubricating plate 46 having on its under side a concave surface 48 mating with surface 44. The upper surface 50 of plate 46 is flat, the same as surface 28 and this flat surface engages with the flat under surface 52 of top plate 54. The end of the I-beam with which this construction is used will be secured to the top of plate 54 in the manner heretofore explained. The behavior of the construction of Fig. 7 under elongation, contraction and bending of I-beam 6 will be the same as that of the construction in Figs. 2 to 6 with this exception. When the beam assumes the position under load as shown in Fig. 4, the self-lubricating plate 46 will necessarily slide to the left with respect to bottom plate 42 and plate 54 will automatically adjust itself longitudinally as required with respect to plate 46.

In the practice of the invention, it has been found preferable to have the dimension of the plates in the direction of the beam shorter than the transverse dimension but the absolute dimensions may be varied to suit particular conditions.

From the foregoing explanation it can be seen that I have provided a load supporting mechanism which is capable of distributing the load over the supporting surfaces to the degree required of the materials being used and at the same time, the free end of the supporting beam may move easily with respect to the fixed supporting pier under all conditions of load and temperature.

It is my intention to cover all changes and modifications of the example of the invention herein chosen for purposes of the disclosure which do not constitute departures from the spirit and scope of the invention.

I claim:

1. Means for supporting the end of a structural metal member in which the said end moves longitudinally under the influence of changing temperature and which turns slightly in a vertical plane when a vertical load is applied to the unsupported portion of said structural member,

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said means comprising a supporting pier, a base plate carried by said pier and fixed in relation thereto and having for its upper bearing surface a segment of a cylinder with the axis of said cylinder extending transversely of said structural member, a self-lubricating plate having recessed areas in its opposed under and upper surfaces containing lubricant and carried on said base plate with the under surface of said self-lubricating plate being a segment of a cylinder and mating with the said cylindrical surface of the said base plate, the upper surface of said self-lubricating plate being flat, a top plate having a flat under surface mounted on the upper surface of said self-lubricating plate and secured to the end of said structural member whereby said top plate may slide with respect to said self-lubricating plate in the plane of their flat engaging surfaces and whereby said self-lubricating plate may rotate with respect to said base plate, all as may be required by the movement of the end of said structural member.

2. Means for supporting the end of a structural metal member as set forth in claim 1, the said segment of a cylinder that constitutes the upper bearing surface of said base plate being concave and the said segment of a cylinder that constitutes the under surface of the said self-lubricating plate being convex.

3. Means for supporting the end of a structural metal member as set forth in claim 1, the said segment of a cylinder that constitutes the upper bearing surface of the said base plate being convex and the said segment of a cylinder that constitutes the under surface of the said self-lubricating plate being concave.

4. Means for supporting the end of a structural metal member in which the said end moves longitudinally under the influence of changing temperature and which turns slightly in a verti-

cal plane when a vertical load is applied to the unsupported portion of said structural member, said means comprising a supporting pier, a base plate carried by said pier and fixed in relation thereto and having an upper bearing surface, a self-lubricating plate having recessed areas in its opposed under and upper surfaces containing lubricant and having its under surface in load carrying engagement with said base plate, the upper surface of said self-lubricating plate being in load carrying engagement with the under surface of a top plate, said top plate secured to the end of said structural member, one pair of the co-operating surfaces between said self-lubricating plate and said base plate and said top plate being segments of a cylinder with the axis of said cylinder extending transversely of said structural member and the other pair of said cooperating surfaces being flat, whereby the said cooperating flat surfaces may slide with respect to each other in the plane of their flat engaging surfaces as the said structural member expands and contracts and whereby said cooperating cylindrical surfaces may slide with respect to each other as may be required by the turning movement of the end of said structural member as a vertical load is applied to the unsupported portion of the said structural member.

References Cited in the file of this patent  
 UNITED STATES PATENTS

| Number    | Name     | Date          |
|-----------|----------|---------------|
| 484,971   | Morison  | Oct. 25, 1892 |
| 592,852   | Westwood | Nov. 2, 1897  |
| 1,132,759 | Bache    | Mar. 23, 1915 |
| 1,174,941 | Bache    | Mar. 7, 1916  |
| 1,496,809 | Johnson  | June 10, 1924 |
| 2,187,626 | Merriman | Jan. 16, 1940 |