three lines, and finally the central lines supporting the keel extend forward and aft of these side lines nearly the entire length of the deck. These rams are all connected together by a common system of pipes fitted with valves, by means of which they may be separated into certain groups. When the pontoon is sunk and the weight of the ship is on all these rams, if the entire system is connected together, it is evident that if there be more pressure on one ram than on another this pressure will be equal throughout the whole system. Mr. Eads' idea is that the ship will not be curved in the direction of her length unless the roadway gives way under her. A first class roadway is therefore indispensable, and this having been provided no superior longitudinal strength is required in the traveling cradle. But the weight has to be distributed over the six rails which constitute the track, the two outer ones of which are twenty-nine feet apart. To do this it is necessary that the traveling cradle shall be composed of strong transverse girders spaced six feet nine inches apart from centre to centre. If we suppose a 3,000-ton ship upon such a cradle, having thirty transverse girders spaced as above under the ship's bottom, the problem will be to cause each one of these girders to carry 100 tons, or, in other words, to transfer the excess of weight concentrated amidships to the ends of the cradle, where the vessel is lean and lacks weight. This problem is ingeniously solved in the following manner. When the traveling cradle is run on to the pontoon each of the central girders comes exactly over seven of the rams, while the end girders have only one ram under them, as the keel only is to be carried by these girders. By making the one ram equal in area to the aggregate area of the seven rams under each central girder, it follows that the single large ram will, with the same water pressure, lift as much as the seven together, and that if they all have a common pressure the one large one will lift no more and no less than the central seven. A few of the girders nearer to the bow and stern have only five rams under them, and these five have an aggregate area only equal to that of one of the large rams. Where the ship becomes narrower there are only three rams under each beam, the aggregate area of the three rams, however, being precisely equal to that of one of the single rams at the bow or stern, where only one support is available—namely, under the keel. Now, if all these rams with their diameters thus relatively adjusted be forced up with a gentle pressure against the ship while she is still floating, and the water valve admitting the pressure be locked until she is lifted up by the pontoon out of the water, it is evident that her weight will be evenly distributed throughout from stem to stern—that is, every six feet nine inches each ram, and each series of rams, will hold 100 tons weight.

We have now got the weight of the ship evenly borne by the pontoon, but as she has to be run off from this support on her cradle on to the railway, the next problem is to transfer her weight from the pontoon to the cradle, so as to obviate the necessity of carrying the hydraulic rams across the country under the ship. And here another simple but very ingenious arrangement comes into operation. The heads of the rams do not come into direct contact with the girders or the ship, but over every ram is a vertical screw jack which passes up through the girder, and when pressure is applied by the ram the head of the jack is pushed up against the bottom of the ship. Each of the largest sized cradles will therefore be supplied with a number of screw jacks equal to the whole number of rams in the pontoon, the smaller cradles having a lesser number, and when any cradle is run on to the pontoon it is stopped and secured by a very simple looking arrangement, so that each one of the screws comes directly over a ram. The screw jack resembles nothing so much as an orchestral music stand, for it has a flat head, formed of steel plate, and which in practice would be about three feet square. This head plate is secured on the top of the screw by means of a toggle joint, which enables the plate to adjust itself to any angle presented by the ship's side, just as the book-rest on an invalid chair can be adjusted. In order to prevent damage to the ship from abrasion, the top of the plate is cushioned with rubber or canvas, so that it perfectly adjusts itself to the curvature of the vessel. The stem of each of these screw jacks is provided with an adjusting nut, which is run up against the upper end of the screw near the plate and when the rams are down these nuts stop the descent of the jack by their contact with the top side of the girder on which they will rest. When the ship is floated in over the cradle the heads of the screw jacks, with the nut beneath each, are all down resting on the platform of the cradle, with their stems hanging below in the water, directly over the rams. A small amount of water pressure put upon the rams raises all these screw jacks with their head plates pressed up against the bottom of the ship and throughout the entire length of her keel. This having been done, the valve admitting water to the rams is closed so that the water cannot escape, and the pontoon is then pumped dry and the ship raised out of the water, supported on the screw jacks, which in their turn are supported by the hydraulic system in the deck of the pontoon. In this position the nuts will be found to be at varying heights above the tops of the girders. The nuts are therefore screwed down with the undersides resting on the girders, which in effect constitute the platform of the cradle. The valves of the rams are now opened, and the pressure being relieved, the rams retire downwards and the weight of the ship is evenly and without alteration transferred to the platform of the cradle.

The cradle is mounted on about 360 wheels, each wheel being flanged on both sides. Each of the platform girders is supported by twelve strong spiral springs resting on the bearings of twelve of these wheels, and as each girder carries but 100 tons of the dead load, each spring transfers to a wheel eight and a half tons. Each spring requires twenty tons to close it, and has a range of five inches. When the rams are withdrawn the weight of the platform rests on these springs, and, of course, partially closes them, leaving still two and a half or three inches of play in each spring to allow the wheels to pass