graphic view of the completed bridge; Fig. 2 shows elevation and plan of the general structure; while Figs. 3 to 5 give drawings of various sections and details, from all of which the design and construction will be clearly understood.

The arch is struck with three circular radii, and approaches the parabolic form. From mere consideration of

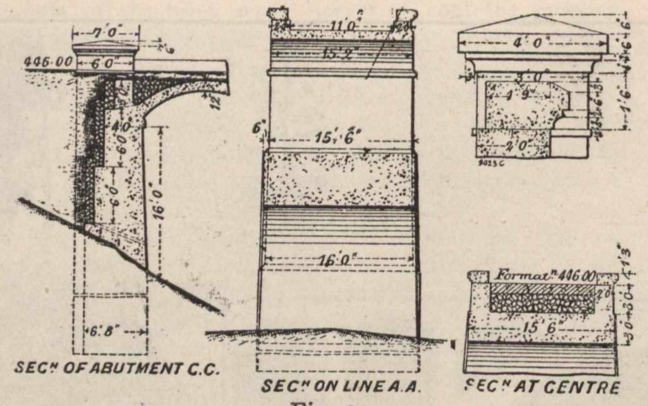

Fig. 3.

the questions of loading, a rather more irregular curve than that adopted would have been the more correct. The calculations were worked out in accordance with Professor Cain's elastic theory. A live load of 1.875 tons per lineal foot of bridge was taken, this being nearly 20 per cent. in excess of the heaviest engine load in use.

The main span is 80′-0″, the arched member being 3′-0″

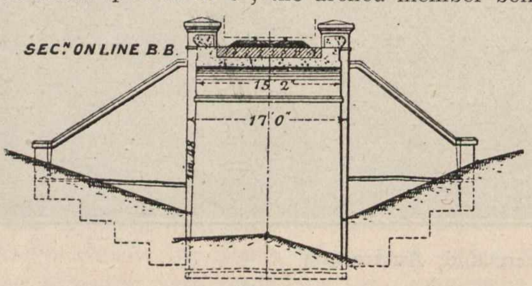

Fig. 4.

thick at the crown, and 5′-0″ at the springings. It has a rise of 28′-0″, and is 15′-6″ in width. The spandril arches are 13′-0″ span, with a rise of 3′-0″, and 12″ thick at the crown. A temperature range of 48° Fahr., was allowed for in the design. The excellence of the material at hand: in the shape of stone, sand, and abundance of water, led to the use of concrete. A comparative estimate for reinforced work was made, and found to be slightly higher than for simple concrete. The proportions in which the concrete was mixed were 1.3.6.—the stone being broken to 2″ gauge. Tests blocks 9″ cubes of concrete, mixed in the same proportions as that used in the construction, on being subjected three months after mixing, to a crushing test, failed at 95½ tons: equivalent to a crushing strength of 170 tons per cubic foot. Cement of Australian manufacture, by the Commonwealth Portland Cement Co., Ltd. (Union Brand), was employed, costing $19.40 per ton, delivered at the site.

The main arch centreing supports were made of local hardwood, the bracings of bush timber of light scantling, and the lagging of 9″ x 2″ hardwood planks, cut at a neigh

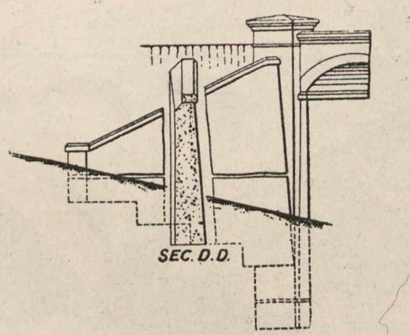

Fig. 5.

boring sawmill. Much of this timber was used over again in the construction of other bridges, drains, etc., on other portions of this line.

The main arch was allowed to set one month after its completion before the centres were struck. Levels taken after striking showed no deflection; neither was any deflection observed when running traffic over the bridge.

The work took seven months to complete, and cost $10636, or about $82 per lineal foot, inclusive of plant and supervision. The average cost of all concrete, amounting to a total of 860 cubic yards, came out at $10.98 per cubic yard. The rock excavation cost $2.09 per cubic yard. Rates of wages were as follows:—Laborers, $1.56; carpenters, $2.04 to $2.40 and $2.52 per diem of eight hours.

The bridge was designed and constructed under the supervision of Mr. W. Pagan, Chief Engineer of the Government Railways of Queensland, whom we congratulate upon this excellent example of modern bridge building.

DREDGE BUILDING AT WELLAND

By Robert L. Hamilton.

THE "MONARCH" DREDGE.

The dredge illustrated is the first of two built, launched and completed by Beatty & Sons, Ltd., at their yard on the canal at Welland.

The hull is steel throughout, being 100 feet long, 36 feet wide, 10 feet deep at bow, and, owing to the rake of the bottom, about 8 feet at stern.

The plating is extra heavy on the bottom and sides in the neighborhood of the bow, which is composed of two ⅞″ plates.

Keelsons of channels and I beams run across the bottom, to which the sides are connected by gussets of ample height and width.

Two deep oak fenders traverse each side, affording substantial protection to the side plating.

As will be seen from the illustration, two main trusses, 29 ft. centre to centre, run from end to end of the hull, distributing the stresses from the anchors and crane throughout the whole structure.

The internal construction is specially to be noticed. Between the main trusses and the full depth from the deck beams to the top of the keelsons, as far back as the bow deck extends, are two trusses of deep channels and bar diagonals secured to the bow with large deep gusset plates.

Under the machinery these trusses are reduced in depth to wide girders of box section, to provide ample stiffness and take the stresses due to the engines and hoisting drum.

Aft of the engine, the lower channels of the truss act as box girders to carry boiler seats.

The bow structure consisting of the two bow anchor slides and head beam to take the top of the mast, are braced to the bow plate by heavy channel diagonals. All castings connected therewith. anchor keepers, hinges, etc., being of steel.

The mast is stationary, and constructed of two extra heavy I beams, with steel upper and lower ends, upon which the crane swings; the foot step being a steel casting secured to the bow plate by a flange of liberal area.

The crane is built up throughout of plates and angles, both upper and lower members being of box section, latticed on the outside as shown.

The top member of the crane has a swing of 40 feet radius, the lower members being made specially wide in the middle of their length to provide for the severe stresses induced by the swinging of the crane when the dipper is loaded.

Swinging is performed by means of a turntable, with special channel rim 18 feet in diameter, and heavily braced.