

round growling and fault-finding would look at some of the above points in a reasonable light, his criticism would assume a milder form, and he would admit that engineers, dredgemasters, and others engaged in the industry had a lot to put up with, and that their efforts to recover the gold that all other systems had failed to get, are worthy of at least a little consideration.

From the above the necessity of a stiff construction is obvious.

The bows (noses) of all "Paddock" dredges should be well rounded to permit of being easily manipulated in a corner, and should also be more heavily planked and framed than the other portions, so that she may not be damaged by striking the face, as the dredge surges at her work. Very often the bows are sheathed with steel plates as a protection against blows and chafing.

The bottom of the hull at the forward end should be sprung or bevelled upwards for clearance and handiness in working, and the bottom from the bows aft to the position of the ladder at her "maximum dredging depth" should have the thickness of planking considerably increased to obviate accidents through logs being caught in the buckets, and by them being dragged upwards through the bottom. This type of accident is by no means infrequent.

For clearness in describing I shall refer to the dredge complete as the "dredge;" to the two pontoons (namely the "port" and the "star-board" pontoons) tied together to make one structure as the "hull." Amongst dredging hands the "hull" is usually alluded to as the "pontoon" or "pontoons," but in describing the construction it is necessary, to avoid confusion, to discriminate the terms used. The ordinary hull consists of two long narrow pontoons joined together for about a third of their length by a third small one equal in width to the width of the ladder well required. The two longitudinal sides of the third small pontoon are really a portion of the inner or well sides of the two main (or long "pontoons") before mentioned. The floor and deck beams where the three pontoons are tied together are in single lengths and are common to the three pontoons. These three pontoons form the "hull." Besides the floor and deck-beams a number of very much heavier beams also run across the entire width of the three pontoons alongside the floor and deck beams; and these are lattice braced to form thwartship girders, to overcome the tendency of the structure to "sag" inwards towards the ladder well or "hog," according to the distribution of the weights on board. In a similar manner the stringers, girders, etc. (according to the design adopted), and planking in this inner (or well) side of each pontoon are run its entire length. This construction forms the hull into three distinct water-tight compartments, namely, the two main pontoons and the small connecting pontoon. The two main pontoons are, (or ought to be), each subdivided into three water-tight compartments, making in all seven water-tight compartments in the hull. Unfortunately both here and in New Zealand, from motives of economy, and through the over-ruling power possessed by individuals totally ignorant of what is required (and what is not required), these very necessary safeguards have been omitted, and the result is that a number of our dredges have had a trip to the bottom of their paddocks, and now carry with them the effects of their immersion in the shape of twists, bends, cracked castings, machinery out of line, besides other defects added to all of which is the cost of lifting, loss of working time, etc., while current expenses are running on just the same without the necessary gold coming in to meet them.

There are several other types of construction adopted by different designers, but in all the general principal of construction is as above described. I shall briefly describe a few of them.

*The Double Skin.*—In this method of construction on the sides of the dredge, the outside planking is of the usual sizes, but the fore and aft stringers are done away with, and in their place very deep planks attached to the frames forming an inner but not a water-tight skin, the

outside planking alone being caulked. The inner planking is secured by long vertical drift bolts. The "inner" and "outer" skins are also bolted together through the frames. For this form of construction the timber should be very well seasoned, or the shrinkage will be considerable in the wide inside timbers. The bottom, and deck are of single planking of ordinary construction.

This is a light and simple form of construction, the principal faults in it being the difficulty of locating and stopping a leak, owing to the internal side planking and the absence of diagonal bracing where the machinery happens to be heavy.

*The Fore and Aft Keelson.*—This is a method of construction in which the thwartship beams and floors we usually see in a ship are done away with, and a series of keelsons and fore and afters run the entire length of the pontoons in place thereof. The bottom and deck planking is laid athwartships, wide planks being used for the purpose. No side frames (or ribs) are used, but a number of stringers run the entire length of the pontoons. The side is trebly planked, that is, the planking is put on in three courses. The first is put on diagonally, at an angle of about  $45^\circ$  to the deck line. The second at about right angles to the first, and the third, or outer planking, horizontally as in ordinary ship work. The outer planking is caulked and felt, or "chenam" is generally interposed between each course of planking. The diagonal seams are not caulked.

Like the last method of construction, the difficulty of locating and stopping leaks occurs. The thwartship planking is also a very weak point. It is also a simple form of construction, and quite a number of dredges have been constructed here on this principle, but only two, as far as I know, in New Zealand have been built on this plan.

*The Braced Stringer.*—In this method three stringers of different sections run the entire length on each of the four sides of the pontoons the one on the bilge being generally square in section. These are bolted to the frames (or ribs) and stiffened by diagonal bracing checked on to their faces. On the inside the planking is spiked and bolted to the outer side of the frames (or ribs) and laid horizontally in one thickness. The floors are bolted to the frames (or ribs) and the deck beams to the frames (or ribs) as well as to the stringers.

This construction is a strong one, and makes an excellent job, but as it involves a lot of joiner work it is rather expensive, and it is not one that can be placed in the hands of amateurs. It must be performed by first-class tradesmen.

*The Wedged Stringer.*—This method is identical with the above, with the exception that long double wedges are used between the stringers and the diagonal bracing dispensed with. The bad feature in this construction is the wedges. The excessive vibration on a dredge when working causes these wedges to work loose, and they are then practically non-existent, unless they are carefully watched and kept driven hard home.

*The Girder Side.*—Several varieties of this form exist, but they are more or less complicated and expensive to make.

The latest New Zealand design consists of a top and bottom member of a heavy flat section. The cross bracing is used in such a manner that the lower end of the brace butts against the floor and the upper against the deck beams. The cross braces entering into and mutually assisting each other in forming a compact and highly efficient design. The top and bottom members of the girder are further tied together by "king bolts," situated in pairs in the diamond formed by each pair of cross braces. The frames (or ribs) are bolted to the outer face of the cross bracing to permit the "king bolts" to draw up, from time to time, any play that may appear in the joints of the girder, due to shrinkage in the timber, over-straining, or other causes. The planking is spiked to the ribs as in ship work. These girders extend the full width of the pontoon forming the four sides; and four or more of similar design run athwartships of the pontoon, namely, one forming the after end and one