at the end of the well, each extending the full width of the hull, and one shorter one, or two in the case of longer pontoons, athwartships in each pontoon.

This construction reduces all the defects in the others mentioned to a minimum, and possesses as well the feature of being a simple one, that is, one in which the efficiency is great, compared with the cost of labour in obtaining it

There are other constructions in which a series of girders of complicated designs run fore and aft through the centres of the pontoons, as well as forming the sides, but, in my opinion, the quantity of timber used and the labour required in their construction makes them very expensive to build, and does not warrant their adoption for this purpose. There is, however, no doubt that they possess the feature of strength in a marked degree, but are unnecessarily ponderous. These examples just mentioned practically embrace those in general use by dredging engineers, but others exist, such as the "cellular" type, etc., but as a rule their novelty far exceeds their utility.

All the above types are stiffened laterally (that is, athwartships) by diagonal or cross bracing, and are provided with hold pillars to support the weight of the deck on which the bulk of the heavy machinery is placed, and are also capable of being sud divided into any required number of water-tight compartments, and should be sub-divided in such a way that any one, or even two compartments, could be filled with water without sinking the dredge. Dredge owners, when placing a dredge in the hands of an engineer to design, should stipulate that water-tight compartments should be incorporated in the design, and also that these compartments should be practically tested, that is, filled with water and the effect noted. The test would cost very little, and the owners would, at all events, be satisfied that with ordinary care the chance of their dredges sinking was a remote one. Within the past two years, to my knowledge, no less than seven dredges out of a working total of thirty sunk, and two of these performed the feat twice, and quite a number of others had some very narrow squeaks for it. I mention these facts here to emphasize my remarks on the necessity of sub-dividing dredges into water-tight compartments by the simple and inexpensive method of a few water-tight bulkheads. Had the dredges alluded to in this been properly sub-divided with a few water-tight bulkheads their immersion would never have occurred.

Another point in bulkheads is that they stiffen the hull laterally (that is, athwartships), and if employed do away with a large amount of the transverse bracing, and as all the machinery, with perhaps the exception of the centrifugal pump, is usually on deck, there is no obstacle in the way of placing bulkheads or lateral bracing where required. One important point to be noticed regarding bulkheads in timber pontoons, however, is that ventilation must be provided for each compartment, in addition to the usual small hatchway.

Having dealt with the pontoon itself, the next consideration is the superstructure which consists of "tumbler framing," "gear framing," "hog framing," screen or sluice box framing," "gantry," etc., etc.

The "tumbler framing" consists of very heavy uprights and beams, cross diagonally braced and well tied in every direction with heavy tie bolts, and as it also supports the ladder with its tumbler and buckets, as well as the main tumbler with its gearing, the structure requires to be exceedingly strong and rigid to withstand the shocks it is subjected to.

The "gear framing," in construction, is similar to the tumbler framing, but considerably lighter. It is usually braced athwartships to the tumbler framing. As it supports all the intermediate gearing and shafting it also requires very rigid bracing.

The "hog framing" is constructed of vertical posts, really Samson posts, or lattice braced framing of the "A" or other types, erected where deemed necessary. Iron or steel rods, or heavy steel ropes provided with tension, or rigging screws lead from the top of these posts or frames forward and aft, for the purpose of counteracting the tendency long dredges have of hogging, that is, dropping at the stem and stern, but it is sometimes dispensed with in short dredges. The hog framing is also used as a derrick to support the elevator in dredges carrying elevators.

The "screen framing," where a screen or screens are used, is very much the same in its principle of construction as the tumbler and gear framing, and the sizes of the scantlings used are the same as in the gear framing, perhaps a bit lighter.

The "sluice box framing" follows the general design of those just mentioned, but is very much lighter still.

The "gantry" is a very important part indeed of the structure of the dredge, and more so of the "paddock" dredge, whose well, owing to the necessity of having the ladder projecting in front, must be left open forward. The gantry, therefore fulfils a dual duty, that is, it ties the two "pontoons" together, as well as sustaining a very large proportion of the weight of the ladder, amounting to many tons.

A "gantry" requires to be extremely rigid, and besides possessing the features mentioned, must also be capable of overcoming the tendency the pontoons have of sagging inwards towards the well caused by the excessive weight of the ladder being concentrated on one central point forward in the weakest portion of the dredge's structure, and for obvious reasons its weight must be centralised there or thereabout. This strain can, however, to a certain extent, be neutralised by the distribution of machinery on board. The scantlings in the gantry, if of hardwood, are very heavy, and as a rule are of similar size to those in the tumbler framing.

In an ordinary 4½ft. bucket dredge this weight varies from twenty-five to forty-five tons, according to the dredging depth and application of the strain.

The remarks I have made practically embody concisely the salient features in the construction of the hull and super-structure of a modern gold dredge built of timber. I shall now deal with the machinery to be erected on the hull.

The two most important factors in dealing with the machinery required are the dredging depth and the capacity; this allows us to arrive at the power of engine, size of buckets, etc. Before going further it might be as well to define the term "capacity" as applied to a dredge. Capacity, or nominal capacity, is the actual amount the dredge can lift ruuning full buckets, with the ladder lying at an angle of forty-five degrees. The buckets of all dredges should be so shaped that they will hold their maximum capacity at that angle. A favourite complaint from speculators in dredges that are not getting as much gold as they would like, is:—"We were told the dredge would treat one hundred and twenty tons an hour, and we have measured up what she has done and it is not half that." In the first place they have measured up the ground in the solid, quite overlooking the fact the buckets of the dredge break this down and loosen it under water, it therefore occupies considerably more space than when in the solid, that there is a lot of broken stowage in a bucket without one or two big stones in it, and running at the speed dredge buckets run (say twelve buckets a minute) a badly filled bucket will come up occasionally, in spite of the efforts of the winchman, it may be very hard cemented ground, and the dredge has to actually pick every foot of it down with her grabs, and scrape up what she can get with the buckets; or, it may be, a stiff puggy clay appears in the face, which is compressed into the buckets with the full power of the dredge, much the same as a brick machine would squeeze it into a brick mould. Now, having got this clay into the buckets, the next problem is how it is to be got out again in the interval of time lapsing between each bucket, one-twelfth of a minute (that is five seconds, it is really less) and, lastly you probaby find on discussing the matter further with them, that their dredge has struck a bit of shallow gronnd, say six or eight feet deep, and that the ladder is lying at such an angle that it would be a physical impossibility to fill the buckets to more than one third of their capacity.