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## **SMALL COASTAL STEAMERS.**

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By WALTER REEKS.

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In the early days of small coasting craft in this country, a direct follow of conventional construction met the case well enough, because the craft were small, and their proportions more or less normal. Four beams to length, and ten depths to length, being common in the schooners and ketches that for many years did the coastal carrying.

With the advent of steam came a change, not only in size, but in proportions, and with that change came trouble.

Clearly the steamer must carry not less than the schooners she was intended to displace, and obviously the hull must be increased in size, to find room for machinery and coal, and to supply displacement for that weight.

The river bars remained about the same, varying only with the weather, so no increase in draft of water could be allowed, and even to-day is such that all our small coasters must be extremely light draft.

Leaving altogether extreme cases out of account, 7ft. 6in. may be regarded as the maximum loaded draft permissible. Now, it will be seen at once that 7ft. 6in. loaded draft, or say 8ft. depth moulded, was quite a reasonable depth for a schooner or ketch of 80ft. between perpendiculars, being, say, ten depths to length, and calling for no special treatment; but the draft remaining, and the depth of hold increasing only as much as the freeboard rules require for extra length (which is so little as to hardly affect our case), conditions rapidly changed, because, to get the

carrying capacity, both length and beam had to be increased, and with that increase in length the proportion of depth to length soon became abnormal. Taking, for example, the present-day boats, running to about 130ft. B.P., 26ft. beam, 8ft. 6in. moulded depth, it will be seen that the proportion of depth to length has jumped to 15 depths.

Quite early in the history of these small coasting steamers weakness manifested itself by the undue hogging, or drooping in the ends, and to stiffen them longitudinally has been the problem cur builders have been intent on solving for many a year, and if this paper serves no other purpose, it gives an opportunity of paying a tribute to the ingenuity and skill of what we call our bush builders—for most of the coasting steamers are built on the rivers and bays outside the port of Sydney, and are generally alluded to as “bush built.”

I have every respect for and sympathy with the builders of small coastwise steamers, for they are up against it in almost every case. It is popularly supposed that they can build in the bush cheaper than in Sydney, because they are close to the timber, and have no freight to pay; that much is true, but everything, excepting the hard wood, has, from their point of view, to be imported, and the freight paid. There may or may not be some difference in the hours of labour and rates of pay, but all the same they get the work because they do it cheaper.

Now, it is this insatiable desire for cheapness that has held back advance in our small coasters, as in many other things. A man, knowing that he has got his job because he was the lowest tenderer, has probably used up most of his ingenuity in simplifying his construction scheme to keep his price low, and hasn't much left, and still less margin in price to devote to structural improvements. Yet, with all that against him, and frequently at a loss to him-

self, he has introduced structural improvements, and so made progress, however slow.

We have some good small coasters which, but for this undue striving for cheapness, might have been as good years ago, and very much better to-day.

Turning from the sordid question of cost to the structural side, we find that at first, merely increasing scantlings appeared sufficient, but the bugbear, hogging, still showed itself, and it became clear that something more was required. A few slides have been prepared to illustrate some of the methods employed to overcome the trouble of hogging, or, in other words, to provide sufficient longitudinal strength to produce a serviceable vessel.

Fig. 1 shows the ordinary construction, differing in no wise from that of a coasting schooner of the same size.

Fig. 2 shows the introduction of two lattice girders placed in from the side, but not so far in as to interfere with loading heavy cargo. Such girders have been found to add to fore and aft strength, and so help considerably.

Fig. 3 goes one stage further, and in addition to the lattice girders, double diagonal planking has been introduced in the sides, inside the ordinary planking, and, further than that, has been run right up to the rail, such rail together with its stringers, forming what is known as a box rail. This form of construction has proved satisfactory, but adds a good deal of weight, obviously to the detriment of the cargo carrying capacity.

Fig. 4 shows the construction just described, and in addition a centre line keelson the entire depth of the vessel, and practically all fore and aft; further to that, it will be noted that the bottom is a series of fore and afters, with the bottom planking and ceiling running thwartships. This vessel has had a remarkable career, and has earned much money, and is said to be good and sound to-day; certainly the workmanship in her is remarkably good.

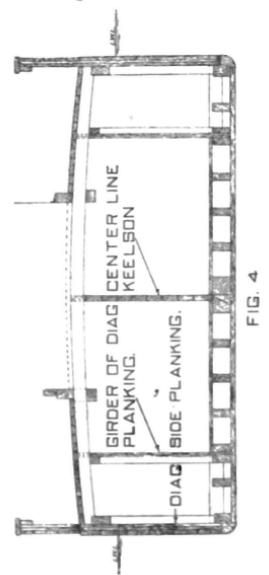
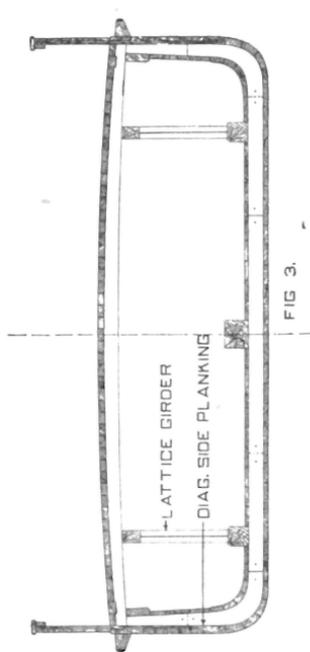
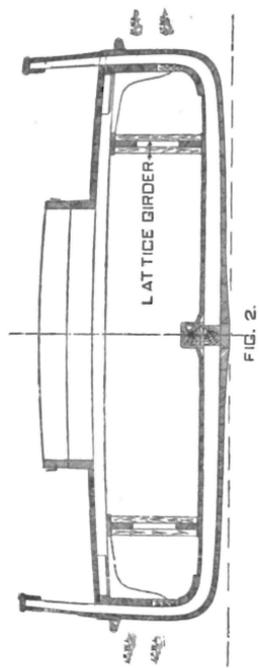
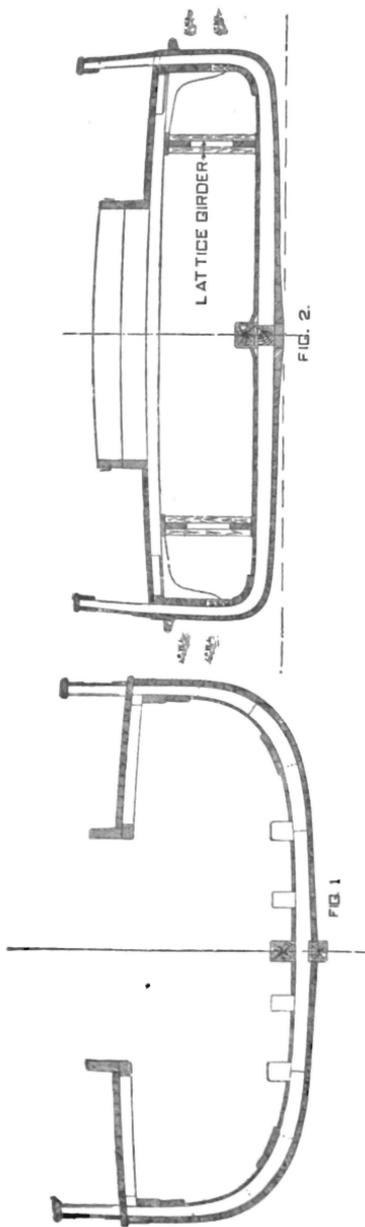




Fig. 5 is the construction plan of a lighter class of vessel, carrying passengers and some cargo, but much higher-powered and of greater speed. Tie plates of steel were introduced, together with wood diagonals at intervals of 6ft., measured on the square along the sides, and proved effective.

It is rather remarkable that, so far, though clearly prescribed by Lloyds and other classification bodies, diagonal steel or iron strapping on the outside of frames has never been incorporated in the construction of our wooden coasters, probably, and almost certainly, on account of the cost, and partly, perhaps, because the builders of wooden ships have no time for iron.

Turning now from wooden vessels to steel, the problem is simplified, and, at first sight, one would be inclined to say, "Why does anybody build a wooden steamer?"

In steel we have data in the shape of moments of inertia, known stresses per square inch, accurate knowledge of the strength or percentage of joints, a material that stays where you put it, and does the same thing every time; but immediately we get back to the old cupboard skeleton, cost—first cost, cost of maintenance, and cost of repairs. Remember our subject is small steamers; that is all changed in large ones.

The difficulties that have just been seen, particularly that of providing longitudinal strength up to the size and proportion of present wooden steamers, can easily be met by increasing the stringer plates, sheerstrake, and stringer angles connecting them. Excepting extreme cases, but say up to 15 depths, this simple method holds good; beyond that special construction is required, which generally takes the form of a centre line lattice girder over the keelson, or two placed in the wings.



Figs. 6 and 7 illustrate what is meant, where, having to deal with 18.8 depths to length, longitudinal stiffening was sought in lattice girders below decks, the coamings of machinery house and hatch utilised, bridging over between them by continuing the coaming, and stiffening with a good angle on the top edge. Such extremes of depth to length have not yet been reached in the ordinary cargo boats on this coast, but the tendency is all the time to increase the carrying capacity, and soon the demand will have outgrown the capabilities of wooden steamers, and steel must inevitably take its place.

The man who is equally familiar with both wood and steel cannot fail to appreciate the facilities the latter affords for tying a structure together in any direction desired, as compared with the former, which, good, durable and strong as it is, permits of treatment only in certain directions, and those limited in number. In spite of that, many wooden steamers will yet be built in Australia, but no great advance in size, beyond that attained already, can be looked for if built entirely of wood; if larger boats are needed it would appear that the introduction of steel stringer plates, tie plates, and probably diagonal strapping will be necessary.

We can make no direct comparison between stringer plates and equivalent hardwood waterways; it would be safer to regard the stringer plates as an added weight; but as lodging knees can be dispensed with altogether where a plate is fitted, the addition can safely be put at 50 per cent. of the plate, or about one ton. Tie plates must be all added; but it would pay, seeing that the tie plates and fastenings only represent  $1\frac{1}{2}$  ton, while diagonal straps on the outside of the frames, as required by Lloyds, would represent a saving over solid diagonal hardwood, as usually employed, of 85 per cent., or about 7 tons. A nett saving of, say, 5 tons.

An attempt was made recently by the author to calculate with reasonable accuracy the relative strength of two small vessels, one to Lloyds in steel, and one in wood having steel stringer and tie plates, for coast service.

Fig. 8 illustrates this, where, alongside the scantling plans are the equivalent girders of each. Really the girder representing the wooden vessel looks quite funny, perhaps because it is unfamiliar.

It we take the timber commonly used in the construction of wooden vessels in Australia at a tensile strength of 15,000 lbs., and steel at 60,000 lbs., we get a ratio of 1 to 4, which at first glance looks promising; it would mean that a 2in. hardwood plank was equal to a  $\frac{1}{2}$ in. plate; but in ships the tensile stresses and compressive stresses are alternating every few seconds, and here we find that the same hardwood has ability to resist compression of only 7500 to 8000 lbs. as against 60,000 lbs. in steel, so we drop to a ratio of roughly 1 to 8, or a 2in. plank equal to a  $\frac{1}{4}$ in. plate, which still looks pretty good for the wooden vessel; but when we get to connecting the parts, we find that in a butt for all practical purposes there is no connection against tensile stresses, and in the scarphs, as usually cut in wood ship practice, the connection is only that due to the tie bolts, usually one-quarter the thickness of the plank or stringer, and while such tie bolts are represented by 15,000 lb. shearing strength, or equal to the wood, the tendency of the wood to split cuts that down to an unknown quantity, depending on circumstances, probably averaging not more than one-third of the above.

It would appear, therefore, that, broadly speaking, there is at best very little direct connection to provide tensional strength in a vessel built entirely of wood; the strength of each member at its butt or scarph being borrowed from its neighbour, and in turn supplying that strength at its neighbour's butt or scarph.

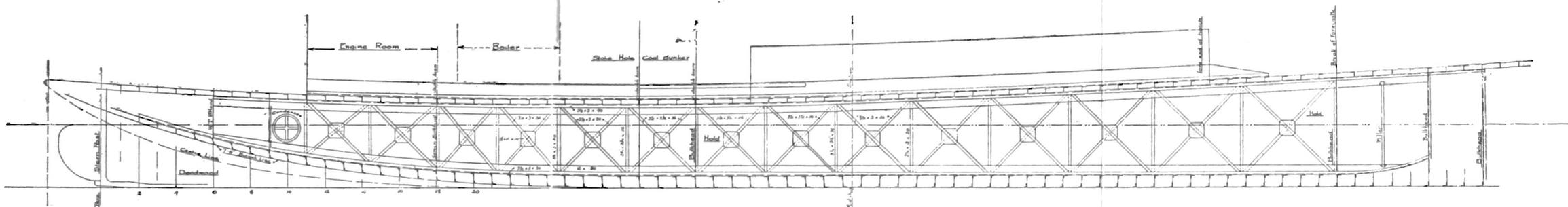
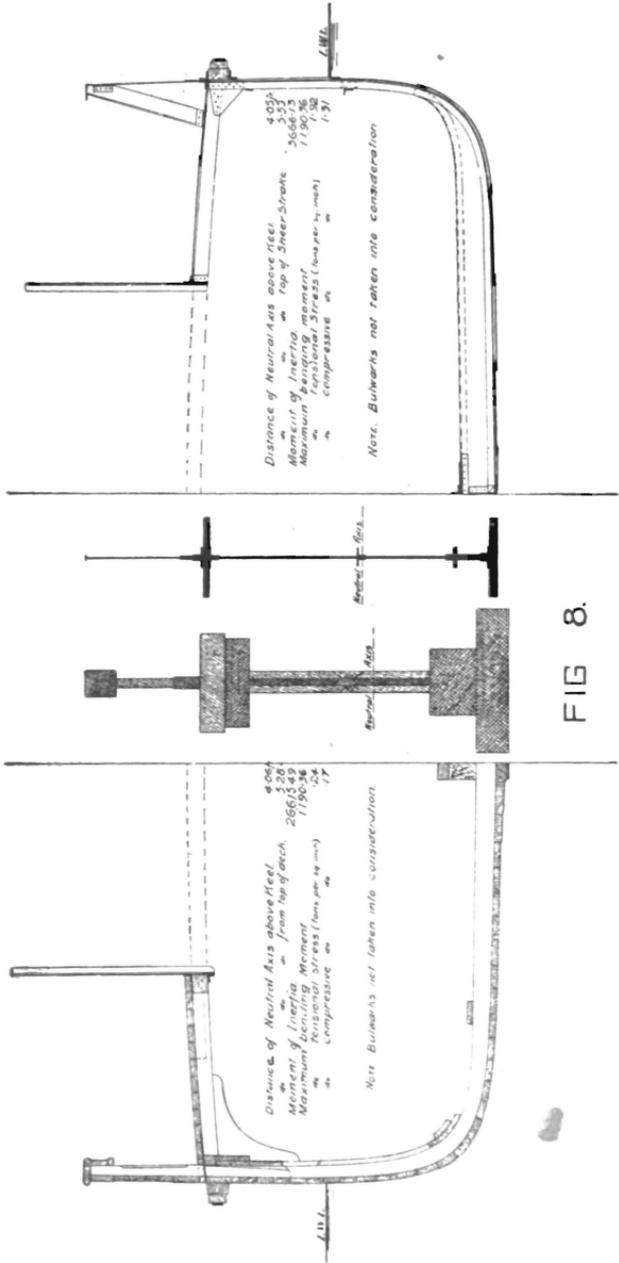


FIG. 7





It is in this connection that the steel ship prevails over the wooden one, for every part is directly connected to every other part by joints varying from 50 to 84 per cent., thus producing a continuity of strength, unobtainable in the other material.

Referring to Fig. 8, and assuming that the hardwoods are equal to one-eighth that of steel, the soft woods one-twelfth, and the tie plates and stringer plates full strength, we have the stresses on the members representing the extreme outside edges of the girder, one eight times that of the other, or both vessels the same strength; but that is only on paper, for though a good deal of work was put into the calculations, of which the figures on the slide are only the summary, we are very little better off for having made them, by reason of being still in the dark as to the value of the connections, or want of them, between part and part.

It would appear, therefore, that, for the next decade, small wooden coasting steamers will be possible, assisted by a judicious introduction of steel longitudinal members, gradually giving way to all steel, or something better, which, in the light of modern progress, is quite conceivable.

The point is, are we to continue importing our coasting steamers, other than those built of wood, or are we going to build them ourselves? Hitherto the material required for the construction of the steel vessels that have been built locally has all been imported; but, with the advent of steel works capable of turning out all plates and sections required, the unlimited number of sites suitable for launching, and the fact that the technical skill of both staff and workmen is already here, there would appear no sound reason for going elsewhere for anything required of reasonable size.

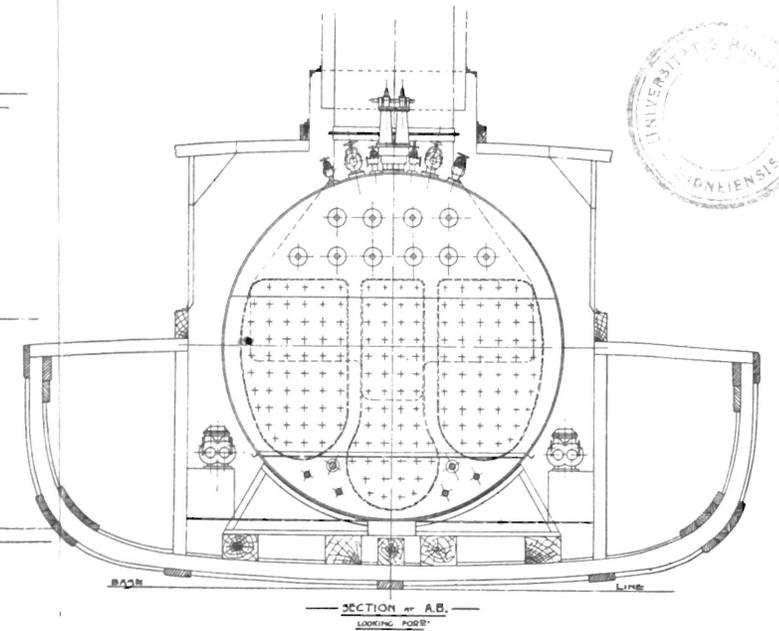
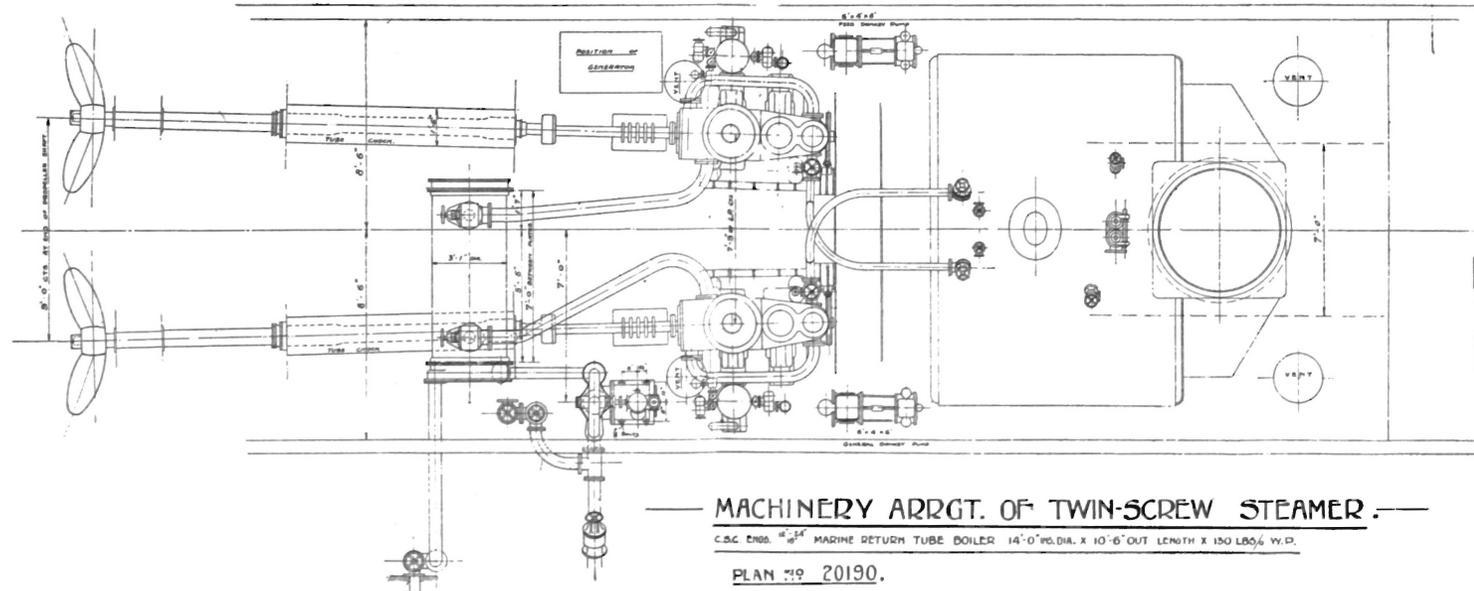
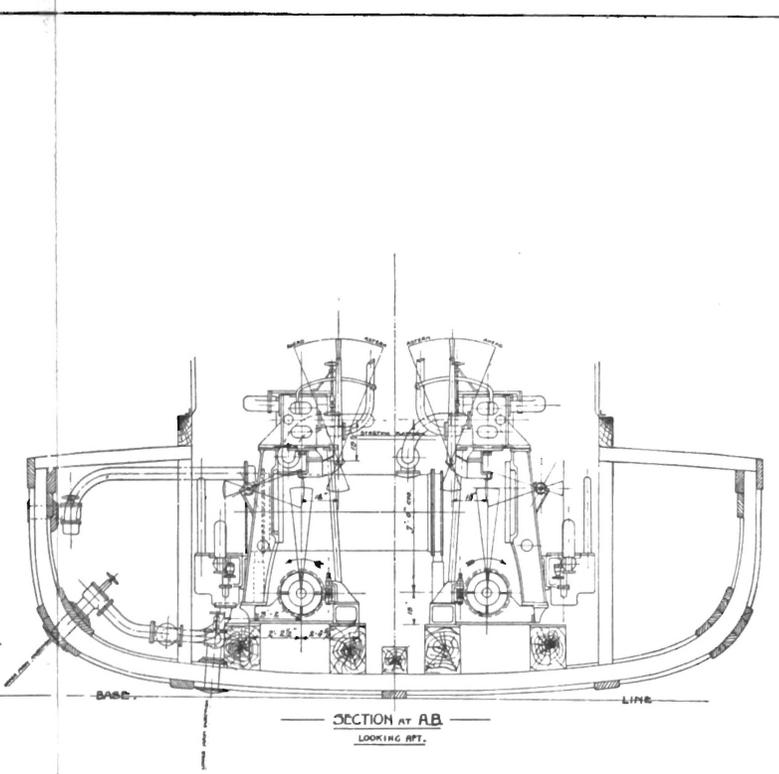
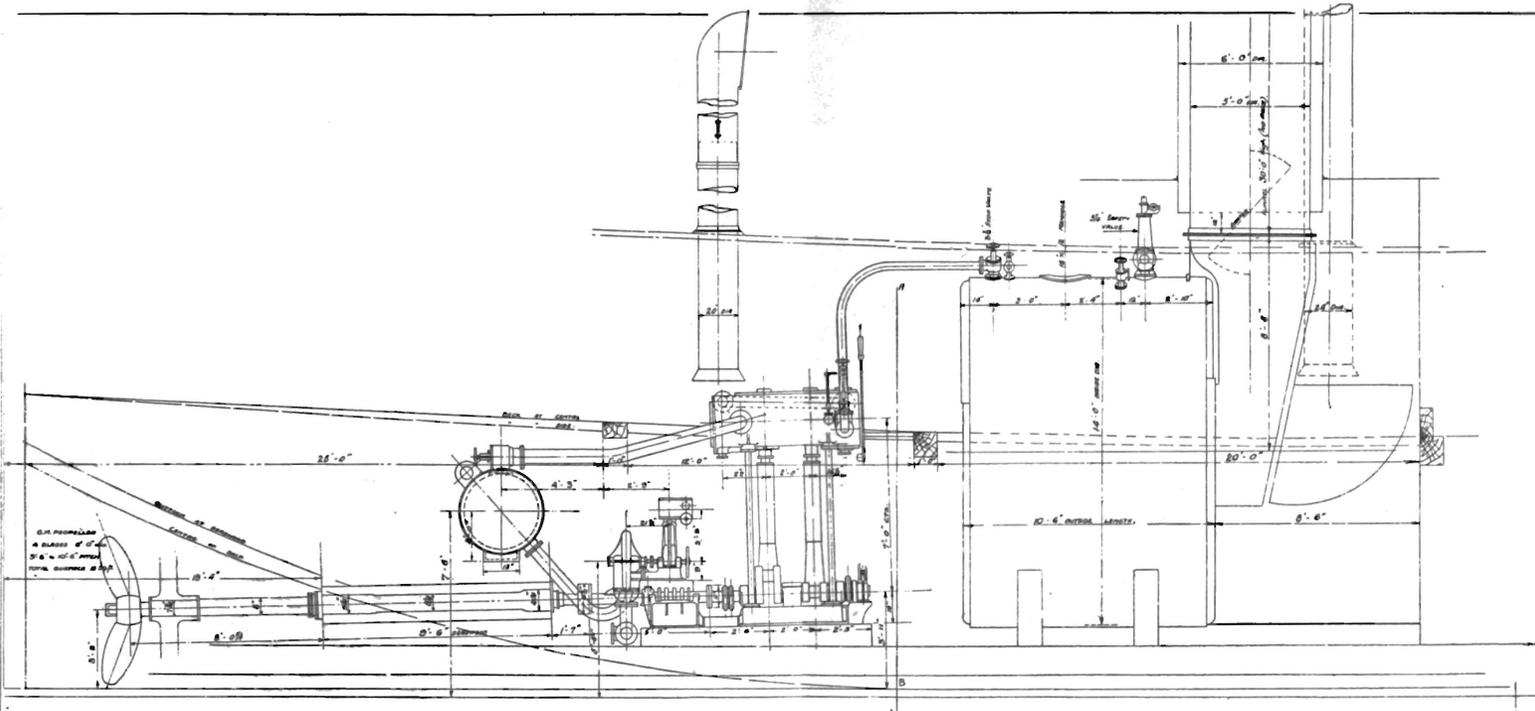
Facilities also exist for the manufacture of machinery, but that will be dealt with by Mr. Sinclair.

Just before leaving the subject, it should be stated frankly that there is nothing new or original in the foregoing; our experience on this coast has been just that which obtained in the shipping world. The small vessels of years ago were built of all wood, and many of them have lasted, in full work, upwards of 100 years; but as they grew larger, particularly as they increased in length, means other than wood became necessary, and iron filled the bill in the shape of reinforcement; then followed ships built entirely of iron; that gave way to steel, and to-day we have not only steel as usually understood, that is, mild steel, ranging from 26 to 30 tons per sq. inch, but high tension steel is being largely used, obviously with a view to the required strength of the upper longitudinal members without increasing weight.

These later stages will be passed through in the natural process of keeping pace with the requirements of our coastwise service.

Some have long since passed through those stages, but they are, generally speaking, of greater tonnage, and, as represented by the North Coast Company's fleet, the Illawarra and Hunter River boats, and some steel steamers privately owned, constitute a fleet of coasters of which the country can well be proud. Interesting as a tracing of their evolution would be, it is outside the scope of this paper.

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**MACHINERY ARRGT. OF TWIN-SCREW STEAMER.**

C.A.C. ENGRS. 14'-0" MARINE RETURN TUBE BOILER 14'-0" I.D. DIA. X 10'-6" OUT LENGTH X 150 LBS. W.D.

PLAN NO. 20190.

