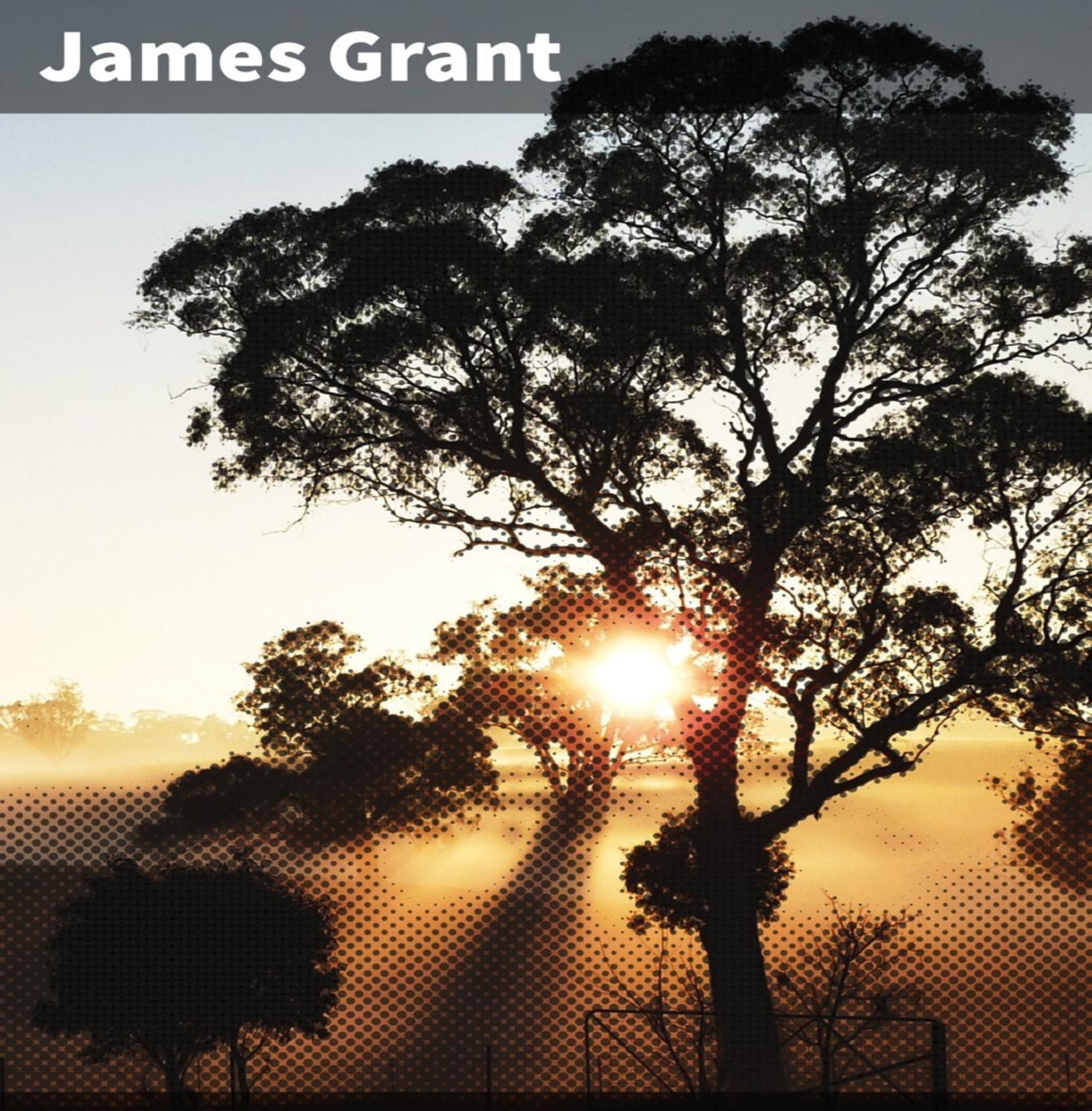
James Grant



Voyage of Discovery to N.S.W. in the Lady Nelson in 1800

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AN ACCOUNT

OF THE

ORIGIN OF SLIDING KEELS,

AND THE

ADVANTAGES RESULTING FROM THEIR USE.

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Advantages applicable to Ships in general when constructed with Sliding Keels.

THE great utility of vessels constructed with Sliding Keels, having been fully proved in the Lady Nelson, a vessel of sixty tons burthen, sent on a Voyage of Discovery to New South Wales, as will appear by the Narrative contained in the following sheets, I am induced to believe this short account of the rise, progress, and present state of the invention itself, will not fail to give satisfaction to my Readers, many of whom, though of the nautical profession, may not be thoroughly acquainted with their construction and use.

The Sliding Keels, of which the annexed Plate will give a clearer and more perfect idea than can be conveyed by words, is an improvement in ship-building, for which this Country is (and all maritime Europe will hereafter probably be,) indebted to the skill and ingenuity of Captain John Schank, of the Royal Navy, formerly one of the Commissioners of the Transport Board. This Gentleman, during the American War, gave

evident proofs of his talent for invention and resource on the Lakes of that Continent, and any attempt on my part to write his eulogy would be superfluous: suffice it to say, that he has always distinguished himself as the disinterested friend of mankind, and a sincere well-wisher of his Country.

It was in America, during the fatal contest betwixt the Mother Country and her Colonies, that Captain Schank obtained the favour and patronage of his Grace the Duke of Northumberland, then Earl Percy, who was on service there with his regiment. His Grace had so long ago as that period discovered a taste for naval architecture, the knowledge of which he now possesses in an eminent degree. It was there in a conversation on the art of ship-building, betwixt his Grace and Captain Schank, that the idea of *Sliding Keels* first suggested itself to the latter.

His Grace observing, that "if Cutters were built much flatter, so as to go on the surface and not draw much water, they would sail faster, and might still be enabled to carry as much sail, and keep up to the wind, by having their Keels descend to a greater depth; and that the flat side of the Keel when presented to the water would even make them able to spread more canvas, and hold the wind better, than on a construction whereby they present only the circular surface of the body to the water." Captain Schank coincided in this opinion, and observed, that if this *deep Keel was made moveable, and to be screwed upwards into a trunk or well formed within the vessel*, so as that on necessity they might draw little water, all these advantages might be obtained.

Captain Schank having maturely considered the principle thus suggested, was fully convinced of its use and practicability, and afterwards (viz. in 1774) solicited Lord

Percy, then at Boston in New England, to permit him to build a boat for his Lordship upon that construction. He did so, and it was found to answer in every respect.

In 1789 he built a boat at Deptford with three Sliding Keels, and in the following year the Trial cutter at Plymouth. Since that time Captain Schank has built a number of other vessels on the same construction, three of which are at this time in the service of Government: these are, the Trial cutter before mentioned, the Cynthia sloop of war, and the Lady Nelson, the smallest of the three; of the successful voyage to South Wales, in the last of which, the following sheets contain the narration.

All these vessels have proved the utility of this construction, as will appear by the Certificates contained in the Appendix. Other vessels might be mentioned, built on the account of private persons with the like construction, which have been found to answer every useful purpose.

Having now given a brief account of the origin of the invention of Sliding Keels, I shall lay before my nautical and other Readers the advantages resulting from their use; and this I am enabled to do from Papers with which I have been favoured by Captain Schank himself.

That Gentleman has comprehended their advantages under the six following heads:—1. That vessels thus constructed will sail faster, steer easier, and tack and wear quicker, and in less room: 2. They will carry more, and draw less water: 3. They will ride more easy at an anchor: 4. They will take the ground better: 5. In case of shipwreck, of springing a leak, or of a fire, they are more safe and more likely to be saved: 6. And lastly, that they will answer better as men of war, bombs, fire-ships, floating batteries, gun boats, gun batteaux, and flat-bottomed boats for landing troops.

1. With respect to vessels so constructed sailing faster, he says; it has ever been his opinion, that a ship's sailing fast does not so much depend upon her being sharp-built, as it does on her depth in the water; because water is the less easy to divide the deeper it is; to ascertain which, figures of different forms may be sunk to greater or less depth. Such experiments have been made by him, and their results have determined his predilection of the Sliding Keel.—Suppose a frigate drawing seventeen feet, and another alike in burthen drawing eleven; the last has a body of six feet less to divide, opposing only three, two, or one Keel, as may be found necessary to make her hold a good wind; while the other has six feet depressed, or about one-third of her real size opposing the water: of course she has a body of water to displace and force through equal to the difference of eleven feet to seventeen, and the deeper the stronger. North country built vessels, or those in the coal trade, are proofs of this observation. These vessels generally draw about one-third less water than other English vessels; yet when employed as Transports, they are found to sail as fast as any others; and when going before the wind, in ballast or half loaded, they frequently beat the King's ships. Now when these vessels come close hauled on a wind they drop to leeward, but had they Sliding Keels it may be presumed they would have the advantage of all others. The Dutch take little pains to make their trading vessels sail, yet when these are light they sail fast before the wind, and this by reason of their small draught of water. That nation has likewise other flat vessels; such as pilot boats, yagers for carrying the first herrings to market, and pleasure boats, all of which have lee-boards, by the help of which they sail as fast as most other vessels in the Northern

Seas. Vessels with Sliding Keels will steer better, be safer, and receive many advantages in consequence of steering easy and with little helm. The use of the Sliding Keels in steering is seen in every action of the ship's movement; by the Sliding Keels the ship's course is kept in a more direct line, for the easier the ship steers the nearer she goes on a given point, and the ship's hull, as well as the stern-post, rudder, masts, rigging, and sails are less strained. In place of two, three or four men at the helm, the largest ship may be steered by one. This is a great advantage, for it is not uncommon that vessels steer ill even in fresh breezes or light winds, so as not to be able when the wind is on their quarter to carry all their sails, and thereby are necessitated to go one or two knots an hour slower. Through such defect, and with such a wind, they lose in the twenty-four hours as many knots or double that number. This in the distance, besides what may be lost in longitude or latitude by an incorrect course. Hereby the loss of the ship might be occasioned; for even with a good observation the error of the longitude cannot be rectified. But if no observation should happen to be taken, and the steerage be wild, the error may be great, and the ship in danger in making the land. But the worst consequence of a difficulty in steering is, what it is to be feared has too frequently happened, though rarely heard of, and that is the ship's broaching-to. This, though sometimes the consequence of wild or careless steerage, is more frequently occasioned by strong gales and high seas. Thus, for instance, a ship scudding before the wind, or quartering, having little sail set, and that low, such as a reefed fore-sail, when between two seas, is almost becalmed, and therefore loses her way: the next or following sea raises her stern, her bow inclines downwards, the cutwater having a different

direction from the intended course, the stern by this is lifted so high that the rudder has little or no power, it being almost out of water. In this situation, the ship pressed on the lee-bow by the water having got on the weather quarter and the ship on the top of the sea, she flies with such violence as to bring her head round; and then lying on the broadside she plunges with the greatest velocity into a high or raging sea, the water breaks into her, washing and carrying away every thing off the deck, frequently some the crew; and it is to be feared by such accidents vessels themselves go to the bottom, and are no more heard of. Now there is nothing more clear and certain, than that Sliding Keels counteract these dreadful effects; for in a fresh breeze or light winds all possible sail may be made without regard to the wind or on what mast sail is carried. The moment sail is made, and the course shaped, the Keels may be raised or lowered, until the ship is found to steer easy, and with little helm, by which means quick progress is made, a straight or direct course, and an easy ship. To prevent the dreadful accident of the vessel's broaching-to, no more need be done than to heave the main and fore Keels close up, and let down as much as is thought necessary of the after Keel; and if enough of it is down, it is impossible that any ship can meet with this accident. How pleasing must this reflection prove to the minds of every one on board; but more especially to him, with whom the ship's safety and the lives of all on board are particularly intrusted, and whose memory may suffer from an accident, which neither his prudence could foresee, nor his presence of mind prevent; and of which, perhaps, he himself falls the unfortunate victim!

Vessels having three or only two Sliding Keels must tack quicker and in less room, because the foremost Keel and the

after one have each an effect on them nearly equal to the rudder. Therefore when going about or working to windward in a narrow channel, river, &c. where the vessel has little room, they may venture to stand nearer the shore, being more certain of not missing stays. Thus, for instance, in tacking or going about, it has been experienced that to heave up the after-keel and let the fore-keel close down, at the same time putting the helm a-lee, will make the vessel come much faster round than if she was without Sliding Keels. Indeed, in the latter case, the difference is so great, that it is as much as the men can do to work or attend the sails, and in a fresh gale they can scarcely trim them in time. The next advantage from the fore-keel is, that being hove up as soon as the ship is right with her head to the wind, it remains ready to prevent what happens to most square-rigged vessels, her falling round off, and thereby losing a deal of ground, time and tide: therefore the instant the sails are full, and the vessel has hauled off, and is falling off more, the fore-keel must be hove down which will stop her, and with the least headway she flies to as fast as if coming about; and even must be prevented coming round by again raising the fore-keel a little up. Vessels with this construction wanting to wear are to heave up the fore-keel, and heave down the after-keel; and if it be requisite to wear very quick the main-keel should be hove up also; vessels will then turn or come round as if upon a pivot, the rudder being used at the same time as in common cases. The reason of this is plain; for the fore and main keels being up and the after-keel down, the latter acts as a rudder, and hinders reaching, the effect of it being not unlike what would be produced by a rope fastened to the stern of a vessel in the tide's way, which the moment her head is at liberty would swing round with her

stern to the tide. In the same manner a vessel drawing more water aft than forward, when she takes the ground with her keel, turns her head round from the sea or tide.

2. Vessels constructed with Sliding Keels will carry more freight, and draw less water. It is well known to every person conversant in naval architecture, that different constructions of vessels cause a difference in the quantity carried. Vessels sharp fore and aft lose a great deal of stowage, and some of them carry the floor so straight and narrow the whole of their length, that by looking down into their holds the difference is easily discernible by the eye. For this reason it is impossible a true measurement can be made, so that, notwithstanding all that has been written on the subject by mathematicians of different nations, no method will ever be discovered to ascertain a true measurement of vessels until they shall be built more alike. It has been observed that some vessels of the same measurement would not take in near the quantity they measured, whilst others took in more than theirs, and, moreover, carried it with ease. But if vessels sharp-built could be brought to hold their measurement they would not be able to carry it, owing to their sharpness forward, which would cause them to pitch and ship water. This difference is constantly to be observed as proceeding from the vessel's construction. Sharp vessels go down so fast, that by the time they come to their bearings they are full, and frequently not near loaded; whereas those of flat and long floors go down slowly, and having the quantity according to what they measure, have still room for more, and are high out of the water. The improvements, therefore, which remain to be made in ship-building, must be tried on a long and flat floor; and by improvements herein, there is a promise of every advantage

that can be derived from the use of shipping. On the plan of long and flat floors every thing can be obtained, except working to windward; and if Sliding Keels answer the expectation hoped from them in that respect, the point is gained, and vessels will in general hold more than they can carry; whereas at present the contrary is the case with sharp-built vessels.

That vessels thus constructed will draw less water is demonstrable, from the largest vessel in the world to the Indian canoe. The collier, the coal lighter, corn barge, bean cod, all afford proofs that the flatter a vessel is, the less water she draws; because the more space a body covers on the surface of the water the less it will sink in it.

3. Vessels constructed in the manner herein described will be more easy at an anchor, by the same reason that they sail faster, carry more, and draw less water. In proof of this assertion the same instances may be adduced. The north country shipping, and Dutch fishing vessels, ride at an anchor when no other vessels can; and this because they have long floors, are full fore and aft, rise and fall easier, that is to say, do not pitch or plunge so violently as sharp-built vessels, but have a rolling motion when at anchor, which greatly lessens their pitching and plunging. In consequence, they do not strain the cables or anchors, or the bull, so much as vessels built on a sharp construction. It is a great advantage in navigation to be able to ride at anchor safely. Voyages may be undertaken with such security, that durst not be attempted in vessels that do not ride well at anchor. One of the reasons why Captain Cook gave a preference to a North country collier for his voyages of circumnavigation was, that they more nearly possessed all these qualities now mentioned.

4. Vessels constructed in this manner will take the ground better, and sit upright and easier than others. Flat-floored vessels, not having a rank keel, when on the ground sit so that every part of their bottom, from the forming of the entrance forward to the run abaft, bear equally on it; therefore, unless the ground be as perpendicular as their sides, little danger can be apprehended. If the sand or rock be the length of the ship's bottom, or whatever length it be, if nearly even or flat, so much of the vessel's bottom will rest on the ground, and she will certainly not be strained so much as if only a small part of the middle of the vessel touched; which must be the case with a sharp-built vessel. They who have seen vessels take the ground must have observed, that sharp-built vessels, (in which number may be included the ships of war of all nations, the Dutch excepted) the instant they do so, heel in proportion as the water leaves them. Supposing a frigate in this situation, when the water is gone from her, the gun-wale would be little more than the height of a man from the ground, and the ship would lay along so much that no one could walk the deck. Thus situated the vessel would strain so much from the weight of her mast, guns, rigging, &c. that she would be ruined, even if she were to get off. But if on the flowing of the tide it blows the least wind, so that the necessary assistance cannot be given her in the act of righting, she will be filled with water by the hatchway before it flows high enough to float her. Suppose a flat and sharp vessel in company, and both running aground in a sea, the flat vessel runs on or sticks fast, in either of which cases she sits upright, but the sharp vessel heels in both. The heel the latter takes exposes her to the sea breaking upon her, and by that means either filling her or washing the crew off the deck: whereas the vessel which sits upright runs

none of these risks, and unless the bottom is beat out, the chance of saving crew, ship and cargo is greatly in favour of the flat-floored vessel. This is so well known to seamen, that both English and Dutch flat-floored vessels coming into harbours where the ground is even, no matter whether soft or hard so it be smooth, have run aground in the hardest gales rather than be at the trouble or risk of bringing up: by this means they avoid the danger of breaking their cables and anchors, or running on board other vessels. It is remembered that a fleet of transports, coming into Cork Harbour for troops in a hard gale, did so, when a sharp vessel, through mistake, following the example was nearly lost.

5. In cases of shipwreck, springing a leak, or of fire, vessels thus constructed are safer, and more likely to be saved. The reasons last given explain the advantages such vessels have in case of shipwreck; however, it may be added, that the vessels thus recommended would possess a superior degree of security if built as nearly as can be solid; that is, all the frame of timber put so close as to be caulked in the same manner as the plank on the outside. And if the plank or ceiling of the inside were equally caulked, the vessel by this means would be much stronger, and of course would bear more beating on the rocks, sands, &c.: then if the rocks, &c. occasion a leak, if this leak does not go through, it will be stopt in its progress by the caulking: but if it does go through, it will more readily be heard, and of course more easily come at to be stopt. If a rock is the cause of the damage, and it goes half way or two-thirds through and sticks in the vessel, it becomes a plug for the hole it makes; and if it drop out, even then it will not occasion a leak. But if the vessel be divided into many equal rooms or different holds,* supposing a hole to

be so large that all the pumps in the ship, and twenty more, cannot clear away the water that rushes in, it will then only come into that single part or division in which the leak happens to be, and will flow in no longer than till it is raised withinside to the level of the sea without. The vessel would in this case be in no more danger than before, nor would the hull be loaded or depressed in the water. The difference of construction prevents a flat vessel from oversetting as soon as a sharp vessel; and her sitting up right admits of her crew working and loading, or unloading her, as the circumstances may require. Add to all this, that inestimable advantage which the one vessel has over the other, of drawing so little water. By this the flat vessel is enabled to sail over those very rocks on which the sharp-built one will strike; and admits of the former going into shallow water, where the violence of the sea becomes less and less the nearer she approaches the shore.

[* Captain Schank is here alluding to his recommendation of dividing the hold of vessels by separate bulkheads, sufficiently secured against any communication of water from the one to the other, except by cocks in case of necessity.]

The reasons given why vessels built upon this construction stand a better chance of being saved, in case of shipwreck, will in a great measure apply to the circumstance of a ship springing a leak at sea, as the effect and appearance of the one correspond with the other, though proceeding from different causes. In the former case you are supposed to be forced on the shore or rocks by the sea, wind or tide, but in the latter to be in the ocean on your voyage at a great distance from land: your ship springs a leak which seriously alarms you; you see that you cannot pump out the water; your cocks in the bulkheads being turned directly, shew in what

part of the ship the leak is; you then try with all your pumps to empty this hold, division, or room; not being able to pump it out, you try to get out of that part of the vessel what is in it, and if you can only see the bottom of the ship you will see the leak, and it must be directly stopt. Whereas, in the present construction of ships, the great inconvenience is, that the water may come from any other part of the ship, and the real situation of the leak remain undiscovered. In the case now put, supposing the worst, and that you cannot stop the leak, then putting into that part or division of the ship such things of your cargo as will not receive damage by the wet, and applying the pumps to the other parts, you proceed on your voyage with very little difference, as if no such accident had happened. It may be further observed, that the more things you put into the damaged part or division of the ship the better, as it will lessen the quantity of water, and the weight of its motion in the rolling of the ship. As ships on this construction will be more solid, it is a great chance if, in case of a shake in a plank or timber or a butt-end starting, water will find its way more than a few inches; for every part of the plank, inside and out, being closely joined together and caulked, it is impossible it should, unless the leak or hole be directly through. The same observation may be made on a shot or shots striking the ship betwixt wind and water, or even below the water-mark; whereas, according to the present construction of vessels, if a shot only splits or shatters the outside plank, or goes through into the timber or ceiling, it occasions a leak of a more dangerous nature, than if it went clear through the ship's side or bottom; because in the one case the water running in can easily be discovered, and may be stopt from the inside; but in the other, it may run in at the middle of the ship, and oozing

fore or aft amongst the timbers may make its appearance in quite a different place. As already mentioned, in vessels built on this solid construction, the shot sticking in the ship would make a plug for its own hole; and the same observation will apply to accidents occasioned by rocks, sands, or other violence that ships meet with, by which leaks are generally occasioned; and wherever a leak may happen to be, the new invented method of stopping leaks can be applied with more certainty of success.

Vessels divided according to this plan, having three, four, five, six or more holds, catching fire in any one of such divisions, have in the first instance the advantage of containing all the water thrown in by pumping, &c. in one hold or division, and can have pipes or leathern hose below the water-line to communicate with the three wells. By applying all those to the place on fire, which can be done instantly, no ship can burn be low the water-line; so that all the water drawn or pumped will be applied to keep the fire from the upper works, rigging, &c.: and by this means the magazine can instantly be drowned, or any part of the ship where combustible matter is, can be filled with water. The crew then have every encouragement to stick by the vessel, and endeavour to extinguish the fire: and if the vessel be in company of other ships, each ship will come as near as possible to that which is in distress, and send boats, men and engines to her assistance. Whereas, according to the present construction of vessels, a man seeing a ship on fire, and knowing that ship to have powder on board, will not approach her for fear of her blowing up, and thereby involving his own ship in her fate. This was the case with his Majesty's ship St. George, the surrounding vessels not daring to render her any effectual

assistance, from the apprehension of her magazine exploding; whereby, though every exertion was made to save her crew, numbers of them were either burnt, drowned or blown up.

6. And lastly, that vessels thus constructed will answer as men of war, bombs, fire-ships, floating batteries, gun boats, gun batteaux, and flat-bottomed boats for landing troops.

The advantage of the wells in filling the magazine with water has, in some measure, been already explained, yet it may not here be improper to mention, that a convenience of this kind has long been a favourite idea with, and the earnest wish of the greatest Officers of the Navy. The late ingenious Sir Charles Knowles and Captain Bentinck, with many others, had this object much at heart, but the opposition they met with and other views, prevented either of them from accomplishing what they so much wished. Captain Bentinck had formed plans not only for the magazine but for every store-room in the ship. The great difficulty with him was in placing the cocks; but had Sliding Keels and these wells* been at that time invented, the speedy and easy conveyance of the water would soon have been seen, and there is no doubt would have been applied as has been herein already proposed. Almost every class of vessels having the magazine either fore or aft, the foremost or after-most well might be so connected with it as in time of action to keep every thing damp.

[* The wells here spoken of are the grooves in which the sliding keels move: and by which they are raised up or lowered down. They may have cocks let into them on either side.]

Such Admirals, Captains and Lieutenants as have done the duty of Master's-mate, know the trouble of the duty of the hold, and it is known to few others. In long cruizes or passages it is a desirable object to keep the ship in her best sailing trim;

and this greatly depends on filling the empty casks with salt water. This, from the great trouble attending it, is a duty which is generally put off as long as possible; sometimes, indeed, so long, that the ship is by far too light to carry sail; and a gale coming on in this situation occasions much inconvenience. Then every exertion is used to fill up empty casks; but as there is but one cock, and that only suited to fill the lower or middle tier, it takes up much time; and pumping or drawing water in bad weather is commonly found impracticable. But were ships built with Sliding Keels, there would be no danger in having two or three cocks to each well, so that all the water necessary could be had in one hour. Water might also by the same means be let into a cistern wherein the hand-pump stands, and from thence be conveyed to any part of the ship, either to fill the casks or wash the decks; and by such assistance all the decks in the ship would be washed at the same time. Another great convenience might be derived from the wells to men of war victualling for long voyages. In fresh water rivers all the casks in the ship could be filled from them with the greatest ease. Turtle, lobsters, oysters, and other sorts of fish usually kept for any time in well vessels, might in men of war be preserved alive, by means of the wells, without the least inconvenience to the vessel.

The importance it is of that ships should keep their station in the line of battle is well known, both from recent instances, and from the history of sea-fights in times past. As vessels are now constructed, from the difference of their draught of water, and their varying height, some ships are more or less leewardly than others, and therefore do not all keep the line equally well. To obviate this inconvenience the French generally keep a point or two from the wind, the fleet keeping

under way and under steerage, which frequently draws them a-head and to leeward, yet still they form a good and well connected line. Great advantage too might be derived from this circumstance in going on expeditions. It often happens that a commander in chief, with a fleet of men of war with troops and stores under his command, brings-to at night to keep his fleet together, on account of some ships being more apt to go to leeward than others. He finds in the morning that they have shifted their situation as to him, and their respective situation with each other. This often produces much inconvenience: it may however be remedied, in a great measure, by the use of Sliding Keels. For should a commander in chief, on seeing a gale coming on bring-to before night, fix on the sail he intends to lay-to under (if possible) all night, order the helm to be put as intended for the night, the yards to be braced, backed or pointed to the wind, the keels to be hove down or up, and the signal to be made for the fleet to take up this drift, it is to be presumed that in the course of the whole night there would not be the difference of three miles in a fleet of a hundred sail or more, unless occasioned by neglect, or through the wind shifting; whereas, according to the present mode of ship-building it seldom happens, even with men of war, that fleets and even the smallest squadrons are not separated by lying-to in long winter nights. This we need not be surprised at when we take notice in the day of the difference between a frigate and a line of battle ship in the act of lying-to. In order more clearly to explain what is here said with respect to keeping ships together when in fleets, and lying-to, or even standing on a wind, it may be added, that by the use of the keels, though a vessel or a number of vessels should be left behind, owing to their not being able to sail as

fast as the King's ships, yet they may be prevented from falling to leeward: and, therefore, if in the morning it be found that any ships have fallen astern and are missing, there is a greater certainty of their coming up if waited for; or if a frigate be sent after them, she is surer of finding them. The Trial cutter, in which the experiment has been made, when brought-to, and all her keels up, will drive to leeward, leaving her wake over the weather-beam; but on the keels being hove down, she proportionably lessens her drift and fore-reaches; nay, if the helm be given, and all the keels hove down, she will, from one knot or two, increase her motion to four or five; and so on in proportion, and according to circumstances.

The situations of harbours in consequence of points of land, tides, rocks, shoals, and sands, being as various and as numerous as the harbours themselves, the approach of ships to towns and forts which are to be attacked or bombarded are thereby often rendered both difficult and dangerous. In expeditions of this kind great impediments have been observed to have arisen from the sharpness of vessels, and their great draught of water. The circumstance of drawing much water prevents them from getting near the object of attack, and often occasions, perhaps, the failure of an expedition, from their being obliged to wait for a full tide, which gives the enemy an opportunity of discovering the design, and taking measures accordingly. With regard to the sharpness of vessels, besides the inconvenience of drawing more water, they are subject likewise to another, from the aukward manner in which they take the ground. For supposing a sharp-built vessel to get near enough to the object of attack, and to be left in that situation by the tide, she cannot throw her shells, because she will be lying almost on her broadside.

Being thus exposed to the fire of the enemy, without ability to return it, it is more than probable that before the tide return she will be taken, or the water flow into her before she rights. But vessels built flat and solid, as on the plan herein-before recommended, will not be equally liable to these inconveniences; the circumstance of drawing less water will enable them to come nearer the object of attack, remain there longer, and withdraw easier from it; even should such vessels be left by the tide, they might remain during the ebb, doing their duty equally as if afloat.

All the inconveniences now just before pointed out in the case of bombs, from such vessels being sharp built, and having a great draught of water, apply with equal force to fire-ships. But some other advantages may be enumerated as derivable to fire-ships from Sliding Keels, which could be of no use with respect to bombs. Such as when, in certain situations, opportunities occur by placing the keels, and making the sails, that fire-ships may run on a direct point, and do the duty required amongst shipping in a road or harbour, or against a town near the water; and it is to be presumed, that with fire-ships thus constructed it is practicable not only to set fire (if no boom,) to a fleet in a harbour, but at the same time so effectually to destroy the harbour itself, as to prevent the ships that should not be burnt from coming out, or any other ships of the line from going in.

Many of the reasons given in the two last cases against sharp-built vessels, and in favour of those on a flat construction with Sliding Keels, apply to floating batteries, gun boats, gun batteaux and flat-bottomed boats for landing troops. If a floating battery is to be built, it should be constructed suitable to the place and object it is intended for,

whether it be to go to sea, or to work up rivers; to run a certain distance before the wind, or be towed by boats to the place where they are to act. In either of these cases a variation in the construction would be required; but the most considerable part of the improvement would be in making separate bulk-heads, which in batteries or boats the more numerous the better. For instance; suppose gun boats are attacking a vessel or fort, or a great number of flat-bottomed boats landing men, if a large shot strike any one of these boats and go through her, the boat must inevitably sink, to the great alarm of the men in the other boats; but if these vessels are built with bulk-heads, the water only can come into one or two places; and unless the shot goes in below the water-line at one end of the boat, she will not sink, nor will the men in the other boats know any more of a shot striking her, than of a man being killed.

Advantages applicable to Ships in general when constructed with Sliding Keels.

Thus much Captain Schank has delivered, respecting the advantages resulting to vessels constructed with Sliding Keels, and applicable to ships in the service of Government; the observations which follow, apply more particularly to trading vessels, and the general improvement of navigation.

1. Vessels thus constructed will answer better as Coasters of all kinds, and for the coal trade. The advantages which Coasters will derive from this construction are many. It is certain that great numbers of them are lost owing to their great draught of water; and it is also well known that their passages are frequently much lengthened, by their being

obliged, when the wind is contrary, to run to leeward to get a good harbour or roadstead. In such cases, if they drew a few feet less water, they would go into many harbours, which they are now obliged to pass. But the inconvenience does not rest here, for even when they arrive at the intended port, they are, perhaps, often obliged to wait several days for a spring tide, which, when it comes, a gale of wind probably prevents them from taking advantage of, and getting in: and often the same time may be lost in getting out of the harbour. Besides loss of time, and consequent expences to the owners, great quarrels are sometimes produced through the same causes, betwixt owners, captain and crews. All which would, in a great degree, be prevented, were these vessels of a smaller draught of water. According to the plan herein recommended, vessels of one hundred and twenty to one hundred and forty tons, would not draw when loaded above five feet and a half of water at most; and all other vessels in the same proportion. They who are concerned in shipping, and know what water vessels of such burthen at present draw, must see with astonishment the advantage of this construction; which would likewise prove more convenient, as such vessels would not require a pier to lie to, and are capable of being moored in any part of a harbour; and if the ground admit of it, carts, &c. might come alongside, and load or unload them, which also would save a great expence.

2. Vessels built on this construction would answer in canals; where the canal is above four or five feet deep. Let us suppose the Duke of Bridgewater's canals, and all others now made, or to be made in the kingdom, to be equal to the depth of the Scotch canal betwixt Glasgow and Carron, the locks to be from sixty to seventy feet long or more, and from twenty to twenty-