line of the compass plate as the compass in the binnacle ſhall ſltow that the deviates from her true courſe ; ſo that in whatever direction the ſhip ſhall sail, the palate D will always look full to the ſouth-weſt point of the horizon, or towards the port of deſtination, and conſequently will preſent only an oblique ſurface to the re­filling medium, more or leſs oblique as the ſhip deviates more or leſs from the true courſe of her voyage. As, therefore, the reſiſtance of the water will operate leſs upon the palate in an oblique than in a direct poſition, in exact proportion to its obliquity, the index H will not ſhow how many knots the veſſel runs in her then courſe, but will indicate how many ſhe gains in the direct line of her intended voyage—Thus, in fig. 9. if the ſhip’s courſe lies in the direction of the line AB, but ſhe can ſail by the wind no nearer than AC ; ſuppoſe, then, her progreſſive motion ſuch as to perform AC equal to five knots or miles in an hour, yet the index H will only point to four knots on the graduated arch, becauſe ſhe gains no more than at that rate on the true line of her voyage, viz. ſrom A to B. Thus will the difference between her real motion and that pointed out by the index be always in proportion to her deviation from her intended port, until ſhe sails in a line at right angles therewith, as AD ; in which case the palate would preſent only a thin ſharp edge to the refitting medium, the preſſure of which ſhould not be ſufficient to overcome the friction of the machine and the bearing of the ſpring L. So that at whatever rate the ſhip may ſail on that line, yet the index will not be affected, ſhowing that ſhe gains nothing on her true courſe. In this caſe, and alſo when the veſſel is not under way, the action of the ſpring L ſhould cauſe the index to point at O, as repreſented by the dotted lines in ſig. 5. and 8.

As the truth of this infiniment muſt depend on the equal preſſure of the resiſting medium upon the palate D, according to the ſhip’s velocity, and the propor­tionable action of the ſpring L, there ſhould be a pin or ſcrew at the joints C and F, ſo that the rod may be readily unſhipped and taken in, in order to clean the palate from any foulneſs it may contract, which would greatly increaſe its operation on the index H, and there­by render the graduated arch falſe and uncertain.

Further, the ſpring L may be expoſed too much to injury horn the ſalt water, if fixed on the outſide of the ſhip s bow. To remedy this, it may be brought under cover, by conducting the machine as represented by fig. 8. where AB is the rod, C the fulcrum or centre of its motion, D the palate, E the horizontal arm leading through a ſmall hole into the forecaſtle ; M is a ſtrong chain faſtened at one end to the arm E, and at the other to a rim or barrel on the wheel G, which by means of its teeth gives motion to the ſemicircle I and index H. The ſpring L is ſpiral, and encloſed in a box or barrel, like the main ſpring of a watch. A ſmall chain is fixed to, and paſſing round the barrel, is fasten­ed by the other end to the fuzee W. This fuzee is connected by its teeth with the wheel G, and counter­acts the motion of the palate D. N, N, are the two

ſockets through which the rod AB paſſes, and in which it is turned round by means of the little index R. S is the ſmall compaſs plate, moveable on the top of the upper socket N. The plate S hath an upright rim round its edge, cut into teeth or notches, ſo that when the index R is a little raised up, in order to bring it round to any intended point, It may fall into one of theſe notches, and be detained there ; otherwiſe the preſſure of the water will force the palate D from its oblique position, and turn the rod and index round to the direction in which the ſhip ſhall be then sailing.— Should it be apprehended that the palate D, being placed ſo far forward, may affect the ſhip’s ſteerage, or obſtruct her rate of sailing, it ſhould be considered that a very ſmall plate will be ſufficient to work the machine, as one or three or four inches in diameter would pro­bably be ſufficient, and yet not large enough to have any ſensible effect on the helm or ſhip’s way.

The greateſt difficulty, perhaps, will be in gradua­ting the arch K, (if the machine is conſtructed as in fig. 5.) ; the unequal divisions of which can only be aſcertained by actual experiment on board of each ſhip respectively, inasmuch as the accuracy of theſe gradu­ations will depend on three circumſtances, viz. the position of the fulcrum C with reſpect to the length of the rod, the ſize of the palate D, and the ſtrength or bearing of the spring L. When these graduations, however, are once aſcertained for the machine on board of any one veſſel, they will not want any future alte­rations, provided the palate D be kept clean, and the ſpring L retains its elaſticity.

But the unequal diviſions of the graduated arch will be unneceſtary, if the machine is conſtructed as in fig. 8.; for as the chain goes round the barrel L, and then winds through the ſpiral channel of the fuzee W, the force of the main ſpring muſt operate equally, or nearly ſo, in all poſitions of the index, and conſequently the diviſions of the arch K may in ſuch caſe be equal.

After all, it is not expected that a ſhip’s longitude can be determined to a mathematical certainty by this inſtrument. The irregular motions and impulſes to which a ſhip is continually expoſed, make ſuch an ac­curacy unattainable perhaps by any machinery : But if it ſhould be found, as we flatter ourſelves it will on fair experiment, that it anſwers the purpoſe much better than the common log, it may be conſidered as an acquiſition to the art of navigation.

It ſhould be obſerved, that in aſcertaining a ſhip’s lon­gitude by a time-piece, this great inconvenience occurs, that a ſmall and trifling miſtake in the time makes a very great and dangerous error in the diſtance run. Whereas the errors of this machine will operate no far­ther than their real amount ; which can never be great or dangerous, if corrected by the uſual obſervations made by mariners for correcting the common log.

A like machine, made in its ſimple form (as at fig.5.), ſo conſtructed as to ſhip and unſhip, might occaſionally, be applied alongſide about midſhips, in order to aſcertain the leeway ; which, if rightly ſhown, will give the ſhip’s preciſe longitude. As to ſea currents, this and all other machines hitherto invented muſt be ſubject to them influence ; and proper allowances muſt be made according to the ſkill and knowledge of the naviga­tor.

Laſtly, ſome diſcretion will be neceſſary in taking obſervations from the machine to be entered on the log-book : that is, the moſt favourable and equitable mo­ment ſhould be choſen for the obſervation ; not whilst the ſhip is rapidly deſcending the declivity of a wave, or is ſuddenly checked by a ſtroke of the ſea, or is in the very act of plunging. In all caſes, periods may be found in which a ſhip proceeds with ***a*** true average