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Power Driven Tools on Board Ship.

BY MR. J. H. THOMSON (Member).

READ

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CHAIRMAN: MR. J. E. ELMSLIE.

THE object of this paper is to initiate a discussion amongst the members of the Institute, with the hope that as the result of such discussion a clear expression of opinion may be obtained as to the power driven tools on board ship, their number, size, arrangement and general equipment. In addition many members will doubtless be able to give a description of various expedients to which they have resorted in order to overcome the absence of such equipment, and thus help others who find themselves similarly placed.

It might be thought that in the present age of machinery, there would be little need to plead for up-to-date power driven tools for executing the everyday mechanical work on board a modern steamship; yet the majority of ships will be found deficient in this respect, many possessing no power-tools whatever, others only a nondescript lathe put on board with considerable disregard of the probable requirements, size of ship, etc., and of the large range of work which can be economically carried out, given suitable and suitably equipped tools. It is therefore necessary to try and state a few of the advantages of fitting such tools on board, in the hope that it may persuade the ship owner that capital so invested is well spent and will give a good return.

Any repair that can be efficiently carried out on board ship, by the ordinary staff, without entailing the neglect of other duties, and without entailing any overtime work will cost anything from 75 per cent. and upwards less than such repair would cost ashore. For there are no extra wages to pay for such repair; there is no charge for the use of shore machinery; the profit required by the shore firm is saved; much scrap material which usually goes ashore for a very small return can be profitably worked up on board; there is an enormous saving in the time taken to execute the repair, a saving which in some cases would avoid the ship being detained in port; owing to the quickness and ease with which work can be done, the machinery will be kept in better repair, as the ship staff will have more time to devote to it; there will be a saving in the bill for files and other hand tools used on board; and last, but not least, it will tend to minimise that fruitful cause of discontent on board ship—overtime.

To take a simple illustration of everyday routine work: suppose a 3in. dia. by 2in. wide bearing wants stripping, the amount of metal to be removed—ascertained in the usual way by leads—is $\frac{25}{1000}$, it could be put in the lathe, the amount required taken off to within $\frac{1}{1000}$, a true plane surface left, parallel with the opposite plane surface of the bearing, or parallel with the bearing itself as may be required, sharp edges and rags removed—all in well under a half-hour, with a minimum of physical labour by anyone with a slight knowledge of turning. In the vise, with a good file, the same job would take from an half to an hour-and-a-half, and, given a good tradesman, might have the required amount off to within $\frac{2}{1000}$ and in that time have an approximately plane surface, approximately parallel with the other surface of the bearing. With a poor tradesman there might be $\frac{5}{1000}$ or more of error in the parallelism of the two surfaces, and the new surface might resemble the Bay of Biscay on a rough day, more than a true plane. In contrasting these two methods of doing the same job, remember that such a job has often to be carried out in an engine-room at a high temperature, particularly so in the tropics. Doing the job in the lathe it has been a pleasure to the engineer, and he is practically as fresh after its completion as he was before he started. Doing it in the vise is mere mechanical drudgery, and the engineer is wet with perspiration, and has lost a considerable amount of energy. In passing, a simple method of taking off exactly the right amount of metal in the lathe might be given: Face up only about a quarter or less of the surface to be stripped, until, when laying a good straight edge across the old surface, the required feeler will just slip in between the straight edge and the new surface, after which the remainder of the old surface can be faced down to the same plane: See Fig. 1.

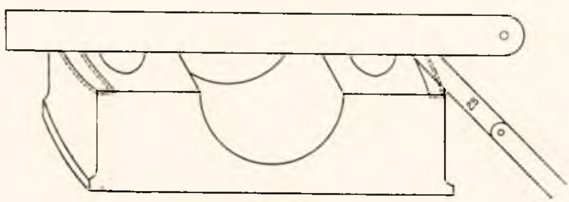


Fig. 1.

An illustration of common repair: The valve spindle of a steam stop valve is broken on the day of sailing; with a power driven lathe on board, and a small stock of various sizes of brass rod, such a spindle could be replaced in about four hours, possibly less if it so happened that there were any old valve spindles on board which could be worked up for the job. Without a lathe and with the necessity to send the spindle ashore to be made good, the time lost may be anything from a half-day upwards.

The minimum power driven tools advocated on board a ship are: a lathe, a drilling machine and a high-speed grinder. These tools should be so arranged that each can be used independently of the others, or that all these can be in use simultaneously. It will be most convenient, if the three machines are grouped together, so that all may be driven off the one counter shaft, fitted in the usual way with driving and loose pulleys. For driving the counter shaft an electric motor complete with starting switch, etc., will be required, the power of the motor depending upon the size of the tools that it is proposed to instal, one of $2\frac{1}{2}$ H.P. should be ample for all ordinary requirements.

A point which might be considered is whether the motor might not be fitted so as to be capable of assisting the lathe gearing in getting the required slowness of speed for turning a job of large diameter, such a job being of infrequent occurrence, there would

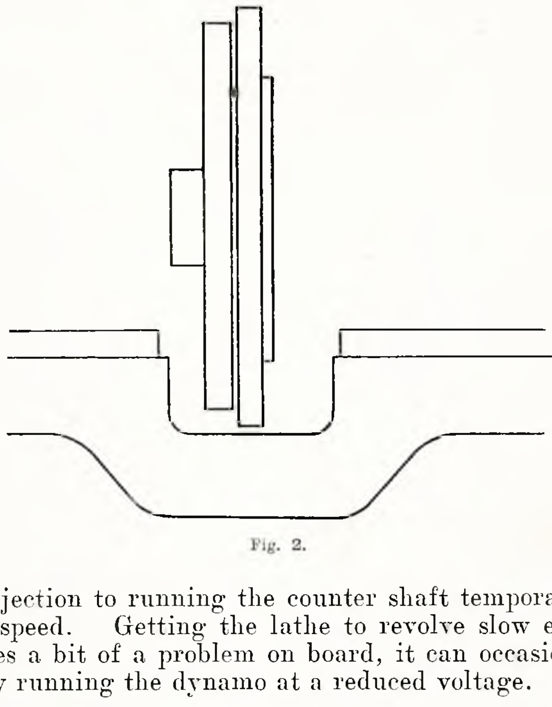


Fig. 2.

be no objection to running the counter shaft temporarily at a reduced speed. Getting the lathe to revolve slow enough is sometimes a bit of a problem on board, it can occasionally be solved by running the dynamo at a reduced voltage.

The Lathe:—It is difficult to definitely fix the size of the lathe that should be fitted on board ship, and the point should be one that will bear discussion; the suggestion is put forward that the aim should be to have a lathe which with the gap removed would be capable of dealing with the H.P. junk ring, the H.P. piston being the one which usually gives the most trouble from wear, etc., and for length capable of dealing with any of the main engine valve spindles, not that it is thereby implied that the valve spindle should be accommodated between the lathe centres, it will be sufficient if by the aid of a fixed stay, that part of the spindle which works through the neck bush, stuffing box, gland, and guide, can be efficiently dealt with. Space in a ship for a lathe of such size is not always obtainable, but with a little contriving it should be managed, unless in very small boats, where the length may require consideration. A suitable position in a turbine driven ship is often found in the shafting space, which usually extends right

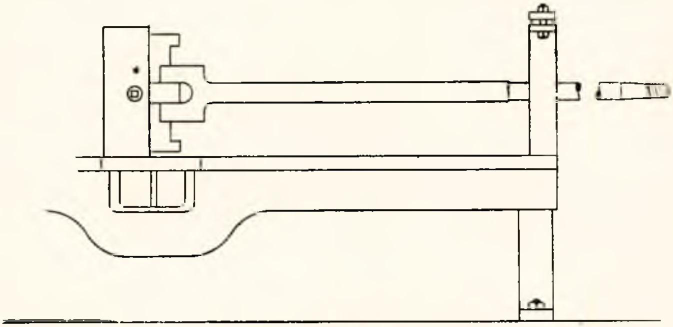


Fig. 3.

across the engine space, there the lathe, drilling machine and grinder can be ranged along the ship's side, using the ship's frames for the purpose of attaching counter shaft brackets, motor, etc. The forward starboard side is usually the more suitable, thus leaving the ends of the shears clear for any extra long job to overhang, this point should also be kept in mind if the lathe is placed in the engine room, as one often sees the end of the shears close up against the ship's skin, which renders the turning of a long job impossible. If the space is so limited that the end of the shears cannot be left clear, then they may abut on a hold or bunker bulkhead, which can have a circular hole cut in it in line with the lathe centres, such hole being made water-tight with a covering plate, this means that a time must be selected for doing any job which is extra long, when the bunker is clear of coal, or the hold of cargo. It may be mentioned that such a hole by bolting a suitably shaped piece of wood to it, may be utilised as a fixed stay.

There is one point that must on no account be lost sight of in selecting a position for these tools: the space selected must be well ventilated, and cool enough at all times, even with steam on the main engines, and the ship in the tropics, for a man to work in comparative comfort; efficient work cannot be done, and moreover very little work will be attempted, if the machine tools are placed in a situation which entails a Turkish bath to the operator. Engineers get enough compulsory hot jobs on board ship, and can dispense with having one supplied to them every time they wish to use the ship's lathe, though one would often imagine that in selecting a site there was great fear entertained in case the operator might get cold feet. The speed at which the ship's lathe can be driven requires more consideration than it usually gets, for seeing that there is only the one machine one would think it stood to reason that it was necessary it should be capable of a very much larger range of speed than would be the case in shop practice. Thus, if the suggestion that the lathe should be capable of dealing with the junk rink be accepted, then it follows that the lathe spindle should be capable of being driven from a speed suitable for such ring up to the speed suitable for turning a small diameter brass pin, and if the suggestion made later on, regarding the supplying of one or two emery wheels for use in the lathe is carried out, then the lathe spindle should be capable of a higher speed still, say 1,500 revs. per minute, which is suitable for a 14in. dia. wheel.

A discussion of the general construction of the lathe required would take up too much time, every maker has his own peculiarities and ideas which are more or less good, it will be sufficient if the tool is got from a maker of repute, and he is fully informed of the work that will be required of it. There are several good makers who have recognised that for ship work a special tool is needed, and who have laid themselves out to design one suitable. The ship lathe must be capable of cutting screws of all the standard pitches, and it may require to have one or two odd wheels for bastard pitches, if the engine builder happens to be one of those who use bastard threads, a practice resorted to in order to compel the user to come back to the maker for renewals. Every shipowner should make it clear in the specifications, that no bastard pitches or peculiar shaped threads are to be used in any part of the main engines or of the auxiliaries, or of the various cocks and valves in the steam and water ranges. The usual compound saddle rest is required with cross feed, etc. Quadrant should be marked off in degrees. The moving headstock should have a cross adjustment for purposes of alignment or turning up tapers. A suggested fitting for the moving headstock which would be of great use is a drill chuck which would be attached to the moving cylinder of the headstock, the boring of holes in work which is attached to the running spindle being of much more frequent occurrence than of that in which the drill is attached to the running spindle. Drills are sometimes supplied capable of being placed in the taper hole which holds the fixed centre or a special drill holder, but the practice is not good, as the hole gets damaged, and so renders the fixed centre shaky or out of alignment. A suggestion for a holder is given in Fig. 4, which is self-centreing and

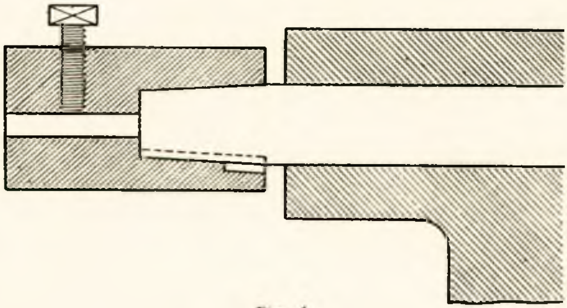


Fig. 4.

free from shake, and can be detached by drawing in the cylinder by means of its screw, when the holder will abut on the barrel and be forced off; a sunk feather is fitted to the holder engaging in a key-way cut on the under side of cylinder end. The attachments for the running spindle will consist of:—

One large face plate for use with gap removed.
One face plate for use with gap in place.

One driver plate for driving work held between the centres.

One chuck with four independent dogs each having three steps, and capable of being reversed and holding circular work securely when they are so.

A shortcoming of most dogs is that they will not very readily catch small work, say of $\frac{1}{4}$in. diameter; in Fig. 5 is shown an

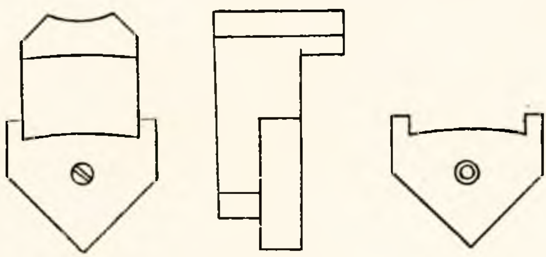


Fig. 5

attachment which will be found useful in this connection. Any-one wishing to use it should make a wooden pattern a neat fit for the dog, and get four forged off it in tool steel, true up one flat surface of the forgings and fit them to the dogs, make sure when boring the holes and fitting the pins that the strain when screwing up the job will not come on the set pins, the set pins will last better if they are also made of tool steel. After the forgings have been fitted to the dogs, true up the sides of the V-shaped portion, until the four points meet in the centre of the plate; the dogs are lying in a true circle and the sides of the V-shaped portions form true radii of a circle, the front faces of the segments may be faced up with the chuck running on the lathe spindle. The V-shaped portions should not come to absolute points, but be left about 1/16th in. wide, a small rack consisting of a piece of $\frac{1}{8}$in. plate with four tapped holes to take the set pins is desirable to hold pins and segments when not in use.

One drill chuck which will hold the drills supplied to the ship, this may be one of the numerous small self-centreing grip chucks, or a chuck with a plain parallel hole, say $\frac{5}{8}$in. diameter, if the drills are, as is very common, forged from $\frac{5}{8}$in. round tool steel bar.

One fixed stay, which can be bolted down to the lathe shears.

One running stay, which can be attached to the saddle, those with adjustable metal dogs are more useful than those requiring the fitting of various size wooden blocks.

One hand rest for wood turning tools.

The following lathe centres are required:—

Two ordinary pointed centres.

One ordinary pointed centre with end of reduced diameter for small work.

One cutting centre.

Two or more driving centres for wood turning.

One hollow centre (optional).

The lathe tools are a very important subject, and it is hoped that members will give their experiences as to what tools should be supplied. It is a good many years since the author worked in the shops, and shop practice has altered very considerably, in particular with regard to the use of small tools held in a tool bar or turret rest; a list of tools is given of the ordinary form $\frac{1}{2}$in. or $\frac{5}{8}$in. square section common tool steel, this steel being selected, as the many special self-hardening steels require an experienced tool-smith to deal with them; and while tools made of such steel could be dressed ashore, there is always the possi-

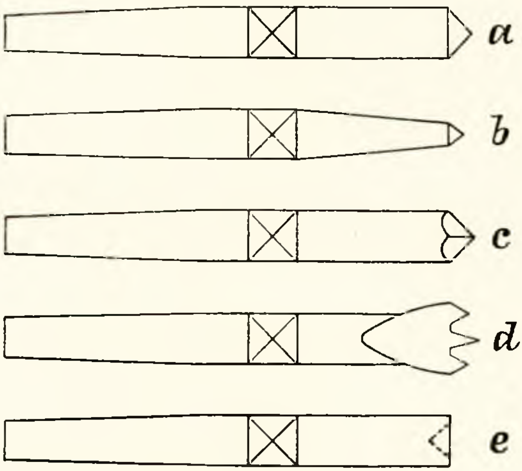


Fig. 6.

bility of these getting broken when away from port and requiring to be re-dressed by the ship's staff.

Tool List:—

Three ball point roughing tools, two for iron, one for brass.

Two right-hand side cutting tools, one for iron, one for brass.

Two left-hand side cutting tools, one for iron, one for brass.

One spring scraper.

One right-hand knife tool.

One left-hand knife tool.

Two Whitworth standard thread screw cutting tools, one medium, one small, both to be dressed as right-hand tools.

Three parting or square thread cutting tools, of width, say $\frac{1}{12}$in., $\frac{1}{8}$in., $\frac{1}{6}$in.

Five inside screw cutting tools, to correspond with outside screw cutting tools; the smaller size V-thread, and the $\frac{1}{12}$in. square thread to be capable of cutting a thread in a $\frac{1}{2}$in. hole.

In the event of the shifting headstock not being fitted to hold drills, one drill holder suitable for fixing in the tool rest.

A set of inside and outside combs.

Other tools may be added from time to time as may be required, but with the foregoing outfit any ordinary job can be tackled. In getting tools made or dressed for ship's use, it should be remembered that they will be principally used for light duty, that is, taking a light cut or skimming off work that has been previously machined, and they can therefore be dressed of lighter shape than would be the case for shop work; further, the facilities for grinding tools on board being usually of the most crude description, the underside of the tools should be cut well back, so that there may be as small a surface of steel to grind as possible. Fig. 7—A, shows a ball point roughing tool as used in the shop; B, a similar tool for light duty in a ship's lathe, when it will be noticed that the surface to be ground (*a*) when the tool requires sharpening is only about one-third in tool B of what it is in tool A.

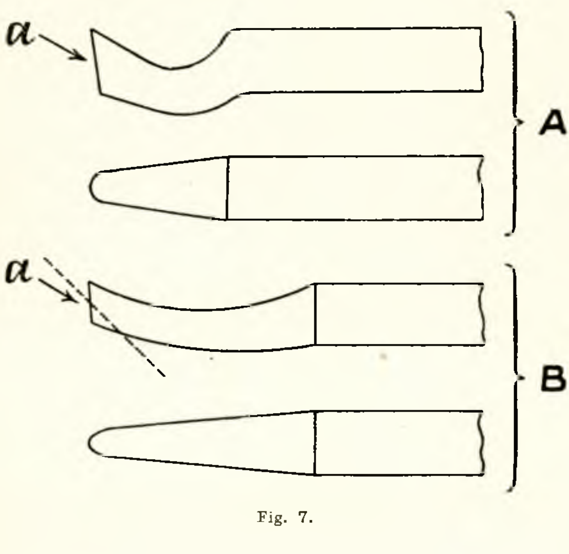


Fig. 7.

The Drilling Machine.—If the lathe on board ship is often inadequate for the work, what can be said of the drilling machine?; driven by manual labour, hand feed, lacking rigidity, it is a most efficient drill breaker and spoiler of work. A possible reason for the neglect of this important tool, and the supply of an inadequate makeshift, may be that the lathe is expected to do the most of the drilling work that is required; admitted that it can do so, it can only do so if not in use for other work, and this with the large amount of work to be put through in the short time the steamer is in port, is seldom the case; as with a good lathe and engineers once accustomed to making every possible use of it, it is hardly ever idle. Further, for its special class of work a drilling machine has great advantages over the lathe, the different position of the work being one of the greatest. In the drilling machine the average job simply requires to be laid on the table, moved into and held in position by hand and the hole bored, the job lying on the table of its own weight, and the thrust of the drill assisting the action of gravity. For ship work a machine which will bore holes from $\frac{1}{32}$in. up to $1\frac{1}{2}$in. is required, and it must therefore have the range of speeds and power required for such sizes; it will not matter if the speed is not quite so high as boring a hole of $\frac{1}{32}$in. permits, but it must be able to revolve slowly enough, and have the requisite power and rigidity for the $1\frac{1}{2}$in. hole, a speed ranging from 30 revs. per in. to 300 revs. per in. per minute should be obtainable. When space can be had, a useful type of machine is the one which has the drilling spindle and its driving and feed gear mounted on a short cast-iron pedestal or column; a double bracket capable of swinging round, being raised or lowered, and clamped in position on the column. One end of the bracket supports a round table capable of revolving on its axis, and of being clamped; the other end consists of small shears on which slides a parallel vise. This is a well-known type of machine familiar to most engineers, and made by practically all the well known tool-makers. It has the further advantage that the brackets when swung at right angles to the spindle leave the floor space clear for putting any extra large job under the spindle.

When space is not available various modifications can be made, thus, instead of a double swing bracket a single one can be used, allowing the machine to go close against a bulkhead, or the ship's side; when the flat revolving table should be retained and a parallel vise supplied, which can be bolted on top of the same. The advantage of the vise fitted on the shears is the clearance which is available under the vise; the limit to the length of the work which may be held being the floor underneath. A ship's frame can be utilised instead of the cast-iron column, the drilling spindle and its gear being secured to the frame at a suitable height; the table could consist of an ordinary good sized cast-iron knee plate, capable of being bolted to the frame at various heights, or of being removed to allow the job to sit upon the floor. A parallel vise should be supplied which will be suitable to attach to the table. Fig. 8 is a rough sketch

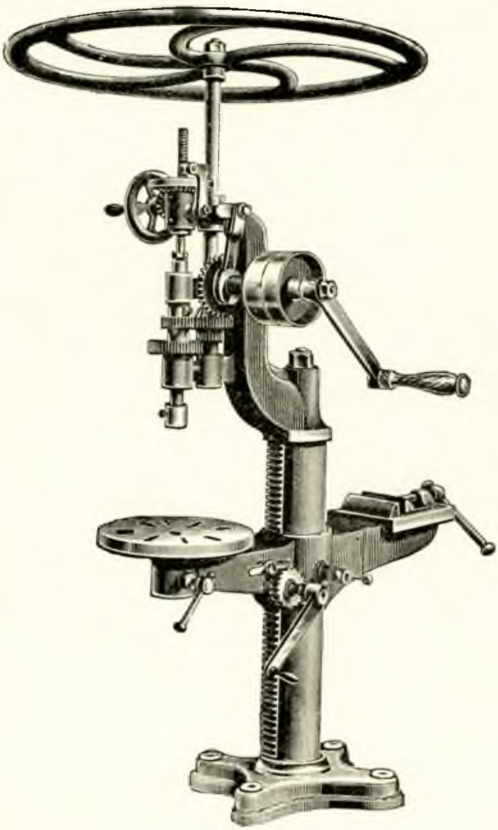


Fig. 8. Vertical Drilling Machine for hand and power; double-geared, self-acting (Messrs. Buck and Hickman, Ltd., London).

of a drilling machine with the double swing bracket; and Fig. 9 is a drilling machine attached to the ship's frames, in both instances all driving, feed gear, etc., is omitted. Members will be able to give details of other machines of which they have had experience, and of various devices which have been resorted to when space was limited.

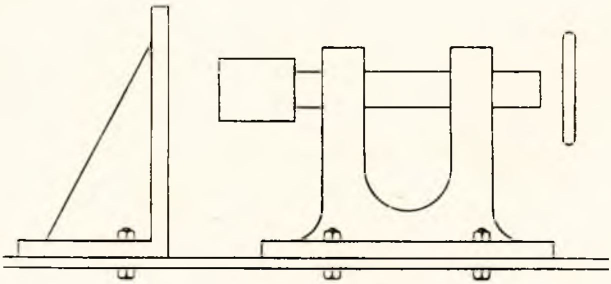
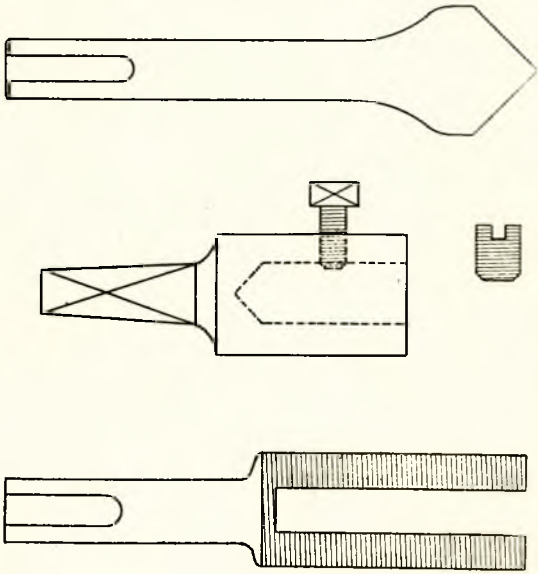


Fig. 9.

The drills for the machine are the next consideration: should they be twist, flute or common, should they have parallel round shanks, taper round shanks, or taper square shanks? In deciding this important point it must be remembered that the same set of drills will probably have to be available for use in the ordinary ratchet, where they are subject to much harder use and abuse than they are in a drilling machine or lathe. Twist and flute drills are the most efficient, and bore the truest to size; their disadvantage for ship's use, where they are used for ratchet work, is the ease with which they are broken, and the fact that being of the same section throughout, they often break so near the shank that the life of the drill is finished; also in order to get the best results from them, they require to be machine ground; this latter objection disappears if the ship is to be supplied, as it should be, with a grinding machine. The ideal would be to have two complete sets of drills, the twist or flute for use in the machines, and the common drills for use in the ratchets or machines; failing this, choice must be made of the one kind for all purposes. The drill which can be most easily made, repaired and ground, is the common drill forged from plain $\frac{5}{8}$in. round bar tool steel, with a flat at the one end to take the point of the set pin. The sockets of the ship's ratchets should suit this, or a loose socket with square tapered male end and round $\frac{5}{8}$in. parallel female end be supplied; such sockets are not very difficult to make, and two or three of various lengths are most useful for ratchet work; and will often save a lot of time being spent in hunting up, and fixing packing. The set pins for these sockets should be of tool steel with the cheese points slightly tempered, each socket having two set pins, one with a square head, the other of a grub screw shape, the latter is only for use when there is not clearance room for the one with the square head. If flute or twist drills are to be supplied,



Figs. 10, 11 and 12.

the flute shape will be found the more useful, they are more easily ground, and they are more efficient for use in reamering out a hole parallel and true to size, at which class of work a twist drill has a great tendency to draw itself into the work, seize and snap. In attempting to reamer a hole with a twist drill, it usually pays to plug up the original hole first with hard wood or brass.

The sizes of drills should range, at least, from $\frac{3}{16}$in. to $1\frac{1}{2}$in. advancing by $\frac{1}{16}$in. with four extra drills for $\frac{3}{8}$in., $\frac{1}{2}$in., $\frac{5}{8}$in. and $\frac{7}{8}$in. tapping sizes, and one good large counter-sink point, making 27 drills in all. Better still if the sizes range from $\frac{1}{16}$in. to 1in., by $\frac{1}{32}$in., and from 1in. to $1\frac{1}{2}$in. by $\frac{3}{16}$in., with counter-sink point, making 36 drills in all. There remains the question of sizes smaller than $\frac{3}{16}$in.; for this purpose a good method is to have them forged from $\frac{1}{16}$in., $\frac{3}{32}$in. and $\frac{1}{8}$in. square tool steel rod; a short length, say 2ft. of each size, being also supplied to provide for any breakage or odd length drill that may be required. Steel rod of this size and section requires the minimum of forging, and the square section provides a most efficient grip for the ordinary shark jaw chuck, with which the American brace is usually fitted; for use in the power driven drilling machine a chuck should be supplied. A useful chuck for the drilling machine and lathe can be made by making a male part as shown in Fig. 12, to suit the shark jaws and outer nut removed from either the American or the wood brace. Other tools might be suggested for use in the drilling machine, such as cutter bars and cutters, etc., but the need for them on board is not very great. Before quitting the subject of the drilling machine, it may be of interest to give details of a job carried out on board and the tools used, as an illustration of the value of the power driven tools on board. The job was to make good the faces of all the water valves and valve seats of a standard Weir's pump fitted with the usual group-valves, in this case the pump had 60 valves. The 60 seats were all faced up in the drilling machine in five hours, and the 60 valves were faced up in the lathe, also in five hours, that is a total of 10 hours for 60 valves and 60 seats; to have "done them up" by hand, that is, filing and grinding with ground glass, emery, carborundum powder, bath-brick, etc., etc., would take anything from 25 to 50 hours, and the result would not be so perfect as those done in the machines. It may be added that the ship in question had three such pumps and one set of spare water valves, in all 240 valves and seats. The tool used in the drilling machine is shown in Fig. 13. A is turned out of a mild steel, top portion $\frac{5}{8}$in. diameter with flat filed for set pin of vertical, and the screw portion

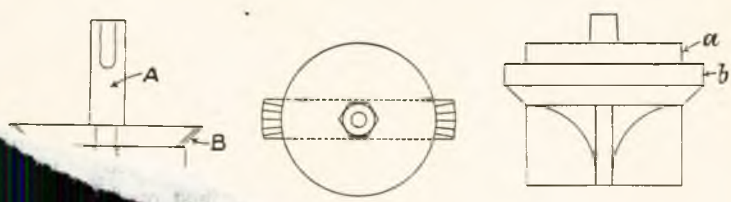


Fig. 13A.

is $\frac{3}{8}$in. diameter common Whitworth thread. B is a tool steel milling cutter, in this case it formed part of the valve facing machine outfit belonging to the ship; an invaluable outfit with which every ship should be supplied. Such a cutter can be made on board if desired, or a single cutter can be bought for a shilling or two, the advantage of the bought cutter is that it has been machine ground after tempering, which of course is impossible on board. In tempering on board give the cutting ends all the water, and leave the centre soft. For facing up the valves, which in Weir's pumps are roughly as shown in Fig. 13A; take a new boiler zinc tile, chuck it up fair in the lathe, bore out the centre to take the portion of the valve marked A, a good tapping fit with the hand hammer, also face the tile partly, leaving a face with a diameter $\frac{1}{4}$in. larger than diameter B of valve. The valve may now be slightly driven into the tile, faced up, and released by light blows on the points of the wings; the time taken for the complete operation is four to five minutes. As the diameter A varies slightly, it is advisable to select those of the largest diameter first, any of the smaller diameter may be made to fit the tile by means of one or two thicknesses of paper. The zinc tile should be used up for the boiler when finished with, and not kept for a future occasion as it is better and quicker in doing lathe work by this method to use a fresh block, which gives a hole, and face running dead true.

The grinding machine.—Why, it may be asked, should the engine room of a modern ship, a space full of intricate machinery, have placed in it a dirty, inefficient, manual power grindstone? It is some years since the author asked for the loan of a hand rest and cone cutter, from one of the largest marine engine firms in the South of England, for the purpose of trueing up the engine room grindstone. The reply received was that they had not such a thing in the works, grindstones having been scrapped, and high-speed emery buffs installed in their place many years ago. The only place where a grindstone is permissible, is in the stokehold for grinding up boiler scrapers, etc. The most suitable grinder for a ship should open up some discussion and suggestion from those who have expert knowledge of the subject. A machine with a 12in. to 14in. by $1\frac{1}{2}$in. wet wheel on one end of the spindle, and a similar sized emery facer on the other end with suitable rests, etc., shou
prove a useful and satisfactory machine for ship use.
tachment should be supplied for grinding twist o
Those who have to contend with the old-

will find the expedient of getting an emery wheel and using it in the lathe a welcome help, a sketch of such a wheel fitted on suitable spindle to fit the drill chuck is given in Fig. 14. In ordering a wheel for this purpose, get as large a diameter wheel as the lathe will accommodate with the gap in place in order to get a good peripheral speed; a small wheel at the usual fastest lathe speed is not of much utility. It should be possible to provide a lathe with a sufficiently high speed for driving an efficient wheel of medium size, and this might be done when for reasons of want of space a grinder could not be installed. The drawbacks to the emery wheel being used in the lathe, are the difficulty of keeping the wheel running true, and the grit that tends to get into the spindle bearings, and under the saddle—with due care the latter can be much minimised. As the spindle in Fig. 14 requires a special forging, a sketch is given in Fig. 15 of a construction that can be carried out on board ship. The spindle is turned out of a good-sized piece of steel in order to get as large a collar as possible, the washers are made of $\frac{1}{4}$in. plate, $\frac{1}{3}$ diameter of wheel, faced on one side sufficient for collar and nut respectively, and recessed on the other side in order that they may grip the wheel at their edges, or, instead of recessing, a ring of $\frac{1}{16}$in. paper or fibre on either side will give the same result.

The Forge.—This may not be strictly speaking a power driven tool, unless the term may be permitted if the blast is supplied from a power driven fan; why it should not be so is difficult to understand, as the cost would not be much greater than supplying the usual hand forge, with which members are doubtless familiar, possibly painfully so. The name cast on these forges, such as "Cyclone," "Typhoon," is usually the only thing about them that is at all suggestive of a blast of air. Seeing that the average steamer is provided with power driven fans for the boiler furnaces, it should not be a difficult matter to provide a forge with an air pipe led to it from a convenient fan trunk. The following are details of an expedient that was carried out: The cyclone part of the forge was removed and the remaining cast iron pan and tuyere on its stand was bolted down in a corner of the stokehold, immediately under a fan trunk, some old 3in. iron pipes, flanges and elbows, that happened to be on board were utilised to make a connection from the bottom of the fan trunk to the tuyere, a thick asbestos millboard joint was put between two of the flanges, with a portion of the joint cut away, and one bolt left out; in the space thus provided a bit of sheet iron of U shape was inserted, which acted as a valve.

The result was an excellent forge capable of melting cast iron, as was conclusively proved by the prompt disappearance of the tuyere; however, a new one protected by firebricks and fire-clay lasted better, and gave most efficient service; a water cooled tuyere of the usual style would of course be better still.

Still, a coal forge is not the ideal fitting for a steamer, and so possibly some of the members could give information as to

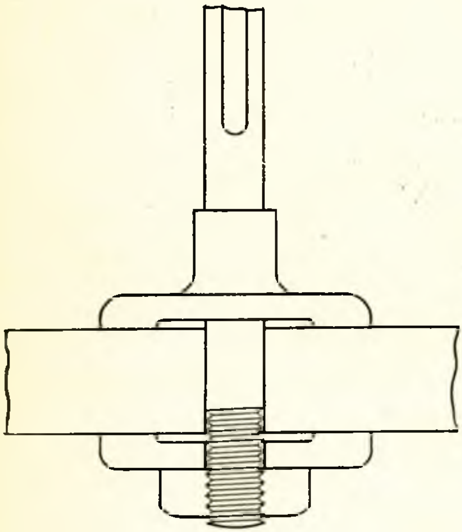


Fig. 14.

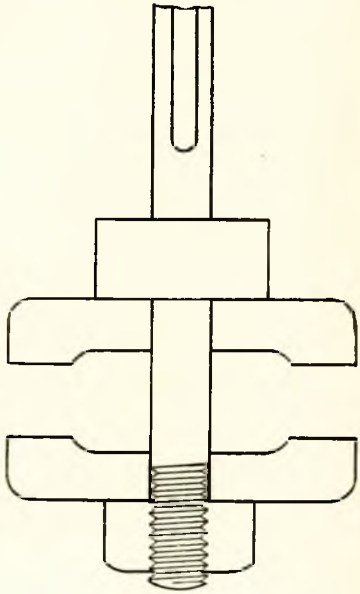


Fig. 15.

A.—The spindle and back washer are best if made in one piece, as this gives a greater rigidity to the back washer and so gives a truer running wheel, but if the fitting is ship made, a spindle fitted with two washers will answer the purpose almost as well, making the back washer a good fit for the spindle, and providing the latter with as large a collar as possible. Fig. 15.

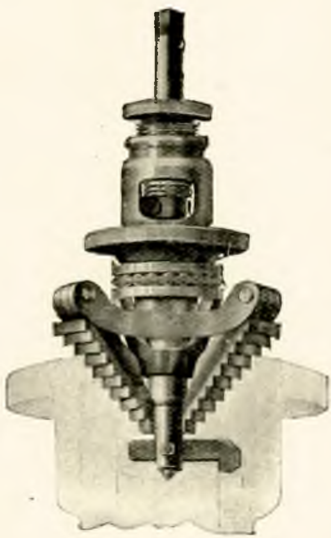
An actual job carried out in one on board ship with the tool used. may be useful, and will assist to demonstrate the point that to fit power driven tools pays.

The job to be done was to face up all the water valves and seats of a standard Weir's pump fitted with the usual group valves; in this case the pump had 60 valves and seats, the 60 seats were faced up in the drilling machine in five hours; the 60 valves were faced up in the lathe also in five hours; to have "done them up" by hand in the usual ship fashion—filing, ground glass, emery, bath-brick, etc.—would have taken anything from 25 to 50 hours, and the result would not be nearly so perfect as those done in the machines.

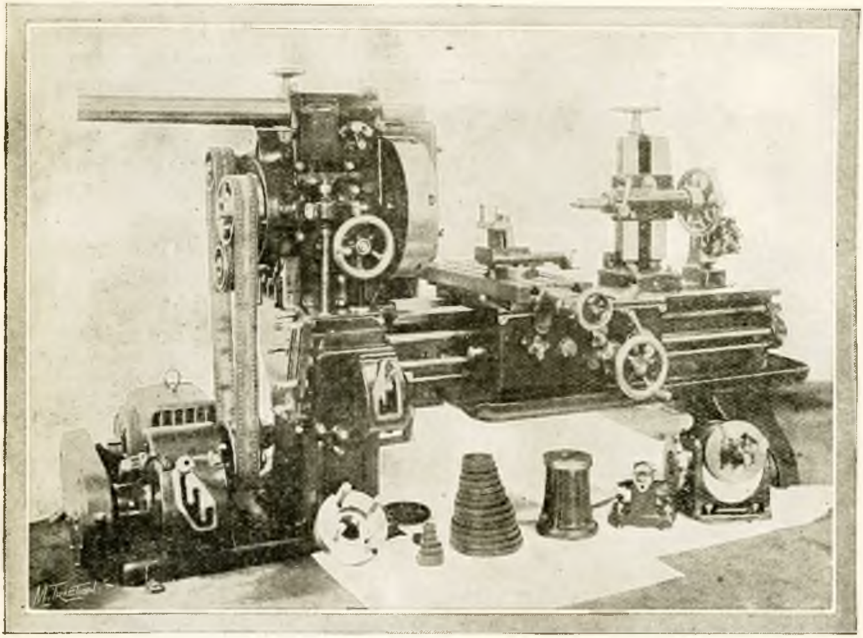
Fig. 13 illustrates the tool used: A is turned out of mild steel, top portion $\frac{5}{8}$in. dia., screw-joint $\frac{3}{8}$in. common Whitworth thread. B is a toothed tool steel cutter or milling tool; in this case it formed part of the set of the Morse valve facing machine belonging to the ship. If such is not available, then a single cutter can be bought for a shilling or two, or it is not a very difficult matter to make one, the advantage of the bought one is that it is reground after tempering, a somewhat difficult feat to perform on board ship with the limited appliances.

the utility and cost of some form of oil fuel forge which would be small and compact, and could be placed in the engine room, where it would be always available for use; it would require to be smokeless or nearly so, able to be put in operation on short notice, and should be capable of heating up $\frac{3}{4}$in. square tool steel to white heat in a reasonable time, say five minutes. It is seldom that any larger job than this turns up on board, and when it did it could probably be dealt with in one of the boiler furnaces.

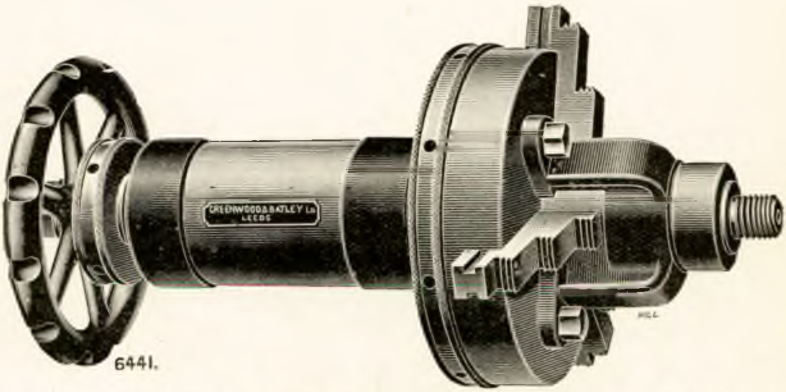
This paper has not covered the whole ground of power tools for a ship, there are many other tools which could by suggested, which would be most useful and not very costly; such as an arrangement for driving a hack saw, a small shaping machine, both of which could be arranged as lathe attachments; a portable electric driven driller which can be used in any part of the ship, the current being got from the nearest lamp socket, etc. It is hoped that enough has been said to initiate a good discussion and to induce members to give details of any useful contrivance they may have seen or evolved, and it is suggested that such details should refer to power driven contrivances only, otherwise so large a subject is opened up as to be unwieldly. Possibly at some future time the author or some other member will take up the subject of the outfit of hand tools for a ship. It should render available a large store of personal experience, both for the use of those who go to sea and have to use the tools, and for those who have to do with putting a suitable outfit on board.



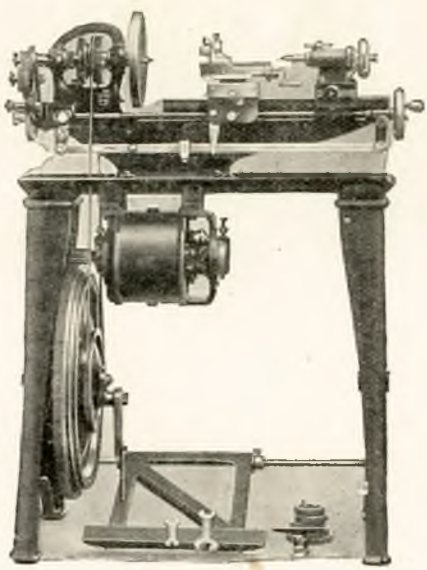
The "Simplex" Patent Valve Re-seater (Bromell Patents Co., Ltd., Glasgow).



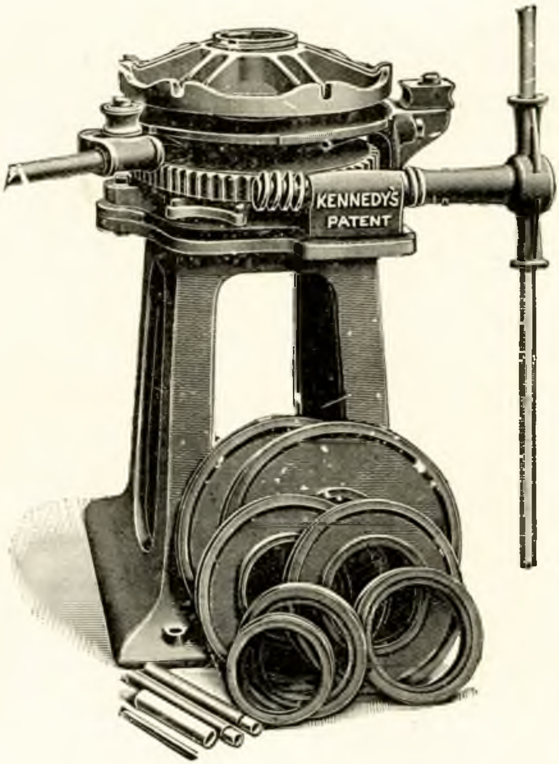
The "Drummond Barreto" Universal Turning, Boring, Drilling, Screw-Cutting, Milling and Gear-Cutting Machine (Messrs. Drummond Bros., Guildford).



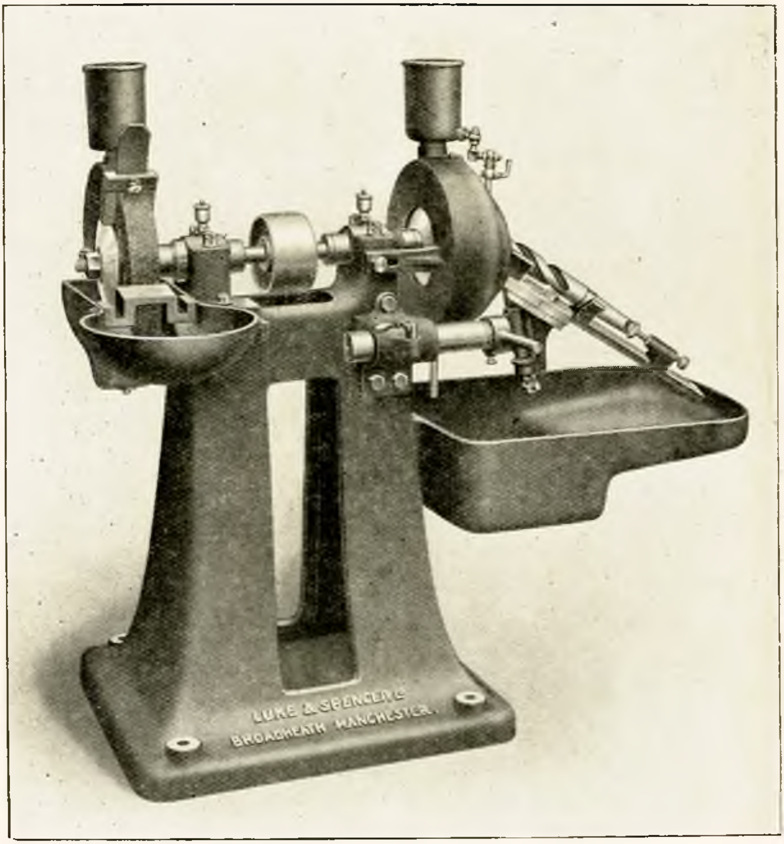
Valve Re-seating Machine as supplied to various Repair Ships in H.M. Service (Messrs. Greenwood and Batley, Ltd.).



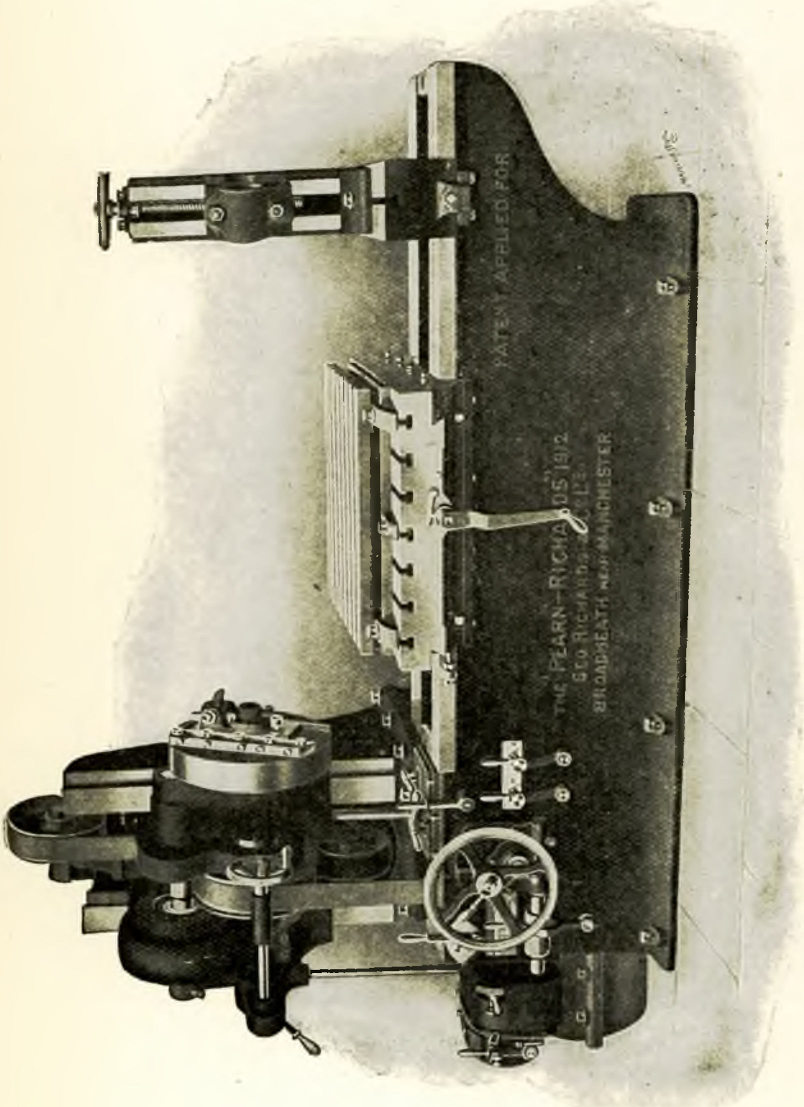
$3\frac{1}{2}$in. Motor Driven Lathe as supplied to Ships of H.M. Navy (Messrs. Drummond Bros., Ltd., Guildford).



The "Kennedy" Pipe Bending Machine, as supplied to H.M. Repair Ships (Mr. W. Kennedy, West Drayton).



Combined Tool and Twist Drill Grinder (Messrs. Luke and Spencer, Ltd.).



The "Pearn-Richards" High-speed Combined Surfacing, Boring, Milling and Drilling Machine (Messrs. Geo. Richards and Co., Broadheath).

DISCUSSION.

Mr. W. McLaren: The author wants, no doubt, to bring about an up-to-date condition of things on board ship, but, taking into consideration the expense of the plant, what would the shipowner think of it? It seems to me that the outfit indicated for any ordinary ship would weigh about a ton, and except when he is dealing with liners, or other important work, would the engineer require it? Let us consider that for a year the whole outfit is carried on board, what has he earned in that time? That is one way to look at it. I do not say that he should not have the tools, as the Marine Engineer is always willing and ready to work when an emergency arises, but I do not know whether he would always be ready to do work on board ship which can be done on shore. When he is at sea he is aware of the necessity, but in port where there is an open door from the ship to the shore, that is another matter. The engineer will show his worth if he has any tools at all, and he who can use a lathe at all, ought to be able to do anything in reason. The drilling machine referred to appears a delicate piece of mechanism and an ideal machine to have on board ship. It would occupy a space of about 7 ft. × 2 ft., added to the space for a motor to drive it. The size of the lathe I would prefer to be about 12 in. to 5 in.

I wish to express my thanks to the author of the paper, and I may conclude by saying that the engineer is known by his tools and what use he can make of them.

Mr. Donaldson: This paper opens up a subject for great discussion and the first consideration is the question of accomodation. It is of no use putting machinery into a ship unless sufficient and suitable space is provided for it, and the first thing is to see whether suitable recesses can be arranged in the engine room. In this connection, the consulting engineer should give the subject more attention than is general, and should arrange suitable accommodation for a tool-room and machine shop. There is very little use in having a lathe and drilling machine if these are fitted in odd corners with no regard to accessibility of facility for working. I consider that in a small vessel an 8 in. lathe is ample for all requirements. For instance, in grinding in valves if you can first face up your valve in a lathe the seat can then as a rule be made good very much more easily than otherwise. I would not suggest anything larger than an 8 in. lathe in an ordinary ship, and if the vessel has electric light, which nearly every modern ship has, all power-driven tools should be electrically driven direct, without any intermediate shafting and belting. With reference to a drilling machine, I do not like the ordinary standard drill, as its scope is too limited. A radial drilling machine of good size, if space is available, should be fitted. Every ship which has got an electric installation should be equipped with a portable electric motor and fan combined, of not less than half H.P., and this with flexible attachments, would be useful in supplying the blast for any ordinary hearth or fire required in any position. The author has not touched the subjects of smith work or of brazing, which are of first importance. I have had many instances of engineers sending copper pipes ashore requiring brazing, particularly at the neck of the pipe above the flange, and it is difficult to convince them that the only effective way, in the majority of cases, is to cut the pipe and put a piece in, which is not only cheaper, but more quickly done. A very simple and effective brazing forge, which could with advantage be carried on vessels, is made in two parts and is applicable for brazing flanges, joints, or teepieces; the heat is easily regulated, and it is beyond comparison with the ordinary hearth or rivet forge. It is made in two halves and it can be placed on any suitable table or stand.

As slight troubles with pipes aboard ship are of common occurrence, I think a few brass flanges in the rough would be most useful, as these could be cleaned up in the lathe as required, and even if brazing were not done, the pipe can be turned over the flange and if necessary a distance piece fitted.

An advance in the direction of better facilities for carrying out repairs aboard ship could certainly be made in many ways; instead of adding to the labour of the engineer it would lessen it. The addition of, say, a couple of hundred pounds to the cost of the vessel, made by the superintending engineer including power driven tools in the specification, is an item which I do not think the shipowner would object to if he has confidence in his adviser, and it should not be difficult to show how this would give a good return, not only in better upkeep of plant but also in saving in repair accounts. Certainly, some ships are understaffed, and in these particularly the engineers are expected to rise to every emergency; but even in these cases, suitable tools would not add to, but lessen the labour. It is to the interests of the Marine Engineer to show that he can effect a saving by having suitable power driven tools fitted, but I am afraid in many cases the lack of these in the ordinary cargo vessel is due to the engineers themselves.

The CHAIRMAN: It seems to me that the question is whether it would pay the shipowner better to have a ship with sufficient space allotted for all these tools—sacrificing perhaps space which might otherwise be used for cargo—or to have his repairs done on shore. The whole matter, it seems to me, resolves itself into the question of how the balance sheet works out at the end of the year. If you have a breakdown, of course it is convenient to have a machine shop with you; the question is, can the space be spared? The engineroom would have to be made larger, for here you have a certain amount of capital which you are going to lock up in these tools.

*Mr. JAS. PATERSON: I have served on board a ship where we had a lathe, and it was very seldom used; the owners gave us as much spare gear as we liked to ask for within reason. Other ships are not so fortunate. Still, I consider that all ships should have a lathe, placed on a cool spot on the bottom platform. With regard to a valve re-setting machine, this is very necessary and especially so in an old ship; one should be supplied to do up main stop valves as well as the other small valves on the boilers (when you have to disconnect those valve chests you are apt to break some of the flanges).

The old-fashioned grindstone is no doubt out of date, but I think quite good enough for the ordinary ship, unless one of our big liners. I am in favour of a handy sized forge on board for dressing chisels and drills, but not one that takes up much space. I am not in favour of pipe bending machines and planeing machines on the ordinary steamer. If a shipowner is going to give space on board for a workshop and fit it up with modern tools which cost a lot of money, he expects some return for the outlay, and if the ship is of full power and trading out in the Tropics, this cannot be done without overworking the engineers, where only four are carried. Mr. J. H. Thomson's ideas are good, but they apply entirely to the large passenger steamer. The ordinary cargo tramp gets along very well under present conditions, and is likely to do so, unless the number and power of the auxiliary machinery units is increased and little or no spare gear carried.

*Contributed by Correspondence.

*Mr. F. O. Beckett: The suggestion set forth as regards tools for the various repair work on board ship is admirable. The author is to be congratulated on the work of facing up the Weir pump valves and seats. From my experience on board ship one has to be prepared to deal with repairs over a wide area, say, from a phonograph needle to removing a bulkhead. I have found a diamond pointed chisel the most useful hand tool for the ordinary emergency repair work. In one case we had to use the end of a donkey crankshaft for want of a lathe and true up a donkey boiler safety valve seating at sea, to have the boiler ready for use in port. On one occasion, in dry dock, the firm entrusted with the work, only put seven rings of packing instead of eight for our stern gland, hence leakage and the consequences. We found it out on a voyage to Rio de Janeiro. We had left port a week and the glands were heavily leaking, this condition being aggravated by a heavily loaded ship, and we had to make a false gland. Fortunately we had a plank of wood thick enough to carve out a box; and this is where the diamond pointed chisel came in useful, as by means of it the extra gland was made quicker. We curved out the side of a bunker door and cut holes in each to fit the studs, and with two turns of packing in this false gland we arrived at Rio de Janeiro with a reduced gland leakage till the ship was practically discharged. By tipping the ship we repacked the box ourselves. A drilling machine would have been of great assistance as we were in a hot climate oppressed by the emergency of the leakage. On another occasion, with a coal strike on, we had the misfortune to get a short supply of bunker coal, so we had to take in brickets at a French port. To the credit of the Frenchmen, they built the brickets as if they were building a breakwater. After a few days out, we could not get the brickets to run; it was too dangerous to let a man get in at the bunker door and we could not get in at the upper hatch on account of the cargo. Here again the diamond pointed chisel came into service to cut a hole in the bulkhead to reach the fuel and knock it down. I find that engineers at sea, as a rule, usually carry small tools suitable for repairing small work, such as indicators, prismatic compasses, and other small work. With the modern ships it has outgrown the stereotyped Board of Trade requirements, and I consider that where evaporators and distilling plant are fitted, including allowances for overhaul added to the large amount of copper piping and connections now found in large steamers, almost an engineer's workshop is wanted. In the telegraph

*Contributed by Correspondence.

and salvage steamers that are out on stations many months where they have much to do in the shape of repairs apart from the main engine, it is essential for them to have a well equipped engineer's shop, with lathe, drilling machine, grinder and forge, for both smithing as well as copper work. I consider Mr. Thomson's paper very commendable in his illustrations of combined lathes and machinery and for truing up valve facings.

*Mr. D. M. Smart: I think the paper was so clearly written and so exhaustive that it called for very few remarks and practically covered all the advantages to be derived from having such tools fitted on board ships. I have had some experience of tools, lathes, and drilling machines fitted on board ships, and can testify to the benefits, both to engineers and owners, derived from them, as regards saving in time, temper and material. I have lately had conversations with a good many sea-going engineers on the subject, and have, with very few exceptions, found them in favour of having a good screw cutting lathe about 6 in. to 8 in. centres and about 6 ft. long with all tools and accessories and a drilling machine to take drills up to 1 in. dia., installed on board. Most of the modern ships are so roomy now that it would not be a difficult matter to find a suitable place to fix them. They would save much material being scrapped, such as broken valve spindles, stripped threads on nuts and spindles, leaky cocks, valves and seats, and for small winch and auxiliary engine fittings. These are only a few remarks on what I considered a very important subject, both to engineers and shipowners, and I think it would be to the advantage of every steamer to have such tools on board, as they would save many a long and probably expensive job in a foreign port and would be a source of saving and pay for the first cost in a short time.

The Chairman: As stated by the Hon. Secretary, when he read the paper on behalf of the author, Mr. Thomson is at sea in Indian waters, and the remarks made this evening and those contributed by correspondence will be forwarded to him for any comments he may see his way to add, to further enhance the value of the paper we greatly appreciate, and we thank him for introducing the subject to our consideration and discussion.

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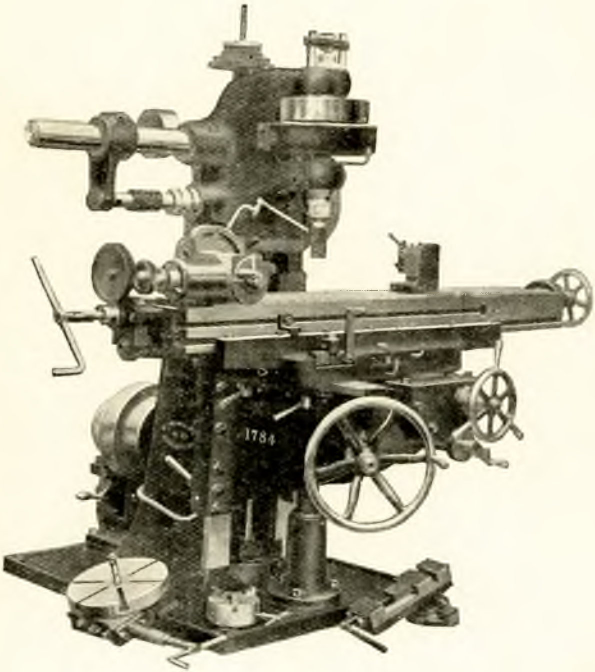
*Contributed by Correspondence.



Universal Milling Machine, by Messrs. Wm. Muir and Co., Ltd., Manchester, as fitted in several of H.M. Repair Ships.

LLOYD'S REGISTER SCHOLARSHIP.

The death of Sub-Lieutenant Chas. P. Tanner, R.N., on H.M.S. *Indefatigable*, in the course of the North Sea fight, is much regretted. Not only did he gain the Lloyd's Register Scholarship, and pass through the courses of Glasgow University where he received the B.Sc. degree, but he also contributed essays in connection with the awards for the Graduate Section of our membership. His brother, who enlisted in the army soon after the outbreak of war, is still in the fighting line. Our sympathy is extended to the mother in her cloud of sorrow.

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GRADUATE SECTION.

Apprentices who are serving in workshops with a view to becoming Marine Engineers are eligible to become Graduates. All the advantages of the Institute are available to each section of the membership. Marine Engineers, seniors and juniors, meet in the premises for free discussion on technical subjects. A room is specially set apart for the juniors, with books, journals, drawings, and models, where they can study or compare notes. The aims of the Institute are to elevate and improve the status of Marine Engineers, and that of their profession, and the co-operation of all who are interested in the rising generation of our engineers is cordially invited to set forth these aims and advantages as they have opportunity. The Institute has always sought to encourage apprentices to attend technical classes, recognising that at such the scientific ground work in preparation for the future is gained. The further help given in the operations of the Institute is a continuation of technical study. J.A.

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TITANIC ENGINEERING STAFF MEMORIAL FUND.

Kenneth Chas. McFarlane, aged 9, son of the late Robt. McFarlane, was was on watch in the *Minneapolis*, when the vessel was struck by an enemy torpedo, has been admitted to the Merchant Seamen's Orphanage, Snaresbrook, under the provision of this Fund.

ELECTION OF MEMBERS.

The following were elected at a meeting of Council of the Institute held on Tuesday, May 16th, 1916:—

As Members.

James Carnaghan, Lloyd's Register of Shipping, Dundee

Charles Cooper, Lloyd's Register of Shipping, Sunderland

Lewis Conford Davis, 3, Park Avenue, Roker, Sunderland

James E. Dickinson, Meadow Hill, Berwick-on-Tweed

Thomas Field, Lloyd's Register of Shipping, Newcastle-on-Tyne

Herbert Cecil Forster, Lloyd's Register of Shipping, 7, Wind Street, Swansea

John William Gwynne, 2, Parade, Barry, Glam.

William Dennis Heck, Lloyd's Register of Shipping, 342, Argyle Street, Glasgow

Joseph Henderson, P.O. Box 805, Johannesburg, S. Africa

Ernest Kirk, Marine Engineers' Institute, Shanghai

Benjamin George Oxford, Lloyd's Register of Shipping, 201, Tower Building, Liverpool

Wm. Albert Hodgson Pigg, 19, Vicarage Park, Plumstead, London, S.E.

John Sim, View Bank, Rhynu, Aberdeenshire

Lawrence Walker, Offices of High Commissioner for New Zealand, 13, Victoria Street, London, S.W.

John Wallace, 6, Lloyd's Avenue, London, E.C.

As Associate-Member.

Robert Muir (Corporal, R.E.), "Boblanie," Rangemore Road, Inverness