Burges, theire executors, administrators, assignes, deputies, and servantes, in the execucon of theis our Lrs Patente — as they tender our indignacon and displeasure, and will avoid the same at theire Vttermoste perills, although expresse mencon &c."

"In witness whereof &c. Witness ourselves at Westm, the eleaventh daie of March.

Pbre de prinato sigillo, &c."

The principle that an invention must be novel, to be entitled to protection, did not exist in the year 1617, the date of this patent. The applicant was the first to undertake the manufacture in the realm, and he asked for a monopoly, which was granted to him. A somewhat similar provision applies in Great Britain at the present day, where the first importer, though not the actual inventor, is entitled to protection.

Coming now to our own colony, interest centres in New Zealand Patent No. 1. We find it was granted to Purchas and Ninnis, in the year 1857, for treating New Zealand flax. The drawings accompanying the application are very crude. The specification is as follows:—

26 MARCH 1861.

"PURCHAS, Arthur Guyon, Clerk, and NINNIS, James, Mining Registrar, both of Onehunga, Auckland.

(An invention for the preparation of the Fibre of the Phormium Tenax and other plants for the manufacturing purposes).

The specific object of the invention is to separate the fibre of various plants from the cortical and other vegetable tissues of the plants, so as to render the said fibre fit for manufacture into cordage or woven fabrics.

The principle claimed is that of percussion.

The mode of application is by means of beaters, hammers, beetles, or stampers, made of various forms and sizes to suit the particular plant or kind of plant which is to be operated on. The said beaters may be made either wholly of wood or iron, or other metal, or in part of wood and in part of iron or other metal; or of various metals combined; or of any other suitable material; and may have their faces either plain or wrought, and may be made to act either by gravity or springs, or by any other convenient mechanical arrangement; and may work upon either wood or metal, or other material, fixed or movable, with or without springs.

The machinery may be driven by any kind of power.

The raw material is subjected to percussion, either in a fresh state or after maceration, and may be worked either with or without water.

The fibre may be dried immediately after percussion or washed and then dried; or subjected to maceration and further percussion before drying.

Several forms of beaters are shown in the drawing."

By the date of British Patent No. 5 it was apparently recognised that a patent might become a source of revenue to the Crown for we find that Thomas Marraye in return for the monopoly of making swords was compelled to pay "duringe the whole terme of twentie and one yeares, the yearlie some of five poundes* sterling of lawfull money of England into the receipte of the Exchequer at Westm," until the trade be well established, after which "the yearlie rente or some was to be increased to "tenne poundes."

At the date 1627 of Patent No. 38 the "yearlie rente" had risen to "foure hundred poundes" for the monopoly of manufacturing iron.

Patent No. 8 dated January 9th, 1618, approaches more nearly to the requirements of a present-day specification which must "particularly describe and ascertain the nature of the invention"

It reads: "Whereas wee are informed that the said drawing and drayning of myne's, myneralles, and colepittes, and raysing of waters aforesaid, is to be done and performed by the vse of C'teine engines and instrumentes by Robert Crumpe, newly devised and found out as aforesaid, which are farre different and exceeding all engines, instruments, or devises heretofore oute or vsed in or aboute the p'misses (that is to say) by a c'teine hollow trunck or pipe of one entire length, to be made of tymber or leade, which is to reache from the waters that are to be drawne or raysed vnto the toppe or place where the same waters shalbe to vent or yssue forth, att the foote of which said trunck or pipe so made of entyre length as aforesaid, and in some other partes or places thereof, there are to be placed and fyxed C'teine suckers, drawers and other devises, and other engines of brasse, copper, or other metal, and att the vpper part or end of said trunck or pipe there are to be planted and placed severale peeces of tymber fyxed and framed together, wherein are likewise to be placed c'teine suckers, drawers, and other devises, together with one or more wheele or wheeles with spindles and cranks of yron or brasse, whereby the waters may be drawne or raised from any depth whatsoever."

For the monopoly of making the above pumps which avoided the necessity of a series of pumps one above another, Roberte Crumpe was enjoined to pay a yearly sum of ten pounds for twenty-one years.

*The "pounde" of those days signified the pound of silver that was coined into twenty shillings, a shilling, in the middle ages, having had the same value as to-day.—[Ed. Progress.]

CRUISING TURBINES FOR WARSHIPS.

By E.S. Fortis.

The application of steam turbines to the propulsion of warships is a more complex problem than that of its application to ordinary mercantile vessels, principally because so much coal is consumed in cruising at low powers and very low speeds. In all cases it involves many elements other than the actual change in the application of the motive power. Thus, if the original propeller and shafting of the ordinary reciprocating (piston) engine are retained, the same speed of revolution of the propeller must also be retained and the turbine engine which replaces the piston engine would compare most unfavourably in weight and space. It is, therefore, necessary to drive the screws at a higher rate, and at the same time the diameter and other dimensions of both the screw and its shafting must be reduced and suited in other ways to the new conditions. In the Amethyst, three screws are used in place of two in the Topaze (piston engines), and the rate of revolution is almost exactly doubled. There is by this means a comparatively large saving in weight and space, because within the same limits about 40 per cent. more power is obtained. In the Carmania (turbines), three screws are also fitted in place of two in the Caronia (piston engines), and the rate of revolution is increased about 90 per cent. This results in an apparent gain of about 11½ per cent. in power and about one knot in speed, with possibly about 5 per cent. less weight. In both the Amethyst and Carmania there is an undoubted gain in economy of fuel, whether it be calculated on a propulsive h.p. basis or in gross weight per knot. The latter is perhaps the more correct way of looking at matters in which turbines are concerned.

A large cruising radius for warships is best secured by limiting the size of the engine to that necessary for some power somewhat below the full power. Naval engines of the piston type have for many years past been designed for a maximum efficiency at about 70 per cent. of the full i.h.p., and this policy seems even more desirable with regard to turbine engines. Turbines used in shore practice for generating electricity, where the brake h.p., or energy of rotation of the shaft, can be easily measured, are well known to be capable of carrying a considerable overload, amounting to nearly 40 per cent. in some cases, with only a very moderate decrease of efficiency, and with a comparatively small increase in coal consumption per unit of power.

The large apparent increase of i.h.p. in the Amethyst may not have been anticipated, but in any case it was considered advisable to fit special turbines on each wing shaft for cruising purposes. Increased work per lb. of steam and economy of steam can only be obtained by increasing the rate of expansion; the same quantity of work, assuming hyperbolic expansion, can be obtained from 1lb. weight of steam, whether it be expanded either from 200lb. down to 100lb. absolute, or from 10lb. down to 5lb. absolute, because the rate of expansion is the same in each case. With the same final pressure, which for turbines is practically obtainable in the condenser, the rate of expansion can only be maintained by admitting steam at its highest pressure. At very low powers the steam is necessarily reduced in pressure by throttling and although some of its heat energy may be devoted to improving the quality of the steam at the instant of admission it has very small useful effect, and does not overcome a decrease in the rate of expansion from, say, 150 (150 to 1lb. absolute) to 20 (20lb. to 1lb. abs.). With piston engines the rate of expansion is fairly well maintained by "linking up" at low powers, and therefore cutting off the admission of steam earlier in the stroke of the h.p. piston.

Cruising turbines are fitted for naval purposes, and being of smaller capacity (and also somewhat differently constructed with regard to blading), the steam commences its work at a higher pressure and thus tends to maintain the rate of expansion. At low powers, with their aid, a higher efficiency than with the Topaze engines can be maintained until the power decreases to about one-eighth of the full power, with a speed of about 14.2 knots. An alteration, by which it is now possible to utilise the auxiliary exhaust steam in the l.p. turbines, is said to improve the economy of the Amethyst still further and to enable it to compare favourably with the Topaze down to 10½ knots. The cruising turbines are not used for propelling purposes at the higher powers, but revolve idly in the vacuum created by the condenser, with the l.p. turbines fitted on the same shafts.

Recent comparisons of efficiency relative to pressure show that there is a loss rather than a gain by using higher pressures for certain single-stage expansion turbines. If this be applicable to the peculiar circumstances of warships, then cruising turbines are unnecessary; but these conclusions point particularly to the economical importance of as little moisture as possible in the steam, both on admission and during expansion, and of expanding in the stages. An excessive rate of expansion in any one stage produces excessive moisture and fluid friction, whose resistance more than counter balances the increment of kinetic energy obtaining from a greater fall in pressure. The percentage of moisture in the steam on its exit to the condenser from turbines is probably double that from piston engines working with similar initial and condenser pressures, which tends to show that the two or three stages of expansion adopted at present are insufficient for the best working economy at full power, and that if a greater number of stages were adopted it would be unnecessary to fit cruising turbines.

Up to the present there has been a disposition in turbine vessels to fit the maximum, rather than the most economical, power within the space and limits allowed. If the engines of the Amethyst had been designed for 10,000 instead of the equivalent 14,000 i.h.p. obtained, would it have been possible to dispense with cruising turbines without any appreciable decrease either in efficiency at low powers or of the highest speed? Every element which contributes to the total efficiency of the propelling plant points to a favourable result. Turbines of smaller power would require less steam, and the boilers, which are now worked above their most economical rate of steam production, would give an increased efficiency of about 13 per cent., making 65 per cent. instead of the 52 per cent. now obtained at full power. The efficiency of the screws, also, principally owing to their slower rate of revolution and to less frictional resistance from a possibly reduced blade area, might be increased from 60 to about 70 per cent. These two elements, without taking into account the possible increases in efficiency which might be obtained respectively from the steam as a working substance, from the engine mechanism, and from the thrust mechanism, would increase the overall efficiency in the ratio of $\frac{65}{52} \times \frac{70}{60} = \frac{35}{24} = 1\frac{11}{24}$, or about 44 per cent. This result corresponds very closely with the apparent increase of power obtained from the Amethyst over the Topaze, which Mr. Parsons puts at 42 per cent. With such a large margin it appears very probable that the full speed of the Amethyst could be obtained from turbines of not much greater than two-thirds of the present power and without serious loss, or possibly without any loss, in efficiency; while at lesser powers a greater steaming radius would undoubtedly obtain at all speeds.

Recent trials and the generally satisfactory working of various vessels prove conclusively the superior economy of steam turbines in fuel, weight and space. Until the establishment, and more or less general acknowledgment, of their merits the fitting of unnecessarily great engine power was excusable; but if my reasoning is correct, and it is frankly admitted that the information on which it is based is not absolutely conclusive, then it should be recognised that there is for each vessel a limit beyond which any increase in power becomes inefficient and practically useless for the purpose for which it is designed. For naval vessels the lower this limit can be pitched, while still retaining, by possible overloading, the highest practicable speed, the more economical and useful will they become for their extended employment as cruisers and for purposes of war.

A train telegraph system, which provides for communication between drivers and stations, and includes an automatic signal in the engine cab to show when another train is in the block, has been invented by an American. Two metallic conductors are laid, insulated to form block sections, and the engines are fitted with the necessary electrical apparatus. When a train enters a clear block the signal in the cab displays a white light; but in case of another train being in the block, or a rail broken, a switch open, a red light would be shown and a bell sounded. The station attendant would also be able to operate the signals on the engine.