bubbles of vapour or steam, will, by its greater specific gravity, descend and continually arrange itself under the rising columns of the outer vessel, and so produce a circulating current.

The principle of this action, which is found to exist under numerous shapes of this new boiler, is attended by results of most important value.

It has been shown that the rising current will increase in power and rapidity with every increment of heat applied, and that the descending current will keep pace with it.

If a fire, composed of the strongest fuel, be urged with extreme intensity round a boiler of this construction, so rapid and forcible will be the rising current, that it will draw towards and carry up with it sand, gravel or stones, or almost any kind of heavy substance of moderate size which may happen to be in the boiler, sweeping off, in its ascent, all the steam bubbles which form on the interior surface of the outer vessel, keeping that surface cleared from every kind of vapour which would otherwise act as a non-conductor of heat, or form an impediment to the free passage of heat from the fuel to the water, effectually preventing the adhesion to the boiler of salt, lime, or earthy matter of any kind, and by forcing a continued succession of watery particles into actual contact with the metal, will cause them to take up all the heat at the instant of its formation, and accelerate the production of steam with astonishing rapidity.

Thus may water be converted into steam four times faster than by the common method; or, in other words, by an apparatus of this kind, of one-fourth the size and weight of an apparatus of the common kind, an equal quantity of steam of any required power can be made in a given time, saving

Three-fourths of the space occupied by the ordinary apparatus,

Three-fourths of its weight, and

Three-fourths of the inconvenience and danger arising from its bulky contents of heated water.*

An account of the important and successful results of experimental trials in Demerara, to obtain native raw sugar from the cane juice, by an improved operation of evaporation in vacuo. By Mr. Abraham Booth, experimental chemist, and lecturer on Chemistry and Natural Philosophy.

When England, by her maritime superiority, had obtained the whole of the continental West India possessions, a stimulus was

*The principle upon which the action of this boiler is founded, will, under modifications, prove applicable to many other useful purposes, and with a view to investigate and illustrate them with perfect accuracy, experiments are in progress: for instance—

In the evaporation of brine for making salt.

In the boiling of wort with hops for brewing beer.

In the process of distillation, sugar boiling, &c. the importance whereof will be obvious to individuals engaged in such pursuits.

given to the trade in sugar, which rendered the merchants who were engaged in it, distinguished for their wealth and respectability. Many causes have, however, recently operated in producing a depreciation in the value of this species of property; estates, the profits of which formerly produced annual fortunes, now encumbered by heavy mortgages, are a burden to the proprietors; and the colonies themselves, instead of proving a benefit, are actually a drawback to the mother country. No one connected with the history of our colonial possessions can doubt but that one great cause of this depression is in the inadequate return afforded for a most extensive outlay. When England possessed an almost exclusive monopoly of the supply of sugar to the whole world, plantations formed a very profitable channel for the employment of capital; extensive establishments were formed, and the whole of the land capable of growing sugar cane was put into active cultivation; but the return of peace, and the surrender of a large portion of the colonial conquests, gave the first shock to our West Indian interests, the effects of which have since been so largely and sensibly felt.

Planters, and West Indian proprietors, appear to have been aware that any legislative privilege which the government of the mother country could afford would be inefficient unless it was seconded by their local exertions. The method by which so large a quantity of deteriorated material as they were in the habit of procuring, in the shape of *uncrystallizable sugar*, or *molasses*, might be saved, suggested itself as a valuable consideration. The important advantages which might be anticipated, were this object effected—in a more adequate return from the plantations, and in a necessity for employing so large a number of hands—gave a stimulus to every research. It has thus ever afforded a source of speculative enterprise to industrious schemers, who have always found a market for their projects, however preposterous or visionary. The evaporation of the cane juice in vacuo, at the last stage of concentration, was proposed, not for the purpose of improving the molasses, but to prevent their formation, and thus it differed in its objects from the various schemes which had often been proposed. So often, however, had the planters been injured, and not unfrequently ruined by following the various specious plans which had been imposed upon them, that at its first introduction this process had to combat with all the obstacles which the failures of others had raised up against it. It has, however, already made such progress, that by the most competent judges it is considered to have opened a new era in the history of the colonies; as likely to revive the spoiled fortunes of the planters, and render these possessions a service of benefit, instead of an obstacle to the prosperity of the mother country. It may be noticed as somewhat extraordinary, that at the period when the apparatus was first sent to the colonies, some French adventurers were at Demerara, with a process, for divulging which they required the sum of *ten thousand pounds*, and that the question was then in discussion before the Board of Commerce. The important results of the present improved process, had, however, the effect to put a stop to these negotiations, and if the present is not the

perfection of the manufacture, it will, at least, be long before the colonies can boast such an important improvement in their staple commodity and support.

For the introduction of this valuable process, we are solely indebted to the indefatigable exertions of Mr. William Oaks, of Houndsditch; who, after long experience in the manufacture of the apparatus, struggling for a considerable time against those obstacles which naturally impede the introduction of every new invention or application, at last succeeded in gaining the co-operations of an extensive West Indian proprietor at Liverpool, whose attorney on the estate gave every possible facility; it may be considered fortunate, that the attempt met with such valuable co-operation. Thanks are also due to Mr. Thomas Dodson, for his determined perseverance in the erection and completion of the apparatus, and to Mr. Jacob Benson, an English boiler, who has shown considerable practical knowledge, and to whom belongs the credit of being the first to boil the cane juice in vacuo, and produce these desirable results.

I shall offer no further comment before introducing the following able and judicious letter, extracted from the *Guiana Chronicle*, in which are developed the views which led to the introduction of the process, and also the complete success attendant upon the first trials.

From the Guiana Chronicle and Demerara Gazette.

TO THE PLANTERS OF DEMERARA AND ESSEQUIBO.

GENTLEMEN,—The attention which has latterly been excited by the various attempts to improve the manufacture of the staple produce of the colony, whilst it evinces your sense of the importance of the object, and implies a conviction on your part that the manufacture of sugar is susceptible of improvement, also encourages a hope that any communication which may have for its object the accomplishment of so desirable an end, and one so intimately connected with your interests, will, in its turn, meet with its due share of attention.

The respective merits of the several systems which have from time to time been proposed for your adoption, have not only been the subject of much private discussion, but have given rise to some animated discussion in the public prints, in the course of which allusions have been made to the principle of boiling in vacuo.

Several months have elapsed since my arrival in this colony for the express purpose of introducing this scientific system, which, though till now never applied to the original practice of manufacturing sugar from the cane, has, by the advantages resulting from its adoption by the principal refiners in Great Britain, during twenty years' practical operation, acquired the highest reputation. It is the fruit of many scientific experiments and much indefatigable perseverance of a late very eminent chemist; and has received the unqualified approbation of the most eminent of that profession, amongst whom are to be found the names of Sir Humphrey Davy, Drs. Ure, Trail, &c.

Although a long acquaintance with the properties of the vacuum-pan, might have warranted me in soliciting your attention thereto at an earlier period, I considered it not only more respectful to you, but also much more in accordance with the diffidence, which, as a stranger to the profession of a planter, I ought to feel to abstain from so doing, until the applicability of the apparatus to colonial purposes was placed beyond dispute—in other words, until I had completed the erection of an apparatus in the colony. I considered also that by postponing it until then, the subject would be divested of that speculative character, which is always, more or less, attached to new applications; and that instead of having to meet objections, which no doubt would have been raised against the system, whilst its advantages were problematical, I should, upon the successful result of the experiment then making, be enabled to adduce actual results instead of plausible conclusions, and facts instead of reasonings.

The experiment has now been tried, and its effects are equal to our most sanguine expectations. The apparatus has been some weeks in full operation on one of the largest estates in this colony; and its results enable me to offer it to the notice of the sugar planter, as the means of making a superior article, and in a much greater quantity than can be produced by any other process hitherto discovered.

Although it would exceed the limits of this address, to give a detailed description of our apparatus and the process, it may be expected that I should give an outline, and by a few general remarks on the principles upon which this system is founded, point out the connexion between the effects and their causes. It is somewhat remarkable that whilst almost every branch of manufacture has been improved by the advance of science and the general diffusion of scientific knowledge, and its application to practical purposes, that the art of manufacturing sugar should have remained stationary from the time that Bryan Edwards described that process in his *History of the West Indies*, and that it should be reserved to the planter of the present day to make the attempt to verify his predictions, when he said, "That it was no extravagant hope, that the time would come when the salt of the cane, or what we call sugar, would be made pure, and strike into transparent crystals."

The concentration of the cane-juice on the present mode of making sugar in the boilers, requires a long exposure to the action of the fire, the temperature increasing as the operation advances, until it has acquired its proper grain and consistence, when it may be quoted at 250°.

The length of time required to complete the process varies according to circumstances, and depends much upon the skill with which the boilers are hung, the state of the megass, and the consequent intensity of the heat, &c.

Practical chemists well know how injurious so high a temperature is to the flavour and colour of any delicate extract, its tendency to carbonise being in proportion to its consistence; a desire to counteract which, led to the invention of the vacuum-pan by the late Hon.

Edward Charles Howard, and its application on an extensive scale to the refining of sugar.

The vacuum-pan is a large, strong, copper vessel; its form is elegant and scientific; its parts are manufactured and fitted with so much care and exactness as to exclude the admission of all external air. It is worked by the agency of steam, applied externally between the lower part of the pan, and an outside casing. An air-pump, worked by, and attached to, the steam-engine, is connected by pipes to the upper part of the pan.

The pressure of the atmospheric air on the surface of sugar, or any other liquid, boiling in an open vessel, counteracts the ebullition, and by thus retarding the evaporation, renders either an excessive heat, or a longer exposure to one less intense, unavoidable. The common culinary operations of the kitchen afford us daily proofs of the effects of fire upon animal and vegetable substances, and their tendency to carbonise. Milk, for instance, exposed to a fierce fire, not only contracts colour and a disagreeable taste, but forms a black and adhesive crust on the bottom of the vessel. Meat, fish, eggs, &c., possess this tendency in a greater or less degree; a certain portion of this substance is either entirely destroyed, or undergoes a chemical change, which leaves it little or no identity with the original mass of which it formed a component part.

In the manufacture of sugar in the teache, the destructive effects of excessive heat obtain to an effect beyond what may generally be suspected. It destroys a great proportion of the crystals, or, what is the same, it converts the sirop, which would otherwise crystallize, into molasses, by which the quantity of sugar is very materially diminished, and by the creation of carbon, or colouring matter, deteriorates its quality. By this twofold disadvantage the planter is subjected to a great loss, from which he now possesses the opportunity of relieving himself by the adoption of this system.

The excellence of the principle of boiling in vacuo consists in the exclusion of the atmospheric air, and the consequent removal of its pressure; of being able to perform that operation at from 90° to 100 less heat than is required in an open vessel, at which temperature it cannot possibly sustain any injury in its crystals or its colour.

The crystals, or grain, of the sugar thus manufactured are very large and brilliant. These characteristics give to it a greater superiority over sugar made on the present system. It is also semi-transparent: this proves its purity, or freedom from molasses. The size of the crystals involves a very important consideration as connected with the interests of the planter. It is, I believe, a truth susceptible of mathematical demonstration, that in proportion to the increased size of the grain is the increased weight of the sugar. A piece of candy, when broken to pieces, or in other ways disintegrated, cannot be made to occupy as small a space as before. The greater the number of the fractures, the greater is the number of interstices between them, and consequently the greater room required for their reception; from which it is clear, that any measure of capacity which

contains the least divisions of matter, will contain the greater quantity of weight.

A gallon of sugar of a large grain, and perfectly cured, will outweigh a gallon of sugar equally well cured of small grain. By actual experiments on sugar, made on one estate, four gallons of sugar made in the teache weighed 24lbs.; four gallons made in the vacuum-pan weighed 32lbs.; giving as the result the difference of 8lbs., or 2 lbs. to the gallon, a difference much greater than was anticipated.

The clearing of the liquor from its impurities, previous to being boiled, has been a desideratum in the manufacture of sugar, and many attempts have been made to accomplish so desirable an object, but without success. This operation forms one part of our system, and to it we owe in part the production of so clear a crystal. By attention to the proper consistence, temperature, and previous preparation of the liquor, we have succeeded in this very important department by filtering.

Our system of potting and curing is marked by several important deviations from the usual mode, into which it is not my intention to enter beyond making a few general remarks.

I have before observed that sugar made on this principle exceeds in quantity or weight the sugar made in open vessels (as appeared by experiment) in the proportion of 32lbs. to 24lbs., is an increase of 25 per cent. which I endeavoured to show was attributable to the size of the crystals, and which result corroborates the truth of another observation, viz., that a great proportion of *sirops* is converted into molasses by excessive heat. Now this excess not being required in vacuo, the production of molasses is limited to the proportion which nature has given in the cane, although I am not prepared to state with the confidence and precision which I could wish, what that proportion may bear to the whole saccharine substance; yet it is evident from these data that the operation of curing must be necessarily diminished or assisted in the ratio of the diminished quantity of molasses it is intended to separate. I have also observed that *carbon*, or *colour*, is another effect of the same cause; which being obviated in the improved plan of boiling in vacuo, there exists no necessity to have recourse to those powerful chemical menstrua, which were only calculated to repair an injury sustained in the original process at the expense of quantity. As this injury is proved not to take place in the vacuum pan, the sugar stands in need of any artificial expedients of this nature.

Having in the course of this letter felt myself warranted in offering the vacuum-pan and accompanying apparatus to the notice of gentlemen connected with sugar estates, and endeavoured to show, by actual results, that the advantages of this system are not chimerical, and by a very imperfect and superficial explanation of the principles which govern its operations, having attempted to convey some general idea of its characteristic features, it only remains for me to inform those gentlemen who may be desirous of further satisfaction on any points connected therewith, with a view of availing them-

selves of its advantages, that as the agent of Messrs. W. Oaks & Son, of London, I shall be happy to afford any additional information.

I am, gentlemen,

Yours very respectfully,

THOMAS DODSON.

Pl. Vreede en Hopp, Demerara, 1st Feb. 1832.

The Editor of the *Guiana Chronicle* notices the foregoing communication in the following remarks:—

“We refer to an article on sugar boiling, which we this day insert. We leave it to experienced planters to decide on the practical advantages of the plan. We always avail ourselves with pleasure of every opportunity of submitting to their judgment any proposed improvement in a process of such vital importance to the interests of the Colonies, where such proposals bear the appearance of being the offspring of science, experience, and practicability.”

From the samples which I have seen prepared upon different estates, I have no hesitation in stating, that the great desideratum since the cane has been cultivated has now been accomplished—the *preparation of pure sugar direct from the cane juice*. The sugar is obtained in granular crystals, of four and six-sided prisms, terminated by two and three-sided summits, and they are perfectly transparent. It has a very rich mellifluous taste, unknown to that prepared by any other process; it is a purer sweet than even the best refined, and is in no danger of turning into acid in solution, as are other refined sugars.

On the plantations, where this mode of operation has been introduced, it is proved that an addition of 25 per cent. in quantity is obtained; an addition of from 10s. to 12s. in price per cwt., has been already received for a considerable quantity which has been introduced into the Liverpool market. The apparatus possesses the power to make double the quantity of sugar in the same space of time as the old method.

The advantages of the present improved process consists principally in effecting the last stages of concentration of the juice at so low a temperature as shall merely evaporate the aqueous part without decomposing any portion of the rest. This method of concentration has for twenty-one years been in successful operation in the principal sugar refineries of Great Britain.

The process of the operation is as follows: the canes are crushed, and the juice is concentrated in the usual way, and all extraneous matters are removed by skimming, &c. until the liquor is of nearly equal gravity, water, and saccharine, which is proved by the saccharometer. It is then received into a cistern, from whence it is admitted into a vessel closed against the atmosphere, called a vacuum-pan, and having a double bottom, in which steam circulates, whilst the upper part communicates with an air pump, which, maintaining a partial vacuum, causes the sugar to boil rapidly at a temperature

incapable of decomposing any part of it, or of effecting any changes in its chemical composition.

When sufficiently concentrated, the sugar is discharged into a receiver, called the heater, which is surrounded by steam. Here it is again heated for a short time to strengthen the granulation; and it is then put into very shallow vessels to drain off any small portion of uncrystallizable sirop which may adhere to the crystals. When drained it is placed in trays, and dried in the sun, or removed to the drying house, which, if heated by steam pipes, the same raw sugar can be pressed direct from the curing pans into the stamped loaves, which there is no doubt will soon form a very available and efficient article of commerce.

It may be added, that while there is no apparatus to compete with the vacuum principal, there is none so suitable to be put into action, in all climates where the cane is reared, with such beneficial advantages in profit or durability. Its application is particularly adapted for the Mauritius, East Indian, and all foreign sugars, as it possesses a superior advantage in protecting all delicate qualities from decomposition.

On some early occasion I may again trouble your readers with some further observations upon the successive developments and application of the advantages of this system. In the mean time I may mention that samples of the sugar may be seen at the counting house of Messrs. Oaks & Son, 97, Houndsditch, who will communicate any further information upon the subject to any of your readers interested in the inquiry.

London, July 14, 1832.

[The sample of sugar which Mr. Booth has been so good as to send with the preceding very valuable communication, fully bears him out in every thing he has said in its favour. It is left at our office, and may be seen there by any person desirous of examining it.—*Ed. Mec. Mag.*]

[*Mech. Mag.*

¶ On Oiling Machinery.

Sir,—there are some remarks in your last number, page 270, taken from the Journal of the Franklin Institute, in which it is stated that oiling of axles continually, so as not to waste a drop of oil, had not been done, till the latest improvement in the friction-saving carriage of the Baltimore rail-road.

This may be true as regards America; but in England that desirable object has been accomplished some time, by the axles of Mr. Collinge, Mr. Mason,

Messrs. Theo. Jones, and some others; in each of which, the continual lubrication of the working parts has been carried to great practical perfection.

With respect to the statements of Mr. M'Ilvaine and George W. Smith, Esq. "that the finest sperm oil most effectually relieves machinery from the effects of friction," I beg leave to add my own humble testimony, as well as the corroborative evidence of several scientific friends, to the correctness of this opinion.

One gentleman, an eminent clock maker, informs me that after a series of well conducted and long continued experiments, he has arrived at the conclusion, that the finest sperm oil, when purified, is the very best that can be used for all kinds of watch and clock work; as well as for every other description of well finished machinery, from the smallest lathe to the largest steam engine.

I must certainly differ from Mr. Rennie, "that the more fluid unguents apply best to light loads." My opinion is, that the finish of the working parts interferes more with the character of the unguent than the mere weight of the load. Thus, for instance, with accurately turned, and highly polished, case hardened axles and collars—such as those of Mr. Theo. Jones & Co.—the fluid unguents are the best, whatever may be the weight of the load. While, on the contrary, axles of less exquisite workmanship, in which the friction is consequently much greater—such as the axles of ordinary carts and coaches—are best lubricated by an unguent of greater consistency, although the load upon them may be lighter than in the former case.

A very beautiful method of lubricating the axles of fixed machinery, was contrived some years ago by Mr. John Barton, and, I believe, included in one of his patents. It consisted of a tin vessel, as delineated in the prefixed figure, having a tube *a, a*, passing down through it, and a cover to keep out dust, &c. A number of cotton threads were placed with one end down the tube, the other ends laying over the sides, and descending to the bottom of the vessel. The cup being filled with oil to the line *o o*, and the small tube *a* being inserted in the upper gudgeon of the axle, the cotton fibres become a syphon acting by capillary attraction, which slowly and gradually conveys the oil from the vessel down the tube to the axle to be lubricated.

By increasing or diminishing the quantity of cotton, the flow of oil is regulated to suit the consumption of the machine. In the same way, a gradual supply of *water* may be obtained for any required purpose, such as some grinding processes, the nourishment of delicate plants, &c. &c.

I remain, sir,

Yours, respectfully,

WM. BADDELEY.

[*Ibid.*

July 22, 1832.

¶ Weight of anchors, and a statement of the dimensions and weights of Chain Cables, &c. used in the British Navy.

We have thought that a portion of our readers may derive information of a useful kind from the tables which we give below, and which are taken from the United Service Journal for August, 1832.

COM. PUB.

Weight of Anchors supplied to each class of his Majesty's Ships.

Rate.	SHIPS.	Bower Anchors.	Stream.	Kedge.
	Guns.	Cwt.	Cwt.	Cwt.
1st.	Three decked ships from 98 to 120	90 to 95	21	10
2nd	80 and upwards	77 to 80	16	7
3d	70 and less than 80	73 to 76	16	7
4th	50 and less than 70	58 to 68	12	6
5th	38 and less than 50	46 to 50	10	5
6th	24 and less than 26 and 18 gun brigs	20 to 22	8	5

All rates are supplied with four bower anchors, one stream, and one kedge anchor. One of the bowers is technically called the sheet anchor, and another the spare anchor.

Dimensions and Weight of the Chain Cables used on board his Majesty's ships.

RATE.	Inches in diameter.	Equal to hemp cables of	Weight of each chain cable of 100 fathoms in length.
	Inches.	In's. in circumf.	Cwt.
First rate	2 1-8	25 to 23	223
74 to 60 guns	2	22 to 21	200
50 guns	1 7-8	20 to 18½	160
40 to 42	1 3-4	18 to 17½	150
38 guns	1 5-8	17 to 16½	135
28 guns	1 1-2	16 to 15	112½
First rate stream and large sloops	1 3-8	14½ to 14	96
74 guns, stream, and large brigs	1 1-4	13½ to 13	85
Frigates, stream, brigs 10 guns	1 1-8	12½ to 11	64
Stream 600 tons	1	10½ to 10	50
Stream 500 tons	0 7-8	9½ to 9	40
Streams for large brigs	0 3-4	8½ to 7½	30
Small craft	0 11-16	7 to 6½	24
do. do.	0 5-8	6 to 5	20
do. do.	0 1-2	4½ to 4	14

N. B. Each chain consists of eight lengths of twelve and a half fathoms long, united by shackles capable of removal in a moment.

Establishment of Ballast for his Majesty's Ships.

Ships.	Rate.	Proportion.	Remarks.
Ships of 3 decks	1st	1-8th part of their computed tonnage.	Frigates built of fir to have half more than is allowed to those built of oak. Schooners and cutters to have such quantity as may be thought best to suit them. The ballast of ships fitted in wood or cement of twenty-eight guns, having quarter-deck and fore-castle, is to be reduced one-fifth of the established quantity, and in flush decked ships and brigs one-third.
do 2 decks	2nd and 3d	1-10th part of their tonnage.	
Large frigates	4th	1-6th do	
Frigates .	34 guns.	1-5th do	
do. .	32 do	do do	
do. .	28 do	do do	
do. .	26 do	do do	
do. .	24 do	do do	
Ship sloops	22 do	do do	
do. .	20 do	do do	
Brigs .	18 do	1-7th do	
do. .	16 do	do do	

Note.—The iron ballast is cast in bars or pigs, which vary in weight and dimensions as follows:—

				cwt. qrs. lbs.	
The pigs of 3 ft. in length by 6 ins. width and depth,	weigh	2	3	12	
„ 1½ „ „ 6 „ „ 4½ in depth,		1	0	12	
„ 1 ft. 5 in. „ 5½ „ 4½ „ „ 1		0	0	0	
„ 1 „ „ 4½ „ 4½ „ „ 0		2	0	0	

Contents, Weight, and Size, of the iron Water Tanks supplied to his Majesty's Ships.

Description of tanks.	Imperial gallons.		Old measure galls.		Weight.			Size.			
	Galls.	Qts.	Galls.	Qts.	cwt.	qrs.	lbs.	Feet In.	by	Feet In.	
Whole tank.	398	3	478	0	7	0	0	4	0	4	0
Long large half	199	1½	239	0	4	3	0	4	0	2	0
Square half	197	3	238	0	3	2	0	3	2	3	2
Quarter square	98	3	119	0	2	0	24	3	2	1	7
Large bilge	268	0	312	0	5	2	3	4	0	3	8
Small bilge	110	0	132	0	2	2	20	3	2	2	6
do	110	0	132	0	2	2	20	2	6	3	2
Flat half	188	0	218	0	4	0	0	4	0	2	0

N. B. 224 imperial gallons weigh one ton, and one gallon weighs ten pounds.

The number of Sheets of Copper required to copper a Ship of each Class.

No. of guns each class.	100	98	74	64	50	38	36	32	Ships. Sloops.	Brigs. Large.	Brigs. Small.
No. of sheets each ship.	3923	3609	3357	3018	2846	2291	2267	2230	2162	1089	850

It requires about eighty nails to each sheet.

¶ CANNING'S *Life Raft*.

SIR, it is probable that during the last summer many of your readers may have seen on the river Thames, in the vicinity of New London and Blackfriars bridges, a singular looking machine, composed of spars, and floated by barrels, the object of which was not very apparent.

The machine is, however, one of considerable importance to the maritime world, being a life raft, invented by Mr. Alfred Canning, R. N. for the relief of persons in danger of being shipwrecked; and as a knowledge of its construction cannot be too widely circulated, I submit the following description for insertion in your Magazine.

There are two forms of Mr. Canning's raft, as represented by figs. 1 and 2.

Fig. 1.

In fig. 1, A is a main yard or other spar, with two cross spars *b b* lashed near each end of it, and kept in their places by the ropes or stays *c c*. To give the necessary firmness to the machine, four of the ropes terminate in a loop at *d d*, through which a smaller coil is rove, and braced up *tight*.

The machine is floated by means of empty water casks, one being attached to each end of the cross spars *b b*. The projecting end of each cask is covered with a hammock, to protect them from being stove in by rocks, &c. &c. The number and disposition of the casks, must, of course, be regulated according to the number of persons to be carried. When the number is great it is advisable to place the barrels as shown by the dotted lines, to obtain sufficient buoyancy. The raft exhibited on the river was so supported.

A platform, *c*, for the reception of passengers, is slung upon the main yard *A* by a strong loop, so as to turn freely upon it; one or two loops being used, according to the size of platform required. The loops are kept in the middle of the yard by a chock on each side of them.

It will be observed, that only four of the casks can be immersed at one time, and the object of the inventor in using twice that number, is to permit the raft to roll over, without any risk to the parties on the platform *c*; that being suspended as just described, so as to retain a horizontal position whichever set of barrels may be undermost.

Fig. 2.

Fig 2 shows another modification of this raft. It is composed of three spars, lashed together crosswise at the middle, and braced up by means of the ropes *f.f.* To each end of these spars* is attached an empty cask, or a cork fender, to give the requisite buoyancy. If casks are used, they should be protected with hammocks as before described. The persons upon this raft support themselves in the centre, holding on by the ropes, and shifting themselves whenever the raft rolls over.

It is right to state that the merits of this raft do not rest upon fresh water experiments; Mr. Canning having made numerous trials with it on various parts of the French and English coasts, with invariable success, particularly at Cherbourg and Jersey. At the former place, a raft of the description shown at fig. 1, was drawn out to the head of the jetty in very stormy weather; Mr. Canning having seated himself on the platform, the raft was turned adrift, and was driven by the wind across the mouth of the harbour upon the rocks, and was eventually thrown by the waves, high and dry, upon a shore of the most dangerous character, without any injury either to the machine or to Mr. Canning.

This machine possesses the requisite firmness and stability, with

* For the sake of clearness, only one end so provided is shown in the drawing.

just so much elasticity as is necessary for its safety. It carries the person on it higher, and consequently drier than any other raft, and is perfectly safe and certain on shores where a life boat would inevitably be dashed to pieces. The materials of which it is composed are such as may be found on board almost every ship, and the raft may be put together in a comparatively short period of time.

When a vessel has been wrecked on a lee shore, and a communication formed by means of Captain Manby's apparatus, or the more recent improvements of Mr. Murray, this raft would be found a most eligible mode of landing the crew.

Mr. Canning, some time since, exhibited and explained the construction of his raft, in a lecture delivered to the members of the London Mechanic's Institution, in which he gave an interesting account of several of his experiments in different places; and expressed his readiness to put to sea in the severest storm on any part of the British coast; thereby showing his perfect confidence in the safety and efficiency of his simple life raft.

The Society of Arts have presented Mr. Canning with their large silver medal, as a token of the high opinion they entertain of the ingenuity and utility of his contrivance; and *I guess* it will be some time before they have an opportunity of rewarding another of equal merit.

I remain, sir, yours respectfully,

W. BADDELEY.

London, August 30, 1832.

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¶ DR. ARNOTT'S *Hydrostatic Bed for Invalids*.

We are indebted to Dr. Arnott, the author of the above mentioned inestimable invention, for the following account of it, which he has prepared for the fifth edition of his "*Elements of Physics*," now in the press.

"In many of the diseases which afflict humanity, more than half of the suffering and danger is not really a part of the disease, but the effect or consequence of the confinement to which the patient is subjected. Thus a fracture of the bone of the arm is as serious a local injury as a fracture of one of the bones of the leg; but the former leaves the patient free to go about and amuse himself, or attend to business as he wills, and to eat and drink as usual—in fact, hardly renders him an invalid; while the latter imprisons the patient closely upon his bed, and brings upon him, first, the irksomeness of the unvaried position, and then the pains of the unequal pressures borne by the parts on which the body rests. These, in many cases of confinement, disturb the sleep and the appetite, and excite fever, or such constitutional irritation as much to retard the cure of the original disease, and not unfrequently to produce new and more serious disease. That complete inaction should prove hurtful to the animal system, may by all be at once conceived; the operation of the continued local pressures will be understood from the following state-