

**Wholesome houses : being an exposition of the Banner system of sanitation / by Edward Gregson Banner.**

**Contributors**

Banner, Edward Gregson.

**Publication/Creation**

London : printed for the proprietors and sold by Crosby Lockwood and Co., 1878.

**Persistent URL**

<https://wellcomecollection.org/works/n5evjue6>

**License and attribution**

This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.



Wellcome Collection  
183 Euston Road  
London NW1 2BE UK  
T +44 (0)20 7611 8722  
E [library@wellcomecollection.org](mailto:library@wellcomecollection.org)  
<https://wellcomecollection.org>



SANTAS SANITATUM OMNIA SANTAS®

EB/2.1

WHOLESOME HOUSES

1883

AN EXPOSITION OF THE  
BANNER SYSTEM  
OF SANITATION

K

54275

Price ONE SHILLING



D. 4 ✓  
J 8

8

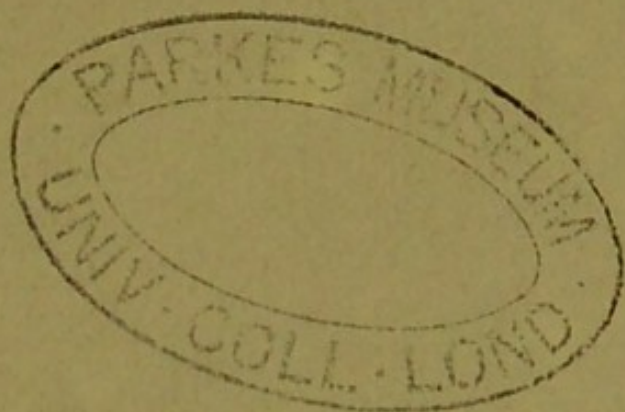
**J 4**

B. B.



22101918412

Presented by the Author







WHOLESOME HOUSES



*THE SOCIETY OF ARTS ON THE HEALTH AND SEWAGE  
OF TOWNS.*

THE Executive Committee report . . . . "4. That, for use within the house, no system has been found in practice to take the place of the water-closet. 5. That, although there are appliances and arrangements by means of which the sewer-gases may be effectually prevented from entering houses, they still do so in the great majority of dwellings, both in town and country, including the metropolis. 6. That it is of the highest importance, in a sanitary point of view, that the metropolitan and local authorities should exercise great vigilance with respect to this matter, and that it should be made by law the duties of these bodies to enforce efficient measures for the exclusion of sewer-gases from dwellings, and to watch over their being efficiently carried out under such a system of payment as shall not press too heavily on those at whose charge the work is done."

(Signed by)

THE RIGHT HON. JAMES STANSFELD, M.P.,  
*Chairman of the Conference.*

LORD ALFRED CHURCHILL.

SIR H. COLE, K.C.B.

LIEUT.-COL. SIR E. F. DU CANE, R.E., K.C.B.

F. A. ABEL, F.R.S.

GENERAL F. C. COTTON, R.E., C.S.I.

CAPT. DOUGLAS GALTON, R.E., C.B., F.R.S.

TIMES, 9th January, 1873.

"I have, however, I am sorry to say, too much experience as to the absolute necessity of attention and alteration being required in the matter of Drains and Ventilation, even in the most recently constructed and costly mansions.

"ROBERT RAWLINSON."

TIMES, 8th April, 1874.

"The word 'impossible' has ceased to exist in the vocabulary of the sanitary reformer: if a prevalent evil ought to be removed, it can be removed."

*"SANITAS SANITATUM OMNIA SANITAS."*

---

# WHOLESOME HOUSES

BEING

AN EXPOSITION OF THE

# BANNER SYSTEM

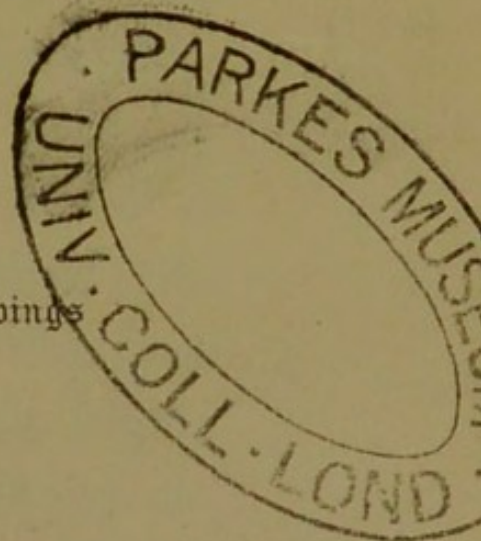
OF SANITATION

BY

EDWARD GREGSON BANNER, C.E.

*TWENTY-FIFTH THOUSAND*

Illustrated with Numerous Wood Engravings



PRINTED FOR THE PROPRIETORS

AND SOLD BY

CROSBY LOCKWOOD AND CO.

7, STATIONERS' HALL COURT, LUDGATE HILL, LONDON

1878



WELLCOME INSTITUTE  
LIBRARY

Coll. welMomec

Call

No.

WA

K54275

## PREFACE.

---

IN the following pages will be found a description of the new system of sanitation, and of certain sanitary appliances, with the opinions of numerous leading journals and eminent sanitarians concerning them.

With respect to the description, it is given in the briefest manner possible.

The opinions quoted are the outcome of careful observation and inspection by those who have given them.

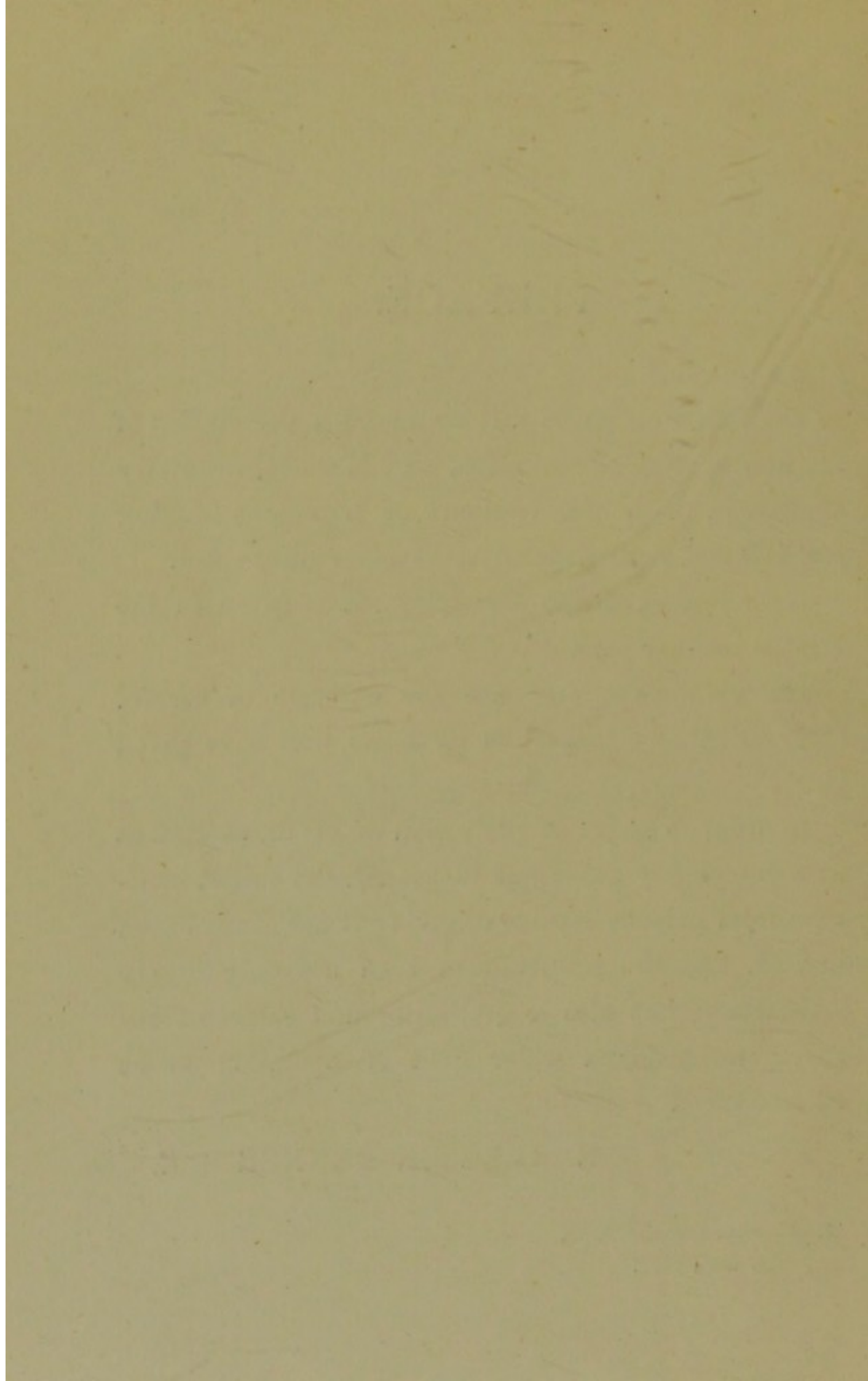
In order to arrive at perfection of detail, as well as at a completely unbiassed judgment, the fullest criticism from persons capable of giving it has always been invited, and the results have been not only highly satisfactory, but also a gratifying and sufficient encouragement for a wider field of operation to be entered upon.

E. GREGSON BANNER, C.E.

11, BILLITER SQUARE, E.C.,

1st Dec., 1877.





## WHOLESOME HOUSES.

---

### BANNER'S SYSTEM OF SANITATION,

WHICH consists in effectual trapping, by a single trap to each house, and thorough ventilation, will be the better understood if the reader will bear in mind the following facts:—

The gas of which *a drain or sewer is always full cannot unassisted rise up a vertical shaft*, and the best agent to utilise in order to afford such assistance is the wind, which in this country blows at an average velocity of ten miles an hour or so all the year round.

It is well known that *liquid* will not flow out of a cask unless the vent peg, to admit air, is taken out, but it has hitherto escaped attention that to *withdraw air*, especially foul air, a mere outlet is not enough, and that in order to do so, and keep up a constant current of air, *some extracting power is also necessary* (as shown at Plates 1, 2, 3, and 7), even if the cask or tube or drain has two tubes inserted into it, and they be open at *both ends*. Therefore, it is now contended that, for thorough or true ventilation *mere inlets and outlets* are insufficient; because, as is also here contended, FOUL air or gases, so "vitiated," do not rise to the highest points, but diffuse themselves throughout



the area of the whole space, even though the *hottest* air, so "vitiated," does rise to the highest level in any room.

Some people profess to believe that, "in obedience to the never-failing law of Nature," *foul* gases must rise and give place to others, *because the latter are heavier*. This theory, in the majority of cases, is in reality a mere excuse for ignorance, or indifference to the great principles involved, and will certainly be admitted as untenable as soon as the law of *the diffusion of gases* is properly understood.

A rotten egg when first broken causes an intolerable stench. Soon after fresh air has passed through or over the shell it affords very little proof of its having contained putrescent matter; the same condition of purity is produced in the *soil-pipe* of any house by passing fresh air up it constantly, and nearly the same would be the result in the case of a sewer, or of a ship's hold, thoroughly ventilated on the *vacuum* principle of Banner's System of Sanitation.

When the terrible stagnation which at present exists in sewers and drains is prevented by better flushing and *thorough* ventilation, *dangerous gas* will cease to be generated and stored in *them*, but until then simpler means will not suffice to render our houses safe.

The Banner System of Sanitation, in its entirety, may be described thus:—A single trap suffices for the whole house, and only pure fresh air is allowed to remain in the soil-pipes or drains of a house for a single moment; while under the old system—that universally adopted *in* houses hitherto—there is a multiplicity of traps and other costly contrivances employed, which are not only useless, but dangerous, since the application of them results in the soil-pipes and drains being



kept constantly "full to the brim of sewer gas" from year's end to year's end.

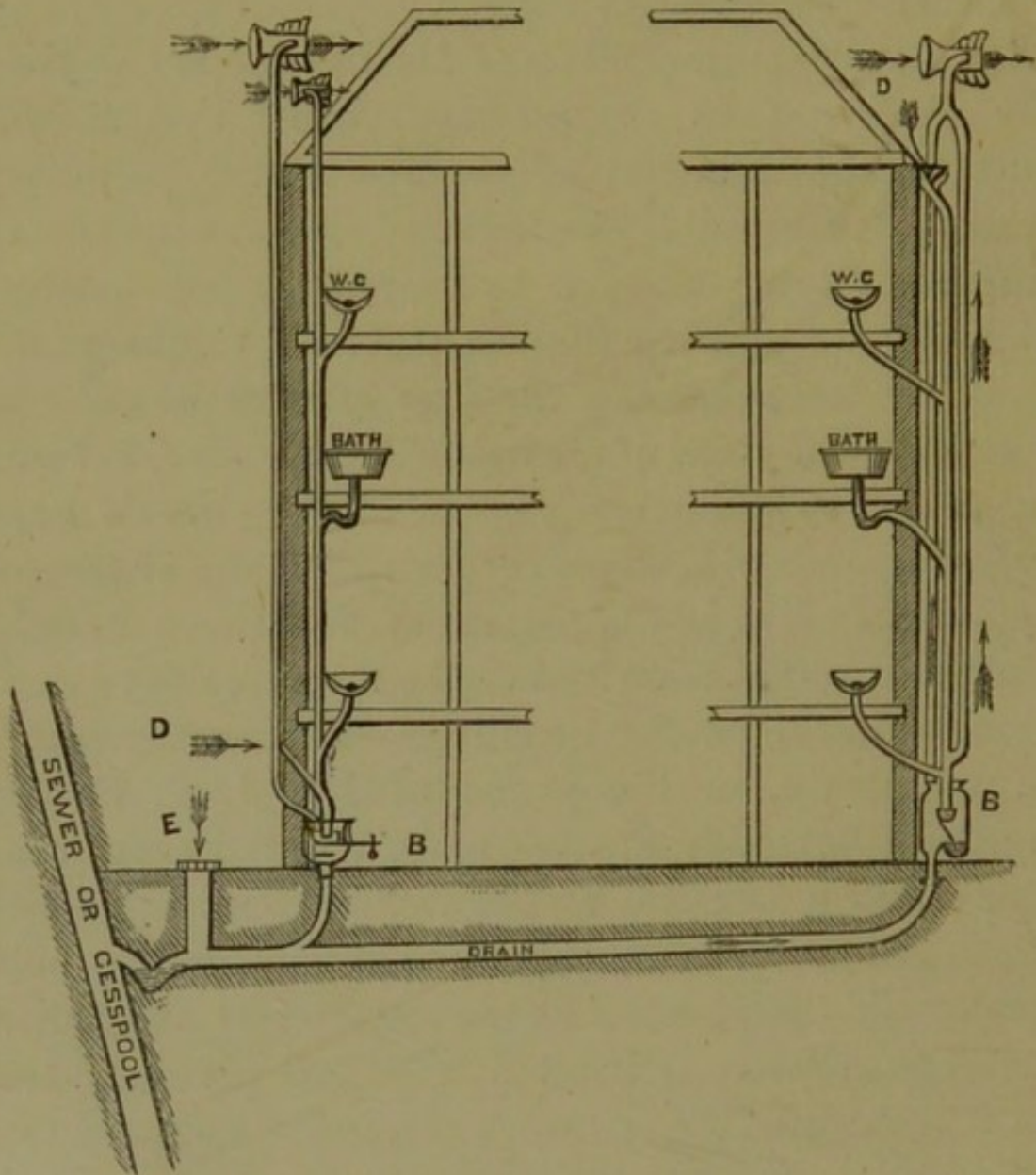
It is therefore hoped that the truth of the facts, as stated above, will force conviction upon unwilling minds, and satisfy even them, not only that the Banner System of Sanitation is the best and safest, but that the continuance of the old system cannot but be attended with the greatest danger.

*A full and fair comparison of the two systems is fearlessly challenged, in the confident belief that it will result in the influence of the few whose pecuniary interest may possibly be affected by the necessary change, not being allowed to override common-sense, and by so doing perpetuate a state of things which will still endanger not only the lives of more members of the Royal Family and of the nobility of the land, but continue to destroy and seriously affect, in many untold ways, yearly, hundreds of thousands of the community at large—whether they live in the palaces of the Queen herself, or in the splendid mansions of the most wealthy everywhere, or in the poorest dwellings—by allowing houses still to remain, in the words of Mr. J. P. Seddon (page 50), "DEADLY FEVER-TRAPS, WHETHER THEY BE MANSIONS IN BELGRAVIA OR COTTAGES IN THE SUBURBS."*

Such a statement as the foregoing would be most reprehensible if it were untrue, and it is only upon conviction that it is substantially and perfectly true that it is made.



PLATE 1.



## WHOLESOME HOUSES.

---

### PLATES 1 TO 3 AND 7

Represent the mode introduced by the patentee for *thoroughly ventilating the soil-pipe*, and the *house drain* by means of a separate shaft; the two being joined near the top, one cowl mounted thereon above the roof *can* then be made to suffice for both.

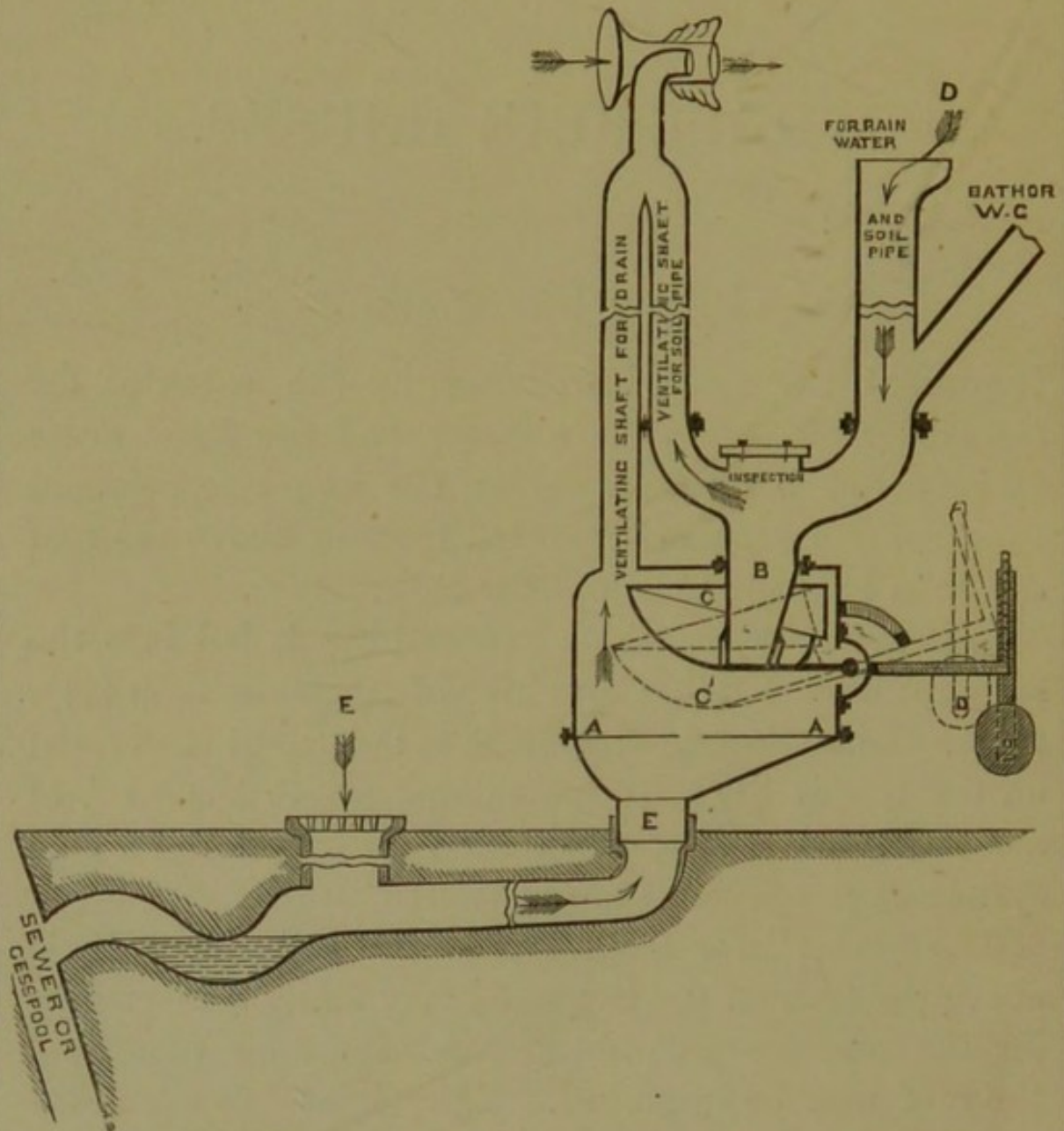
D is the inlet by which external air is led into the soil-pipe immediately above his Patent Drain Trap (B), thereby admitting, by the action of the patent cowl fixed on the top of the soil-pipe carried above the roof, of a constant current of fresh air throughout the whole system of soil-pipes of the house.

The "inlet" for fresh air to the soil-pipe a little above the trap on the basement may be by a short pipe for that express purpose, or the rain-water pipe from the roof may be employed. The "inlet" to the drain may be a rain-water pipe from the roof of the house or that of an adjoining building, or it may be through a grid to convey also surface water into the drain.

The conditions to be dealt with vary at different houses, and great care is therefore necessary in arranging the details so as to insure the thorough efficiency of the system.

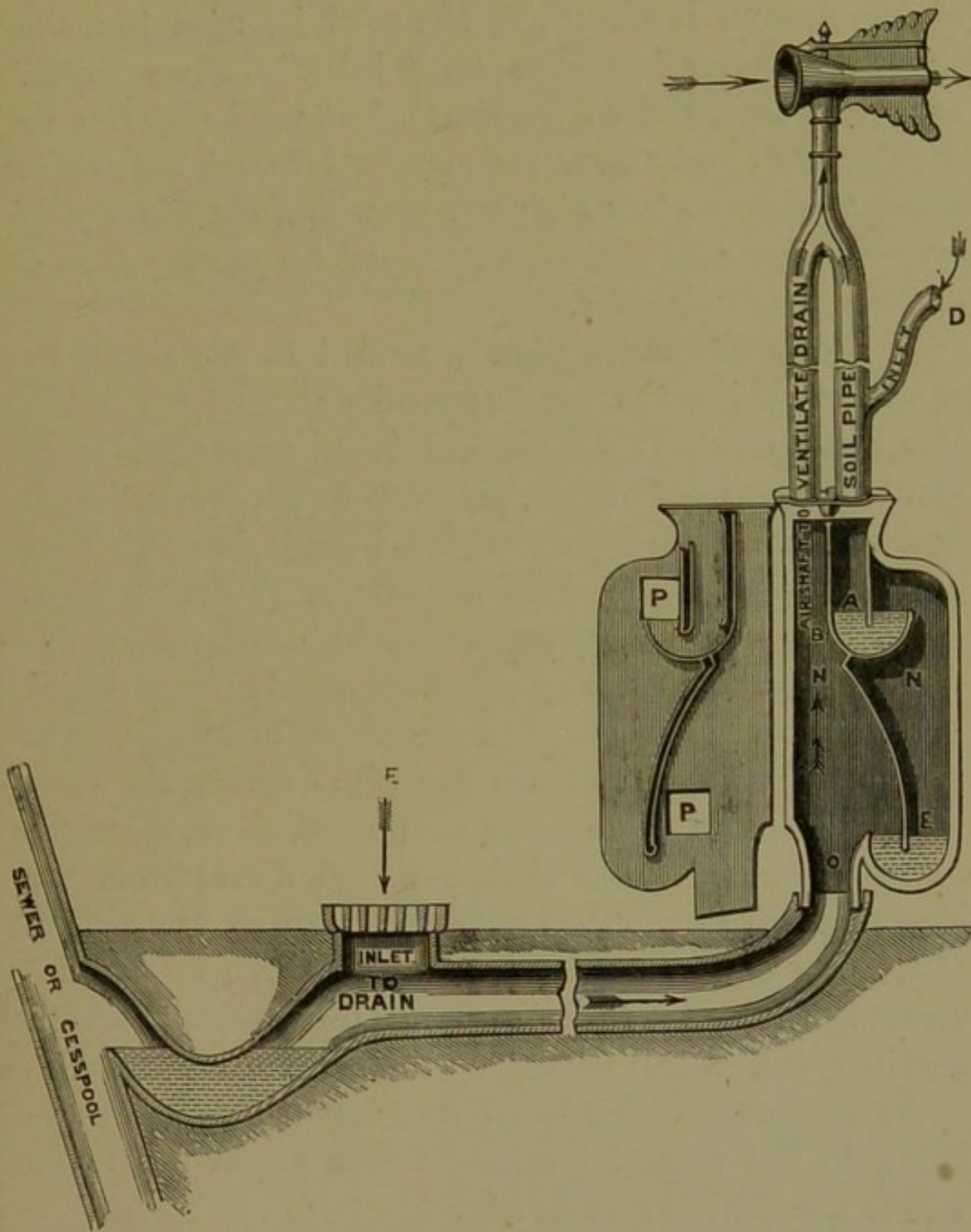


PLATE 2.



The above is the model introduced by the Lever-trap, patented 1st August, 1872, as exhibited at the International Exhibition in 1874, and afterwards at the Sanitary Exhibition at Glasgow in October, 1874.

PLATE 3.



The above is a simpler mode of effecting the same object as shown in Plate 2. Patent dated 2nd July, 1875, No. 2401.



The gases formed in *the drain* will escape therefrom at *the lowest point*, viz. at the "ventilator" (so called) at the ground level, unless the cowl be used to make the "ventilator" always an "inlet." *From actual experience we are able to certify that with a 4-inch Banner Ventilating Cowl a constant current of fresh air can be made to course along a HORIZONTAL drain a distance of over one thousand feet while the sewage is passing down it in the opposite direction.*

E shows the same plan extended to *the sewer*, by means of which the present road or street "Ventilators," so called, would become *inlets*, whereby a constant current of fresh air would be created and, accelerated by the action of the patentee's cowl fixed on the top of a sufficient number of shafts or pipes carried up outside houses, would be constantly maintained throughout not only the house and street drains but the sewer itself, causing the whole to be always as pure, comparatively, as are the pipes *within the house* where the patentee's system is adopted to ventilate the *soil-pipe*. Rain water should be led direct from the roof through the sink or pavement trap so as to flush the house and street drains, instead of, as now, destroying the metal roads, stopping up the gullies with detritus, and at last silting up the main sewer itself.

As self-preservation is the first law of nature, everything in the way of Sanitary action ought not to be left to the Sanitary authority.

On the principle "Take care of the pence, the pounds will take care of themselves," if all the house drains were ventilated *outside* the houses, the sewers, which at present are dangerous, would become not only innocuous, but would cease to be inconvenient.



By the adoption of the same plan, vitiated air may be drawn from any room in a house or from the cabins, fore-castle, or holds of ships.

---

### BANNER'S PATENT SANITARY APPLIANCES.

From the *Sanitary Record* of 30th Oct., 1875.

In point of value as a sanitary invention, the patent trap and foul air withdrawing cowl of Mr. Banner, of Brighton and London, were the gems of the exhibition. We say this advisedly, for if there are two contrivances more than any others in the way of sanitation that have puzzled our inventors, the house trap and the drain ventilator are those two. The trap invented by Mr. Banner has been several times referred to in our pages, and a description of it attempted, but without woodcuts it is quite impossible to do justice to it. We shall shortly be placed in a position to illustrate this trap with its last improvements, and also the cowl, for use upon the ventilating pipe in connection with the drain. Meanwhile we will venture to say that Mr. Banner's system of trapping is a sound one, inasmuch as one trap suffices for the whole house. And we know his method of ventilation is a good one, because he introduces a current of air into the foul-air pipe, and the cowl perpetually draws it out. *He also showed by experiment that without an inlet of air into the ventilating pipe, no cowl will work as a foul-air extractor.*

Major Seddon, R.E., in his report in *The Architect* on the general applicability of these appliances, and upon the excellency of the Banner System of Sanitation in its entirety, concludes his remarks in these very flattering words:—

I must say, in justice to Mr. Banner, that the greatest possible credit is due to him for having succeeded in solving a problem which has hitherto baffled all the combined talent of the best sanitary authorities of the day.



Mr. J. P. Seddon very fully endorses and confirms Major Seddon's report (page 41), and adds:—

The first thing that Mr. Banner showed us was, by experiment upon a small scale, that a pipe open at the top, charged with the noxious gases, which are heavier than the atmosphere, remained so charged—that is, full to the brim, notwithstanding all efforts to disturb by blowing down the pipe (as wind might be supposed to do), until an aperture at the bottom of the pipe, to allow of the admission of air, was opened, *and an extracting force applied at the top* by means of one of his patent cowls, to be hereafter described. Then instantly, but not till then, was the pipe emptied of its contents, which represented the foul air in a soil-pipe, and a current of fresh air *upwards* maintained through the pipe.

We next proceeded to inspect the patent trap, which was fixed in a cupboard in the basement, and resembled in size and appearance an ordinary gas-meter. The description of this trap had appeared to us complicated, and as such to present weak points, but when its handy position, and facility for inspection, and the ease with which it could be got at, cleansed, and repaired, if necessary, were taken into consideration, these fears seemed to be unwarranted, and of its efficiency in securing a perfect seal, under all circumstances of its action, we were speedily convinced.

We took some trouble to test the trap by throwing cloths, corks, &c., down the closets and watching its action under these circumstances. The cloths disappeared bodily, with a swiftness that almost escaped our vigilance.

We then went to inspect the outlet of the ventilating pipe which brought fresh air to the bottom of the soil-pipe, just above the trap.

This certainly proved to demonstration the satisfactory working of the current of air kept up between the ventilating pipe and this cowl, in preventing the slightest accumulation of foul air or gas in the pipes.

We then went to examine the cowl itself. *Without doubt, the cowl is an admirable one, and may be applied to many other purposes besides the one under consideration, with great advantage, as for instance, to the exhausting ventilating pipes Mr. Banner proposes for house ventilation.*

*To sum up the result of our examination into these sanitary ap-*



*pliances connected with house drainage, I would say that, in my opinion, Mr. Banner's system is, under existing circumstances, an excellent one to adopt in houses and buildings of any pretension. Its first cost, which is not great, may be considered as to a great extent compensated for by the facility it gives for inspection and repairs, which, with the ordinary appliances, all hidden out of sight, are such a constant source of annoyance and expense to householders and of profit to plumbers, who would be more than human if they did not constitute them a means of obtaining an income to themselves.*

The first cost, however, is capable of considerable reduction, and Mr. Banner has now in hand the construction of a much simpler trap (since perfected), which he believes would perform the same object as the one above described. *The system permits of the complete abandonment of the abominable D Trap, and indeed of all other traps in connection with the closet apparatus itself. This is obviously a great saving in cost which would go far towards defraying that of the main trap in the basement, which is the only one wanted.*

Extract from the Annual Report of R. P. B. Taaffe, Esq., M.D., M.S., Lond., Medical Officer of Health for Brighton:—

*Let me sketch what I consider would be a perfect scheme for the prevention of the ingress of sewer gas into houses. The closet to be without a D trap. The soil-pipe to have a 2½-inch ventilator to the top of the house. At the bottom of the soil-pipe a Banner's drain trap. A 4-inch ventilator from the house drain to the top of the house; this ventilator, and also that of the soil-pipe, should run up some feet above the parapet, and each be covered with a Banner's ventilating cowl. The adoption of the above scheme would, I feel quite certain, render any house perfectly secure against the ingress of foul gas from drains or closets.*

Extract from a letter from the author of "Healthy Houses," "Sanitary Arrangements for Dwellings," &c.:—

10th May, 1875.

The conclusions I have come to after a considerable time spent upon their study is that they are the best *media* out for the work which they are intended to compass, that I can confidently recommend them, and that they ought to be specified by architects generally.



## BANNER'S PATENT DRAIN TRAP.

---

### PLATE 4.

It is found impossible, *with the ordinary forms of traps in use*, to prevent the inflow of gas from the sewer into the house.

Banner's Patent Drain Trap effects that most important object. *It is entirely self-acting and always perfectly air-tight; it flushes clean and cannot be unsyphoned.* The arrangement is novel and effectually prevents *at all times* the escape of sewer gas into the house, while it dispenses with the ordinary forms of D and other traps used in connection with water-closets, the universally acknowledged inefficient action of which is a constant source of danger. The very construction of D traps prevents a clearance of soil from them ever being effected, and they therefore become generators of impure gas, which is freely admitted through the "container" into the house each time the closet is used, and the gas from the sewer is also constantly *drawn* through them and through faulty pipes *into the house*, by the varying temperature of the latter, which is facilitated by the syphon action of one closet upon another when there are more than one in the house. D traps, again, often become "choked" by foreign



Fig. 1.

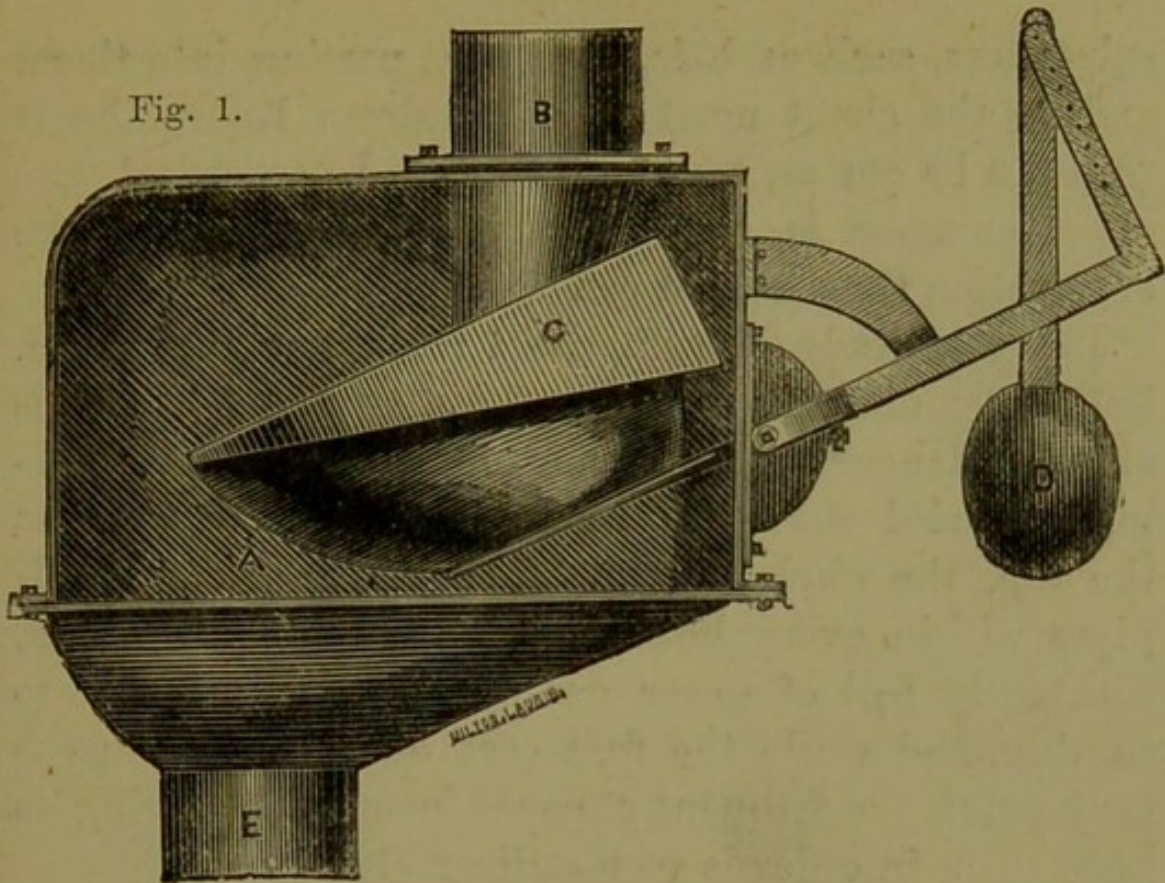
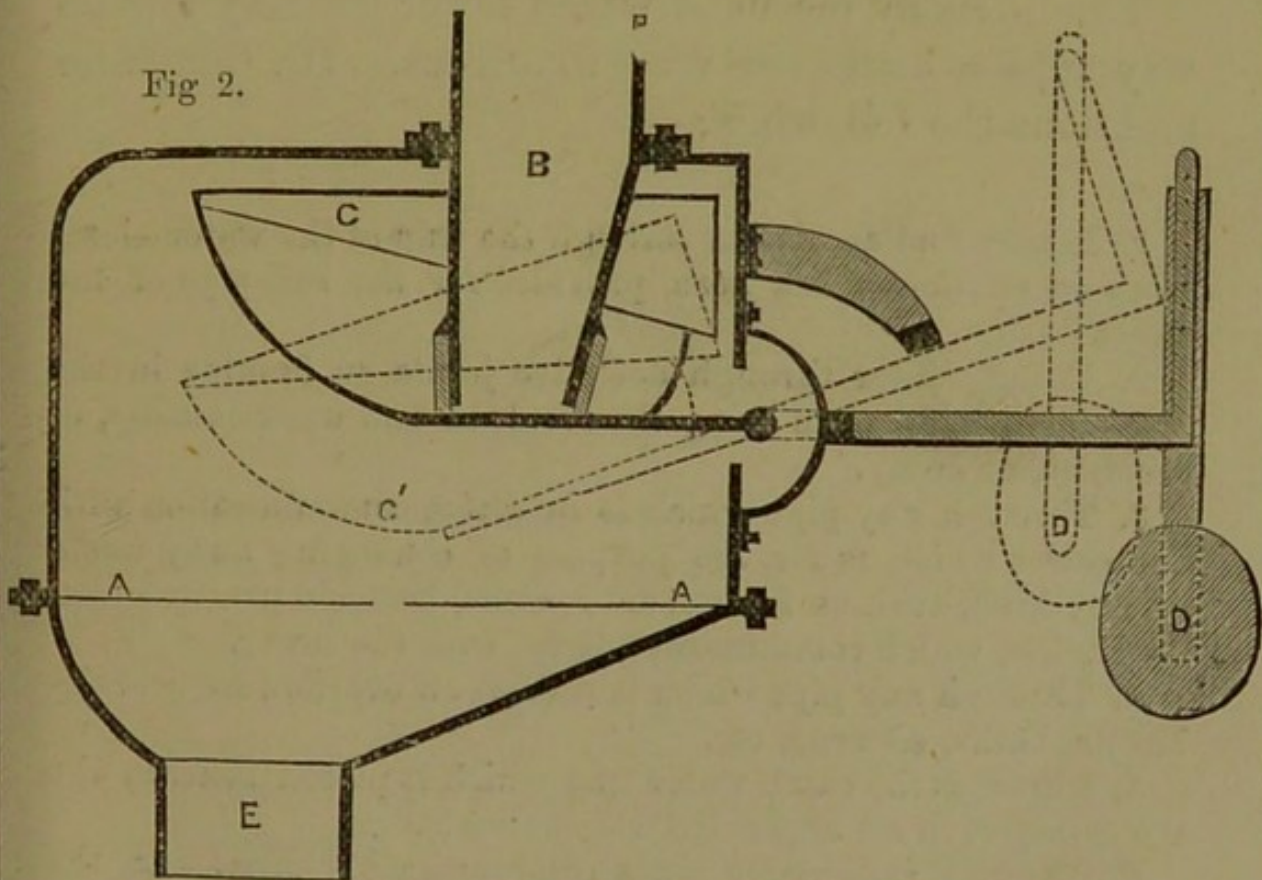


Fig 2.



The patent for the above trap is dated August 1, 1872, No. 2303, and is the first patent by which the "inlets" are secured, as shown in the arrangements at Plates 1, 2, 3 and 7, and without which no cowl will act.



substances, such as hair, cork, &c., passing into them, and as the closet must be taken down before the D trap can be got at, a plumber has to be employed, and great expense is consequently incurred before the obstruction thus created can be removed.

In a multitude of counsellors there may be wisdom, but in a multitude of traps within any house there is absolute danger, for it is now admitted that with soil-pipes carried above the roof, and merely left open at the top, the whole system of closets, traps, and soil-pipes within every house remains, as already stated, constantly full of sewer gas from one year's end to another, and while the first cost of so many traps is very great, the frequent expense incurred in trying to keep them in order is even still greater.

The inlets by means of which sewer gas may find its way into a house are very numerous. Dr. Carpenter mentions the following :—

1. It may find admission through the trap of the water-closet *when no ventilation* has been provided for the soil-pipe of the closet itself.

2. It may enter through defective joints or fissures in the soil-pipe, such defects being the result of bad workmanship, of accident, or decay.

3. Through any pipe which is in direct communication with the sewer which is for the purpose of conveying away waste of any kind, such as housemaid's sinks, butler's pantry sinks, and baths, which communicate direct with the sewer.

4. Through any pipe which is used as an overflow from wash-basins, baths, cisterns, etc.

5. Through the catch water tray which is placed beneath the water-closet in all expensive water-closets.

6. Through rain-water pipes communicating *direct* with the sewer, when *they open in enclosed positions or near to open windows*.

7. Catch-water drains, which generally exist in cellars and



areas under cover, and which are supposed to be trapped by a bell trap.

Most of the connections enumerated are *supposed* to be trapped by some modification of a *syphon*. *We believe that syphons are liable to be delusions and snares for entrapping the unwary.* Any one may prove this for himself by watching a glass syphon, similar to an ordinary syphon trap when put into action, and then thrown out by cessation of function for want of water. The long leg of the tube sucks the short leg dry, and untraps the bend. It follows from this that *all traps which depend for efficiency upon a syphon action are practically useless.* If their function has been brought into play for the prevention of an overflow, when the overflow ceases the trap is at once untrapped by the long leg of the syphon itself, whilst it is also as certain that if the function has not been exercised, the water which was put into the trap has evaporated and *left a clear channel for the conveyance of air into the house without let or hindrance.* It must follow, therefore, that traps which depend for efficiency upon water being always present in the trap will fail *unless a provision is made for the arrest of the syphon action.* *This provision is the exception which is seldom present.* *Not one in ten thousand contain the required protective action, and syphon traps without it are worse than useless.*

A well-known writer on the same subject says—

It may, perhaps, interest your readers to know that the results of the experiments as to *the passage of sewer gas through water traps*, which Dr. Fergus refers to in his admirable paper of last week, are *fully borne out by practical experience.*

*The true and only remedy for the defects pointed out by Dr. Fergus is to remove their cause—viz. improper construction; and the water-carriage system can be made as perfect as the strictest sanitarian can desire.*

The principle of disconnection has long been applied to the waste-pipes of sinks, baths, overflows, &c., but *until recently it has been the usual practice to consider the principle as inapplicable to the soil-pipes from water-closets.* This is, however, quite a mistake, *as with suitable arrangements soil-pipes as well as waste-pipes can either be absolutely disconnected, or ventilated in such a manner as to be virtually disconnected.*

By the employment of the improved trap, shown



in the engraving, all these evils are entirely obviated, for neither pressure, suction, nor syphon action can affect it; and one trap fixed like a gas meter inside or outside the house, in any convenient place in the basement, is sufficient for a house containing several closets, and can be readily adapted to existing houses.

The lever trap consists of a small air-tight chamber (A) of cast-iron, or other material, fitted with a 4-inch inlet pipe (B), which projects several inches into its interior; the lower end of this inlet, surrounded by an india-rubber band, sprung on and slightly projecting beyond the end of the pipe, is closed and made air-tight by a copper cup (C), of peculiar form, which is pressed up to it by a suitable *weight* (D) mounted upon a lever fulcrumed on an air-tight centre, and having its outer end bent upwards at a right angle. The *weight* is suspended by a link on the raised end of the lever, and is so arranged that when the pan is in the act of tilting (C<sup>1</sup>), the centre of gravity of *the weight* (D<sup>1</sup>) is brought nearer the fulcrum, thus reducing the load and allowing the pan (C<sup>1</sup>) to remain tilted, without at any time unsealing the trap, till it is thoroughly flushed, yet retaining sufficient power to completely close the trap again after flushing. A series of holes in the raised end of the lever permits of a proper adjustment of the *weight*, and a bend in the soil-pipe, just above the trap, breaks the force of the water reaching the latter from above. The lower part of the chamber (E) is formed with sloping sides, terminating in an outlet in connection with the drain.

*Before flushing*, the cup, when full, weighs *over* 15 lbs., while the utmost weight opposed to it on the lever is *less* than 15 lbs.



*After flushing, the cup and clean water left in it weigh under 7 lbs., while the weight on the lever after flushing is over 7 lbs.*

The column of water in the soil-pipe (B) cannot rise more than 12 inches *above the chamber*, but the weight on the end of the lever is sufficient to maintain *in the soil-pipe* a permanent column of several inches of fresh overflow water, besides the clean water left in the bottom of the cup after each thorough flushing, till the closet is again used and its contents are discharged into the drain, when the copper pan filling again is again tilted, and remains down sufficiently long to admit of a thorough flushing (*but at no time unsealing the end of the inlet-pipe, as will be seen from the dotted lines in the engraving, which shows the pan in its tilted position*), after which the trap is brought back by the action of the weighted lever to its normal position, when, besides the air-tight valve thus formed, there is a water seal of three inches in the cup, and several inches up the soil-pipe.

A small piece of pipe from outside the house to a little *above the trap* may be safely and advantageously used to lead external air into the soil-pipe, and thus there will be established a constant current of fresh air throughout all the pipes *between the trap and the cowl fixed on the soil-pipe carried above the roof of the house.*

A separate pipe may, if thought desirable, be fixed *into the chamber*, and taken up above the roof of the house, *to ventilate the sewer or the drain.*

This is a most advantageous form of trap for all low-lying districts, where there is danger, in times of flood or high water, of the drains returning their contents



into the basements, as the greater the pressure of the returning sewage matter towards the chamber below the trap, the more tightly is the copper pan closed against the end of the soil-pipe inlet, so that no flood-water, sewage, or sewer gas can possibly be forced past it into the basement or any other part of the house; *a desideratum which cannot be obtained by any other trap.*

The outer end of the lever being exposed to view, in the event of any foreign substance causing a stoppage, it can be readily remedied by a domestic in two or three very simple ways.

Fig. 2, in Plate 4, shows the Cup Valve in the position it takes while flushing, when the opening is increased from the diameter of the inlet pipe above it, to 12 inches.

The apparatus can, if more convenient, be fixed *in the place* of an ordinary D trap, immediately under the "Container" of a closet, and in such case the inlet pipe for fresh air (D) Plate 1, can be led directly into the "Container."

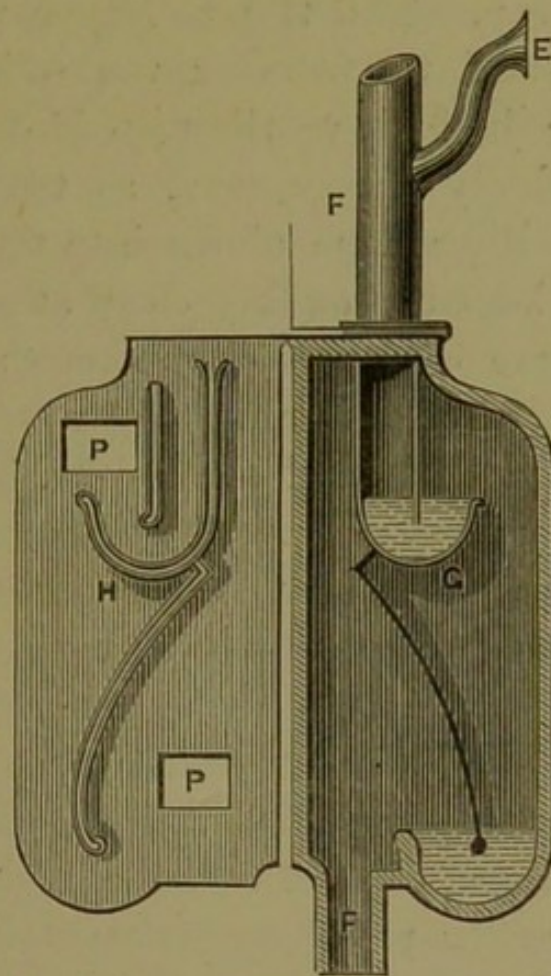
The outlet from each closet is so arranged, without being trapped, that whatever can pass through it will freely pass through the patent trap in the basement.

Plate 5 is a diagram of another house drain trap patented by Mr. Banner, July 2, 1875, No. 2401; while it is less expensive, having no movable parts, it is nevertheless equally as effective as his patent lever trap for the complete exclusion of sewer gas from the house. Its great advantages over the ordinary syphon or dip trap are manifold and apparent; like the lever traps already described, it is self-acting, always air-tight, flushes clean, and cannot be unsyphoned by any action whatever of the sewer or otherwise; it may be used



to ventilate the soil-pipe only, or the sewer or cesspool also; or, if preferred, only the soil-pipe and house drain, by a pipe of any desired diameter led from it, outside or inside the house, to above the roof and having a cowl mounted thereon. One trap in the basement, inside or outside the house, will suffice for

PLATE 5.



- E—Inlet air pipe.
- F—Soil pipe.
- C—Double dip trap.
- H—Outer plate of trap reversed.
- P—Inspection plates or screw caps.

any number of closets, and placed in any cupboard or recess, or against the wall, only occupies a distance therefrom of five inches, while there is a vertical fall of *two feet* between the two dips. The space between them, which is always air-tight, would hold, if it



could be filled with water, over two gallons, the weight of which alone would then exercise a downward force of over 20 lbs. on the lower dip, while the fall of water from the upper closets, often as much as 40 or 50 feet, will always keep the upper "dip" completely free from any possibility of the slightest impurity ever remaining in it for a moment, precisely as in the case of the lever trap. The trap is larger than the soil-pipe to be carried up from it; the soil-pipe may be curved a little just above the trap if desired, which, however, is wholly unnecessary, as the *direct* action of the water falling from above into the first dip insures its being kept thoroughly clean at all times. The admitted extreme weakness of ordinary syphon traps is not only their great liability to be unsyphoned by the least suction action of the sewer, as well as in many other ways, but where they *can* be placed outside houses, for which there is no convenience in the small close areas of town houses, provision has necessarily to be made for frequently cleansing them in consequence of their great liability to become foul, owing to the greatly diminished force with which the water, &c., from the closets, however high above, dribbles into them after passing a great length of drain pipe, often under the floor of the house, *horizontally* for some distance before the syphon trap—probably situated under an *open grating in an area*—is reached. Many other inconvenient and otherwise serious objections to this mode of trapping are too apparent to need further mention here. One very serious one is forcibly pointed out in the earlier part of this pamphlet, which shows that the sewer gas is often forced by the action of the sewer itself through the water in such traps. As



has been clearly shown by Dr. Fergus, of Glasgow, foul matter is retained in ordinary traps, and consequent decomposition goes on. The inlet, *as introduced by the patentee*, to convey external air to the foot of the soil-pipe just above the trap, and which may be used without or in conjunction with a ventilating cowl or ventilator above the roof, for the purpose of establishing a constant current of fresh air throughout the whole of the pipes inside or outside the house, is admitted by all who can speak authoritatively upon such a matter to be a point of importance and value, constituting a great stride in sanitary science. It needs no charcoal tray or other nonsensical contrivance, such as is found necessary for ordinary syphon traps, to *prevent the escape* of poisonous sewer gas at the ground level when they are placed in areas outside houses, *as by the action of the cowl above the roof, the "inlet" in this system is always really an inlet for fresh air and never an outlet for sewage gas.*

The very great advantage of a foul-air withdrawing cowl being mounted on the soil-pipe above the roof is, that it insures *at all times* a current of fresh air *up* the soil-pipe, while without it the wind would blow down any pipe open at the top, and then the most poisonous sewer gas which passes the water in an ordinary trap or "disconnection" would be forced out at the *intended* inlet, to the great danger of persons on the basement floor, or at open windows, *as at present.*

This most important fact must never be lost sight of  
—GAS *from a sewer or drain* CANNOT, UNASSISTED, RISE  
UP A VERTICAL SHAFT.



BANNER'S  
PATENT VENTILATING COWL, OR HORIZONTAL  
VENTILATOR.

---

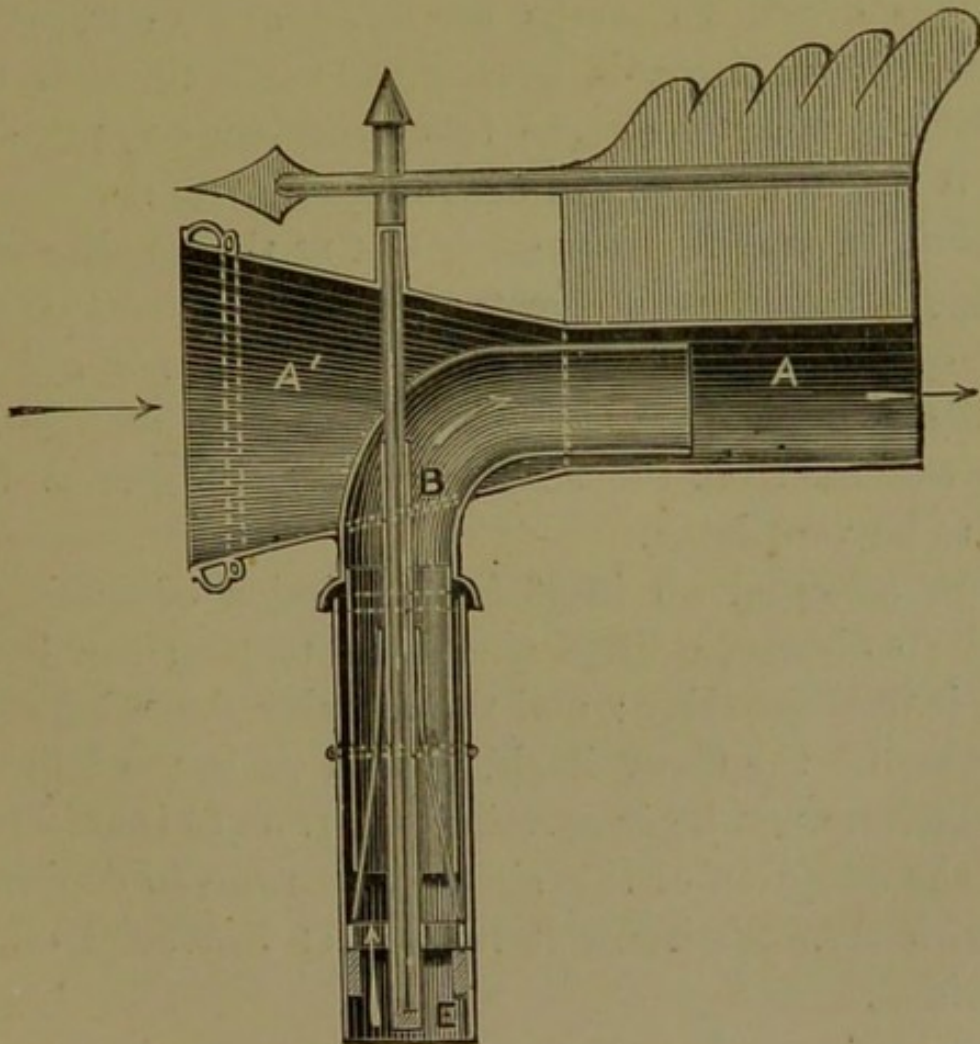
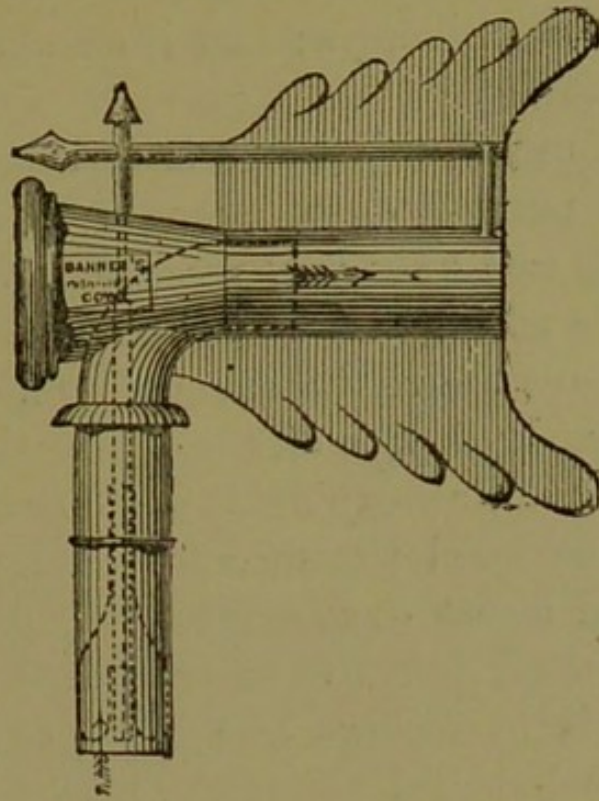
THE patent for this cowl is dated October 5, 1874, No. 3400.

The small sizes were specially designed for soil-pipes and drains, and used with the trap with "inlet" patented, as already stated, on the 1st of August, 1872, No. 2303, would alone be useful, as without such "inlet" no cowl can be of any use.

The public are cautioned against the use of weak or specious imitations of the original Banner Cowl. None are genuine unless they have on a brass label affixed to them "Banner's Patent Ventilating Cowl," each of them being numbered.

This novel apparatus supplies the want of the age, and should be used universally; it is inexpensive, and, though it is simple in construction, its action is so important and effectual that no house having a water-closet in it should be without one fixed on the soil-pipe carried above the roof; as well as one on a pipe led from the drain to ventilate it. It will be found most useful in many other ways, to draw off vitiated air from heated rooms in public buildings, banks, offices, schools, stables, granaries, warehouses, ships' holds in which the cargoes, alive or otherwise, are liable to become over-heated, and the cabins or forecastles of vessels;

PLATE 6.





also smoke and heated air from railway carriages, &c., and smoke from chimneys; and it effectually prevents any down draught.

The great use of this Cowl is not only to *draw off* foul air and prevent down draught at all times, *but especially to do both when most needed*; viz. during high winds or gales when, without it, all the mere outlets in the shafts above the roof become closed, owing to the greater external pressure of the wind, which not only prevents the foul air escaping at such outlets then, but, by causing increased pressure from all points within the sewer and street drains, forces the gas *thus locked into them*, through defective traps, *into the houses*.

Its action is as follows (see Plate 6): The larger end of a funnel-shaped tube ( $A^1$ ), placed horizontally, is always directed towards the wind, and a current of air passing in there, is pressed forward through the annular space between the two cylinders ( $A, B$ ), and when it reaches the end of the inner one ( $B$ ) it expands all round it, and in its passage out at the smaller end of ( $A, A$ ) a vacuum is created round *the point* of the inner cylinder ( $B$ ), which by suction *draws out* its contents into the open air, and thus induces an upward current of air from the shaft or pipe leading from the place to be ventilated.

To be effectual an inlet for admission of fresh air into the soil-pipe, a little above the trap on the basement, is indispensable; and the annular space between the tubes of the Cowl itself, as well as in the lengths of the latter, must be in certain proportion to their sizes.

By the adoption of this simple apparatus in conjunction with Arnott's ventilators, a most beneficial effect is obtained.



## LETTER ON SEWER GAS AND D TRAPS.

To the Editor of the *Sanitary Record*.

SIR,—The use of D traps under each closet should be entirely forbidden by legislative enactment.

It is generally represented that a trap should be placed as near to the closet as possible; but now that a good supply of water is obtainable, it may at least be doubted whether the good a D trap is supposed to do is not greatly overborne by the positive harm it does. That dangerous receptacle, called a D trap, is always placed under every closet, in some form or other. In addition to always being itself virtually full of most impure matter, generating foul and often poisonous gas, which every time the closet is used rushes into the house, it also affords free access for gas to pass direct from the sewer into the house, to the great danger of the inmates; for where there is more than one closet in the house, or where, besides the one closet, there is a bath in the house, the D trap is constantly rendered ineffectual *through an inch or so of the water in it* being by syphon action pumped or drawn out, at the same time that the "trap" in basement, by the syphon action of the sewer upon it, has been in its turn rendered ineffectual as a trap.

Dr. Alfred Carpenter, in a very able paper which appeared in No. 12 of the *Sanitary Record*, says:—



“The air contained in an upright soil-pipe must get into an unsafe state for people to inhale, if it is allowed to find its way into sleeping, or indeed into any inhabited rooms. This has now become an established axiom of sanitary science. The air in soil-pipes must be stagnant for many hours together if no means are taken to ventilate them, and when used every gallon of water which passes down must displace a nearly equal volume of air, which will necessarily find its way either through the trap or through some of the junctions, into the water-closet, and thence into the house.”

D traps are always full of soil; no rush of water can be had to flush them; for though the cistern for the closet may be fifty feet above it, as the water falls first into the basin and then into the “containers,” its real fall for flushing the D trap is only an inch or two; thus it only dribbles down into the D trap, and in like fashion dribbles out of it, *leaving the soil in it*. Most unquestionably these D traps generate foul gas, which must rush into the room every time the closet is used, and the larger the D trap the greater the danger; for, besides the foul gas which is forced up from it every time water passes down, I am told the plumbers, to prevent syphoning in some slight degree, often perforate the top side of the D traps, and thus make an outlet for the gas from it and from the sewer always into the house. I have long done away with D traps in my house, and with the most satisfactory results; and I hope, before very long, it will be generally admitted that they are chief offenders in every house, though, as yet, they are left, often I fear, to do deadly work silently and unseen; for in the language of the *Times* lately, in its article on the untimely death of Dr. Anstie:—



*“ Sewage stagnating in an IMPERFECTLY CLOSED cesspool is sure to be a source of noxious gases, and it is difficult to conceive how such a violation can ever have been tolerated.”*

I am surprised at the absence of severe remarks from Dr. Carpenter upon this chief defect of the present system of house-sanitation, viz. the D trap, but the strong opinion which he so ably expresses seems to fully confirm the belief that, under existing arrangements, the sewers are ventilated generally, through the D trap and soil-pipes, and other defective traps and joints, *inside the house*. While, however, Dr. Carpenter is no doubt perfectly right in the principle he advocates—that both soil-pipes and sewers should be ventilated, I venture to express a belief that the plan he advocates, viz. of ventilating the sewers *through the houses* by “10,000 openings in soil-pipes,” would be attended with great danger to the inmates, for several very weighty reasons.

*He shows, by his suggesting these 10,000 soil-pipe openings as ventilators for the sewer, that the “traps” or “disconnections” between the house and the sewer do not answer their intended purpose, for if they were really traps, then the 10,000 soil-pipe openings could not ventilate the sewer, but only the D traps and pipes of the closet between the roof and the basement of the house; it will, nevertheless, be admitted if the soil-pipe openings only ventilate these latter, that by that alone they perform a most important purpose, and certainly would lessen the probability of syphon action within the house.*

I submit that it is dangerous to allow the gas from the sewer *to pass up the soil-pipe*, because, from various causes, it will be likely to escape, or to be drawn into



the rooms of the house ; *yet it seems clear that it would be most advantageous that the sewers should be ventilated at "10,000 openings into them," by a separate pipe for that sole purpose, being led from a real trap in the basement to above the roof of each house ; such pipes being fitted with cowls, which will draw the foul air out of the sewers, and thus cause the "ground" ventilators to supply fresh air to the sewer, instead of foul air from the sewer passing out of them.*

As is suggested by Mr. Thomas Reid in the *Sanitary Record* of 19th ultimo, "*ventilators carried above the roofs of buildings should be for the discharge of sewer gas, and not for the supply of fresh air.*" And by Dr. Carpenter in the same paper, "*The principle to be kept in view is that there shall be a sufficient number in the periphery of the system which shall promote a movement from below upwards ; make openings enough, and danger is dispersed, or rather does not come at all. A continuous current carries away the sewer gases before they are concentrated enough to do harm.*"

E. GREGSON BANNER.

October 5th, 1874.

In a long letter recently published in the *Architect*, one of the correspondents of that journal, speaking of the Banner System of House Sanitation, "*a system at once so simple yet so effective,*" thus describes it :—

"It is a tri-partite system, consisting of, first, 'the trap ;' secondly, 'the inlet pipe ;' and, thirdly, 'the cowl.' The first unit herein is based upon one of the simplest principles—and one of the oldest known to us—that of the steel-yards ; the second is something entirely new, when applied to the ventilation of drains or soil-pipes. I say entirely new, because I



hear and read that other sanitarians are claiming this innovation as something well known before. I go further, and say advisedly, it has never been applied in practice for the purposes to which the patentee has adopted it, nor was it seen before it was introduced to public notice at the patentee's house at Brighton, during the Social Science Congress meeting there. Mr. Banner has very wisely secured it by patent, for without this inlet his cowl, or any other cowl, would be perfectly useless; the inlet being the lungs of the pipe or system, and the cowl the breathing power. This also illustrates another simple principle—the vent-peg in the barrel.

### BANNER'S COWL FOR WITHDRAWING FOUL AIR.

(From the *Sanitary Record*, 15th of May, 1875.)

Hitherto in the matter of simple ventilation, the great difficulty has been to light upon some ventilating medium which should absolutely remove all the contaminated air, and that steadily and in no intermittent fashion, as is the case with many highly-lauded ventilators, which, however, are biassed in their action by the prevailing wind. It has been usual, even in the case of the top of a soil-pipe, to be content with a common funnel top, or a Tredgold pattern cap, but neither of these devices *withdraw* the foul air generated in the drains, but allow it simply to *escape* at *times*, more especially during *lulls* in the weather. The open-mouth revolving cowls are an improvement upon these latter contrivances, but still these behave far from satisfactorily, as the levitation of the gases is not mechanically assisted. *They are allowed sluggishly to accumulate in the ventilating tube until the outer air permits them to find an exit.* To remedy such evils Archimedean screw ventilators have been invented, and they perform excellent work in many situations, for instance, in cotton or woollen manufactories, where the withdrawal of the fluff in the air is desirable. And many other species of air regenerators have been tried with more or less success for these and kindred evils.

The difficulty, however, has been to provide a simple ventilator which, without unnecessarily forcing a change of air in a room and so creating a draught, should still readily act in quietly removing the stratum of air which has become unfit for



respiration, and enable the room to be quickly filled with fresh air through the inlets provided for that purpose. The same beneficent result ought, of course, to follow its application to sewers and drains, and even vessels at sea. All that ought to be done by the workman should be merely affixing upon the top of the shaft the peculiar pattern of cowl which is the best adapted for the purposes sought, and the wind ought to carry out the rest of the contract. It is sufficient to say that a really effectual ventilating cowl would work equally well, whether withdrawing the air which passes up the soil-pipe of a closet, pumping up the air from a general trap in the basement of a house, or retiring upon a larger scale the gases evolved by a main sewer; in the first case by dissipating the foul air through a four-inch pipe, in the second, it may be, by a six-inch pipe, and in the last-mentioned case by perhaps a shaft of two feet sectional area.

The principle of Mr. Banner's cowl or foul-air withdrawer, and which is specially adapted for places such as we have described, is as follows. A revolving cowl is fitted upon the top of a foul-air shaft, and this is pierced both at back and front, the end best adapted for exit being always held to the direct current of air. The foul air naturally rises up the shaft, and from the simple blow-pipe action would at most times escape from the mouth of the vane, because the wind would be blowing through the aperture at the back and assisting in its removal. But Mr. Banner has not been content with this idea of an occasional suctional action across the shaft, but has contrived a means of continuously extracting it under all the varying influences of wind and weather. *By means of this cheaply made and otherwise simple apparatus, the foul air in any shaft will be continuously extracted.* The invention is also adapted for use in churches or schools where a shaft would not be needed, but merely an opening at the ridge.

Professional gentlemen who have to deal with sanitary questions have long been in search of a ventilator which could really be relied upon to perform, uninterruptedly, useful work under the circumstances which we have already enumerated; and we esteem it a fortunate thing for them, and, of course, for ourselves and the public generally, that it will, in future, only be necessary to specify the cowl now before us. The inventor, Mr. E. G. Banner, of Billiter Square, London, is well known to sanitary men as the inventor of what we cannot help terming



*the best devised house-trap in existence, and to the history and working of which it is our intention to refer on an early occasion. Meantime let our readers who require foul-air withdrawers—as we have most uneuphemistically called them—try the Banner cowl. We have no doubt that in a very short time the name will be familiar in our mouths, and that the inventor—whom we understand, by the way, to have taken up the subject of sanitation on public grounds, and outside his own avocation—will do as much or more for health as Moore has done with glass *louvres*, Cooper with revolving panes, or the Boyles with mica flaps, and ridge, vane, and turret ventilators.*

---

In a paper read before the Social Science Congress at Glasgow, in October, 1874, Dr. Fergus said:—

All sanitarians are agreed as to the necessity of trapping drains, and many contrivances have been adopted in order to do so. We may explain that a trap is a body of water interposed between the sewers and the pipes leading into our houses to prevent the entrance of sewer-gas through these pipes, and generally supposed sufficient to do so. A very common form of these is what may be termed the tongue trap, and it acts most effectually in *preventing the entrance of vermin into houses*. I may be allowed to state, that to ventilate the sewers is quite as important as to trap them, but let us pause a moment to inquire whether we are using a proper term. *The term “ventilation,” I should suppose, means the replacing of foul air by fresh air, of which the various plans proposed certainly fall short. They do, indeed, provide for the escape of a certain portion of foul air from the sewer into the open air—not, however, to be replaced by fresh air, but by equally foul air, from the decomposition going on in the sewer.*

I must not be supposed as undervaluing the sanitary advantage of the removal of foul air from the sewers; indeed, ventilation strictly so called hardly exists.

Formerly I did believe in the ventilation of sewers. This was quite a cherished idea, and I abandoned it with great reluctance; but experience, observation, and reflection compelled me to do so. My impression is that the following is the process going on



without much cessation, viz. *the sewer air is absorbed by the water in the sewer side of the trap and discharged in the house end of it.* I have not hastily arrived at this conclusion; it has been forced on me as the only solution of all the facts of the case—the passage of sewer air *through the water in the trap.* We ought to take a broader view of the question, and feel that this gigantic evil *must* be got rid of.

---

### PATENT DRAIN TRAP AND FOUL AIR EXTRACTOR.

(From the *Builder* of December 11th, 1875.)

In the course of our remarks on the recent exhibition of Sanitary Appliances in Brighton, we alluded briefly to the trap and ventilating cowl invented by Mr. Banner. The subject, however, is so important that we think it desirable to enable those who are interested in the matter to understand more fully the patentee's views, and to judge for themselves as to their soundness.

The patentee maintains, the house will always be effectually trapped against sewer gas; and he is able to dispense with D traps, which from their conformation are, in point of fact, miniature cesspools. One of Banner's traps at the basement of the house, which may be placed above the level of the basement, like a gas meter, is considered sufficient for all the closets in a house.

We must not omit to mention another valuable appliance devised by Mr. Banner. Every one knows that ventilating-shafts communicating with the soil-pipes are recommended by leading authorities upon the subject. Although the theory upon which they are constructed is good, they are not always of practical utility. There is a difficulty in getting sewer gas to ascend a long perpendicular pipe, *while in some conditions of the atmosphere there may be a down-draught instead of an upward current;* and it is to overcome this that the cowl is introduced. The benefit that would result to the community from their general adoption would probably be great, as each would contribute to the ventilation of the sewers as well as of the pipes of the houses where they were fixed.

A branch pipe, led from outside the house to a little above the



trap, is needed, to cause a current of air in, and thus act as a constant ventilator of all the pipes between the trap and the cowl fixed on the soil-pipe carried above the roof of the house. A separate pipe may, if thought desirable, be fixed into the chamber, and taken up above the roof of the house, to ventilate the sewer.

These various arrangements have been in operation for two years in the patentee's house, and, as we are informed, and are prepared to believe, with undeviating good effect.

*One lesson which Mr. Banner has learnt, and in his turn teaches the public, namely, that to make a ventilating pipe of constant avail air must be introduced at the bottom, is of itself a boon of value.*

---

## BANNER'S SYSTEM OF SANITATION.

(From the *Architect* of 20th November, 1875.)

### NOTES ON NOVELTIES.

We have recently had an opportunity of thoroughly investigating the action of the sanitary appliances that have been patented by Mr. E. G. Banner, of 11, Billiter Square, E.C. The system adopted by Mr. Banner completely shuts out the sewer gas from the house, and is used *outside the house* to withdraw the gas from the drains and the sewer itself, and disperse it in the upper atmosphere, far above the height at which it could possibly be injurious to human life. Mr. Banner's invention not only prevents all sewer gas from entering the house, but it also removes immediately the effluvia from the closets, and at the same time is made to thoroughly ventilate the whole of the pipes from the basement to the attics. We have no doubt that some sanitary reformers on reading the above statement will declare that such a result as we have described is impossible. Our answer to such objectors is—do as we have done, investigate and judge for yourselves. The illustration (see Plate 1) will give some idea of the manner in which the novel plan introduced by Mr. Banner is effectually carried out. It will be seen that the system commences at the very bottom of the house, where the outlet to the sewer is thoroughly trapped, and that all other



traps which are generally fixed to closets, bath, &c., can be dispensed with. The trap employed is entirely self-acting, and is always perfectly air-tight, the method of its construction proves that the flush must be complete under all circumstances, and it can be seen at a glance that it is absolutely impossible for it to become unsyphoned. The trap consists of a small air-tight chamber, A (*vide* description already given).

A branch pipe, E, is led from outside the house into the soil-pipe a little above the trap for the admission of fresh air, in order to admit, by the action of the patent cowl fixed on the soil-pipe, carried above the roof, of a constant current of fresh air, being kept up night and day, and during all weathers, throughout the whole of the pipes within the house.

Mr. Banner demonstrates and proves conclusively that without such branch or inlet pipe for fresh air, no current *up* the pipes *can* take place, and he thus shows, according to the plan almost universally adopted hitherto, that all the pipes within the house do and must remain always fully charged with dangerous gases, even though the soil-pipe be carried above the roof and be open, or what has hitherto been improperly called "ventilated" at the top. *We may add that this inlet pipe is a most important and distinctive part of Mr. Banner's system, and forms part of his patent rights.*

The efficiency of the trap thus formed cannot be destroyed by either pressure or suction, and entirely prevents any gas from the sewer getting up into the house.

This excellent invention keeps up a constant ventilation of the shaft, in fact it makes it impossible for foul air to remain in the shaft for a single second. The very instant the foul air is generated it is sucked up by the action of the cowl.

It is noteworthy that while a mere breath of air passing through the cowl creates a sufficient suction action, that the wind in this country blows on an average from 10 to 12 miles an hour throughout the whole year, and that when it is said to be "still" the air is then even moving at the rate of  $1\frac{1}{2}$  to 2 miles an hour.

*We conclude by reiterating that we believe Mr. Banner's system of sanitation will make any house to which it is applied absolutely safe from the intrusion of sewer gas, or noxious odours of any description from the drains or closets.*

---



## BANNER'S SYSTEM OF SANITATION.

(From the *Metropolitan*, February 26th, 1876.)

“Pure air,” says Mr. R. J. Halton, in one of his sanitary lectures, “is the most important of all health factors. When it is breathed freely, plentifully, and continually there are few diseases it will not enable the body to resist.” Every medical man and sanitarian will admit the truth of this. Pure air will sometimes effect that which medicine attempts in vain, and when it is considered that 99 out of every 100 diseases are due to some impurity or other of the blood or secretions, it is evident that where fresh air can be obtained, medicine takes up an inferior position. As, however, pure air removes disease, so does foul air generate it. From the breathing of air vitiated by respiration spring phthisis and other pulmonary complaints as well as typhus. But respiration is not the only form of air vitiation. The effluvia from cesspools and sewage are responsible for nausea, vomiting, diarrhœa, and enteric fever. Much has been said of late as to whether the water-closet and sewer system has increased the illness and mortality from these complaints, but for the present we may safely assume that the gases generated by the decomposition of fœcal matter, whether in D traps or others, cesspools, soil-pipes, house drains, or sewers, are undoubtedly injurious to health; and it is self-evident that the only thing to be done is to prevent their accumulation by dissipating them as soon as formed, and to exclude them *in toto* from our houses. Many have been the attempts to effect this. Hitherto no sanitary authority has been able to adopt any method by which the thorough ventilation of sewers could be accomplished, and as regards the ventilation of soil-pipes in houses, and the exclusion of sewer gas therefrom, that was considered, till recently, impossible.

The public are tolerably well acquainted with the fact that Mr. E. G. Banner, who resides at Brighton, has introduced some inventions of his, *the object of which is to effect what has been described above as not previously accomplished*. We had the opportunity a few days ago of inspecting the ventilating and other apparatus in Mr. Banner's house, and spent several hours with that gentleman in inquiring into the practical and scientific details connected with them.

As a trial of the ventilating contrivances, Mr. Banner's house



is perhaps as good a specimen as could be desired. The trap in the basement acts perfectly, and thoroughly prevents the possibility of any gas passing from the sewer into the soil-pipe. In order to ventilate this pipe, it was carried up above the roof of the house. The next point was to provide means for drawing the air *upwards*—an apparently easy matter. An ordinary cowl would, it may be imagined, effect this whenever the wind blew by a kind of suction power. Here, however, lies the mistake that many people have made, for it is impossible to withdraw air out from the top of a tube which is closed at the bottom. Where such a plan has been found to answer in any degree, the place of the air so withdrawn has been supplied by other and fouler air from the sewers, which has forced a passage through some imperfectly-sealing trap below. The cowl invented by Mr. Banner is of peculiar construction. It consists externally of a funnel-shaped tube placed horizontally on the end of the elongated soil-pipe, and is kept with the wider end always facing the wind by an ordinary arrow. The wind, entering the larger end of the funnel, passes through this annular space, and in so doing creates a partial vacuum. By this means a circulation is kept up. The wind, which on an average blows from eight to twelve miles an hour, no sooner passes through the annular space than air is withdrawn from the soil-pipe, and *fresh* air is admitted at the bottom. In fact, there is a regular circulation; air is constantly being withdrawn, and constantly supplied. On the day of our visit there was scarcely a movement perceptible in the air, yet a simple experiment showed the circulation was going on. It is a peculiar merit of the contrivance that the passage of the air must be upward, not downward. We examined closely the condition of the air in the soil-pipe, and found it perfectly inodorous.

The principle thus applied to the ventilation of a soil-pipe Mr. Banner proposes to apply to sewers. By establishing at suitable places the patent cowls, with a corresponding inlet to each, a circulation will be established, rendering the air within a sewer as nearly pure as that without. It may be said that it will not be wise to let out sewer gas to be breathed by the community at large, but it must be remembered that it is the *confinement* of air in sewers which renders it impure. But by constantly passing fresh air through the sewers no such generation of gas can take place, and consequently houses can never be impregnated with it.



## BANNER'S SYSTEM OF SANITATION.

BY MAJOR H. C. SEDDON, R.E.

(From the *Architect*, January 15th, 1876.)

For the past few years there have been great advances towards remedying the evils to which the convenience of having water-closets inside our dwellings has chiefly given rise. Many have been the patents taken out for closets trapped in diverse ways, as well as for sewer traps, till at one time freedom from sewer gas was generally supposed to be in direct proportion to the number and ingenuity of the traps intervening between the sewer and its different connections with the interior of the house. Then, however, the dreadful truth was announced that sewer gas, under pressure, could, nay did, force its way through all water traps, and that the suction caused by the passage of sewage matter through the pipes frequently unsealed the best traps by drawing the water out of them. Now, however, an entirely new method of dealing with our soil-pipes is being prominently brought before the notice of the public. This is known as the "Banner System," after the gentleman who originated it in his defence, and who worked out the details which form such important features in its practical application. Mr. Banner tells us that immunity from sewer gas is not to be obtained by a multitude of traps, but rather by having but one trap. At one fell swoop he does away with all the traps upon which we have hitherto relied for safety. By means of a very ingenious trap of his own invention, fixed at the foot of the soil-pipe, he cuts off effectually all communication between the soil-pipe and the drain below. This done, he induces a constant current of fresh air from the bottom to the top of the soil-pipe, by means of a patented wind-cowl, fixed at the top of the soil-pipe, above the roof of the house.

An accurate description of Mr. Banner's system, and of the peculiar construction of his trap and wind-cowl, appeared in the *Architect* of November 20 last, under the head of "Notes on Novelties," the details of which need not, therefore, be repeated here; and in a subsequent number I wrote a letter drawing attention to certain points which seemed to me to require very careful consideration before the plan could be safely advocated for general adoption. Seeing that there was much to be said in favour of the system, especially as regards the fresh-air inlet at the foot, and the extracting force at the top of the soil-



pipe, I was anxious to see, in the first place, whether I had correctly understood the description given in these columns, and next, whether any satisfactory answers could be given to the queries in which I endeavoured to point out where failure was likely to occur. I will pass over Mr. Banner's answer to my queries, which appeared in the *Architect* of December 11, except in so far as to state that I accepted his invitation to visit his house and judge for myself. I did so on the understanding that I was at liberty to write a full account of what I saw, and to give my opinions upon it, whatever those opinions might be. This is what I purpose now to do, first to give the result of my personal investigations into the working of the system, as exemplified in his house at Brighton, and afterwards to analyze its claims to supersede, in whole or in part, the most approved methods at present in use for removing sewage matter from dwelling-houses.

Mr. Banner's house has a good external appearance, but, being on a terrace, is only open to the air at the back and front. The reception-rooms are large, lofty, and well lighted, and the bed-rooms are of good size and height; in all there are seventeen rooms, besides the kitchen offices in the basement. The above is all that can be said in favour of the house, for, in my opinion, one worse constructed, so far as all accepted theories of sanitary arrangements are concerned, it would be difficult to find. The water-closets are placed in the very worst positions that could be selected. After passing through the entrance hall, you come upon the inner hall, with a well staircase lighted by a skylight near the roof. Off this hall is a water-closet, with another immediately above it on the second floor, both being in the centre of the house and next to the party wall of the adjoining house, where no fresh air or other than borrowed light can reach them. Mr. Banner, however, set to work seriously, mastered the details connected with his own troubles, first carried up the open soil-pipe above the roof of the house, and after many trials eventually *succeeded, and I say so on conviction, in constructing a trap which most effectually cuts off all chance of sewer gas finding its way into any part of the soil-pipes within the house.* This was a great point gained, and seems naturally to have led up to the next step, namely, the outlet to the open air just above the patent trap at the foot of the soil-pipe. This became a necessity, owing to the air driven down the soil-pipe by water descending from the closets above not being able to force the



patent trap as it would an ordinary syphon trap; the result being, that it had to escape through the closet pans, and other trapped passages, into the house. This apparent objection to the rigid barrier placed at the foot of the soil-pipe, no doubt suggested the idea of providing a free outlet below for the air forced down by the sewage matter in its descent. The soil-pipe running down the centre of the house being now open to the air both at top and bottom, and effectually cut off from the sewer, *the crowning point of Mr. Banner's system was attained by placing a patent wind-cowl on the top.* The cowl is so constructed that the wind passing through it produces a constant draught up the soil-pipe, drawing fresh air from the garden level below, and through any untrapped inlets in the house, and so setting up a continuous counter-current in opposition to any tendency of the fires, &c., in the house to draw supplies of air through the house connections with the soil-pipe. The extracting power of the wind-cowl being once established, it became evident that the traps to the closets, sink, bath, and lavatory basin were no longer of any use, and, therefore, being mere obstructions and receptacles for sewage matter, were removed, leaving nothing but the patent trap at the foot of the soil-pipe to guard the way from the interior of the house and the sewer, except, of course, the water in the pans of the closets when not in the act of discharging.

Mr. Banner's patent trap, the working of which has already been described in these columns, occupies about the same space as an ordinary gas-metre, and is concealed from sight by a wood case in a recess in a cupboard, being fixed about 3 feet above the basement floor. About 6 feet above the trap are the closet and lavatory basin on the ground floor, about 30 feet higher are the upper closet and housemaid's sink, the bath being some 8 feet higher still, and the wastes from the bath and sink passing into the soil-pipe just below the closet on the second-floor, whilst that from the lavatory basin, on the ground-floor, discharges into the soil-pipe just below the lower closet. The top of the soil-pipe, upon which the extracting cowl is fixed, rises about 8 feet above the roof, and, being at the centre of the house, is not visible from the road. The communication with the outer air at the foot of the soil-pipe is formed by carrying a 2-inch pipe just above the trap, under the dining-room floor, to the garden in rear of the house. From the foot of the soil-pipe, which it is seen receives none of the refuse water from the kitchen, the



drain runs, as already stated, under the kitchen floor and through the area, with a very considerable fall, till it joins the main sewer in the middle of the road, the total distance being about 45 feet; only receiving on its way what passes through the surface traps in the open area, and the contents of the servants' closet under the street pavement, and discharging freely into the sewer without any intervening trap or flap-valve.

I will now describe what I saw of the practical working of the system in Mr. Banner's house, and of the tests to which it was put in my presence. Beginning at the highest point, namely, the patent cowl—which Mr. Banner informed me had been fixed for over a year, without once getting out of order—I first satisfied myself that it was performing its duty properly, veering with the wind, and drawing up air through the soil-pipe; this was evident from the strong current of air passing in through the mouth of the air-pipe, running from the garden to the foot of the soil-pipe, as well as from a perceptible indraught through the untrapped pipes from the lavatory basin and the closets. It was plain, moreover, that no air could be passing from the soil-pipe into the house. Passing down to the bottom of the soil-pipe, we next watched, through the glass plate which forms the front of the patent trap, the action of the cup valve within, while copious discharges were sent down the closets above. By means of a strip of glass inserted in the front of the soil-pipe, just above the top of the trap, the water could be seen rising in the foot of the soil-pipe, until it reached a height of about 12 inches, when the weight of the column of water being sufficient to overcome the resistance of the weight at the end of the lever arm, forced the valve down, discharging the contents of the pipe above into the drain below *without unsealing the cup*, which, directly the discharge ceased, leaving only the water retained in it when at its lowest point, closed up again with a slight deadened sound, against the indiarubber ring on the end of the soil-pipe. The air-tight joint upon which the weighted lever was fulcrumed was simply and carefully constructed, and can safely be relied on to prevent the passage of sewer gas. *The patent trap itself formed a perfect barrier against the passage of sewer gas from the drain into the soil-pipe above, and could not by any possibility be deprived by suction of the water which alone, when it is open, guards the way.*

*In order to test the efficiency of the trap under extraordinary circumstances, we passed down from the closet above some corks, hair,*



*and a piece of an old curtain about the size of an ordinary duster. The piece of white curtain was seen to pass straight through the trap, which, however, did not close after it, though, of course, the water seal was maintained. Hot water was then discharged from the upper closet, whilst I stood by the outlet pipe in the garden, from which the air in the soil-pipe rushed with considerable force, but without any disagreeable odour, that I could possibly detect, though I fancied I perceived a very faint smell with the first rush which certainly would have been expected after treating with warm water the inside of a soil-pipe which had been more than twenty years in position, and which must necessarily be fouled by every discharge from a closet. In order that we might examine into the state of the cup valve and the india-rubber ring against which it closes, the glass front to the trap was then removed. The cup itself was in perfect order, and free from any solid matter beyond a slimy coating of lime, which the water deposits on all surfaces with which it comes in contact; whilst the indiarubber ring appeared to be as sound as when first put on, more than two years ago, owing, no doubt, to its constant immersion in water free from destructive agents, such as grease.*

When the front of the trap had been replaced, I poured some strong scent into the mouth of the air-pipe, leading from the garden to the soil-pipe, in order to ascertain whether the air passing into the soil-pipe might not, at intervals of unequal action, find its way into the house, as well as out through the wind-cowl. I was unable, however, to detect the odour of the scent in any part of the house, and must therefore conclude that the suction of the wind-cowl was at all times sufficient to overpower that of the house.

*The result of stopping up the mouth of the air-pipe leading from the garden was shown by discharging water from the pan of the upper closet, the effect on the lower closet being that the air in the soil-pipe—finding it impossible to force the patent trap below—in its efforts to escape, first raised the level of the water in the pan, and finally burst through, sending the water flying in all directions.*

The same operation was then repeated, only with the lever of the patent trap raised, so as to put it in the condition of an ordinary water-sealed syphon; the result was that the air forced the trap without repeating the commotion in the pan of the lower closet. Finally, leaving unstopped the mouth of the air-pipe, and removing the plug of the lavatory basin on the ground



floor, water was again discharged through the upper closet, in order to see whether, under such circumstances, air could be forced into the house through the waste-pipe from the basin. Such, however, was not the case, but there was rather a suction through the waste into the soil-pipe.

This closes the account of my investigations into the practical working of Mr. Banner's system of sanitation, as far as I found it had been carried out in his own house. I have no hesitation in saying that *it worked admirably*, and that he has succeeded in rendering his house *absolutely secure against that most insidious of enemies, "sewer gas."*

---

### SEWER GAS.

(From *Public Health*, 8th April, 1875.)

Like many other of our engineering systems, that of the removal of excretal and refuse matter originated through accidental circumstances. The oldest sewer in the world, the *Cloaca maxima*, at Rome, was constructed for the drainage of part of that city. At a subsequent date, the inhabitants began, doubtless upon the principle of "out of sight, out of mind," to avail themselves of the ready means which this channel afforded them of getting rid of refuse matter, so that, by degrees, the monster drain became what its name implies—the main sewer, the *Cloaca maxima*, of Rome. From this second use to which it was put, the sewerage system now in use in most large towns may be said to have taken its rise.

Theoretically, the plan of removing refuse matter by water carriage has much to recommend it. The excretal matters are conveyed from the houses into the sewers, expeditiously and easily. So far, all seems well. But at this point, namely, the connection of the house-pipes with the sewer, we arrive at the first of the difficulties which surround the system, and which may render it injurious to health in the highest degree.

There are only two available modes of diminishing this evil—(1) by frequent flushing with water, so as to wash out the sewer, and (2) by ventilating the sewer, in order to prevent the accumulation of pent-up sewer gas. The former of these, even when large volumes of water are available for the purpose of



flushing, is too temporary and insufficient to be regarded as a positive means of removing the danger; and, at the best, can only be looked upon as an auxiliary measure. *Ventilation is the only certain remedy*, but, as it is *commonly* practised, it is *merely a delusion and a sham*. The ordinary street-grating ventilators are so constructed and so placed that, within forty-eight hours after they have been cleansed, they are again choked, and rendered impervious to the air from the sewers; and as, in the vast majority of instances, they are seen to only once now and then—it may be in several weeks, or several months—they are simply useless, or worse than that, owing to their engendering in the mind of the average British householder a feeling of safety, which has no foundation except in imagination.

*Virtually, then, ventilation of the sewers is, in a great measure, carried on through the connections which exist between them and our houses.* Sewer gas, like other volatile bodies, declines to be imprisoned in the place where it originated, and is constantly seeking for a weak point at which its exit may be effected. Such opportunities are unfortunately very abundant at the junction of the house-pipes with the sewers, and the inevitable consequence of defective joints or weak traps is the passage into the house of sewer emanations, which must, sooner or later, act prejudicially upon the health of the inmates. First, the children suffer; next the adults, especially those whose occupations keep them much within doors. Not only the air that they breathe is poisoned in this manner, but often also the water that they drink.

*As we have already stated, the best general means of diminishing this danger is by free ventilation of the sewers. "Ventilate, ventilate, ventilate!"*

There are very few towns where the sewers can be said to be *properly* ventilated, and we must protect each house separately if we are to combat the difficulty effectually. Sewer gas often plays an important part in the causation of various affections; and notably of typhoid fever, which although it is, in point of fact, a preventible disease, is credited with 20,000 deaths annually in the Registrar-General's returns, whilst, probably, 100,000 more persons (the mortality being 1 in 6) are laid upon a bed of sickness for many weeks, and their constitution undermined and enfeebled, by the same preventible disease which, were it not for the pollution of air or water by sewer gas or sewage matter, would scarcely ever occur.



Up to a recent period, we held the opinion that all drain-traps were apt to be inefficient or to get out of order, but opportunities that we have had of examining, at different times and under different general conditions, a system invented by Mr. E. G. Banner, have led to a modification of this opinion; and *we have further arrived at the conclusion that the inventor has solved the difficult problem of how to keep sewer gas out of our houses.* Mr. Banner's drain-trap was brought under the notice of our readers in *Public Health* of December 16th, 1874. The writer sums up the merits of this apparatus as follows: "It is self-acting, always air-tight, flushes clean, and cannot be unsyphoned."

In this manner the house will always be effectually trapped against sewer gas; and we are able to dispense with D traps, which, from their conformation, are, in point of fact, miniature cesspools, and with other unreliable contrivances. One of Banner's traps at the basement of the house, which may be placed above the level of the basement, like a gas meter, is sufficient for all the closets in a house.

In connection with the question of sewer gas we must not omit to mention another valuable appliance devised by Mr. Banner. Every one knows that ventilating *shafts* communicating with the soil-pipes are recommended by leading authorities upon the subject. Although the theory upon which they are constructed is good, they are not always of practicable utility. *There is a difficulty in getting sewer gas to ascend a long perpendicular pipe, while in some conditions of the atmosphere there may be a down draught instead of an upward current.*

Mr. Banner obviates these drawbacks, and at the same time insures a constant *upward* current, by placing at the top of the ventilating shaft a cowl, so delicately balanced, that the least breath of air creates a suction power which draws the air out of the ventilating shaft into the atmosphere. These cowls can be used anywhere, *and are a necessary adjunct to shafts, ventilating soil-pipes, &c.* The benefit that would result to the community from their general adoption cannot be over-estimated, as each would contribute to the ventilation of the sewers as well as of the pipes of the houses where they were fixed.

On one occasion of our seeing the apparatus at the inventor's house, where they have been in operation for more than twelve months, there were present a number of gentlemen interested in



sanitary matters, including several Medical Officers of Health for large and important districts. The apparatus received the highest commendation of all present, whose favourable judgment fully confirmed the opinion at which we had previously arrived.

---

### BANNER'S SANITARY APPLIANCES.

(From the *Building News*.)

SIR,—It seems to me rather useless to discuss this matter with Mr. Buchan, as he acknowledges he has not seen nor endeavoured to prove Mr. Banner's appliances, and I have done both the one and the other; and I should not have replied to his letter in your last on that ground, but that others might imagine that the objections he has brought forward theoretically alone have some weight in disparaging a system which I consider has conferred a practical boon upon the public.

Mr. Banner has shown how pipes can be instantly emptied, and kept empty of all gases, and has thereby done good. If, instead of the term "sewer gas," I had said "sewage gas," it might have been better, and I should have been in order when remarking upon those foul gases which are generated in branch drains as well as in sewers. But when Mr. Buchan comes to speak of what he calls the heart of the system, and goes on to say that it is not new, but has been tried before and failed, I say he knows nothing of what he has taken no trouble to examine, and jumps at erroneous conclusions. *It is no wonder that the attempts which he described came to grief for want of the very extracting power of the cowl which he ignores. This power is not only a matter of theory, but has proved perfectly successful in practice.*

Mr. Buchan himself acknowledges the correctness of the keynote of Mr. Banner's system—namely, the ventilation of the bottom as well as the top of the soil-pipe, but prefers to do without the patent cowl and trap. *If the cowl be omitted, then traps become necessary to all the pipes, as he says. But Mr.*



Banner has shown us *that the latter are needless if the former be provided.* Feeling sure that Mr. Buchan only wishes, with myself, to find out and support what is really useful, I would advise him to go and see Mr. Banner's appliances before he writes any more in opposition to them, in order to air his own theories, and I certainly shall not answer him again till he does. I have already said that I think that much of what Mr. Banner has effected might be done more simply,\* but this is, however, mere theory, for I have not done it, and, until some one does, householders cannot do ill in making use of a system which is neither costly nor elaborate, and *which does thoroughly effect what it proposes—namely, to render houses wholesome which are now mere deadly fever-traps, whether they be mansions in Belgravia or cottages in the suburbs.*

I am, &c.,

JOHN P. SEDDON.

1, Queen Anne's Gate, Westminster,  
January 26, 1876.

---

(From the *Architect*, 8th April, 1876.)

“SIR,—I desire to add my testimony to the perfection of a system which has been rightly and pithily described as being ‘*at once so simple, yet so effective.*’ I have heard scores of other sound practical men make similar remarks. Indeed, I might again quote the language of the author of ‘*Paradise Lost,*’ and say:—

‘The invention all admir’d; and each how he  
To be th’ inventor miss’d, so easy it seem’d  
Once found, which, yet unfound, most would have thought  
Impossible.’

“One of the best proofs of the value of a discovery is the amount of envy or imitation which it excites. It is really

\* Not as long as the house-drain and sewers are allowed to remain in their present dangerous condition through want of proper ventilation.—E. G. B.



amusing to observe how one set of men will occupy themselves with detracting from the merits of any good thing which they did not themselves find out, while another set will deliberately assert that they knew all about it long before. Such is the present aspect of the case as regards Banner's system. There are numerous individuals who, not understanding its excellent points, depreciate them, and *there are other persons who, understanding them, coolly try to appropriate them.*

“ I will close my letter by stating, in evidence of my being in a position to express an opinion upon Banner's system, that, from the date (December 15, 1874) when the first published account of it—appeared in *Public Health*, I have had the system under my notice, and that I have arrived at the conclusion that it accomplishes everything that is aimed at, and all that can be desired, by the absolutely certain manner in which it excludes sewer gas from houses.

“ Your obedient servant,

“ S.

“ London, *April 4, 1876.*”

---

## SANITARY IMPROVEMENTS AT THE HOSPITAL.

(From *Guy's Hospital Gazette*, January, 1877.)

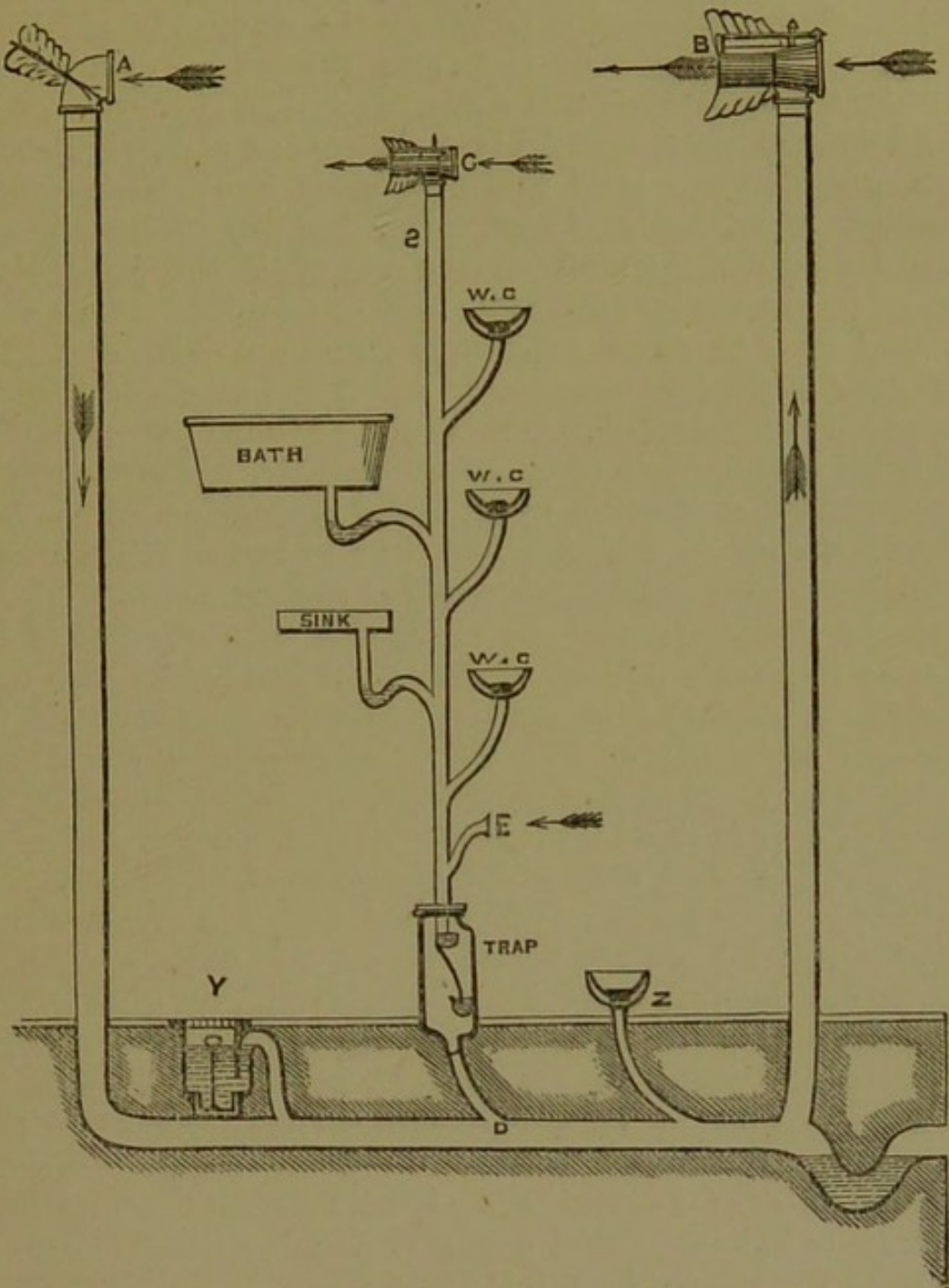
We redeem a promise to our readers to give a more lengthened notice of the alterations made on the east side of the hospital, with the view of improving the sanitary condition of the surgical wards, and which were referred to in a previous number. We may as well premise, that, prior to the adoption of the “Banner system,” much had been done to render the sewers in this division of the hospital more efficient, by the sub-



stitution of glazed earthenware pipes for the numerous brick-barrel drains which had been made to do duty for an indefinite period. These latter were found in many parts of their course to have suffered from decay and consequent leakage, mainly attributable to the energetic incursions of successive colonies of rats, which appear to have retained an undisputed possession of the stygian domains for upwards of a century, and, probably, as long as the hospital has existed. After securing a free current for the soil underground, to its point of junction with the Metropolitan sewers, it became a question of not less moment, how the escape of sewer gas into the wards and other residences was to be prevented; or, in other words, how the soil-pipes and minor conduits leading to the drains, as well as the drains themselves, were to be ventilated. Now, in nearly all private houses, and certainly in all public institutions, the reflux of sewer gas into the habitable apartments is restrained, or sought to be restrained, by means of valves or traps placed immediately under and continuous with the soil-pipe of the w.c., and the ingenuity of plumbers and of sanitary engineers has been taxed to the utmost to discover the best apparatus for this purpose. An infinite variety of syphons are consequently in use, each professing to impose a sealed barricade on the noxious intruder, but experience, of late years especially, has shown that, under certain conditions of the weather, both above and below ground, the supposed safeguards are not only valueless, but very often mischievous. It has also been repeatedly shown that the D trap, in such universal use, becomes in time so encrusted with deposits from the soil *as to prove a source of danger of itself*, independent of its faulty action. In what is unquestionably the best w.c. yet introduced—viz., Jennings' Patent Valve—in which the basin and trap are made in one piece of imperishable earthenware, and provision is made for continuous flushing, the inventor has thought it necessary to supplement the syphon action by a process for discharging a small quantity of disinfecting fluid into the pan every time it is used, mainly with the view of neutralising the pernicious effect of reflux sewer gas from the valve, but it is clear that in all these attempts at removing a nuisance we are beginning at the wrong end. What we wish to effect is, first, a free passage to the soil downwards; and, secondly, an equally free exit to the sewage gases upwards, and at the same time to render them perfectly innocuous by free admixture with the external atmo-



PLATE 7.



- A—Inlet to admission air shaft to drain.
- B—Outlet to extraction shaft from drain.
- D—Drain.
- C—Outlet for air from soil-pipe.
- E—Inlet for fresh air to soil-pipe.
- S—Soil-pipe.
- Y—Deane's trap.
- Z—Pearson's trapless closet.



sphere. How this has been done at the hospital through Mr. Banner's intervention may be partially seen from the accompanying sketch intended to illustrate the manner in which the soil-pipes are ventilated, and also the means adopted for securing a free circulation of air in the drains.

The main object sought for is a continuous atmospheric current, which, when once obtained, must carry the mephitic nuisance, in a highly diluted form, free out of harm's way above the level of the roof. In the case of the soil-pipe, this is effected by the inlet pipe E at its base and by the foul air withdrawing cowl C which surmounts its upper extremity. The inlet pipe is placed immediately above the single trap which guards the communication betwixt the soil-pipe and the drain, and is fed continuously from the external air, while the cowl is so constructed as to exert at all times a considerable suction-force on the air in the pipe, and thus to maintain a current, variable with the wind's velocity, *but still permanent*. Nearly every one is familiar with the ventilating tube attached to the soil-pipe in private houses, so strongly recommended, and even insisted on by numerous sanitary authorities, to facilitate the escape of sewer gases. This air or safety-pipe is doing good service as far as its limited powers permit, but it cannot be too strongly borne in mind that the contrivance can only act intermittently, and then only under certain fixed conditions. For the most part the air in soil-pipes and drains is stagnant, and *in this state* it is known to vitiate the water in traps, and unless counter openings are made, for the double purpose of admitting and withdrawing air, we have no security against the foul effects of deleterious gases, simply because we are deprived of the means of keeping up an atmospheric current. Again, to prevent any communication betwixt the drain and the soil-pipe, and thus nullify the action of the fresh air from the inlet tube, Mr. Banner has introduced a trap of peculiar construction, an illustration of which is given at Plate 5.

This trap is very simple and effective; it is cast in iron, and in the drawing the outer plate has been reversed so as to show its internal mechanism. One of these traps will suffice for any number of closets placed separately on floors above. There are two underneath the scullery projection of Accident ward, each doing service for four of the w.c.'s of the wards above, and since their introduction they have never been at any time unsyphoned. The trap has a double dip, and, while its depth is



only five inches, there is a vertical fall of two feet between the two dips, which would leave a space sufficient to contain a couple of gallons of water, exerting a downward force of over 20 lbs. on the lower dip, while the fall of water from the ward closets has been found amply sufficient to keep the upper dip free from any obstruction.

We have already referred to the wind cowl as the main *motive* agent for *maintaining* the continuous upward current. *That it does so effectually, by utilising the aspiratory force of the air, is beyond question; but it does more than this.* Its suction-force, though mainly employed in extracting the vertical column of air in the soil-pipe, is also imparted to the minor conduits connecting it with the numerous soil-pans, as has been repeatedly shown by the familiar experiment of holding a lighted taper over the pans to test the direction of the current. *From this circumstance Mr. Banner has felt justified in dispensing with the numerous traps, whether metallic or earthenware, attached to each closet, and has thereby got rid of a constant source of annoyance and expense, besides securing us an immunity from an ever-fruitful source of danger.*

The diagram also shows the manner in which the drain outside and running parallel with the hospital is ventilated. This drain is about 250 feet in length, and receives the soil and waste water from the wards and officers' houses on this side of the building. It is continuous throughout, that is to say, there are no syphon obstacles betwixt the various residences to interfere with the two soil currents which coalesce on account of the gradients near the centre, where they pass through a large earthenware syphon into the main sewer of the hospital. A free passage through the whole extent of the drain being thus obtained, its ventilation has been secured in the following manner:—At one extremity of the drain a down-cast shaft, A, has been introduced, surmounted with a wind cowl, with a cup-shaped orifice always exposed to the full force of the natural atmospheric current, and air being freely admitted from this source to the drain, the circuit is completed by an up-cast shaft at the other end, B, which is capped with a large foul air withdrawing cowl. Each shaft rises 10 feet above the roof of the hospital and is over 50 feet in height, so that we have here a channel of 350 feet in length, through which the air is made to traverse always in the same direction, a space dealt with, considering the number of houses and their numerous occupants,



equal in extent to the side of a square or division of a street, and from the drain to the large hospital sewer *there is but one outlet, which in its turn is guarded both at its entrance and at its point of junction* with the Metropolitan sewer by a similar apparatus. It may be noticed that the system of sewer ventilation here referred to is not dissimilar to that employed in coal mines or on board ships, and is the same in principle as that advocated by Desagulier, Reid, Pelet, and their numerous imitators, differing only (and the difference may be considered by many fatal to the theory) in the absence of an intermediate motive force to regulate the currents. *So far as our experience enables us to judge, the system appears to fulfil all the conditions specified in the contract. There is no foul air generated in the w.c.'s. The several currents in the soil-pipe, in the drain, and in the large sewer have uniformly been found to be flowing in the right direction whenever they have been tested (and this has been done repeatedly), while no inconvenience has arisen from the removal of the numerous traps and other apparatus which were thought to be the only safeguards of our closet system.*

It is very likely that exception may be taken to some of the principles on which this novel system of sanitation is based, and it is but right that it should be so. It may be open to question whether in a large city of varying levels, and among a dense population, it is preferable to have every house and drain evolving its noxious effluvia\* into the outer abyss, to having it pent up underground and insidiously finding its way into habitable apartments, and from the notoriously eccentric character of atmospheric currents are we by any means assured that they will at all times follow the orthodox course; but these are matters that may be safely set aside for the present. It is sufficient for us to know that in this simple invention we have the means at our command of grappling with a great practical evil of ever-increasing dimensions, which has hitherto baffled the skill and ingenuity of architects and sanitarians, and the merit of the remedy is not the less commendable because it comes to us through the originality of a gentleman who, whatever his other accomplishments are, admits himself to be a mere novice in the art of sanitation.

\* N.B.—As stated a few lines above, there is no foul air generated in the w.c.'s, neither is there in the soil-pipe or the drain.—E. G. B.



## SANITATION AT GUY'S HOSPITAL.

(From the *Metropolitan*, December 16, 1876.)

In the early part of this year we took the opportunity of describing a method of ventilating soil-pipes introduced by Mr. E. G. Banner, of Billiter Square. It will be remembered that we paid a special visit to that gentleman's private residence at Brighton, where, having previously some vague notions of the theoretical part of the business, we had the advantage of learning some practical details by seeing the system in operation. We were thoroughly convinced of the efficacy of the plan, and described the action of the mechanical appliances used and the principles upon which they acted. There was no doubt about the matter. Mr. Banner's house was at one time almost uninhabitable by reason of the sewer gas which pervaded it, but ever since his system—born of the necessity for it which existed in the house—has been applied, the most perfect freedom from noxious effluvia has existed. Many scientific persons have inspected the house, and have done their best to find a flaw in the system, but those who arrived as sceptics went away convinced, some very much against their will. This was a great triumph so far, and we believe many other houses have been treated in a similar way with unvarying success. It is not to be wondered, therefore, if Mr. Banner desired to make more extensive experiments, so as to see if that *bête noir*, gas in sewers, could not be got rid of. Opportunity has not yet served for dealing with an entire system of sewerage, but a result has been recently achieved at Guy's Hospital which shows that, properly applied, Mr. Banner's system of sanitation is a great fact.

A short time ago we inspected the improvements effected by that gentleman in a large block of buildings forming part of the above hospital. We regret exceedingly that we did not view the premises before the alterations were made, so as to have compared the former with the present state of the building. At present there is not the slightest amount of effluvia in any of the wards, passages, or closets, but we have been assured that formerly sewer gas was the prevailing odour. The system of soil-pipes and drainage was upon the most unsanitary principle



imaginable. The drains were, and still are, in the worst possible position, and the soil-pipes were not even carried up to the upper part of the building, but were carefully sealed at the top, so as to encourage a rush of sewer gas into the closets and wards every time the closet-handle was drawn up. The interior of the pipes may be imagined, when it is said that some of them were 150 years old, well encrusted with hardened soil, fouling the already foul air within.

It would be difficult to convey, without the aid of diagrams, a complete idea of the alterations which have been made at the hospital. Our object is to explain the principles upon which the ventilation has been effected, rather than to describe minutely the mechanical details. We may say, however, that all the D traps in this part of the hospital have been removed, and each soil-pipe is virtually cut off from the drains by a Banner's patent double dip trap. The drains have but one delivery into the sewer, and the whole drain, several hundred feet in length, is ventilated by means of an inlet through an old grating and a vertical shaft at the opposite end with a patent cowl at the top. Another section of drains is ventilated by means of two shafts carried up to the top of the building, one having an inlet cowl, the other with a patent outlet cowl. Each soil-pipe is provided with an inlet pipe at the lower end, and a patent cowl at the upper.

The conclusions to be drawn from an examination of the improvements at Guy's Hospital are important. The principal is the fact that the system is practically shown to be applicable to a series of buildings as well as to single houses. The various departments of the block we have been referring to are, although not disconnected, virtually distinct buildings, so far as closets and soil-pipes are concerned. The frontage of the block, or rather the area drained, is equal to that of about forty ordinary houses, and it is no slight thing to thoroughly ventilate all the sewers and pipes connected with it by one process of treatment. Another point to note is the further confirmation of the soundness of the principles upon which Mr. Banner's system is based. It shows indisputably that a tube, whether it be straight or crooked, can be constantly ventilated by means of a continual current of pure air passing through it, providing there is an inlet at the lower end, and some kind of drawing or exhausting power at the upper. There must be these two conditions. An inlet without the drawing power, such as a properly constructed



cowl, amounts to nothing; and a cowl alone, without any inlet below, is perfectly inoperative. *It is amusing to notice how loth some sanitarians are to admit this self-evident fact.* They seem to believe that a tube may be ventilated by having both ends open, without any drawing power whatever. This might be, if elevated high above the ground, and fixed horizontally; but sewers, drain and soil-pipes, are not placed in such a position. Then, again, they argue that a sewer can be ventilated by inserting a long open vertical pipe at each end, and that by some natural law, which they do not explain, air will spontaneously rush down one tube, pass along the sewer, and ascend the other in the most obliging manner, without having any particular inducement to do so. Let such theorists simply take a tube bent into this shape—**U**, and apply smoke at one end, and see if the “natural law” they speak of will make it go down and up again. Place, however, an exhausting cowl on one orifice, and it will descend at once. This is the principle upon which the sewers are ventilated at Guy’s, and no “natural law” would cause air, as it now does, to go down a grating some 12 feet, traverse a drain 300 feet in length, where sewage is flowing in an opposite direction, and then ascend a pipe 50 feet or 60 feet in height. There must be an exhausting power, or no circulation can possibly take place. That there is a constant current in the ventilating arrangement at Guy’s Hospital we can testify. *The atmosphere at the time of our visit was dull, aqueous, and almost motionless, yet, by testing, we found there was a decided inward current at the inlets, and we ascended to the topmost parapet of the building, and, climbing to the orifice of the cowls, found there was an outward current containing only the faintest suspicion of odour.* The system introduced by Mr. Banner has now undergone a crucial test, and can only be looked upon as a great fait accompli.

---



## ESCAPE OF SEWAGE GAS INTO HOUSES.

(From the *Journal of the Society of Arts*, June 29, 1877.)

The public are daily becoming more alive to the paramount importance of this subject, and, thanks to the efforts which the Society of Arts has lately been making, it may safely be said that increased progress is observable towards the end in view, by attention having been drawn to the grievous insecurity arising from the impure state of the drains and soil-pipes of houses, with a view of discovering the best modes of overcoming the difficulties of removing the dangers we are all thus exposed to.

The object of the Society of Arts, clearly, is not only to gather the latest and best information on the subject, but to disseminate it everywhere, by means of the powerful influence and through the excellent channels it is known to possess.

From the number alone of suggestions offered, a great deal of bewilderment must actually exist, and the difficulty is sometimes increased by a habit in some, who should fairly be looked to as guides, of straining the mind or the vision in search of very remote and merely possible difficulties—a habit which sometimes unwisely hinders activity, and by creating needless doubts, retards, and even prevents proper progress. The public, however, will as usual apply the winnowing process to the various suggestions offered, and will no doubt, as is their habit, in the long run, sooner or later, act upon the best.

Taking it as settled beyond dispute that it is imperatively necessary to exclude sewage gas and its fever-germ concomitants from dwelling-houses, with the Council's permission I will, as briefly as possible, show how such a most devoutly to be wished for consummation may be attained.

With all respect to Mr. Rogers Field, I must state that the plans he proposed, as illustrated by the diagrams exhibited at the Conference, not only do not satisfactorily accomplish that object, but, on the other hand, in some respects, have the reverse effect. Without repeating the criticisms of Drs. Vacher, Syson, and Ainley, and of Mr. Baldwin Latham, I will here only endorse those criticisms, and having described the system I



suggest, leave with all confidence the verdict to the intelligence of your readers.

The system I advocate as the most or only perfect system is that known to the world as the "Banner system." It consists of a trap inlet to soil-pipe and an exhaust cowl. The trap is fixed near the foot of the soil-pipe, whether it be inside or outside the wall of the house, or between the house and the sewer. This trap can never become unsyphoned, a liability of constant occurrence in suggested syphon traps; and another good feature in it is that its condition can be inspected at any moment without any trouble or expense. The inlet is an opening for fresh air to the soil-pipe a little above the trap. This inlet will be referred to later on. The next feature is the exhaust cowl. This cowl, unlike all other cowls, really produces a draught, and this draught, though varying according to the wind, is constant. Air, in the "Banner system," is constantly being drawn in at the inlet, and made to flow up the drain or soil-pipe, until it is discharged at the cowl outlet; or, if preferred, and a little more expense not objected to, the current may be brought down the soil-pipe, over the inner trap and out up an independent pipe, having the cowl fixed upon it above the roof: but in either case no sewage gas can remain in, or by any possibility enter the house. Another advantage of the system is, that all abominable D and other traps are avoided; in short, slightly paraphrased, the physician's motto is *par excellence* the Banner motto, "*Cito, jucunde, et tutissime.*" Being very simple, the system is economical. Without a cowl, an inlet is often worse than of no service; with no inlet, a cowl is of no service; with an ordinary cowl, no draught is insured; with the Banner cowl, the draught is perpetual. Mr. Banner claims to have been the very first to have introduced this safe and comparatively perfect system of efficient trap, inlet, cowl, and perpetual through draught. This being debated ground shall not be discussed. I will only say that I believe this system to be the only one which fulfils its purpose effectually, and that at the Conference no plan approaching it was brought forward, save when it itself was alluded to by speakers, in pointing out defects and shortcomings in plans proposed.

Since the late Conference, a report has been received from the surveyor of Guy's Hospital, where the system has been applied on a large scale, and, coming from such a source, I give a copy of it for the information of the Council of the Society of Arts:—



Guy's Hospital, *May 8th*, 1877.

SIR,—I regretted I had not an opportunity, when at the late Conference at the Society of Arts, to have entered into the discussion in reference to your system of sanitation, as carried out to a portion of "Guy's Hospital." I intended to have stated that, having had it in operation now for upwards of six months, I was perfectly satisfied with its results, both as to the patent traps as well as to your patent wind-cowls, neither one or the other having been found, after careful watching, to become unsyphoned or out of order.

I believe the action of your wind-cowls, placed upon the top of the soil-pipes, when coupled with the air inlet pipe, *as in your complete system*, to be quite effectual in maintaining a continuous upward current, not only through them, but also through the drains where they have been so arranged. And even more, their power of suction has been found, by repeated experiments of a lighted taper placed in the closet pans, to show the downward direction even of the current entering the soil-pipes.

You are, therefore, quite justified in dispensing with all D and other traps beneath each closet (which really are nothing better than cesspools on a small scale, proving always a constant source of annoyance and expense, as well as great danger, when retained): thus you are able to withdraw from the drains, as well as from the soil-pipes of the closets, sluice-pans, &c., of the different wards of the hospital where your system has been applied, during all winds and all weather, the foul air or gas from within them, and replace it entirely with a continuous current of fresh air. *I consider this fact alone to show the great blessing it must have conferred upon the inmates of the hospital, and believe it to be worthy of universal adoption.*—  
Yours faithfully,

(Signed)

ARTHUR BILLING,  
Surveyor to the Hospital.

In conclusion, I will only add that the space and conditions dealt with at Guy's Hospital are equal to those of forty or fifty houses, and that the same system can readily be applied to the side of a street, or square, or to a crescent, or terrace of several



houses, whether the sewer be at the back or in front of them. One delivery for the whole of them into the sewer will suffice, while thorough ventilation and ample flushing power can be easily secured. The system is simple, consequently inexpensive. Excreta are never exposed for a moment, no sewage gas can be generated, and the only escape for impure air is above the roof of the houses.

R. BARNES AUSTIN, C.E.





OFFICES OF THE PATENTEE,

11, BILLITER SQUARE, LONDON.

---

*Any one giving information of any infringement of the Patentee's rights will, on proof thereof, be amply rewarded.*



LONDON, *March*, 1878.

# A Catalogue of Books

INCLUDING MANY

## NEW & STANDARD WORKS

IN

ENGINEERING, ARCHITECTURE,  
AGRICULTURE, MATHEMATICS, MECHANICS,  
SCIENCE, &c. &c.

PUBLISHED BY

CROSBY LOCKWOOD & CO.,

7, STATIONERS'-HALL COURT, LUDGATE HILL, E.C.

---

### ENGINEERING, SURVEYING, &c.

---

#### *Humber's New Work on Water-Supply.*

A COMPREHENSIVE TREATISE on the WATER-SUPPLY of CITIES and TOWNS. By WILLIAM HUMBER, Assoc. Inst. C.E., and M. Inst. M.E. Author of "Cast and Wrought Iron Bridge Construction," &c. &c. Imp. 4to. Illustrated with 50 Double Plates, 2 Single Plates, Coloured Frontispiece, and upwards of 250 Woodcuts, and containing 400 pages of Text, elegantly and substantially half-bound in morocco. 6*l.* 6*s.*

#### *List of Contents:—*

I. Historical Sketch of some of the means that have been adopted for the Supply of Water to Cities and Towns.—II. Water and the Foreign Matter usually associated with it.—III. Rainfall and Evaporation.—IV. Springs and the water-bearing formations of various districts.—V. Measurement and Estimation of the Flow of Water.—VI. On the Selection of the Source of Supply.—VII. Wells.—VIII. Reservoirs.—IX. The Purification of Water.—X. Pumps.—XI. Pumping Machinery.—XII. Conduits.—XIII. Distribution of Water.—XIV. Meters, Service Pipes, and House Fittings.—XV. The Law and Economy of Water Works.—XVI. Constant and Intermittent Supply.—XVII. Description of Plates.—Appendices, giving Tables of Rates of Supply, Velocities, &c. &c., together with Specifications of several Works illustrated, among which will be found:—Aberdeen, Bideford, Canterbury, Dundee, Halifax, Lambeth, Rotherham, Dublin, and others.

#### OPINIONS OF THE PRESS.

"The most systematic and valuable work upon water supply hitherto produced in English, or in any other language."—*Engineer* (first notice).

"Mr. Humber's work is characterised almost throughout by an exhaustiveness much more distinctive of French and German than of English technical treatises."—*Engineer* (third notice).

"We can congratulate Mr. Humber on having been able to give so large an amount of information on a subject so important as the water supply of cities and towns. The plates, fifty in number, are mostly drawings of executed works, and alone would have commanded the attention of every engineer whose practice may lie in this branch of the profession."—*Builder*.



*Humber's Modern Engineering. First Series.*

A RECORD of the PROGRESS of MODERN ENGINEERING, 1863. Comprising Civil, Mechanical, Marine, Hydraulic, Railway, Bridge, and other Engineering Works, &c. By WILLIAM HUMBER, Assoc. Inst. C.E., &c. Imp. 4to, with 36 Double Plates, drawn to a large scale, and Photographic Portrait of John Hawkshaw, C.E., F.R.S., &c. 3*l.* 3*s.* half morocco.

*List of the Plates.*

NAME AND DESCRIPTION.	PLATES.	NAME OF ENGINEER.
Victoria Station and Roof—L. B. & S. C. Rail.	1 to 8	Mr. R. Jacomb Hood, C.E.
Southport Pier .....	9 and 10	Mr. James Brunlees, C.E.
Victoria Station and Roof—L. C. & D. & G. W. Railways .....	11 to 15A	Mr. John Fowler, C.E.
Roof of Cremorne Music Hall.....	16	Mr. William Humber, C.E.
Bridge over G. N. Railway .....	17	Mr. Joseph Cubitt, C.E.
Roof of Station—Dutch Rhenish Railway ..	18 and 19	Mr. Euschedi, C.E.
Bridge over the Thames—West London Extension Railway .....	20 to 24	Mr. William Baker, C.E.
Armour Plates .....	25	Mr. James Chalmers, C.E.
Suspension Bridge, Thames.....	26 to 29	Mr. Peter W. Barlow, C.E.
The Allen Engine .....	30	Mr. G. T. Porter, M.E.
Suspension Bridge, Avon .....	31 to 33	Mr. John Hawkshaw, C.E. and W. H. Barlow, C.E.
Underground Railway .....	34 to 36	Mr. John Fowler, C.E.

With copious Descriptive Letterpress, Specifications, &c.

"Handsomely lithographed and printed. It will find favour with many who desire to preserve in a permanent form copies of the plans and specifications prepared for the guidance of the contractors for many important engineering works."—*Engineer.*

*Humber's Modern Engineering. Second Series.*

A RECORD of the PROGRESS of MODERN ENGINEERING, 1864; with Photographic Portrait of Robert Stephenson, C.E., M.P., F.R.S., &c. 3*l.* 3*s.* half morocco.

*List of the Plates.*

NAME AND DESCRIPTION.	PLATES.	NAME OF ENGINEER.
Birkenhead Docks, Low Water Basin .....	1 to 15	Mr. G. F. Lyster, C.E.
Charing Cross Station Roof—C. C. Railway.	16 to 18	Mr. Hawkshaw, C.E.
Digswell Viaduct—Great Northern Railway.	19	Mr. J. Cubitt, C.E.
Robbery Wood Viaduct—Great N. Railway.	20	Mr. J. Cubitt, C.E.
Iron Permanent Way.....	20A	—
Clydach Viaduct—Merthyr, Tredegar, and Abergavenny Railway .....	21	Mr. Gardner, C.E.
Ebbw Viaduct ditto ditto ditto .....	22	Mr. Gardner, C.E.
College Wood Viaduct—Cornwall Railway ..	23	Mr. Brunel.
Dublin Winter Palace Roof.....	24 to 26	Messrs. Ordish & Le Feuvre.
Bridge over the Thames—L. C. & D. Railw.	27 to 32	Mr. J. Cubitt, C.E.
Albert Harbour, Greenock .....	33 to 36	Messrs. Bell & Miller.

With copious Descriptive Letterpress, Specifications, &c.

"A *résumé* of all the more interesting and important works lately completed in Great Britain; and containing, as it does, carefully executed drawings, with full working details, it will be found a valuable accessory to the profession at large."—*Engineer.*

"Mr. Humber has done the profession good and true service, by the fine collection of examples he has here brought before the profession and the public."—*Practical Mechanics' Journal.*



*Humber's Modern Engineering. Third Series.*

A RECORD of the PROGRESS of MODERN ENGINEERING, 1865. Imp. 4to, with 40 Double Plates, drawn to a large scale, and Photo Portrait of J. R. M'Clean, Esq., late President of the Institution of Civil Engineers. 3*l.* 3*s.* half morocco.

*List of Plates and Diagrams.*

MAIN DRAINAGE, METROPOLIS,  
NORTH SIDE.

Plate 1. Map showing Interception of Sewers.—2 and 3. Middle Level Sewer. Sewer under Regent's Canal; and Junction with Fleet Ditch.—4, 5, and 6. Outfall Sewer. Bridge over River Lea. Elevation and Details.—7. Outfall Sewer. Bridge over Marsh Lane, North Woolwich Railway, and Bow and Barking Railway Junction.—8, 9, and 10. Outfall Sewer. Bridge over Bow and Barking Railway. Elevation and Details.—11 and 12. Outfall Sewer. Bridge over East London Waterworks' Feeder. Elevation and Details.—13 and 14. Outfall Sewer. Reservoir. Plan and Section.—15. Outfall Sewer. Tumbling Bay and Outlet.—16. Outfall Sewer. Penstocks.

SOUTH SIDE.

Plates 17 and 18. Outfall Sewer. Bermondsey Branch.—19, 20, 21, and 22.

MAIN DRAINAGE, METROPOLIS,  
*continued—*

Outfall Sewer. Reservoir and Outlet. Plan and Details.—23. Outfall Sewer. Filth Hoist.—24. Sections of Sewers (North and South Sides).

THAMES EMBANKMENT.

Plate 25. Section of River Wall.—26 and 27. Steam-boat Pier, Westminster. Elevation and Details.—28. Landing Stairs between Charing Cross and Waterloo Bridges.—29 and 30. York Gate. Front Elevation. Side Elevation and Details.—31, 32, and 33. Overflow and Outlet at Savoy Street Sewer. Details; and Penstock.—34, 35, and 36. Steam-boat Pier, Waterloo Bridge. Elevation and Details.—37. Junction of Sewers. Plans and Sections.—38. Gullies. Plans and Sections.—39. Rolling Stock.—40. Granite and Iron Forts.

With copious Descriptive Letterpress, &c.

*Humber's Modern Engineering. Fourth Series.*

A RECORD of the PROGRESS of MODERN ENGINEERING, 1866. Imp. 4to, with 36 Double Plates, drawn to a large scale, and Photographic Portrait of John Fowler, Esq., President of the Institution of Civil Engineers. 3*l.* 3*s.* half morocco.

*List of the Plates and Diagrams.*

NAME AND DESCRIPTION.	PLATES.	NAME OF ENGINEER.
Abbey Mills Pumping Station, Main Drainage, Metropolis.....	1 to 4	Mr. Bazalgette, C.E.
Barrow Docks .....	5 to 9	Messrs. M'Clean & Stillman, [C. E.]
Manquis Viaduct, Santiago and Valparaiso Railway .....	10, 11	Mr. W. Loyd, C.E.
Adams' Locomotive, St. Helen's Canal Railw. ....	12, 13	Mr. H. Cross, C.E.
Cannon Street Station Roof .....	14 to 16	Mr. J. Hawkshaw, C.E.
Road Bridge over the River Moka.....	17, 18	Mr. H. Wakefield, C.E.
Telegraphic Apparatus for Mesopotamia ....	19	Mr. Siemens, C.E.
Viaduct over the River Wye, Midland Railw. ....	20 to 22	Mr. W. H. Barlow, C.E.
St. Germans Viaduct, Cornwall Railway ....	23, 24	Mr. Brunel, C.E.
Wrought-Iron Cylinder for Diving Bell.....	25	Mr. J. Coode, C.E.
Millwall Docks.....	26 to 31	Messrs. J. Fowler, C.E., and William Wilson, C.E.
Milroy's Patent Excavator .....	32	Mr. Milroy, C.E.
Metropolitan District Railway.....	33 to 38	Mr. J. Fowler, and Mr. T. M. Johnson, C.E.
Harbours, Ports, and Breakwaters.....	A to C	

*With Copious Descriptive Letterpress, Specifications, &c.*



*Humber's Great Work on Bridge Construction.*

A COMPLETE and PRACTICAL TREATISE on CAST and WROUGHT-IRON BRIDGE CONSTRUCTION, including Iron Foundations. In Three Parts—Theoretical, Practical, and Descriptive. By WILLIAM HUMBER, Assoc. Inst. C.E., and M. Inst. M.E. Third Edition, revised and much improved, with 115 Double Plates (20 of which now first appear in this edition), and numerous additions to the Text. In 2 vols. imp. 4to, 6l. 16s. 6d. half-bound in morocco.

"A very valuable contribution to the standard literature of civil engineering. In addition to elevations, plans, and sections, large scale details are given, which very much enhance the instructive worth of these illustrations. No engineer would willingly be without so valuable a fund of information."—*Civil Engineer and Architect's Journal*.

"Mr. Humber's stately volumes lately issued—in which the most important bridges erected during the last five years, under the direction of our most eminent engineers, are drawn and specified in great detail."—*Engineer*.

"A book—and particularly a large and costly treatise like Mr. Humber's—which has reached its third edition may certainly be said to have established its own reputation."—*Engineering*.

*Strains, Formulæ & Diagrams for Calculation of.*

A HANDY BOOK for the CALCULATION of STRAINS in GIRDERS and SIMILAR STRUCTURES, and their STRENGTH; consisting of Formulæ and Corresponding Diagrams, with numerous Details for Practical Application, &c. By WILLIAM HUMBER, Assoc. Inst. C.E., &c. Second Edition. Fcap. 8vo, with nearly 100 Woodcuts and 3 Plates, 7s. 6d. cloth.

"The arrangement of the matter in this little volume is as convenient as it well could be. . . . The system of employing diagrams as a substitute for complex computations is one justly coming into great favour, and in that respect Mr. Humber's volume is fully up to the times."—*Engineering*.

"The formulæ are neatly expressed, and the diagrams good."—*Athenæum*.

"Mr. Humber has rendered a great service to the architect and engineer by producing a work especially treating on the methods of delineating the strains on iron beams, roofs, and bridges by means of diagrams."—*Builder*.

*Barlow on the Strength of Materials, enlarged.*

A TREATISE ON THE STRENGTH OF MATERIALS, with Rules for application in Architecture, the Construction of Suspension Bridges, Railways, &c.; and an Appendix on the Power of Locomotive Engines, and the effect of Inclined Planes and Gradients. By PETER BARLOW, F.R.S. A New Edition, revised by his Sons, P. W. BARLOW, F.R.S., and W. H. BARLOW, F.R.S., to which are added Experiments by HODGKINSON, FAIRBAIRN, and KIRKALDY; an Essay (with Illustrations) on the effect produced by passing Weights over Elastic Bars, by the Rev. ROBERT WILLIS, M.A., F.R.S. And Formulæ for Calculating Girders, &c. The whole arranged and edited by W. HUMBER, Assoc. Inst. C.E., Author of "A Complete and Practical Treatise on Cast and Wrought-Iron Bridge Construction," &c. 8vo, 400 pp., with 19 large Plates, and numerous woodcuts, 18s. cloth.

"The book is undoubtedly worthy of the highest commendation."—*Mining Journal*.

"The best book on the subject which has yet appeared. . . . We know of no work that so completely fulfils its mission."—*English Mechanic*.

"The standard treatise upon this particular subject."—*Engineer*.



### *Tramways and Tram-Traffic.*

TRAMWAYS: their CONSTRUCTION and WORKING. Containing a Comprehensive History of the System; an exhaustive Analysis of the Various Modes of Traction, including Horse Power, Steam, Heated Water, and Compressed Air; a Description of the varieties of Rolling Stock; and ample Details of Cost and Working Expenses, with Special reference to the Tramways of the United Kingdom. By D. KINNEAR CLARK, M. I. C. E., Author of 'Railway Machinery,' &c., in one vol. 8vo, with numerous illustrations and thirteen folding plates. [Nearly ready.]

### *Iron and Steel.*

'IRON AND STEEL': a Work for the Forge, Foundry, Factory, and Office. Containing Ready, Useful, and Trustworthy Information for Ironmasters and their Stocktakers; Managers of Bar, Rail, Plate, and Sheet Rolling Mills; Iron and Metal Founders; Iron Ship and Bridge Builders; Mechanical, Mining, and Consulting Engineers; Architects, Contractors, Builders, and Professional Draughtsmen. By CHARLES HOARE, Author of 'The Slide Rule,' &c. Eighth Edition. Revised throughout and considerably enlarged. With folding Scales of "Foreign Measures compared with the English Foot," and "fixed Scales of Squares, Cubes, and Roots, Areas, Decimal Equivalents, &c." Oblong, 32mo, leather elastic-band, 6s.

"We cordially recommend this book to those engaged in considering the details of all kinds of iron and steel works. . . . It has been compiled with care and accuracy. . . . Many useful rules and hints are given for lessening the amount of arithmetical labour which is always more or less necessary in arranging iron and steel work of all kinds, and a great quantity of useful tables for preparing estimates of weights, dimensions, strengths of structures, costs of work, &c., will be found in Mr. Hoare's book.—*Naval Science.*

### *Weale's Engineer's Pocket-Book.*

THE ENGINEER'S, ARCHITECT'S, and CONTRACTOR'S POCKET-BOOK (LOCKWOOD & Co.'s; formerly WEALE'S). Published Annually. In roan tuck, gilt edges, with 10 Copper-Plates and numerous Woodcuts. 6s.

"A vast amount of really valuable matter condensed into the small dimensions of a book which is, in reality, what it professes to be—a pocket-book. . . . We cordially recommend the book.—*Colliery Guardian.*

"It contains a large amount of information peculiarly valuable to those for whose use it is compiled. We cordially commend it to the engineering and architectural professions generally."—*Mining Journal.*

### *Iron Bridges, Girders, Roofs, &c.*

A TREATISE on the APPLICATION of IRON to the CONSTRUCTION of BRIDGES, GIRDERS, ROOFS, and OTHER WORKS; showing the Principles upon which such Structures are Designed, and their Practical Application. Especially arranged for the use of Students and Practical Mechanics, all Mathematical Formulæ and Symbols being excluded. By FRANCIS CAMPIN, C.E. Second Edition revised and corrected. With numerous Diagrams. 12mo, cloth boards, 3s.

"Invaluable to those who have not been educated in mathematics."—*Colliery Guardian.*

"Remarkably accurate and well written."—*Artizan.*



*Pioneer Engineering.*

PIONEER ENGINEERING. A Treatise on the Engineering Operations connected with the Settlement of Waste Lands in New Countries. By EDWARD DOBSON, Assoc. Inst. C.E., Author of "The Art of Building," &c. With numerous Plates and Wood Engravings. Crown 8vo, 10s. 6d., cloth. [*Just published.*]

"A most useful handbook to engineering pioneers."—*Iron.*

"The author's experience has been turned to good account, and the book is likely to be of considerable service to pioneer engineers."—*Building News.*

*New Iron Trades' Companion.*

THE IRON AND METAL TRADES' COMPANION: Being a Calculator containing a Series of Tables upon a new and comprehensive plan for expeditiously ascertaining the value of any goods bought or sold by weight, from 1s. per cwt. to 112s. per cwt., and from one farthing per pound to one shilling per pound. Each Table extends from one pound to 100 tons; to which are appended Rules on Decimals, Square and Cube Root, Mensuration of Superficies and Solids, &c.; also Tables of Weights of Materials, and other Useful Memoranda. By THOMAS DOWNIE. Strongly bound in leather, 396 pp., 9s.

"A most useful set of tables, and will supply a want, for nothing like them before existed."—*Building News.*

"Will save the possessor the trouble of making numerous intricate calculations. Although specially adapted to the iron and metal trades, the tables contained in this handy little companion will be found useful in every other business in which merchandise is bought and sold by weight."—*Railway News.*

*Sanitary Work.*

SANITARY WORK IN THE SMALLER TOWNS AND IN VILLAGES. Comprising:—1. Some of the more Common Forms of Nuisance and their Remedies; 2. Drainage; 3. Water Supply. A useful book for Members of Local Boards and Rural Sanitary Authorities, Health Officers, Engineers, Surveyors, Builders, and Contractors. By CHARLES SLAGG, Assoc. Inst. C.E. Crown 8vo, 5s., cloth.

"Mr. Slagg has brought together much valuable information, and has a happy lucidity of expression; and he has been industrious in collecting data."—*Athenæum.*

"This is a very useful book, and may be safely recommended. . . . The author, Mr. Charles Slagg, has had practical experience in the works of which he treats. There is a great deal of work required to be done in the smaller towns and villages, and this little volume will help those who are willing to do it."—*Builder.*

*Sanitary Engineering.*

WHOLESOME HOUSES: being an exposition of the Banner System of Sanitation. By EDWARD GREGSON BANNER, C.E. New and enlarged edition (25th thousand), illustrated with numerous Wood Engravings. Crown 8vo, sewed 6d., cloth 1s. [*Just published.*]

*Steam Engine.*

STEAM AND THE STEAM ENGINE, Stationary and Portable, an Elementary Treatise on. Being an Extension of Mr. John Sewell's Treatise on Steam. By D. KINNEAR CLARK, C.E., M.I.C.E., Author of "Railway Locomotives," &c. With Illustrations. 12mo, 4s., cloth.

"Every essential part of the subject is treated of competently, and in a popular style."—*Iron.*



*Strains.*

THE STRAINS ON STRUCTURES OF IRONWORK; with Practical Remarks on Iron Construction. By F. W. SHEILDS, M. Inst. C.E. Second Edition, with 5 plates. Royal 8vo, 5s. cloth.

CONTENTS.—Introductory Remarks; Beams Loaded at Centre; Beams Loaded at unequal distances between supports; Beams uniformly Loaded; Girders with triangular bracing Loaded at centre; Ditto, Loaded at unequal distances between supports; Ditto, uniformly Loaded; Calculation of the Strains on Girders with triangular Basings; Cantilevers; Continuous Girders; Lattice Girders; Girders with Vertical Struts and Diagonal Ties; Calculation of the Strains on Ditto; Bow and String Girders; Girders of a form not belonging to any regular figure; Plate Girders; Apportionments of Material to Strain; Comparison of different Girders; Proportion of Length to Depth of Girders; Character of the Work; Iron Roofs.

*Construction of Iron Beams, Pillars, &c.*

IRON AND HEAT, Exhibiting the Principles concerned in the Construction of Iron Beams, Pillars, and Bridge Girders, and the Action of Heat in the Smelting Furnace. By JAMES ARMOUR, C.E. Woodcuts, 12mo, cloth boards, 3s. 6d.; cloth limp, 2s. 6d.

"A very useful and thoroughly practical little volume, in every way deserving of circulation amongst working men."—*Mining Journal*.

"No ironworker who wishes to acquaint himself with the principles of his own trade can afford to be without it."—*South Durham Mercury*.

*Power in Motion.*

POWER IN MOTION: Horse Power, Motion, Toothed Wheel Gearing, Long and Short Driving Bands, Angular Forces, &c. By JAMES ARMOUR, C.E. With 73 Diagrams. 12mo, cloth boards, 3s. 6d.

"Numerous illustrations enable the author to convey his meaning as explicitly as it is perhaps possible to be conveyed. The value of the theoretic and practical knowledge imparted cannot well be over estimated."—*Newcastle Weekly Chronicle*.

*Metallurgy of Iron.*

A TREATISE ON THE METALLURGY OF IRON: containing Outlines of the History of Iron Manufacture, Methods of Assay, and Analyses of Iron Ores, Processes of Manufacture of Iron and Steel, &c. By H. BAUERMAN, F.G.S., Associate of the Royal School of Mines. With numerous Illustrations. Fourth Edition, revised and much enlarged. 12mo, cloth boards, 5s. 6d.

"Carefully written, it has the merit of brevity and conciseness, as to less important points, while all material matters are very fully and thoroughly entered into."—*Standard*.

*Trigonometrical Surveying.*

AN OUTLINE OF THE METHOD OF CONDUCTING A TRIGONOMETRICAL SURVEY, for the Formation of Geographical and Topographical Maps and Plans, Military Reconnaissance, Levelling, &c., with the most useful Problems in Geodesy and Practical Astronomy, and Formulæ and Tables for Facilitating their Calculation. By LIEUT-GENERAL FROME, R.E., late Inspector-General of Fortifications, &c. Fourth Edition, Enlarged, thoroughly Revised, and partly Re-written. By CAPTAIN CHARLES WARREN, R.E., F.G.S. With 19 Plates and 115 Woodcuts, royal 8vo, 16s. cloth.



### *Practical Tunnelling.*

PRACTICAL TUNNELLING: Explaining in detail the Setting out of the Works, Shaft-sinking and Heading-Driving, Ranging the Lines and Levelling under Ground, Sub-Excavating, Timbering, and the Construction of the Brickwork of Tunnels with the amount of labour required for, and the Cost of, the various portions of the work. By FREDERICK WALTER SIMMS, M. Inst. C.E., author of "A Treatise on Levelling." Third Edition, Revised and Extended, with additional chapters illustrating the Recent Practice of Tunnelling as exemplified by the St. Gothard, Mont Cenis, and other modern works, by D. KINNEAR CLARK, M. Inst. C.E. Imp. 8vo, with 21 Folding Plates and numerous Wood Engravings, 30s., cloth.

"It is the only practical treatise on the great art of tunnelling. Mr. Clark's work brings the exigencies of tunnel enterprise up to our own time. The great length of modern tunnels has led to a new difficulty in the art, which the last generation was ignorant of, namely, the difficulty of ventilation. In Mr. Clark's supplement we find this branch of the subject has been fully considered. Mr. Clark's additional chapters on the Mont Cenis and St. Gothard Tunnels contain minute and valuable experiences and data relating to the method of excavation by compressed air, the heading operations, rock-boring machinery, process of enlargement, ventilation in course of construction by compressed air, labour and cost."—*Building News*.

"The estimation in which Mr. Simms' book on tunnelling has been held for over thirty years cannot be more truly expressed than in the words of the late Professor Rankine:—"The best source of information on the subject of tunnels is Mr. F. W. Simms' work on "Practical Tunnelling."—*The Architect*.

### *Levelling.*

A TREATISE on the PRINCIPLES and PRACTICE of LEVELLING; showing its Application to Purposes of Railway and Civil Engineering, in the Construction of Roads; with Mr. TELFORD'S Rules for the same. By FREDERICK W. SIMMS, F.G.S., M. Inst. C.E. Sixth Edition, very carefully revised, with the addition of Mr. LAW'S Practical Examples for Setting out Railway Curves, and Mr. TRAUTWINE'S Field Practice of Laying out Circular Curves. With 7 Plates and numerous Woodcuts. 8vo, 8s. 6d. cloth.      \* \* TRAUTWINE on Curves, separate, 5s.

"One of the most important text-books for the general surveyor, and there is scarcely a question connected with levelling for which a solution would be sought but that would be satisfactorily answered by consulting the volume."—*Mining Journal*.

"The text-book on levelling in most of our engineering schools and colleges."—*Engineer*.

### *The High-Pressure Steam Engine.*

THE HIGH-PRESSURE STEAM ENGINE; an Exposition of its Comparative Merits, and an Essay towards an Improved System of Construction, adapted especially to secure Safety and Economy. By Dr. ERNST ALBAN, Practical Machine Maker, Plau, Mecklenberg. Translated from the German, with Notes, by Dr. POLE, F.R.S., M. Inst. C.E., &c. &c. With 28 fine Plates, 8vo, 16s. 6d. cloth.

"A work like this, which goes thoroughly into the examination of the high-pressure engine, the boiler, and its appendages, &c., is exceedingly useful, and deserves a place in every scientific library."—*Steam Shipping Chronicle*.



### *Reynolds' Locomotive-Engine Driving.*

LOCOMOTIVE-ENGINE DRIVING; a Practical Manual for Engineers in charge of Locomotive Engines. By MICHAEL REYNOLDS, Inspector, Locomotive and Carriage Department, London, Brighton, and South Coast Railway. Second Edition. With Illustrations. Crown 8vo, 4s. 6d., cloth. [*Just published.*]

"Mr. Reynolds has supplied a want, and has supplied it well. We can confidently recommend the book not only to the practical driver, but to every one who takes an interest in the performance of locomotive engines."—*The Engineer.*

"The work is as novel as it is useful, and if drivers and firemen will but take as much pains in reading it as the author has in writing it, there can be no question as to the benefit they will derive."—*English Mechanic.*

"Mr. Reynolds has opened a new chapter in the literature of the day. This admirable practical treatise, of the practical utility of which we have to speak in terms of warm commendation."—*Athenæum.*

### *Hydraulics.*

HYDRAULIC TABLES, CO-EFFICIENTS, and FORMULÆ for finding the Discharge of Water from Orifices, Notches, Weirs, Pipes, and Rivers. With New Formulæ, Tables, and General Information on Rain-fall, Catchment-Basins, Drainage, Sewerage, Water Supply for Towns and Mill Power. By JOHN NEVILLE, Civil Engineer, M.R.I.A. Third Edition, carefully revised, with considerable Additions. Numerous Illustrations. Cr. 8vo, 14s. cloth.

"Undoubtedly an exceedingly useful and elaborate compilation."—*Iron.*

"Alike valuable to students and engineers in practice."—*Mining Journal.*

### *Strength of Cast Iron, &c.*

A PRACTICAL ESSAY on the STRENGTH of CAST IRON and OTHER METALS. By the late THOMAS TREGOLD, Mem. Inst. C.E., Author of "Elementary Principles of Carpentry," &c. Fifth Edition, Edited by EATON HODGKINSON, F.R.S.; to which are added EXPERIMENTAL RESEARCHES on the STRENGTH and OTHER PROPERTIES of CAST IRON. By the EDITOR. The whole Illustrated with 9 Engravings and numerous Woodcuts. 8vo, 12s. cloth.

\*.\* HODGKINSON ON CAST IRON, separately. Price 6s. cloth.

### *Steam Boilers.*

A TREATISE ON STEAM BOILERS: their Strength, Construction, and Economical Working. By R. WILSON, A.I.C.E. Fourth Edition. 12mo, 6s., cloth.

"The best work on boilers which has come under our notice."—*Engineering.*

"The best treatise that has ever been published on steam boilers."—*Engineer.*

### *Tables of Curves.*

TABLES OF TANGENTIAL ANGLES and MULTIPLES for setting out Curves from 5 to 200 Radius. By ALEXANDER BEAZELEY, M. Inst. C.E. Printed on 48 Cards, and sold in a cloth box, waistcoat-pocket size, 3s. 6d.

"Each table is printed on a small card, which, being placed on the theodolite, leaves the hands free to manipulate the instrument—no small advantage as regards the rapidity of work. They are clearly printed, and compactly fitted into a small case for the pocket—an arrangement that will recommend them to all practical men."—*Engineer.*

"Very handy: a man may know that all his day's work must fall on two of these cards, which he puts into his own card-case, and leaves the rest behind."—*Athenæum.*



### *Slate and Slate Quarrying.*

A TREATISE ON SLATE AND SLATE QUARRYING, Scientific, Practical, and Commercial. By D. C. DAVIES, F.G.S., Mining Engineer, &c. With numerous Illustrations and Folding Plates. Crown 8vo, 6s., cloth. [Just published.]

"A useful and practical hand-book on an important industry."—*Engineering*.

"A useful embodiment of practical information derived from original sources, combined with a digest of everything that has already appeared likely to be of interest."—*Building News*.

"There is no other book which contains so much information concerning the procedure observed in taking quarries, the processes employed in working them, and such full statistics of the present and past position of the great slate trade of Wales."—*The Architect*.

### *Earthwork.*

EARTHWORK TABLES, showing the Contents in Cubic Yards of Embankments, Cuttings, &c., of Heights or Depths up to an average of 80 feet. By JOSEPH BROADBENT, C.E., and FRANCIS CAMPIN, C.E. Cr. 8vo, oblong, 5s. cloth.

"The way in which accuracy is attained, by a simple division of each cross section into three elements, two of which are constant and one variable, is ingenious."—*Athenæum*.

"Cannot fail to come into general use."—*Mining Journal*.

### *Surveying (Land and Marine).*

LAND AND MARINE SURVEYING, in Reference to the Preparation of Plans for Roads and Railways, Canals, Rivers, Towns' Water Supplies, Docks and Harbours; with Description and Use of Surveying Instruments. By W. DAVIS HASKOLL, C.E. 8vo, 12s. 6d. cloth, with 14 folding Plates, and numerous Woodcuts.

"A most useful and well arranged book for the aid of a student."—*Builder*.

"Cannot fail to prove of the utmost practical utility, and may be safely recommended to all students who aspire to become clean and expert surveyors."—*Mining Journal*.

### *Engineering Fieldwork.*

THE PRACTICE OF ENGINEERING FIELDWORK, applied to Land and Hydraulic, Hydrographic, and Submarine Surveying and Levelling. Second Edition, revised, with considerable additions, and a Supplementary Volume on WATERWORKS, SEWERS, SEWAGE, and IRRIGATION. By W. DAVIS HASKOLL, C.E. Numerous folding Plates. Demy 8vo, 2 vols. in one, cloth boards, 17. 1s. (published at 27. 4s.)

### *Mining, Surveying and Valuing.*

THE MINERAL SURVEYOR AND VALUER'S COMPLETE GUIDE, comprising a Treatise on Improved Mining Surveying, with new Traverse Tables; and Descriptions of Improved Instruments; also an Exposition of the Correct Principles of Laying out and Valuing Home and Foreign Iron and Coal Mineral Properties. By WILLIAM LINTERN, Mining and Civil Engineer. With four Plates of Diagrams, Plans, &c., 12mo, 4s., cloth.

"Contains much valuable information given in a small compass, and which, as far as we have tested it, is thoroughly trustworthy."—*Iron and Coal Trades Review*.

\* \* \* The above, bound with THOMAN'S TABLES. (See page 22). Price 7s. 6d., cloth.



*Fire Engineering.*

FIRES, FIRE-ENGINES, AND FIRE BRIGADES. With a History of Fire-Engines, their Construction, Use, and Management; Remarks on Fire-Proof Buildings, and the Preservation of Life from Fire; Statistics of the Fire Appliances in English Towns; Foreign Fire Systems; Hints on Fire Brigades, &c., &c. By CHARLES F. T. YOUNG, C.E. With numerous Illustrations, handsomely printed, 544 pp., demy 8vo, 1*l.* 4*s.* cloth.

"We can most heartily commend this book. . . . It is really the only English work we now have upon the subject."—*Engineering*.

"We strongly recommend the book to the notice of all who are in any way interested in fires, fire-engines, or fire-brigades."—*Mechanics' Magazine*.

*Manual of Mining Tools.*

MINING TOOLS. For the use of Mine Managers, Agents, Mining Students, &c. By WILLIAM MORGANS, Lecturer on Practical Mining at the Bristol School of Mines. Volume of Text. 12mo. With an Atlas of Plates, containing 235 Illustrations. 4to. Together, 9*s.* cloth boards.

"Students in the Science of Mining, and not only they, but subordinate officials in mines, and even Overmen, Captains, Managers, and Viewers may gain practical knowledge and useful hints by the study of Mr. Morgans' Manual."—*Colliery Guardian*.

"A very valuable work, which will tend materially to improve our mining literature."—*Mining Journal*.

*Common Sense for Gas-Users.*

COMMON SENSE FOR GAS-USERS: a Catechism of Gas-Lighting for Householders, Gasfitters, Millowners, Architects, Engineers, &c., &c. By ROBERT WILSON, C.E., Author of "A Treatise on Steam Boilers." Second Edition. Crown 8vo, sewed, with Folding Plates and Wood Engravings, 2*s.* 6*d.* [*Just published.*]

*Gas and Gasworks.*

A TREATISE on GASWORKS and the PRACTICE of MANUFACTURING and DISTRIBUTING COAL GAS. By SAMUEL HUGHES, C.E. Fourth Edition, revised by W. RICHARDS, C.E. With 68 Woodcuts, 12mo, 4*s.*, cloth boards.

*Waterworks for Cities and Towns.*

WATERWORKS for the SUPPLY of CITIES and TOWNS, with a Description of the Principal Geological Formations of England as influencing Supplies of Water. By SAMUEL HUGHES, F.G.S., Civil Engineer. New and enlarged edition, 12mo, with numerous Illustrations, 5*s.*, cloth boards.

"One of the most convenient, and at the same time reliable works on a subject, the vital importance of which cannot be over-estimated."—*Bradford Observer*.

*Coal and Coal Mining.*

COAL AND COAL MINING: a Rudimentary Treatise on. By WARINGTON W. SMYTH, M.A., F.R.S., &c., Chief Inspector of the Mines of the Crown and of the Duchy of Cornwall. New edition, revised and corrected. 12mo, with numerous Illustrations, 4*s.* 6*d.*, cloth boards.

"Every portion of the volume appears to have been prepared with much care, and as an outline is given of every known coal-field in this and other countries, as well as of the two principal methods of working, the book will doubtless interest a very large number of readers."—*Mining Journal*.



*Roads and Streets.*

THE CONSTRUCTION OF ROADS AND STREETS. In Two Parts. I. The Art of Constructing Common Roads. By HENRY LAW, C.E. Revised and Condensed by D. KINNEAR CLARK, C.E.—II. Recent Practice in the Construction of Roads and Streets: including Pavements of Stone, Wood, and Asphalte. By D. KINNEAR CLARK, C.E., M.I.C.E., Author of "Railway Machinery," "A Manual of Rules, Tables, and Data," &c. With numerous Illustrations. 12mo, 5s., cloth. [Just published.

"A book which every borough surveyor and engineer must possess, and which will be of considerable service to architects, builders, and property owners generally."—*Building News*.

"The volume is suggestive, and will be an acquisition not only to engineers but to the greater number of people in this country on whom devolves the administration of roads as a part of the system of local government."—*The Architect*.

"To highway and town surveyors this book will have the utmost value, and as containing the largest amount of information in the shortest space and at the lowest price, we may predict for it a wide circulation."—*Journal of Gas Lighting*.

*Field-Book for Engineers.*

THE ENGINEER'S, MINING SURVEYOR'S, and CONTRACTOR'S FIELD-BOOK. By W. DAVIS HASKOLL, C.E. Third Edition, enlarged, consisting of a Series of Tables, with Rules, Explanations of Systems, and Use of Theodolite for Traverse Surveying and Plotting the Work with minute accuracy by means of Straight Edge and Set Square only; Levelling with the Theodolite, Casting out and Reducing Levels to Datum, and Plotting Sections in the ordinary manner; Setting out Curves with the Theodolite by Tangential Angles and Multiples with Right and Left-hand Readings of the Instrument; Setting out Curves without Theodolite on the System of Tangential Angles by Sets of Tangents and Offsets; and Earthwork Tables to 80 feet deep, calculated for every 6 inches in depth. With numerous wood-cuts, 12mo, 12s. cloth.

"The book is very handy, and the author might have added that the separate tables of sines and tangents to every minute will make it useful for many other purposes, the genuine traverse tables existing all the same."—*Athenæum*.

"A very useful work for the practical engineer and surveyor."—*Railway News*.

"The work forms a handsome pocket volume, and cannot fail, from its portability and utility, to be extensively patronised by the engineering profession."—*Mining Journal*.

"We strongly recommend it to all classes of surveyors."—*Colliery Guardian*.

*Earthwork, Measurement and Calculation of.*

A MANUAL on EARTHWORK. By ALEX. J. S. GRAHAM, C.E., Resident Engineer, Forest of Dean Central Railway. With numerous Diagrams. 18mo, 2s. 6d. cloth.

"As a really handy book for reference, we know of no work equal to it; and the railway engineers and others employed in the measurement and calculation of earthwork will find a great amount of practical information very admirably arranged, and available for general or rough estimates, as well as for the more exact calculations required in the engineers' contractor's offices."—*Artizan*.

*Harbours.*

THE DESIGN and CONSTRUCTION of HARBOURS: A Treatise on Maritime Engineering. By THOMAS STEVENSON, F.R.S.E., F.G.S., M.I.C.E. Second Edition, containing many additional subjects, and otherwise generally extended and revised. With 20 Plates and numerous Cuts. Small 4to, 15s. cloth.



*Bridge Construction in Masonry, Timber, & Iron.*

EXAMPLES OF BRIDGE AND VIADUCT CONSTRUCTION OF MASONRY, TIMBER, AND IRON; consisting of 46 Plates from the Contract Drawings or Admeasurement of select Works. By W. DAVIS HASKOLL, C.E. Second Edition, with the addition of 554 Estimates, and the Practice of Setting out Works, illustrated with 6 pages of Diagrams. Imp. 4to, 2l. 12s. 6d. half-morocco.

"One of the very few works extant descending to the level of ordinary routine, and treating on the common every-day practice of the railway engineer. . . . A work of the present nature by a man of Mr. Haskoll's experience, must prove invaluable to hundreds. The tables of estimates appended to this edition will considerably enhance its value."—*Engineering*.

*Mathematical Instruments, their Construction, &c.*

MATHEMATICAL INSTRUMENTS: THEIR CONSTRUCTION, ADJUSTMENT, TESTING, AND USE; comprising Drawing, Measuring, Optical, Surveying, and Astronomical Instruments. By J. F. HEATHER, M.A., Author of "Practical Plane Geometry," "Descriptive Geometry," &c. Enlarged Edition, for the most part entirely rewritten. With numerous Wood-cuts. 12mo, 5s. cloth boards.

*Drawing for Engineers, &c.*

THE WORKMAN'S MANUAL OF ENGINEERING DRAWING. By JOHN MAXTON, Instructor in Engineering Drawing, Royal Naval College, Greenwich, formerly of R. S. N. A., South Kensington. Third Edition, carefully revised. With upwards of 300 Plates and Diagrams. 12mo, cloth, strongly bound, 4s. 6d.

"Even accomplished draughtsmen will find in it much that will be of use to them. A copy of it should be kept for reference in every drawing office."—*Engineering*.

"Indispensable for teachers of engineering drawing."—*Mechanics' Magazine*.

*Oblique Arches.*

A PRACTICAL TREATISE ON THE CONSTRUCTION OF OBLIQUE ARCHES. By JOHN HART. Third Edition, with Plates. Imperial 8vo, 8s. cloth.

*Oblique Bridges.*

A PRACTICAL and THEORETICAL ESSAY ON OBLIQUE BRIDGES, with 13 large folding Plates. By GEO. WATSON BUCK, M. Inst. C.E. Second Edition, corrected by W. H. BARLOW, M. Inst. C.E. Imperial 8vo, 12s. cloth.

"The standard text-book for all engineers regarding skew arches, is Mr. Buck's treatise, and it would be impossible to consult a better."—*Engineer*.

*Pocket-Book for Marine Engineers.*

A POCKET BOOK FOR MARINE ENGINEERS. Containing useful Rules and Formulæ in a compact form. By FRANK PROCTOR, A.I.N.A. Second Edition, revised and enlarged. Royal 32mo, leather, gilt edges, with strap, 4s.

"We recommend it to our readers as going far to supply a long-felt want."—*Naval Science*.

"A most useful companion to all marine engineers."—*United Service Gazette*.

"Scarcely anything required by a naval engineer appears to have been forgotten."—*Iron*.



### *Grantham's Iron Ship-Building, enlarged.*

ON IRON SHIP-BUILDING; with Practical Examples and Details. Fifth Edition. Imp. 4to, boards, enlarged from 24 to 40 Plates (21 quite new), including the latest Examples. Together with separate Text, 12mo, cloth limp, also considerably enlarged. By JOHN GRANTHAM, M. Inst. C.E., &c. 2l. 2s. complete.

"A thoroughly practical work, and every question of the many in relation to iron shipping which admit of diversity of opinion, or have various and conflicting personal interests attached to them, is treated with sober and impartial wisdom and good sense. . . . As good a volume for the instruction of the pupil or student of iron naval architecture as can be found in any language."—*Practical Mechanics' Journal*.

"A very elaborate work. . . . It forms a most valuable addition to the history of iron shipbuilding, while its having been prepared by one who has made the subject his study for many years, and whose qualifications have been repeatedly recognised, will recommend it as one of practical utility to all interested in shipbuilding."—*Army and Navy Gazette*.

"Mr. Grantham's work is of great interest. . . . It is also valuable as a record of the progress of iron shipbuilding. . . . It will, we are confident, command an extensive circulation among shipbuilders in general. . . . By order of the Board of Admiralty, the work will form the text-book on which the examination in iron shipbuilding of candidates for promotion in the dockyards will be mainly based."—*Engineering*.

### *Weale's Dictionary of Terms.*

A DICTIONARY of TERMS used in ARCHITECTURE, BUILDING, ENGINEERING, MINING, METALLURGY, ARCHÆOLOGY, the FINE ARTS, &c. By JOHN WEALE. Fifth Edition, revised and corrected by ROBERT HUNT, F.R.S., Keeper of Mining Records, Editor of "Ure's Dictionary of Arts," &c. 12mo, cloth boards, 6s.

"A book for the enlightenment of those whose memory is treacherous or education deficient in matters scientific and industrial. The additions made of modern discoveries and knowledge are extensive. The result is 570 pages of concentrated essence of elementary knowledge, admirably and systematically arranged, and presented in neat and handy form."—*Iron*.

"The best small technological dictionary in the language."—*Architect*.

"A comprehensive and accurate compendium. Author, editor, and publishers deserve high commendations for producing such a useful work. We can warmly recommend such a dictionary as a standard work of reference to our subscribers. Every ironmonger should procure it—no engineer should be without it—builders and architects must admire it—metallurgists and archæologists would profit by it."—*Ironmonger*.

"The absolute accuracy of a work of this character can only be judged of after extensive consultation, and from our examination it appears very correct and very complete."—*Mining Journal*.

"There is no need now to speak of the excellence of this work; it received the approval of the community long ago. Edited now by Mr. Robert Hunt, and published in a cheap, handy form, it will be of the utmost service as a book of reference scarcely to be exceeded in value."—*Scotsman*.

### *Steam.*

THE SAFE USE OF STEAM: containing Rules for Unprofessional Steam Users. By an ENGINEER. Third Edition. 12mo. Sewed, 6d.

N. B.—*This little work should be in the hands of every person having to deal with a Steam Engine of any kind.*

"If steam-users would but learn this little book by heart, and then hand it to their stokers to do the same, and see that the latter do it, boiler explosions would become sensations by their rarity."—*English Mechanic*.



## ARCHITECTURE, &C.

### *Construction.*

THE SCIENCE of BUILDING: An Elementary Treatise on the Principles of Construction. By E. WYNDHAM TARN, M. A., Architect. With 47 Wood Engravings. Demy 8vo. 8s. 6d. cloth.

"A very valuable book, which we strongly recommend to all students."—*Builder*.

"No architectural student should be without this hand-book."—*Architect*.

"An able digest of information which is only to be found scattered through various works."—*Engineering*.

### *Beaton's Pocket Estimator.*

THE POCKET ESTIMATOR FOR THE BUILDING TRADES, being an easy method of estimating the various parts of a Building collectively, more especially applied to Carpenters' and Joiners' work, priced according to the present value of material and labour. By A. C. BEATON, Author of 'Quantities and Measurements.' Second Edition. Carefully revised. 33 Woodcuts. Leather. Waistcoat-pocket size. 1s. 6d.

### *Beaton's Builders' and Surveyors' Technical Guide.*

THE POCKET TECHNICAL GUIDE AND MEASURER FOR BUILDERS AND SURVEYORS: containing a Complete Explanation of the Terms used in Building Construction, Memoranda for Reference, Technical Directions for Measuring Work in all the Building Trades, &c., &c. By A. C. BEATON. With 19 Woodcuts. Leather. Waistcoat-pocket size. 1s. 6d.

### *Villa Architecture.*

A HANDY BOOK of VILLA ARCHITECTURE; being a Series of Designs for Villa Residences in various Styles. With Detailed Specifications and Estimates. By C. WICKES, Architect, Author of "The Spires and Towers of the Mediæval Churches of England," &c. Complete in 1 vol. 61 Plates. 4to, 2l. 2s. half morocco.

\* \* \* A SELECTION FROM THE ABOVE, containing 30 Designs, with Detailed Specifications, Estimates, &c. 21s. half morocco.

"The whole of the designs bear evidence of their being the work of an artistic architect, and they will prove very valuable and suggestive."—*Building News*.

### *House Painting.*

HOUSE PAINTING, GRAINING, MARBLING, AND SIGN WRITING: a Practical Manual of. With 9 Coloured Plates of Woods and Marbles, and nearly 150 Wood Engravings. By ELLIS A. DAVIDSON, Author of 'Building Construction,' &c. Second Edition, carefully revised. 12mo, 6s. cloth boards.

"Contains a mass of information of use to the amateur and of value to the practical man."—*English Mechanic*.

"Deals with the practice of painting in all its parts, from the grinding of colours to varnishing and gilding."—*Architect*.

### *Wilson's Boiler and Factory Chimneys.*

BOILER AND FACTORY CHIMNEYS; their Draught-power and Stability, with a chapter on Lightning Conductors. By ROBERT WILSON, A I.C.E., Author of "Treatise on Steam Boilers," &c., &c. Crown 8vo, 3s. 6d., cloth. [Just published.]

"A most valuable book of its kind, full of useful information, definite in statement, and thoroughly practical in treatment."—*The Local Government Chronicle*.



*A Book on Building.*

A BOOK ON BUILDING, CIVIL AND ECCLESIASTICAL.  
By Sir EDMUND BECKETT, Bart., LL.D., Q.C., F.R.A.S.,  
Author of "Clocks and Watches and Bells," &c. Crown 8vo,  
with Illustrations, 7s. 6d., cloth.

"A book which is always amusing and nearly always instructive. Sir E. Beckett will be read for the raciness of his style. We are able very cordially to recommend all persons to read it for themselves. The style throughout is in the highest degree condensed and epigrammatic."—*Times*.

"We commend the book to the thoughtful consideration of all who are interested in the building art."—*Builder*.

"There is hardly a subject connected with either building or repairing on which sensible and practical directions will not be found, the use of which is probably destined to prevent many an annoyance, disappointment, and unnecessary expense."—*Daily News*.

*Architecture, Ancient and Modern.*

RUDIMENTARY ARCHITECTURE, Ancient and Modern.  
Consisting of VITRUVIUS, translated by JOSEPH GWILT,  
F.S.A., &c., with 23 fine copper plates; GRECIAN Archi-  
tecture, by the EARL of ABERDEEN; the ORDERS of  
Architecture, by W. H. LEEDS, Esq.; The STYLES of Archi-  
tecture of Various Countries, by T. TALBOT BURY; The  
PRINCIPLES of DESIGN in Architecture, by E. L. GARBETT.  
In one volume, half-bound (pp. 1,100), copiously illustrated, 12s.

\* \* Sold separately, in two vols., as follows—

ANCIENT ARCHITECTURE. Containing Gwilt's Vitruvius  
and Aberdeen's Grecian Architecture. Price 6s. half-bound.

N.B.—This is the only edition of VITRUVIUS procurable at a  
moderate price.

MODERN ARCHITECTURE. Containing the Orders, by Leeds;  
The Styles, by Bury; and Design, by Garbett. 6s. half-bound.

*The Young Architect's Book.*

HINTS TO YOUNG ARCHITECTS. By GEORGE WIGHT-  
WICK, Architect, Author of "The Palace of Architecture," &c. &c.  
New Edition, revised and enlarged. By G. HUSKISSON GUIL-  
LAUME, Architect. Numerous illustrations. 12mo, cloth boards, 4s.

"Will be found an acquisition to pupils, and a copy ought to be considered as necessary a purchase as a box of instruments."—*Architect*.

"Contains a large amount of information, which young architects will do well to acquire, if they wish to succeed in the everyday work of their profession."—*English Mechanic*.

*Drawing for Builders and Students.*

PRACTICAL RULES ON DRAWING for the OPERATIVE  
BUILDER and YOUNG STUDENT in ARCHITECTURE.  
By GEORGE PYNE, Author of a "Rudimentary Treatise on Per-  
spective for Beginners." With 14 Plates, 4to, 7s. 6d. boards.

*Builder's and Contractor's Price Book.*

LOCKWOOD & CO.'S BUILDER'S AND CONTRACTOR'S  
PRICE BOOK for 1878, containing the latest prices of all kinds  
of Builders' Materials and Labour, and of all Trades connected  
with Building, &c., &c. The whole revised and edited by  
FRANCIS T. W. MILLER, Architect and Surveyor. Fcap. 8vo,  
strongly half-bound, 4s.



*Handbook of Specifications.*

THE HANDBOOK OF SPECIFICATIONS ; or, Practical Guide to the Architect, Engineer, Surveyor, and Builder, in drawing up Specifications and Contracts for Works and Constructions. Illustrated by Precedents of Buildings actually executed by eminent Architects and Engineers. Preceded by a Preliminary Essay, and Skeletons of Specifications and Contracts, &c., &c. By Professor THOMAS L. DONALDSON, M.I.B.A. With A REVIEW OF THE LAW OF CONTRACTS. By W. CUNNINGHAM GLEN, of the Middle Temple. With 33 Lithographic Plates, 2 vols., 8vo, 2l. 2s.

"In these two volumes of 1,100 pages (together), forty-four specifications of executed works are given, including the specifications for parts of the new Houses of Parliament, by Sir Charles Barry, and for the new Royal Exchange, by Mr. Tite, M.P. Donaldson's Handbook of Specifications must be bought by all architects."—*Builder*.

*Taylor and Cresy's Rome.*

THE ARCHITECTURAL ANTIQUITIES OF ROME. By the late G. L. TAYLOR, Esq., F.S.A., and EDWARD CRESY, Esq. New Edition, thoroughly revised, and supplemented under the editorial care of the Rev. ALEXANDER TAYLOR, M.A. (son of the late G. L. Taylor, Esq.), Chaplain of Gray's Inn. This is the only book which gives on a large scale, and with the precision of architectural measurement, the principal Monuments of Ancient Rome in plan, elevation, and detail. Large folio, with 130 Plates, half-bound, 3l. 3s.

\* \* \* Originally published in two volumes, folio, at 18l. 18s.

*Specifications for Practical Architecture.*

SPECIFICATIONS FOR PRACTICAL ARCHITECTURE : A Guide to the Architect, Engineer, Surveyor, and Builder ; with an Essay on the Structure and Science of Modern Buildings. By FREDERICK ROGERS, Architect. With numerous Illustrations. Demy 8vo, 15s., cloth. (Published at 1l. 10s.)

\* \* \* A volume of specifications of a practical character being greatly required, and the old standard work of Alfred Bartholomew being out of print, the author, on the basis of that work, has produced the above. He has also inserted specifications of works that have been erected in his own practice.

*The House-Owner's Estimator.*

THE HOUSE-OWNER'S ESTIMATOR ; or, What will it Cost to Build, Alter, or Repair? A Price-Book adapted to the Use of Unprofessional People as well as for the Architectural Surveyor and Builder. By the late JAMES D. SIMON, A.R.I.B.A. Edited and Revised by FRANCIS T. W. MILLER, Surveyor. With numerous Illustrations. Second Edition, with the prices carefully revised to 1875. Crown 8vo, cloth, 3s. 6d.

"In two years it will repay its cost a hundred times over."—*Field*.

"A very handy book for those who want to know what a house will cost to build, alter, or repair."—*English Mechanic*.

"Especially valuable to non-professional readers."—*Mining Journal*.

*Useful Text-Book for Architects.*

THE ARCHITECT'S GUIDE : Being a Text-book of Useful Information for Architects, Engineers, Surveyors, Contractors, Clerks of Works, &c., &c. By FREDERICK ROGERS, Architect, Author of 'Specifications for Practical Architecture,' &c. With numerous Illustrations. Crown 8vo, 6s. cloth.



## CARPENTRY, TIMBER, MECHANICS.

### *Tredgold's Carpentry, new and cheaper Edition.*

THE ELEMENTARY PRINCIPLES OF CARPENTRY : a Treatise on the Pressure and Equilibrium of Timber Framing, the Resistance of Timber, and the Construction of Floors, Arches, Bridges, Roofs, Uniting Iron and Stone with Timber, &c. To which is added an Essay on the Nature and Properties of Timber, &c., with Descriptions of the Kinds of Wood used in Building ; also numerous Tables of the Scantlings of Timber for different purposes, the Specific Gravities of Materials, &c. By THOMAS TREGOLD, C.E. Edited by PETER BARLOW, F.R.S. Fifth Edition, corrected and enlarged. With 64 Plates (11 of which now first appear in this edition), Portrait of the Author, and several Woodcuts. In 1 vol., 4to, published at 2*l.* 2*s.*, reduced to 1*l.* 5*s.*, cloth.

"'Tredgold's Carpentry' ought to be in every architect's and every builder's library, and those who do not already possess it ought to avail themselves of the new issue."—*Builder.*

"A work whose monumental excellence must commend it wherever skilful carpentry is concerned. The Author's principles are rather confirmed than impaired by time, and, as now presented, combine the surest base with the most interesting display of progressive science. The additional plates are of great intrinsic value."—*Building News.*

### *Grandy's Timber Tables.*

THE TIMBER IMPORTER'S, TIMBER MERCHANT'S, and BUILDER'S STANDARD GUIDE. By RICHARD E. GRANDY. Comprising :—An Analysis of Deal Standards, Home and Foreign, with comparative Values and Tabular Arrangements for Fixing Nett Landed Cost on Baltic and North American Deals, including all intermediate Expenses, Freight, Insurance, &c., &c. ; together with Copious Information for the Retailer and Builder. Second Edition. Carefully revised and corrected. 12mo, 3*s.* 6*d.* cloth.

"Everything it pretends to be : built up gradually, it leads one from a forest to a treenail, and throws in, as a makeweight, a host of material concerning bricks, columns, cisterns, &c.—all that the class to whom it appeals requires."—*English Mechanic.*

"The only difficulty we have is as to what is NOT in its pages. What we have tested of the contents, taken at random, is invariably correct."—*Illustrated Builder's Journal.*

### *Tables for Packing-Case Makers.*

PACKING-CASE TABLES ; showing the number of Superficial Feet in Boxes or Packing-Cases, from six inches square and upwards. Compiled by WILLIAM RICHARDSON, Accountant. Second Edition. Oblong 4to, 3*s.* 6*d.*, cloth. [*Just Published.*]

"Will save much labour and calculation to packing-case makers and those who use packing-cases."—*Grocer.* "Invaluable labour-saving tables."—*Ironmonger.*

### *Nicholson's Carpenter's Guide.*

THE CARPENTER'S NEW GUIDE ; or, BOOK of LINES for CARPENTERS : comprising all the Elementary Principles essential for acquiring a knowledge of Carpentry. Founded on the late PETER NICHOLSON'S standard work. A new Edition, revised by ARTHUR ASHPITEL, F.S.A., together with Practical Rules on Drawing, by GEORGE PYNE. With 74 Plates, 4to, 1*l.* 1*s.* cloth.



*Dowsing's Timber Merchant's Companion.*

THE TIMBER MERCHANT'S AND BUILDER'S COMPANION; containing New and Copious Tables of the Reduced Weight and Measurement of Deals and Battens, of all sizes, from One to a Thousand Pieces, and the relative Price that each size bears per Lineal Foot to any given Price per Petersburgh Standard Hundred; the Price per Cube Foot of Square Timber to any given Price per Load of 50 Feet; the proportionate Value of Deals and Battens by the Standard, to Square Timber by the Load of 50 Feet; the readiest mode of ascertaining the Price of Scantling per Lineal Foot of any size, to any given Figure per Cube Foot. Also a variety of other valuable information. By WILLIAM DOWSING, Timber Merchant. Third Edition, Revised and Corrected. Crown 8vo, 3s. cloth.

"Everything is as concise and clear as it can possibly be made. There can be no doubt that every timber merchant and builder ought to possess it."—*Hull Advertiser.*

*Timber Freight Book.*

THE TIMBER IMPORTERS' AND SHIPOWNERS' FREIGHT BOOK: Being a Comprehensive Series of Tables for the Use of Timber Importers, Captains of Ships, Shipbrokers, Builders, and all Dealers in Wood whatsoever. By WILLIAM RICHARDSON, Timber Broker. Crown 8vo, 6s., cloth.

*Horton's Measurer.*

THE COMPLETE MEASURER; setting forth the Measurement of Boards, Glass, &c., &c.; Unequal-sided, Square-sided, Octagonal-sided, Round Timber and Stone, and Standing Timber. With just allowances for the bark in the respective species of trees, and proper deductions for the waste in hewing the trees, &c.; also a Table showing the solidity of hewn or eight-sided timber, or of any octagonal-sided column. Compiled for the accommodation of Timber-growers, Merchants, and Surveyors, Stonemasons, Architects, and others. By RICHARD HORTON. Third edition, with considerable and valuable additions, 12mo, strongly bound in leather, 5s.

"Not only are the best methods of measurement shown, and in some instances illustrated by means of woodcuts, but the erroneous systems pursued by dishonest dealers are fully exposed. . . . The work must be considered to be a valuable addition to every gardener's library.—*Garden.*

*Superficial Measurement.*

THE TRADESMAN'S GUIDE TO SUPERFICIAL MEASUREMENT. Tables calculated from 1 to 200 inches in length, by 1 to 108 inches in breadth. For the use of Architects, Surveyors, Engineers, Timber Merchants, Builders, &c. By JAMES HAWKINGS. Fcp. 3s. 6d. cloth.

*Practical Timber Merchant.*

THE PRACTICAL TIMBER MERCHANT, being a Guide for the use of Building Contractors, Surveyors, Builders, &c., comprising useful Tables for all purposes connected with the Timber Trade, Marks of Wood, Essay on the Strength of Timber, Remarks on the Growth of Timber, &c. By W. RICHARDSON. Fcap. 8vo, 3s. 6d., cloth.



### *The Mechanic's Workshop Companion.*

THE OPERATIVE MECHANIC'S WORKSHOP COMPANION, and THE SCIENTIFIC GENTLEMAN'S PRACTICAL ASSISTANT. By WILLIAM TEMPLETON. Twelfth Edition, with Mechanical Tables for Operative Smiths, Millwrights, Engineers, &c.; and an Extensive Table of Powers and Roots, &c., &c. 11 Plates. 12mo, 5s. bound.

"As a text-book of reference, in which mechanical and commercial demands are judiciously met, TEMPLETON'S COMPANION stands unrivalled."—*Mechanics' Magazine*.

"Admirably adapted to the wants of a very large class. It has met with great success in the engineering workshop, as we can testify; and there are a great many men who, in a great measure, owe their rise in life to this little work."—*Building News*.

### *Engineer's Assistant.*

THE ENGINEER'S, MILLWRIGHT'S, and MACHINIST'S PRACTICAL ASSISTANT; comprising a Collection of Useful Tables, Rules, and Data. Compiled and Arranged, with Original Matter, by WILLIAM TEMPLETON. 6th Edition. 18mo, 2s. 6d. cloth.

"So much varied information compressed into so small a space, and published at a price which places it within the reach of the humblest mechanic, cannot fail to command the sale which it deserves. With the utmost confidence we commend this book to the attention of our readers."—*Mechanics' Magazine*.

"A more suitable present to an apprentice to any of the mechanical trades could not possibly be made."—*Building News*.

### *Designing, Measuring, and Valuing.*

THE STUDENT'S GUIDE to the PRACTICE of MEASURING, and VALUING ARTIFICERS' WORKS; containing Directions for taking Dimensions, Abstracting the same, and bringing the Quantities into Bill, with Tables of Constants, and copious Memoranda for the Valuation of Labour and Materials in the respective Trades of Bricklayer and Slater, Carpenter and Joiner, Painter and Glazier, Paperhanger, &c. With 43 Plates and Woodcuts. Originally edited by EDWARD DOBSON, Architect. New Edition, re-written, with Additions on Mensuration and Construction, and useful Tables for facilitating Calculations and Measurements. By E. WYNDHAM TARN, M.A., 8vo, 10s. 6d. cloth.

"We have failed to discover anything connected with the building trade, from excavating foundations to bell-hanging, that is not fully treated upon."—*The Artizan*.

"Altogether the book is one which well fulfils the promise of its title-page, and we can thoroughly recommend it to the class for whose use it has been compiled. Mr. Tarn's additions and revisions have much increased the usefulness of the work, and have especially augmented its value to students."—*Engineering*.

### *Plumbing.*

PLUMBING; a text-book to the practice of the art or craft of the plumber. With supplementary chapters upon house-drainage, embodying the latest improvements. By WILLIAM PATON BUCHAN, Sanitary Engineer. 12mo., with about 300 illustrations. 3s. 6d., cloth.

"There is no other manual in existence of the plumber's art; and the volume will be welcomed as the work of a practical master of his trade."—*Public Health*.

"The chapters on house-drainage may be usefully consulted, not only by plumbers, but also by engineers and all engaged or interested in house-building."—*Iron*.

"A book containing a large amount of practical information, put together in a very intelligent manner, by one who is well qualified for the task."—*City Press*.



## MATHEMATICS, &c.

### *Gregory's Practical Mathematics.*

MATHEMATICS for PRACTICAL MEN ; being a Common-place Book of Pure and Mixed Mathematics. Designed chiefly for the Use of Civil Engineers, Architects, and Surveyors. Part I. PURE MATHEMATICS—comprising Arithmetic, Algebra, Geometry, Mensuration, Trigonometry, Conic Sections, Properties of Curves. Part II. MIXED MATHEMATICS—comprising Mechanics in general, Statics, Dynamics, Hydrostatics, Hydrodynamics, Pneumatics, Mechanical Agents, Strength of Materials. With an Appendix of copious Logarithmic and other Tables. By OLINTHUS GREGORY, LL.D., F.R.A.S. Enlarged by HENRY LAW, C.E. 4th Edition, carefully revised and corrected by J. R. YOUNG, formerly Professor of Mathematics, Belfast College ; Author of "A Course of Mathematics," &c. With 13 Plates. Medium 8vo, 17. 1s. cloth.

"As a standard work on mathematics it has not been excelled."—*Artizan*.

"The engineer or architect will here find ready to his hand, rules for solving nearly every mathematical difficulty that may arise in his practice. The rules are in all cases explained by means of examples, in which every step of the process is clearly worked out."—*Builder*.

"One of the most serviceable books to the practical mechanics of the country. . . . In the edition just brought out, the work has again been revised by Professor Young. He has modernised the notation throughout, introduced a few paragraphs here and there, and corrected the numerous typographical errors which have escaped the eyes of the former Editor. The book is now as complete as it is possible to make it. It is an instructive book for the student, and a Text-book for him who having once mastered the subjects it treats of, needs occasionally to refresh his memory upon them."—*Building News*.

### *The Metric System.*

A SERIES OF METRIC TABLES, in which the British Standard Measures and Weights are compared with those of the Metric System at present in use on the Continent. By C. H. DOWLING, C. E. Second Edition, revised and enlarged. 8vo, 10s. 6d. strongly bound.

"Mr. Dowling's Tables, which are well put together, come just in time as a ready reckoner for the conversion of one system into the other."—*Athenæum*.

"Their accuracy has been certified by Prof. Airy, Astronomer-Royal."—*Builder*.

"Resolution 8.—That advantage will be derived from the recent publication of Metric Tables, by C. H. Dowling, C.E."—*Report of Section F, Brit. Assoc., Bath*.

### *Comprehensive Weight Calculator.*

THE WEIGHT CALCULATOR ; being a Series of Tables upon a New and Comprehensive Plan, exhibiting at one Reference the exact Value of any Weight from 1 lb. to 15 tons, at 300 Progressive Rates, from 1 Penny to 168 Shillings per cwt., and containing 186,000 Direct Answers, which with their Combinations, consisting of a single addition (mostly to be performed at sight), will afford an aggregate of 10,266,000 Answers ; the whole being calculated and designed to ensure Correctness and promote Despatch. By HENRY HARBEN, Accountant, Sheffield, Author of 'The Discount Guide.' An entirely New Edition, carefully revised. Royal 8vo, strongly half-bound, 30s.



*Comprehensive Discount Guide.*

THE DISCOUNT GUIDE : comprising several Series of Tables for the use of Merchants, Manufacturers, Ironmongers, and others, by which may be ascertained the exact profit arising from any mode of using Discounts, either in the Purchase or Sale of Goods, and the method of either Altering a Rate of Discount, or Advancing a Price, so as to produce, by one operation, a sum that will realise any required profit after allowing one or more Discounts : to which are added Tables of Profit or Advance from  $1\frac{1}{4}$  to 90 per cent., Tables of Discount from  $1\frac{1}{4}$  to  $98\frac{3}{4}$  per cent., and Tables of Commission, &c., from  $\frac{1}{8}$  to 10 per cent. By HENRY HARBEN, Accountant, Author of "The Weight Calculator." New Edition, carefully Revised and Corrected. In a handsome demy 8vo. volume (544 pp.), strongly and elegantly half-bound, £1 5s.

*Inwood's Tables, greatly enlarged and improved.*

TABLES FOR THE PURCHASING of ESTATES, Freehold, Copyhold, or Leasehold ; Annuities, Advowsons, &c., and for the Renewing of Leases held under Cathedral Churches, Colleges, or other corporate bodies ; for Terms of Years certain, and for Lives ; also for Valuing Reversionary Estates, Deferred Annuities, Next Presentations, &c., together with Smart's Five Tables of Compound Interest, and an Extension of the same to Lower and Intermediate Rates. By WILLIAM INWOOD, Architect. The 20th edition, with considerable additions, and new and valuable Tables of Logarithms for the more Difficult Computations of the Interest of Money, Discount, Annuities, &c., by M. FÉDOR THOMAN, of the Société Crédit Mobilier of Paris. 12mo, 8s. cloth.

"Those interested in the purchase and sale of estates, and in the adjustment of compensation cases, as well as in transactions in annuities, life insurances, &c., will find the present edition of eminent service."—*Engineering*.

"'Inwood's Tables' still maintain a most enviable reputation. The new issue has been enriched by large additional contributions by M. Fédor Thoman, whose carefully arranged Tables cannot fail to be of the utmost utility."—*Mining Journal*.

*Geometry for the Architect, Engineer, &c.*

PRACTICAL GEOMETRY, for the Architect, Engineer, and Mechanic ; giving Rules for the Delineation and Application of various Geometrical Lines, Figures and Curves. By E. W. TARN, M.A., Architect, Author of "The Science of Building," &c. With 164 Illustrations. Demy 8vo. 12s. 6d., cloth.

"No book with the same objects in view has ever been published in which the clearness of the rules laid down and the illustrative diagrams have been so satisfactory."—*Scotsman*.

*Compound Interest and Annuities.*

THEORY of COMPOUND INTEREST and ANNUITIES ; with Tables of Logarithms for the more Difficult Computations of Interest, Discount, Annuities, &c., in all their Applications and Uses for Mercantile and State Purposes. With an elaborate Introduction. By FÉDOR THOMAN, of the Société Crédit Mobilier, Paris. 3rd Edition, carefully revised and corrected. 12mo, 4s. 6d., cl.

A very powerful work, and the Author has a very remarkable command of his subject."—*Professor A. de Morgan*.

"We recommend it to the notice of actuaries and accountants."—*Athenæum*.

\* \* The above bound with LINTERN'S MINERAL SURVEYOR.

(See page 10.) Price 7s. 6d. cloth.



## SCIENCE AND ART.

### *Brewing.*

A HANDBOOK FOR YOUNG BREWERS. By HERBERT EDWARDS WRIGHT, B.A. (Trin. Coll. Camb.). Crown 8vo, 3s. 6d., cloth. [Just Published.

"A thoroughly scientific treatise in popular language. It is evident that the author has mastered his subject in its scientific aspects."—*Morning Advertiser*.

"We would particularly recommend all teachers of the art to place a copy of it in every pupil's hands, and we feel sure its perusal will be attended with advantage."—*Brewer*.

### *The Military Sciences.*

AIDE-MÉMOIRE to the MILITARY SCIENCES. Framed from Contributions of Officers and others connected with the different Services. Originally edited by a Committee of the Corps of Royal Engineers. Second Edition, most carefully revised by an Officer of the Corps, with many additions; containing nearly 350 Engravings and many hundred Woodcuts. 3 vols. royal 8vo, extra cloth boards, and lettered, 4l. 10s.

"A compendious encyclopædia of military knowledge."—*Edinburgh Review*.

"The most comprehensive work of reference to the military and collateral sciences."—*Volunteer Service Gazette*.

### *Field Fortification.*

A TREATISE on FIELD FORTIFICATION, the ATTACK of FORTRESSES, MILITARY MINING, and RECONNOITRING. By Colonel I. S. MACAULAY, late Professor of Fortification in the R. M. A., Woolwich. Sixth Edition, crown 8vo, cloth, with separate Atlas of 12 Plates, 12s. complete.

### *Field Fortification.*

HANDBOOK OF FIELD FORTIFICATION, intended for the Guidance of Officers preparing for Promotion, and especially adapted to the requirements of Beginners. By Major W. W. KNOLLYS, F.R.G.S., 93rd Sutherland Highlanders, &c. With 163 Woodcuts. Crown 8vo, 3s. 6d. cloth.

### *Dye-Wares and Colours.*

THE MANUAL of COLOURS and DYE-WARES: their Properties, Applications, Valuation, Impurities, and Sophistications. For the Use of Dyers, Printers, Dry Salters, Brokers, &c. By J. W. SLATER. Post 8vo, 7s. 6d., cloth.

"A complete encyclopædia of the *materia tinctoria*. The information given respecting each article is full and precise, and the methods of determining the value of articles such as these, so liable to sophistication, are given with clearness, and are practical as well as valuable."—*Chemist and Druggist*.

### *Storms.*

STORMS: their Nature, Classification, and Laws, with the Means of Predicting them by their Embodiments, the Clouds. By WILLIAM BLASIUS. With Coloured Plates and numerous Wood Engravings. Crown 8vo, 10s. 6d. cloth boards.



*Light-Houses.*

EUROPEAN LIGHT-HOUSE SYSTEMS ; being a Report of a Tour of Inspection made in 1873. By Major GEORGE H. ELLIOT, Corps of Engineers, U.S.A. Illustrated by 51 Engravings and 31 Woodcuts in the Text. 8vo, 21s. cloth.

*Electricity.*

A MANUAL of ELECTRICITY ; including Galvanism, Magnetism, Diamagnetism, Electro-Dynamics, Magno-Electricity, and the Electric Telegraph. By HENRY M. NOAD, Ph.D., F.C.S., Lecturer on Chemistry at St. George's Hospital. Fourth Edition, entirely rewritten. Illustrated by 500 Woodcuts. 8vo, 17. 4s. cloth.

"The commendations already bestowed in the pages of the *Lancet* on the former editions of this work are more than ever merited by the present. The accounts given of electricity and galvanism are not only complete in a scientific sense, but, which is a rarer thing, are popular and interesting."—*Lancet*.

*Text-Book of Electricity.*

THE STUDENT'S TEXT-BOOK OF ELECTRICITY. By HENRY M. NOAD, Ph.D., Lecturer on Chemistry at St. George's Hospital. New Edition, revised and enlarged, with additions on Telegraphy, the Telephone, Phonograph, &c., by G. E. PREECE, Esq., of the Telegraph Department, General Post Office, London. Upwards of 400 Illustrations.

[*Nearly ready.*]

*Rudimentary Magnetism.*

RUDIMENTARY MAGNETISM : being a concise exposition of the general principles of Magnetical Science, and the purposes to which it has been applied. By Sir W. SNOW HARRIS, F.R.S. New and enlarged Edition, with considerable additions by Dr. NOAD, Ph.D. With 165 Woodcuts. 12mo, cloth, 4s. 6d.

"As concise and lucid an exposition of the phenomena of magnetism as we believe it is possible to write."—*English Mechanic*.

"The best possible manual on the subject of magnetism."—*Mechanics' Magazine*.

*Chemical Analysis.*

THE COMMERCIAL HANDBOOK of CHEMICAL ANALYSIS ; or Practical Instructions for the determination of the Intrinsic or Commercial Value of Substances used in Manufactures, in Trades, and in the Arts. By A. NORMANDY, Author of "Practical Introduction to Rose's Chemistry," and Editor of Rose's "Treatise on Chemical Analysis." *New Edition*. Enlarged, and to a great extent re-written, by HENRY M. NOAD, Ph. D., F.R.S. With numerous Illustrations. Cr. 8vo, 12s. 6d. cloth.

"We recommend this book to the careful perusal of every one ; it may be truly affirmed to be of universal interest, and we strongly recommend it to our readers as a guide, alike indispensable to the housewife as to the pharmaceutical practitioner."—*Medical Times*.

"Essential to the analysts appointed under the new Act. The most recent results are given, and the work is well edited and carefully written."—*Nature*.

*Mollusca.*

A MANUAL OF THE MOLLUSCA ; being a Treatise on Recent and Fossil Shells. By Dr. S. P. WOODWARD, A.L.S. With Appendix by RALPH TATE, A.L.S. F.G.S. With numerous Plates and 300 Woodcuts. 3rd Edition. Cr. 8vo, 7s. 6d. cloth.



*Clocks, Watches, and Bells.*

RUDIMENTARY TREATISE on CLOCKS, and WATCHES, and BELLS. By Sir EDMUND BECKETT, Bart. (late E. B. Denison), LL.D., Q.C., F.R.A.S., Author of "Astronomy without Mathematics," &c. Sixth edition, thoroughly revised and enlarged, with numerous Illustrations. Limp cloth (No. 67, Weale's Series), 4s. 6d.; cloth boards, 5s. 6d.

"As a popular and practical treatise it is unapproached."—*English Mechanic.*

"The best work on the subject probably extant. The treatise on bells is undoubtedly the best in the language. To call it a rudimentary treatise is a misnomer, at least as respects clocks and bells. It is the most important work of its kind in English."—*Engineering.*

"The only modern treatise on clock-making."—*Horological Journal.*

"This admirable treatise on clocks, by the most able authority on such a subject, is completely perfect of its kind."—*Standard.*

*Gold and Gold-Working.*

THE PRACTICAL GOLD-WORKER; or, The Goldsmith's and Jeweller's Instructor. The Art of Alloying, Melting, Reducing, Colouring, Collecting and Refining. The processes of Manipulation, Recovery of Waste, Chemical and Physical Properties of Gold, with a new System of Mixing its Alloys; Solders, Enamels, and other useful Rules and Recipes, &c. By GEORGE E. GEE. Crown 8vo, 7s. 6d., cloth. [Just Published.

"A good, sound, technical educator, and will be generally accepted as an authority. It gives full particulars for mixing alloys and enamels, is essentially a book for the workshop, and exactly fulfils the purpose intended."—*Horological Journal.*

"The best work yet printed on its subject for a reasonable price. We have no doubt that it will speedily become a standard book which few will care to be without."—*Jeweller and Metalworker.*

*Silver and Silver Working.*

THE SILVERSMITH'S HANDBOOK, containing full Instructions for the Alloying and Working of Silver, including the different modes of refining and melting the metal, its solders, the preparation of imitation alloys, methods of manipulation, prevention of waste, instructions for improving and finishing the surface of the work, together with other useful information and memoranda. By GEORGE E. GEE, Jeweller, &c. Crown 8vo, with numerous illustrations, 7s. 6d., cloth. [Just Published.

"This work is destined to take up as good a position in technical literature as the *Practical Goldworker*, a book which has passed through the ordeal of critical examination and business tests with great success."—*Jeweller and Metalworker.*

*Science and Scripture.*

SCIENCE ELUCIDATIVE OF SCRIPTURE, AND NOT ANTAGONISTIC TO IT; being a Series of Essays on—1. Alleged Discrepancies; 2. The Theory of the Geologists and Figure of the Earth; 3. The Mosaic Cosmogony; 4. Miracles in general—Views of Hume and Powell; 5. The Miracle of Joshua—Views of Dr. Colenso: The Supernaturally Impossible; 6. The Age of the Fixed Stars—their Distances and Masses. By Professor J. R. YOUNG. Fcap. 8vo, 5s. cloth.

"Distinguished by the true spirit of scientific inquiry, by great knowledge, by keen logical ability, and by a style peculiarly clear, easy, and energetic."—*Nonconformist.*

*Practical Philosophy.*

A SYNOPSIS of PRACTICAL PHILOSOPHY. By Rev. J. CARR, M.A., late Fellow of Trin. Coll., Camb. 2nd Ed. 18mo, 5s. cl.



## DR. LARDNER'S POPULAR WORKS.

*Dr. Lardner's Museum of Science and Art.*

THE MUSEUM OF SCIENCE AND ART. Edited by DIONYSIUS LARDNER, D.C.L., formerly Professor of Natural Philosophy and Astronomy in University College, London. With upwards of 1200 Engravings on Wood. In 6 Double Volumes. Price £1 1s., in a new and elegant cloth binding, or handsomely bound in half morocco, 31s. 6d.

"The 'Museum of Science and Art' is the most valuable contribution that has ever been made to the Scientific Instruction of every class of society."—*Sir David Brewster in the North British Review.*

"Whether we consider the liberality and beauty of the illustrations, the charm of the writing, or the durable interest of the matter, we must express our belief that there is hardly to be found among the new books, one that would be welcomed by people of so many ages and classes as a valuable present."—*Examiner.*

\* \* *Separate books formed from the above, suitable for Workmen's Libraries, Science Classes, &c.*

COMMON THINGS EXPLAINED. Containing Air, Earth, Fire, Water, Time, Man, the Eye, Locomotion, Colour, Clocks and Watches, &c. 233 Illustrations, cloth gilt, 5s.

THE MICROSCOPE. Containing Optical Images, Magnifying Glasses, Origin and Description of the Microscope, Microscopic Objects, the Solar Microscope, Microscopic Drawing and Engraving, &c. 147 Illustrations, cloth gilt, 2s.

POPULAR GEOLOGY. Containing Earthquakes and Volcanoes, the Crust of the Earth, etc. 201 Illustrations, cloth gilt, 2s. 6d.

POPULAR PHYSICS. Containing Magnitude and Minuteness, the Atmosphere, Meteoric Stones, Popular Fallacies, Weather Prognostics, the Thermometer, the Barometer, Sound, &c. 85 Illustrations, cloth gilt, 2s. 6d.

STEAM AND ITS USES. Including the Steam Engine, the Locomotive, and Steam Navigation. 89 Illustrations, cloth gilt, 2s.

POPULAR ASTRONOMY. Containing How to Observe the Heavens. The Earth, Sun, Moon, Planets. Light, Comets, Eclipses, Astronomical Influences, &c. 182 Illustrations, 4s. 6d.

THE BEE AND WHITE ANTS: Their Manners and Habits. With Illustrations of Animal Instinct and Intelligence. 135 Illustrations, cloth gilt, 2s.

THE ELECTRIC TELEGRAPH POPULARISED. To render intelligible to all who can Read, irrespective of any previous Scientific Acquirements, the various forms of Telegraphy in Actual Operation. 100 Illustrations, cloth gilt, 1s. 6d.

*Scientific Class-Books, by Dr. Lardner.*

NATURAL PHILOSOPHY FOR SCHOOLS. By DR. LARDNER. 328 Illustrations. Sixth Edition. 1 vol. 3s. 6d. cloth.

"Conveys, in clear and precise terms, general notions of all the principal divisions of Physical Science."—*British Quarterly Review.*

ANIMAL PHYSIOLOGY FOR SCHOOLS. By DR. LARDNER. With 190 Illustrations. Second Edition. 1 vol. 3s. 6d. cloth.

"Clearly written, well arranged, and excellently illustrated."—*Gardeners' Chronicle.*



DR. LARDNER'S SCIENTIFIC WORKS.

*Astronomy.*

THE HANDBOOK OF ASTRONOMY. 4th Edition. Edited by EDWIN DUNKIN, F.R.S., Rl. Observatory, Greenwich. With 38 plates and upwards of 100 Woodcuts. Cr. 8vo, 9s. 6d. cloth.

"Probably no other book contains the same amount of information in so compendious and well-arranged a form."—*Athenæum*.

*Animal Physics.*

THE HANDBOOK OF ANIMAL PHYSICS. With 520 Illustrations. New edition, small 8vo, cloth, 7s. 6d. 732 pages.

"We have no hesitation in cordially recommending it."—*Educational Times*.

*Electric Telegraph.*

THE ELECTRIC TELEGRAPH. New Edition. By E. B. BRIGHT, F.R.A.S. 140 Illustrations. Small 8vo, 2s. 6d. cloth.

"One of the most readable books extant on the Electric Telegraph."—*Eng. Mechanic*.

LARDNER'S COURSE OF NATURAL PHILOSOPHY.

*Mechanics.*

THE HANDBOOK OF MECHANICS. Enlarged and almost rewritten by BENJAMIN LOEWY, F.R.A.S. With 378 Illustrations. Post 8vo, 6s. cloth. [*Just Published.*]

"The perspicuity of the original has been retained, and chapters which had become obsolete, have been replaced by others of more modern character. The explanations throughout are studiously popular, and care has been taken to show the application of the various branches of physics to the industrial arts, and to the practical business of life."—*Mining Journal*.

*Heat.*

THE HANDBOOK OF HEAT. Edited and almost entirely Re-written by BENJAMIN LOEWY, F.R.A.S. etc. 117 Illustrations. Post 8vo, 6s. cloth. [*Just Published.*]

"The style is always clear and precise, and conveys instruction without leaving any cloudiness or lurking doubts behind."—*Engineering*.

*Hydrostatics and Pneumatics.*

THE HANDBOOK OF HYDROSTATICS and PNEUMATICS. New Edition, Revised and Enlarged by BENJAMIN LOEWY, F.R.A.S. With 236 Illustrations. Post 8vo, 5s. cl.

"For those 'who desire to attain an accurate knowledge of physical science without the profound methods of mathematical investigation,' this work is not merely intended, but well adapted."—*Chemical News*.

*Electricity, Magnetism, and Acoustics.*

THE HANDBOOK OF ELECTRICITY, MAGNETISM, and ACOUSTICS. New Edition. Edited by GEO. CAREY FOSTER, B.A., F.C.S. With 400 Illustrations. Post 8vo, 5s. cloth.

"The book could not have been entrusted to any one better calculated to preserve the terse and lucid style of Lardner, while correcting his errors and bringing up his work to the present state of scientific knowledge."—*Popular Science Review*.

*Optics.*

THE HANDBOOK OF OPTICS. New Edition. Edited by T. OLVER HARDING, B.A. 298 Illustrations. Post 8vo, 5s. cloth.

"Written by one of the ablest English scientific writers, beautifully and elaborately illustrated."—*Mechanic's Magazine*.

\* \* \* The above 5 Vols. form A COMPLETE COURSE OF NATURAL PHILOSOPHY.



### *Pictures and Painters.*

THE PICTURE AMATEUR'S HANDBOOK AND DICTIONARY OF PAINTERS: being a Guide for Visitors to Public and Private Picture Galleries, and for Art-Students, including an explanation of the various methods of Painting; Instructions for Cleaning, Re-Lining, and Restoring Oil Paintings; A Glossary of Terms; an Historical Sketch of the Principal Schools of Painting; and a Dictionary of Painters, giving the Copyists and Imitators of each Master. By PHILIPPE DARYL, B.A. Crown 8vo, 3s. 6d., cloth. [Just Published.

"Useful as bringing together in a compendious form an almost complete biographical stock of information respecting the painters of the world."—*Mayfair*.

"The bulk of the book is occupied by a dictionary of painters which, considering its small compass, is really admirable; where only a few words are devoted to an artist, his speciality is well indicated; and the utility of a table of dates of painters in so portable a form is unquestionable. We cordially recommend the book."—*Builder*.

### *Popular Work on Painting.*

PAINTING POPULARLY EXPLAINED; with Historical Sketches of the Progress of the Art. By THOMAS JOHN GULLICK, Painter, and JOHN TIMBS, F.S.A. Fourth Edition, revised and enlarged. With Frontispiece and Vignette. In small 8vo, 6s. cloth.

\* \* \* *This Work has been adopted as a Prize-book in the Schools of Art at South Kensington.*

"Much may be learned, even by those who fancy they do not require to be taught, from the careful perusal of this unpretending but comprehensive treatise."—*Art Journal*.

"Contains a large amount of original matter, agreeably conveyed, and will be found of value, as well by the young artist seeking information as by the general reader."—*Builder*.

### *Grammar of Colouring.*

A GRAMMAR OF COLOURING, applied to Decorative Painting and the Arts. By GEORGE FIELD. New edition, enlarged and adapted to the use of the Ornamental Painter and Designer, by ELLIS A. DAVIDSON. With new Coloured Diagrams and numerous Engravings on Wood. 12mo, 3s. 6d. cloth boards.

"One of the most useful of student's books, and probably the best known of the few we have on the subject."—*Architect*.

"The book is a most useful *résumé* of the properties of pigments."—*Builder*.

### *Geology and Genesis Harmonised.*

THE TWIN RECORDS of CREATION; or, Geology and Genesis, their Perfect Harmony and Wonderful Concord. By G. W. VICTOR LE VAUX. With numerous Illus. Fcap. 8vo, 5s. cl.

"We can recommend Mr. Le Vaux as an able and interesting guide to a popular appreciation of geological science."—*Spectator*.

### *Geology, Physical and Historical.*

A CLASS-BOOK of GEOLOGY, PHYSICAL and HISTORICAL. With more than 250 Woodcuts. By RALPH TATE, A.L.S., F.G.S. 12mo, 5s., cloth boards.

"The fulness of the matter has elevated the book into a manual."—*School Board Chronicle*.

### *Wood-Carving.*

INSTRUCTIONS in WOOD-CARVING, for Amateurs; with Hints on Design. By A LADY. In emblematic wrapper, handsomely printed, with Ten large Plates, 2s. 6d.

"The handicraft of the wood-carver, so well as a book can impart it, may be learnt from 'A Lady's' publication."—*Athenæum*.



*Delamotte's Works on Illumination & Alphabets.*

A PRIMER OF THE ART OF ILLUMINATION ; for the use of Beginners : with a Rudimentary Treatise on the Art, Practical Directions for its Exercise, and numerous Examples taken from Illuminated MSS., printed in Gold and Colours. By F. DELAMOTTE. Small 4to, 9s. Elegantly bound, cloth antique.

"A handy book, beautifully illustrated ; the text of which is well written, and calculated to be useful. . . . The examples of ancient MSS. recommended to the student, which, with much good sense, the author chooses from collections accessible to all, are selected with judgment and knowledge, as well as taste."—*Athenæum*.

ORNAMENTAL ALPHABETS, ANCIENT and MEDIÆVAL ; from the Eighth Century, with Numerals ; including Gothic, Church-Text, large and small, German, Italian, Arabesque, Initials for Illumination, Monograms, Crosses, &c. &c., for the use of Architectural and Engineering Draughtsmen, Missal Painters, Masons, Decorative Painters, Lithographers, Engravers, Carvers, &c. &c. &c. Collected and engraved by F. DELAMOTTE, and printed in Colours. Royal 8vo, oblong, 4s. cloth.

"A well-known engraver and draughtsman has enrolled in this useful book the result of many years' study and research. For those who insert enamelled sentences round gilded chalices, who blazon shop legends over shop-doors, who letter church walls with pithy sentences from the Decalogue, this book will be useful."—*Athenæum*.

EXAMPLES OF MODERN ALPHABETS, PLAIN and ORNAMENTAL ; including German, Old English, Saxon, Italic, Perspective, Greek, Hebrew, Court Hand, Engrossing, Tuscan, Riband, Gothic, Rustic, and Arabesque ; with several Original Designs, and an Analysis of the Roman and Old English Alphabets, large and small, and Numerals, for the use of Draughtsmen, Surveyors, Masons, Decorative Painters, Lithographers, Engravers, Carvers, &c. Collected and engraved by F. DELAMOTTE, and printed in Colours. Royal 8vo, oblong, 4s. cloth.

"To artists of all classes, but more especially to architects and engravers, this very handsome book will be invaluable. There is comprised in it every possible shape into which the letters of the alphabet and numerals can be formed, and the talent which has been expended in the conception of the various plain and ornamental letters is wonderful."—*Standard*.

MEDIÆVAL ALPHABETS AND INITIALS FOR ILLUMINATORS. By F. DELAMOTTE, Illuminator, Designer, and Engraver on Wood. Containing 21 Plates, and Illuminated Title, printed in Gold and Colours. With an Introduction by J. WILLIS BROOKS. Small 4to, 6s. cloth gilt.

"A volume in which the letters of the alphabet come forth glorified in gilding and all the colours of the prism interwoven and intertwined and intermingled, sometimes with a sort of rainbow arabesque. A poem emblazoned in these characters would be only comparable to one of those delicious love letters symbolized in a bunch of flowers well selected and cleverly arranged."—*Sun*.

THE EMBROIDERER'S BOOK OF DESIGN ; containing Initials, Emblems, Cyphers, Monograms, Ornamental Borders, Ecclesiastical Devices, Mediæval and Modern Alphabets, and National Emblems. Collected and engraved by F. DELAMOTTE, and printed in Colours. Oblong royal 8vo, 2s. 6d. in ornamental boards.



## AGRICULTURE, &c.

### *Youatt and Burn's Complete Grazier.*

THE COMPLETE GRAZIER, and FARMER'S and CATTLE-BREEDER'S ASSISTANT. A Compendium of Husbandry. By WILLIAM YOUATT, ESQ., V.S. 12th Edition, enlarged by ROBERT SCOTT BURN, Author of "The Lessons of My Farm," &c. One large 8vo volume, 860 pp. with 244 Illustrations. 17. 1s. half-bd.

"The standard and text-book, with the farmer and grazier."—*Farmer's Magazine*.

"A treatise which will remain a standard work on the subject as long as British agriculture endures."—*Mark Lane Express*.

### *Spooner on Sheep.*

SHEEP; THE HISTORY, STRUCTURE, ECONOMY, AND DISEASES OF. By W. C. SPOONER, M.R.V.C., &c. Third Edition, considerably enlarged; with numerous fine engravings, including some specimens of New and Improved Breeds. Fcp. 8vo, 366 pp., 6s. cloth.

"The book is decidedly the best of the kind in our language."—*Scotsman*.

"Mr. Spooner has conferred upon the agricultural class a lasting benefit by embodying in this work the improvements made in sheep stock by such men as Humphreys, Rawlence, Howard, and others."—*Hampshire Advertiser*.

"The work should be in possession of every flock-master."—*Banbury Guardian*.

### *Scott Burn's System of Modern Farming.*

OUTLINES OF MODERN FARMING. By R. SCOTT BURN. Soils, Manures, and Crops—Farming and Farming Economy—Cattle, Sheep, and Horses—Management of the Dairy, Pigs, and Poultry—Utilisation of Town-Sewage, Irrigation, &c. New Edition. In 1 vol. 1250 pp., half-bound, profusely illustrated, 12s.

"There is sufficient stated within the limits of this treatise to prevent a farmer from going far wrong in any of his operations."—*Observer*.

### *Good Gardening.*

A PLAIN GUIDE TO GOOD GARDENING; or, How to Grow Vegetables, Fruits, and Flowers. With Practical Notes on Soils, Manures, Seeds, Planting, Laying-out of Gardens and Grounds, &c. By S. WOOD. Second Edition, with considerable Additions, &c., and numerous Illustrations. Cr. 8vo, 5s., cloth.

"A very good book, and one to be highly recommended as a practical guide. The practical directions are excellent."—*Athenæum*.

"A thoroughly useful guidebook for the amateur gardener who may want to make his plot of land not merely pretty, but useful and profitable."—*Daily Telegraph*.

### *Profitable Gardening.*

MULTUM-IN-PARVO GARDENING; or, How to make One Acre of Land produce £620 a year, by the Cultivation of Fruits and Vegetables; also, How to Grow Flowers in Three Glass Houses, so as to realise £176 per annum clear Profit. By SAMUEL WOOD, Author of "Good Gardening," &c. 2nd Edition, revised. With Wood Engravings. Cr. 8vo, 2s., cloth. [Just Published.

"We are bound to recommend it as not only suited to the case of the amateur and gentleman's gardener, but to the market grower."—*Gardener's Magazine*.

### *Horton's Underwood and Woodland Tables.*

TABLES FOR PLANTING and Valuing Underwood and Woodland. By R. HORTON. 12mo., 2s. bound.



*Donaldson and Burn's Suburban Farming.*

SUBURBAN FARMING. A Treatise on the Laying Out and Cultivation of Farms, adapted to the produce of Milk, Butter and Cheese, Eggs, Poultry, and Pigs. By the late Professor JOHN DONALDSON. With considerable Additions, Illustrating the more Modern Practice by ROBERT SCOTT BURN. With numerous Illustrations. Crown 8vo, 6s., cloth. [*Just Published.*]

"An admirable treatise on all matters connected with the laying-out and cultivation of dairy farms."—*Live Stock Journal.*

*Ewart's Land Improver's Pocket-Book.*

THE LAND IMPROVER'S POCKET-BOOK OF FORMULÆ, TABLES, and MEMORANDA, required in any Computation relating to the Permanent Improvement of Landed Property. By JOHN EWART, Land Surveyor and Agricultural Engineer. Royal 32mo, oblong, leather, gilt edges, with elastic band, 4s.

"Admirably calculated to serve its purpose."—*Scotsman.*

"A compendious and handy little volume."—*Spectator.*


*Hudson's Tables for Land Valuers.*

THE LAND VALUER'S BEST ASSISTANT: being Tables, on a very much improved Plan, for Calculating the Value of Estates. With Tables for reducing Scotch, Irish, and Provincial Customary Acres to Statute Measure; also, Tables of Square Measure, and of the Dimensions of an Acre by which the Contents of any Plot of Ground may be ascertained without the expense of a regular Survey; &c. By R. HUDSON, C.E. New Edition, royal 32mo, oblong, leather, gilt edges, with elastic band, 4s.

"Of incalculable value to country gentlemen and professional men."—*Farmer's Journal.*

*Complete Agricultural Surveyor's Pocket-Book.*

THE LAND VALUER'S AND LAND IMPROVER'S COMPLETE POCKET-BOOK; consisting of the above two works bound together, leather, gilt edges, with strap, 7s. 6d.

 *The above forms an unequalled and most compendious Pocket Vade-mecum for the Land Agent and Agricultural Engineer.*

"We consider Hudson's book to be the best ready-reckoner on matters relating to the valuation of land and crops we have ever seen, and its combination with Mr. Ewart's work greatly enhances the value and usefulness of the latter-mentioned . . . It is most useful as a manual for reference."—*North of England Farmer.*

*The Management of Estates.*

LANDED ESTATES MANAGEMENT: Treating of the Varieties of Lands, Peculiarities of its Farms, Methods of Farming, the Setting-out of Farms and their Fields, Construction of Roads, Fences, Gates, and Farm Buildings, of Waste or Unproductive Lands, Irrigation, Drainage, Plantation, &c. By R. SCOTT BURN, Fcp. 8vo. numerous Illustrations, 3s. 6d.

*Scott Burn's Introduction to Farming.*

THE LESSONS of MY FARM: a Book for Amateur Agriculturists, being an Introduction to Farm Practice, in the Culture of Crops, the Feeding of Cattle, Management of the Dairy, Poultry, Pigs, &c. By R. SCOTT BURN. With numerous Illus. Fcp. 6s. cl.

"A complete introduction to the whole round of farming practice."—*John Bull.*



*"A Complete Epitome of the Laws of this Country."*

EVERY MAN'S OWN LAWYER; a Handy-Book of the Principles of Law and Equity. By A BARRISTER. 15th Edition, Revised to the end of last Session. Including a Summary of the Judicature Acts, and the principal Acts of the past Session, viz.—The Canal Boats' Act, The Destructive Insects' (or Colorado Beetle) Act, The Fisheries' (Oyster, Crab, and Lobster) Act, and the Fisheries' (Dynamite) Act, &c., &c. With Notes and References to the Authorities. Crown 8vo, price 6s. 8d. (saved at every consultation), strongly bound.

COMPRISING THE LAWS OF

BANKRUPTCY—BILLS OF EXCHANGE—CONTRACTS AND AGREEMENTS—COPYRIGHT—DOWER AND DIVORCE—ELECTIONS AND REGISTRATION—INSURANCE—LIBEL AND SLANDER—MORTGAGES—SETTLEMENTS—STOCK EXCHANGE PRACTICE—TRADE MARKS AND PATENTS—TRESPASS, NUISANCES, ETC.—TRANSFER OF LAND, ETC.—WARRANTY—WILLS AND AGREEMENTS, ETC. Also Law for Landlord and Tenant—Master and Servant—Workmen and Apprentices—Heirs, Devisees, and Legatees—Husband and Wife—Executors and Trustees—Guardian and Ward—Married Women and Infants—Partners and Agents—Lender and Borrower—Debtor and Creditor—Purchaser and Vendor—Companies and Associations—Friendly Societies—Clergymen, Churchwardens—Medical Practitioners, &c.—Bankers—Farmers—Contractors—Stock and Share Brokers—Sportsmen and Gamekeepers—Farriers and Horse-Dealers—Auctioneers, House-Agents—Innkeepers, &c.—Pawnbrokers—Surveyors—Railways and Carriers, &c. &c.

"No Englishman ought to be without this book."—*Engineer*.

"What it professes to be—a complete epitome of the laws of this country, thoroughly intelligible to non-professional readers."—*Bell's Life*.

*Auctioneer's Assistant.*

THE APPRAISER, AUCTIONEER, BROKER, HOUSE AND ESTATE AGENT, AND VALUER'S POCKET ASSISTANT, for the Valuation for Purchase, Sale, or Renewal of Leases, Annuities, and Reversions, and of property generally; with Prices for Inventories, &c. By JOHN WHEELER, Valuer, &c. Fourth Edition, enlarged, by C. NORRIS. Royal 32mo, cloth, 5s.

"A neat and concise book of reference, containing an admirable and clearly-arranged list of prices for inventories, and a very practical guide to determine the value of furniture, &c."—*Standard*.

*Pawnbroker's Legal Guide.*

THE PAWNBROKER'S, FACTOR'S, and MERCHANT'S GUIDE to the LAW of LOANS and PLEDGES. By H. C. FOLKARD, Esq., Barrister-at-Law, Author of the "Law of Slander and Libel," &c. With Additions and Corrections to 1876. 12mo, cloth boards, 3s. 6d.

*House Property.*

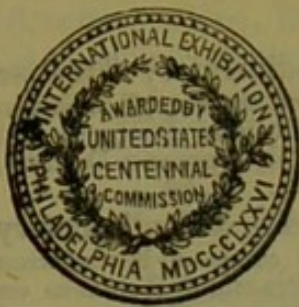
HANDBOOK OF HOUSE PROPERTY: a Popular and Practical Guide to the Purchase, Mortgage, Tenancy, and Compulsory Sale of Houses and Land; including the Law of Dilapidations and Fixtures; with Explanations and Examples of all kinds of Valuations, and useful Information and Advice on Building. By EDWARD LANCE TARBUCK, Architect and Surveyor. 12mo, 5s. cloth boards.

"We are glad to be able to recommend it."—*Builder*.

"The advice is thoroughly practical."—*Law Journal*.



# Weale's Rudimentary Series



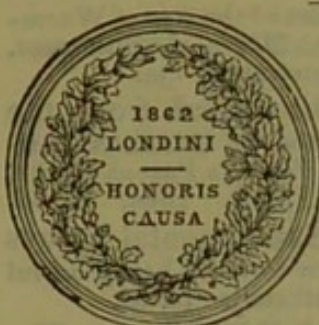
PHILADELPHIA, 1876.  
THE PRIZE MEDAL

Was awarded to the Publishers for  
Books: Rudimentary Scientific,  
"WEALE'S SERIES," ETC.



## A NEW LIST OF WEALE'S SERIES

RUDIMENTARY SCIENTIFIC, EDUCATIONAL,  
AND CLASSICAL.



LONDON, 1862.  
THE PRIZE MEDAL

Was awarded to the Publishers of  
"WEALE'S SERIES."



*These popular and cheap Series of Books, now comprising nearly Three Hundred distinct works in almost every department of Science, Art, and Education, are recommended to the notice of Engineers, Architects, Builders, Artisans, and Students generally, as well as to those interested in Workmen's Libraries, Free Libraries, Literary and Scientific Institutions, Colleges, Schools, Science Classes, &c., &c.*

*N.B.—In ordering from this List it is recommended, as a means of facilitating business and obviating error, to quote the numbers affixed to the volumes, as well as the titles and prices.*

*\*\* The books are bound in limp cloth, unless otherwise stated.*

## RUDIMENTARY SCIENTIFIC SERIES.

### ARCHITECTURE, BUILDING, ETC.

No.

16. *ARCHITECTURE—ORDERS*—The Orders and their Æsthetic Principles. By W. H. LEEDS. Illustrated. 1s. 6d.

17. *ARCHITECTURE—STYLES*—The History and Description of the Styles of Architecture of Various Countries, from the Earliest to the Present Period. By T. TALBOT BURY, F.R.I.B.A., &c. Illustrated. 2s.

*\*\* ORDERS AND STYLES OF ARCHITECTURE, in One Vol., 3s. 6d.*

18. *ARCHITECTURE—DESIGN*—The Principles of Design in Architecture, as deducible from Nature and exemplified in the Works of the Greek and Gothic Architects. By E. L. GARBETT, Architect. Illustrated. 2s.

*\*\* The three preceding Works, in One handsome Vol., half bound, entitled "MODERN ARCHITECTURE," Price 6s.*

22. *THE ART OF BUILDING*, Rudiments of. General Principles of Construction, Materials used in Building, Strength and Use of Materials, Working Drawings, Specifications, and Estimates. By EDWARD DOBSON, M.R.I.B.A., &c. Illustrated. 2s.

23. *BRICKS AND TILES*, Rudimentary Treatise on the Manufacture of; containing an Outline of the Principles of Brickmaking. By EDW. DOBSON, M.R.I.B.A. With Additions by C. TOMLINSON, F.R.S. Illustrated, 3s.

GROSBY LOCKWOOD AND CO., 7, STATIONERS' HALL COURT, E.C.



Architecture, Building, etc., *continued.*

25. *MASONRY AND STONECUTTING*, Rudimentary Treatise on; in which the Principles of Masonic Projection and their application to the Construction of Curved Wing-Walls, Domes, Oblique Bridges, and Roman and Gothic Vaulting, are concisely explained. By EDWARD DOBSON, M.R.I.B.A., &c. Illustrated with Plates and Diagrams. 2s. 6d.
44. *FOUNDATIONS AND CONCRETE WORKS*, a Rudimentary Treatise on; containing a Synopsis of the principal cases of Foundation Works, with the usual Modes of Treatment, and Practical Remarks on Footings, Planking, Sand, Concrete, Béton, Pile-driving, Caissons, and Cofferdams. By E. DOBSON, M.R.I.B.A., &c. Fourth Edition, revised by GEORGE DODD, C.E. Illustrated. 1s. 6d.
42. *COTTAGE BUILDING*. By C. BRUCE ALLEN, Architect. Eleventh Edition, revised and enlarged. Numerous Illustrations. 1s. 6d.
45. *LIMES, CEMENTS, MORTARS, CONCRETES, MASTICS, PLASTERING, &c.* By G. R. BURNELL, C.E. Ninth Edition. 1s. 6d.
57. *WARMING AND VENTILATION*, a Rudimentary Treatise on; being a concise Exposition of the General Principles of the Art of Warming and Ventilating Domestic and Public Buildings, Mines, Lighthouses, Ships, &c. By CHARLES TOMLINSON, F.R.S., &c. Illustrated. 3s.
- 83\*\* . *CONSTRUCTION OF DOOR LOCKS*. Compiled from the Papers of A. C. HOBBS, Esq., of New York, and Edited by CHARLES TOMLINSON, F.R.S. To which is added, a Description of Fenby's Patent Locks, and a Note upon IRON SAFES by ROBERT MALLET, M.I.C.E. Illus. 2s. 6d.
- III. *ARCHES, PIERS, BUTTRESSES, &c.*: Experimental Essays on the Principles of Construction in; made with a view to their being useful to the Practical Builder. By WILLIAM BLAND. Illustrated. 1s. 6d.
116. *THE ACOUSTICS OF PUBLIC BUILDINGS*; or, The Principles of the Science of Sound applied to the purposes of the Architect and Builder. By T. ROGER SMITH, M.R.I.B.A., Architect. Illustrated. 1s. 6d.
124. *CONSTRUCTION OF ROOFS*, Treatise on the, as regards Carpentry and Joinery. Deduced from the Works of ROBISON, PRICE, and TREDGOLD. Illustrated. 1s. 6d.
127. *ARCHITECTURAL MODELLING IN PAPER*, the Art of. By T. A. RICHARDSON, Architect. Illustrated. 1s. 6d.
128. *VITRUVIUS—THE ARCHITECTURE OF MARCUS VITRUVIUS POLLO*. In Ten Books. Translated from the Latin by JOSEPH GWILT, F.S.A., F.R.A.S. With 23 Plates. 5s.
130. *GRECIAN ARCHITECTURE*, An Inquiry into the Principles of Beauty in; with a Historical View of the Rise and Progress of the Art in Greece. By the EARL OF ABERDEEN. 1s.
- \*\* The two Preceding Works in One handsome Vol., half bound, entitled "ANCIENT ARCHITECTURE." Price 6s.
132. *DWELLING-HOUSES*, a Rudimentary Treatise on the Erection of. By S. H. BROOKS, Architect. New Edition, with Plates. 2s. 6d.
156. *QUANTITIES AND MEASUREMENTS*, How to Calculate and Take them in Bricklayers', Masons', Plasterers', Plumbers', Painters', Paper-hangers', Gilders', Smiths', Carpenters', and Joiners' Work. By A. C. BEATON, Architect and Surveyor. New and Enlarged Edition. Illus. 1s. 6d.
175. *LOCKWOOD & CO.'S BUILDER'S AND CONTRACTOR'S PRICE BOOK*, for 1878, containing the latest Prices of all kinds of Builders' Materials and Labour, and of all Trades connected with Building: Lists of the Members of the Metropolitan Board of Works, of Districts, District Officers, and District Surveyors, and the Metropolitan Bye-laws. Edited by FRANCIS T. W. MILLER, Architect and Surveyor. 3s. 6d.
182. *CARPENTRY AND JOINERY—THE ELEMENTARY PRINCIPLES OF CARPENTRY*. Chiefly composed from the Standard Work of THOMAS TREDGOLD, C.E. With Additions from the Works of the most Recent Authorities, and a TREATISE ON JOINERY by E. WYNDHAM TARN, M.A. Numerous Illustrations. 3s. 6d.



Architecture, Building, etc., *continued.*

- 182\*. *CARPENTRY AND JOINERY. ATLAS* of 35 Plates to accompany the foregoing book. With Descriptive Letterpress. 4to. 6s.
187. *HINTS TO YOUNG ARCHITECTS.* By GEORGE WIGHTWICK. New, Revised, and enlarged Edition. By G. HUSKISSON GUILLAUME, Architect. With numerous Woodcuts. 3s. 6d.
188. *HOUSE PAINTING, GRAINING, MARBLING, AND SIGN WRITING: A Practical Manual of.* With 9 Coloured Plates of Woods and Marbles, and nearly 150 Wood Engravings. By ELLIS A. DAVIDSON. Second Edition, carefully revised, 5s. [*Just published.*]
189. *THE RUDIMENTS OF PRACTICAL BRICKLAYING.* In Six Sections: General Principles; Arch Drawing, Cutting, and Setting; Pointing; Paving, Tiling, Materials; Slating and Plastering; Practical Geometry, Mensuration, &c. By ADAM HAMMOND. Illustrated. 1s. 6d.
191. *PLUMBING. A Text-Book to the Practice of the Art or Craft of the Plumber.* With Chapters upon House Drainage, embodying the latest Improvements. Containing about 300 Illustrations. By W. P. BUCHAN, Sanitary Engineer. 3s. [*Just published.*]
192. *THE TIMBER IMPORTER'S, TIMBER MERCHANT'S, and BUILDER'S STANDARD GUIDE; comprising copious and valuable Memoranda for the Retailer and Builder.* By RICHARD E. GRANDY. Second Edition, Revised. 3s.

## CIVIL ENGINEERING, ETC.

13. *CIVIL ENGINEERING, the Rudiments of; for the Use of Beginners, for Practical Engineers, and for the Army and Navy.* By HENRY LAW, C.E. Including a Section on Hydraulic Engineering, by GEORGE R. BURNELL, C.E. 5th Edition, with Notes and Illustrations by ROBERT MALLET, A.M., F.R.S. Illustrated with Plates and Diagrams. 5s.
29. *THE DRAINAGE OF DISTRICTS AND LANDS.* By G. DRYSDALE DEMPSEY, C.E. New Edition, enlarged. Illustrated. 1s. 6d.
30. *THE DRAINAGE OF TOWNS AND BUILDINGS.* By G. DRYSDALE DEMPSEY, C.E. New Edition. Illustrated. 2s. 6d.  
\*\* With "*Drainage of Districts and Lands,*" in *One Vol.*, 3s. 6d.
31. *WELL-DIGGING, BORING, AND PUMP-WORK.* By JOHN GEORGE SWINDELL, Assoc. R.I.B.A. New Edition, revised by G. R. BURNELL, C.E. Illustrated. 1s. 6d.
35. *THE BLASTING AND QUARRYING OF STONE,* for Building and other Purposes. With Remarks on the Blowing up of Bridges. By Gen. Sir JOHN BURGoyNE, Bart., K.C.B. Illustrated. 1s. 6d.
43. *TUBULAR AND OTHER IRON GIRDER BRIDGES.* Particularly describing the BRITANNIA and CONWAY TUBULAR BRIDGES. With a Sketch of Iron Bridges, and Illustrations of the Application of Malleable Iron to the Art of Bridge Building. By G. D. DEMPSEY, C.E. New Edition, with Illustrations. 1s. 6d.
62. *RAILWAY CONSTRUCTION, Elementary and Practical Instruction on.* By Sir MACDONALD STEPHENSON, C.E. New Edition, enlarged by EDWARD NUGENT, C.E. Plates and numerous Woodcuts. 3s.
- 80\*. *EMBANKING LANDS FROM THE SEA, the Practice of.* Treated as a Means of Profitable Employment for Capital. With Examples and Particulars of actual Embankments, and also Practical Remarks on the Repair of old Sea Walls. By JOHN WIGGINS, F.G.S. New Edition, with Notes by ROBERT MALLET, F.R.S. 2s.
81. *WATER WORKS, for the Supply of Cities and Towns.* With a Description of the Principal Geological Formations of England as influencing Supplies of Water; and Details of Engines and Pumping Machinery for raising Water. By SAMUEL HUGHES, F.G.S., C.E. New Edition, revised and enlarged, with numerous Illustrations. 4s.
- 82\*\*. *GAS WORKS, and the Practice of Manufacturing and Distributing Coal Gas.* By SAMUEL HUGHES, C.E. New Edition, revised by W. RICHARDS, C.E. Illustrated. 3s. 6d.



Civil Engineering, etc., *continued.*

117. *SUBTERRANEAN SURVEYING*; an Elementary and Practical Treatise on. By THOMAS FENWICK. Also the Method of Conducting Subterranean Surveys without the Use of the Magnetic Needle, and other modern Improvements. By THOMAS BAKER, C.E. Illustrated. 2s. 6d.
118. *CIVIL ENGINEERING IN NORTH AMERICA*, a Sketch of. By DAVID STEVENSON, F.R.S.E., &c. Plates and Diagrams. 3s.
121. *RIVERS AND TORRENTS*. With the Method of Regulating their Courses and Channels. By Professor PAUL FRISI, F.R.S., of Milan. To which is added, AN ESSAY ON NAVIGABLE CANALS. Translated by Major-General JOHN GARSTIN, of the Bengal Engineers. Plates. 2s. 6d.
197. *ROADS AND STREETS (THE CONSTRUCTION OF)*, in two Parts: I. THE ART OF CONSTRUCTING COMMON ROADS, by HENRY LAW, C.E., revised and condensed by D. KINNEAR CLARK, C.E.; II. RECENT PRACTICE IN THE CONSTRUCTION OF ROADS AND STREETS, including pavements of Stone, Wood, and Asphalte, by D. K. CLARK, M.I.C.E., with numerous Illustrations. 4s. 6d. *[Just published.]*

## MECHANICAL ENGINEERING, ETC.

33. *CRANES*, the Construction of, and other Machinery for Raising Heavy Bodies for the Erection of Buildings, and for Hoisting Goods. By JOSEPH GLYNN, F.R.S., &c. Illustrated. 1s. 6d.
34. *THE STEAM ENGINE*, a Rudimentary Treatise on. By Dr. LARDNER. Illustrated. 1s. 6d.
59. *STEAM BOILERS*: their Construction and Management. By R. ARMSTRONG, C.E. Illustrated. 1s. 6d.
63. *AGRICULTURAL ENGINEERING*: Farm Buildings, Motive Power, Field Machines, Machinery, and Implements. By G. H. ANDREWS, C.E. Illustrated. 3s.
67. *CLOCKS, WATCHES, AND BELLS*, a Rudimentary Treatise on. By Sir EDMUND BECKETT (late EDMUND BECKETT DENISON, LL.D., Q.C.). A new, Revised, and considerably Enlarged Edition (the 6th), with very numerous Illustrations. 4s. 6d. *[Just published.]*
- 77\*. *THE ECONOMY OF FUEL*, particularly with Reference to Reverberatory Furnaces for the Manufacture of Iron, and to Steam Boilers. By T. SYMES PRIDEAUX. 1s. 6d.
82. *THE POWER OF WATER*, as applied to drive Flour Mills, and to give motion to Turbines and other Hydrostatic Engines. By JOSEPH GLYNN, F.R.S., &c. New Edition, Illustrated. 2s.
98. *PRACTICAL MECHANISM*, the Elements of; and Machine Tools. By T. BAKER, C.E. With Remarks on Tools and Machinery, by J. NASMYTH, C.E. Plates. 2s. 6d.
114. *MACHINERY*, Elementary Principles of, in its Construction and Working. Illustrated by numerous Examples of Modern Machinery for different Branches of Manufacture. By C. D. ABEL, C.E. 1s. 6d.
15. *ATLAS OF PLATES*. Illustrating the above Treatise. By C. D. ABEL, C.E. 7s. 6d.
125. *THE COMBUSTION OF COAL AND THE PREVENTION OF SMOKE*, Chemically and Practically Considered. With an Appendix. By C. WYB WILLIAMS, A.I.C.E. Plates. 3s.
139. *THE STEAM ENGINE*, a Treatise on the Mathematical Theory of, with Rules at length, and Examples for the Use of Practical Men. By T. BAKER, C.E. Illustrated. 1s. 6d.
162. *THE BRASS FOUNDER'S MANUAL*; Instructions for Modelling, Pattern-Making, Moulding, Turning, Filing, Burnishing, Bronzing, &c. With copious Receipts, numerous Tables, and Notes on Prime Costs and Estimates. By WALTER GRAHAM. Illustrated. 2s. 6d.
164. *MODERN WORKSHOP PRACTICE*, as applied to Marine, Land, and Locomotive Engines, Floating Docks, Dredging Machines, Bridges, Cranes, Ship-building, &c., &c. By J. G. WINTON. Illustrated. 3s.



Mechanical Engineering, etc., *continued.*

165. *IRON AND HEAT*, exhibiting the Principles concerned in the Construction of Iron Beams, Pillars, and Bridge Girders, and the Action of Heat in the Smelting Furnace. By J. ARMOUR, C.E. 2s. 6d.
166. *POWER IN MOTION: Horse-Power, Motion, Toothed-Wheel Gearing, Long and Short Driving Bands, Angular Forces.* By JAMES ARMOUR, C.E. With 73 Diagrams. 2s. 6d.
167. *THE APPLICATION OF IRON TO THE CONSTRUCTION OF BRIDGES, GIRDERS, ROOFS, AND OTHER WORKS.* By FRANCIS CAMPIN, C.E. Second Edition, revised and corrected. Numerous Woodcuts. 2s. 6d.
171. *THE WORKMAN'S MANUAL OF ENGINEERING DRAWING.* By JOHN MAXTON, Engineer, Instructor in Engineering Drawing, Royal Naval College, Greenwich. Third Edition. Illustrated with 7 Plates and nearly 350 Woodcuts. 3s. 6d.
190. *STEAM AND THE STEAM ENGINE*, Stationary and Portable. Being an extension of Mr. John Sewell's "Treatise on Steam." By D. KINNEAR CLARK, M.I.C.E., Author of "Railway Machinery," &c., &c. With numerous Illustrations. 3s. 6d.

SHIPBUILDING, NAVIGATION, MARINE  
ENGINEERING, ETC.

51. *NAVAL ARCHITECTURE*, the Rudiments of; or, an Exposition of the Elementary Principles of the Science, and their Practical Application to Naval Construction. Compiled for the Use of Beginners. By JAMES PEAKE, School of Naval Architecture, H.M. Dockyard, Portsmouth. Fourth Edition, corrected, with Plates and Diagrams. 3s. 6d.
- 53\*. *SHIPS FOR OCEAN AND RIVER SERVICE*, Elementary and Practical Principles of the Construction of. By HAKON A. SOMMERFELDT, Surveyor of the Royal Norwegian Navy. With an Appendix. 1s.
- 53\*\*. *AN ATLAS OF ENGRAVINGS* to Illustrate the above. Twelve large folding plates. Royal 4to, cloth. 7s. 6d.
54. *MASTING, MAST-MAKING, AND RIGGING OF SHIPS*, Rudimentary Treatise on. Also Tables of Spars, Rigging, Blocks; Chain, Wire, and Hemp Ropes, &c., relative to every class of vessels. Together with an Appendix of Dimensions of Masts and Yards of the Royal Navy of Great Britain and Ireland. By ROBERT KIPPING, N.A. Fourteenth Edition. Illustrated. 2s.
- 54\*. *IRON SHIP-BUILDING.* With Practical Examples and Details for the Use of Ship Owners and Ship Builders. By JOHN GRANTHAM, Consulting Engineer and Naval Architect. 5th Edition, with Additions. 4s.
- 54\*\*. *AN ATLAS OF FORTY PLATES* to Illustrate the above. Fifth Edition. Including the latest Examples, such as H.M. Steam Frigates "Warrior," "Hercules," "Bellerophon;" H.M. Troop Ship "Serapis," Iron Floating Dock, &c., &c. 4to, boards. 38s.
55. *THE SAILOR'S SEA BOOK: a Rudimentary Treatise on Navigation.* I. How to Keep the Log and Work it off. II. On Finding the Latitude and Longitude. By JAMES GREENWOOD, B.A., of Jesus College, Cambridge. To which are added, Directions for Great Circle Sailing; an Essay on the Law of Storms and Variable Winds; and Explanations of Terms used in Ship-building. Ninth Edition, with several Engravings and Coloured Illustrations of the Flags of Maritime Nations. 2s.
80. *MARINE ENGINES, AND STEAM VESSELS*, a Treatise on. Together with Practical Remarks on the Screw and Propelling Power, as used in the Royal and Merchant Navy. By ROBERT MURRAY, C.E., Engineer-Surveyor to the Board of Trade. With a Glossary of Technical Terms, and their Equivalents in French, German, and Spanish. Fifth Edition, revised and enlarged. Illustrated. 3s.



Shipbuilding, Navigation, etc., *continued.*

- 83*bis.* *THE FORMS OF SHIPS AND BOATS*: Hints, Experimentally Derived, on some of the Principles regulating Ship-building. By W. BLAND. Sixth Edition, revised, with numerous Illustrations and Models. 1s. 6d.
99. *NAVIGATION AND NAUTICAL ASTRONOMY*, in Theory and Practice. With Attempts to facilitate the Finding of the Time and the Longitude at Sea. By J. R. YOUNG, formerly Professor of Mathematics in Belfast College. Illustrated. 2s. 6d.
- 100\*. *TABLES* intended to facilitate the Operations of Navigation and Nautical Astronomy, as an Accompaniment to the above Book. By J. R. YOUNG. 1s. 6d.
106. *SHIPS' ANCHORS*, a Treatise on. By GEORGE COTSELL, N.A. Illustrated. 1s. 6d.
149. *SAILS AND SAIL-MAKING*, an Elementary Treatise on. With Draughting, and the Centre of Effort of the Sails. Also, Weights and Sizes of Ropes; Mastng, Rigging, and Sails of Steam Vessels, &c., &c. Tenth Edition, enlarged, with an Appendix. By ROBERT KIPPING, N.A., Sailmaker, Quayside, Newcastle. Illustrated. 2s. 6d.
155. *THE ENGINEER'S GUIDE TO THE ROYAL AND MERCANTILE NAVIES*. By a PRACTICAL ENGINEER. Revised by D. F. M'CARTHY, late of the Ordnance Survey Office, Southampton. 3s.

## PHYSICAL SCIENCE, NATURAL PHILOSOPHY, ETC.

1. *CHEMISTRY*, for the Use of Beginners. By Professor GEORGE FOWNES, F.R.S. With an Appendix, on the Application of Chemistry to Agriculture. 1s.
2. *NATURAL PHILOSOPHY*, Introduction to the Study of; for the Use of Beginners. By C. TOMLINSON, Lecturer on Natural Science in King's College School, London. Woodcuts. 1s. 6d.
4. *MINERALOGY*, Rudiments of; a concise View of the Properties of Minerals. By A. RAMSAY, Jun. Woodcuts and Steel Plates. 3s.
6. *MECHANICS*, Rudimentary Treatise on; being a concise Exposition of the General Principles of Mechanical Science, and their Applications. By CHARLES TOMLINSON, Lecturer on Natural Science in King's College School, London. Illustrated. 1s. 6d.
7. *ELECTRICITY*; showing the General Principles of Electrical Science, and the purposes to which it has been applied. By Sir W. SNOW HARRIS, F.R.S., &c. With considerable Additions by R. SABINE, C.E., F.S.A. Woodcuts. 1s. 6d.
- 7\*. *GALVANISM*, Rudimentary Treatise on, and the General Principles of Animal and Voltaic Electricity. By Sir W. SNOW HARRIS. New Edition, revised, with considerable Additions, by ROBERT SABINE, C.E., F.S.A. Woodcuts. 1s. 6d.
8. *MAGNETISM*; being a concise Exposition of the General Principles of Magnetical Science, and the Purposes to which it has been applied. By Sir W. SNOW HARRIS. New Edition, revised and enlarged by H. M. NOAD, Ph.D., Vice-President of the Chemical Society, Author of "A Manual of Electricity," &c., &c. With 165 Woodcuts. 3s. 6d.
1. *THE ELECTRIC TELEGRAPH*; its History and Progress; with Descriptions of some of the Apparatus. By R. SABINE, C.E., F.S.A., &c. Woodcuts. 3s.
12. *PNEUMATICS*, for the Use of Beginners. By CHARLES TOMLINSON. Illustrated. 1s. 6d.
72. *MANUAL OF THE MOLLUSCA*; a Treatise on Recent and Fossil Shells. By Dr. S. P. WOODWARD, A.L.S. With Appendix by RALPH TATE, A.L.S., F.G.S. With numerous Plates and 300 Woodcuts, 6s. 6d. Cloth boards, 7s. 6d.



Physical Science, Natural Philosophy, etc., *continued.*

- 79\*\*. *PHOTOGRAPHY*, Popular Treatise on; with a Description of the Stereoscope, &c. Translated from the French of D. VAN MONCKHOVEN, by W. H. THORNTHWAITTE, Ph.D. Woodcuts. 1s. 6d.
96. *ASTRONOMY*. By the Rev. R. MAIN, M.A., F.R.S., &c. New and enlarged Edition, with an Appendix on "Spectrum Analysis." Woodcuts. 1s. 6d.
97. *STATICS AND DYNAMICS*, the Principles and Practice of; embracing also a clear development of Hydrostatics, Hydrodynamics, and Central Forces. By T. BAKER, C.E. 1s. 6d.
138. *TELEGRAPH*, Handbook of the; a Manual of Telegraphy, Telegraph Clerks' Remembrancer, and Guide to Candidates for Employment in the Telegraph Service. By R. BOND. Fourth Edition, revised and enlarged: to which is appended, QUESTIONS on MAGNETISM, ELECTRICITY, and PRACTICAL TELEGRAPHY, for the Use of Students, by W. MCGREGOR, First Assistant Superintendent, Indian Gov. Telegraphs. Woodcuts. 3s.
143. *EXPERIMENTAL ESSAYS*. By CHARLES TOMLINSON. I. On the Motions of Camphor on Water. II. On the Motion of Camphor towards the Light. III. History of the Modern Theory of Dew. Woodcuts. 1s.
173. *PHYSICAL GEOLOGY*, partly based on Major-General PORTLOCK's "Rudiments of Geology." By RALPH TATE, A.L.S., &c. Numerous Woodcuts. 2s.
174. *HISTORICAL GEOLOGY*, partly based on Major-General PORTLOCK's "Rudiments." By RALPH TATE, A.L.S., &c. Woodcuts. 2s. 6d.
- 173 & 174. *RUDIMENTARY TREATISE ON GEOLOGY*, Physical and Historical. Partly based on Major-General PORTLOCK's "Rudiments of Geology." By RALPH TATE, A.L.S., F.G.S., &c., &c. Numerous Illustrations. In One Volume. 4s. 6d.
183. *ANIMAL PHYSICS*, Handbook of. By DIONYSIUS LARDNER, & D.C.L., formerly Professor of Natural Philosophy and Astronomy in University College, London. With 520 Illustrations. In One Volume, cloth boards. 7s. 6d.
184. *ANIMAL PHYSICS*. By Dr. LARDNER. Part I., Chapter I—VII. 4s.
184. *ANIMAL PHYSICS*. By Dr. LARDNER. Part II. Chapter VIII—XVIII. 3s.

\*\* Sold also in Two Parts, as follows:—

183. *ANIMAL PHYSICS*. By Dr. LARDNER. Part I., Chapter I—VII. 4s.
184. *ANIMAL PHYSICS*. By Dr. LARDNER. Part II. Chapter VIII—XVIII. 3s.

## MINING, METALLURGY, ETC.

117. *SUBTERRANEAN SURVEYING*, Elementary and Practical Treatise on, with and without the Magnetic Needle. By THOMAS FENWICK, Surveyor of Mines, and THOMAS BAKER, C.E. Illustrated. 2s. 6d.
133. *METALLURGY OF COPPER*; an Introduction to the Methods of Seeking, Mining, and Assaying Copper, and Manufacturing its Alloys. By ROBERT H. LAMBORN, Ph.D. Woodcuts. 2s. 6d.
134. *METALLURGY OF SILVER AND LEAD*. A Description of the Ores; their Assay and Treatment, and valuable Constituents. By Dr. R. H. LAMBORN. Woodcuts. 2s.
135. *ELECTRO-METALLURGY*; Practically Treated. By ALEXANDER WATT, F.R.S.S.A. New Edition, enlarged. Woodcuts. 2s. 6d.
172. *MINING TOOLS*, Manual of. For the Use of Mine Managers, Agents, Students, &c. Comprising Observations on the Materials from, and Processes by, which they are manufactured; their Special Uses, Applications, Qualities, and Efficiency. By WILLIAM MORGANS, Lecturer on Mining at the Bristol School of Mines. 2s. 6d.
- 172\*. *MINING TOOLS, ATLAS* of Engravings to Illustrate the above, containing 235 Illustrations of Mining Tools, drawn to Scale. 4to 4s. 6d.



Mining, Metallurgy, etc., *continued.*

176. *METALLURGY OF IRON*, a Treatise on the. Containing History of Iron Manufacture, Methods of Assay, and Analyses of Iron Ores, Processes of Manufacture of Iron and Steel, &c. By H. BAUERMAN, F.G.S. Fourth Edition, enlarged, with numerous Illustrations. 4s. 6d.
180. *COAL AND COAL MINING: A Rudimentary Treatise on.* By WARINGTON W. SMYTH, M.A., F.R.S., &c., Chief Inspector of the Mines of the Crown and of the Duchy of Cornwall. New Edition, revised and corrected. With numerous Illustrations. 3s. 6d.
195. *THE MINERAL SURVEYOR AND VALUER'S COMPLETE GUIDE*, with new Traverse Tables; and Descriptions of Improved Instruments; also the Correct Principles of Laying out and Valuing Mineral Properties. By WILLIAM LINTERN, Mining and Civil Engineer. With four Plates of Diagrams, Plans, &c. 3s. 6d. [*Now Ready.*]

## EMIGRATION.

154. *GENERAL HINTS TO EMIGRANTS.* Containing Notices of the various Fields for Emigration. With Hints on Preparation for Emigrating, Outfits, &c., &c. With Directions and Recipes useful to the Emigrant. With a Map of the World. 2s.
157. *THE EMIGRANT'S GUIDE TO NATAL.* By ROBERT JAMES MANN, F.R.A.S., F.M.S. Second Edition, carefully corrected to the present Date. Map. 2s.
159. *THE EMIGRANT'S GUIDE TO AUSTRALIA, New South Wales, Western Australia, South Australia, Victoria, and Queensland.* By the Rev. JAMES BAIRD, B.A. Map. 2s. 6d.
160. *THE EMIGRANT'S GUIDE TO TASMANIA and NEW ZEALAND.* By the Rev. JAMES BAIRD, B.A. With a Map. 2s.
- 159 & 160. *THE EMIGRANT'S GUIDE TO AUSTRALASIA.* By the Rev. J. BAIRD, B.A. Comprising the above two volumes, cloth boards. 5s.

## AGRICULTURE.

29. *THE DRAINAGE OF DISTRICTS AND LANDS.* By G. DRYSDALE DEMPSEY, C.E. Illustrated. 1s. 6d.  
\*.\* With "*Drainage of Towns and Buildings,*" in One Vol., 3s. 6d.
63. *AGRICULTURAL ENGINEERING: Farm Buildings, Motive Powers and Machinery of the Steading, Field Machines, and Implements.* By G. H. ANDREWS, C.E. Illustrated. 3s.
66. *CLAY LANDS AND LOAMY SOILS.* By Professor DONALDSON. 1s.
131. *MILLER'S, MERCHANT'S, AND FARMER'S READY RECKONER*, for ascertaining at sight the value of any quantity of Corn, from One Bushel to One Hundred Quarters, at any given price, from £1 to £5 per Qr. With approximate values of Millstones, Millwork, &c. 1s.
140. *SOILS, MANURES, AND CROPS.* (Vol. 1. OUTLINES OF MODERN FARMING.) By R. SCOTT BURN. Woodcuts. 2s.
141. *FARMING AND FARMING ECONOMY*, Notes, Historical and Practical, on. (Vol. 2. OUTLINES OF MODERN FARMING.) By R. SCOTT BURN. Woodcuts. 3s.
142. *STOCK; CATTLE, SHEEP, AND HORSES.* (Vol. 3. OUTLINES OF MODERN FARMING.) By R. SCOTT BURN. Woodcuts. 2s. 6d.
145. *DAIRY, PIGS, AND POULTRY*, Management of the. By R. SCOTT BURN. With Notes on the Diseases of Stock. (Vol. 4. OUTLINES OF MODERN FARMING.) Woodcuts. 2s.
146. *UTILIZATION OF SEWAGE, IRRIGATION, AND RECLAMATION OF WASTE LAND.* (Vol. 5. OUTLINES OF MODERN FARMING.) By R. SCOTT BURN. Woodcuts. 2s. 6d.
- \*.\* Nos. 140-1-2-5-6, in One Vol., handsomely half-bound, entitled "*OUTLINES OF MODERN FARMING.*" By ROBERT SCOTT BURN. Price 12s.
177. *FRUIT TREES*, The Scientific and Profitable Culture of. From the French of DU BREUIL, Revised by GEO. GLENNY. 187 Woodcuts. 3s. 6d.



## FINE ARTS.

20. *PERSPECTIVE FOR BEGINNERS*. Adapted to Young Students and Amateurs in Architecture, Painting, &c. By GEORGE PYNE, Artist. Woodcuts. 2s.
- 40 & 41. *GLASS STAINING*; or, Painting on Glass, The Art of. Comprising Directions for Preparing the Pigments and Fluxes, laying them upon the Glass, and Firing or Burning in the Colours. From the German of Dr. GESSERT. To which is added, an Appendix on THE ART OF ENAMELLING, &c., with THE ART OF PAINTING ON GLASS. From the German of EMANUEL OTTO FROMBERG. In One Volume. 2s. 6d.
69. *MUSIC*, A Rudimentary and Practical Treatise on. With numerous Examples. By CHARLES CHILD SPENCER. 2s. 6d.
71. *PIANOFORTE*, The Art of Playing the. With numerous Exercises and Lessons. Written and Selected from the Best Masters, by CHARLES CHILD SPENCER. 1s. 6d.
181. *PAINTING POPULARLY EXPLAINED*, including Fresco, Oil, Mosaic, Water Colour, Water-Glass, Tempera, Encaustic, Miniature, Painting on Ivory, Vellum, Pottery, Enamel, Glass, &c. With Historical Sketches of the Progress of the Art by THOMAS JOHN GULLICK, assisted by JOHN TIMBS, F.S.A. Third Edition, revised and enlarged, with Frontispiece and Vignette. 5s.
186. *A GRAMMAR OF COLOURING*, applied to Decorative Painting and the Arts. By GEORGE FIELD. New Edition, enlarged and adapted to the Use of the Ornamental Painter and Designer. By ELLIS A. DAVIDSON, Author of "Drawing for Carpenters," &c. With two new Coloured Diagrams and numerous Engravings on Wood. 2s. 6d.

ARITHMETIC, GEOMETRY, MATHEMATICS,  
ETC.

32. *MATHEMATICAL INSTRUMENTS*, a Treatise on; in which their Construction and the Methods of Testing, Adjusting, and Using them are concisely Explained. By J. F. HEATHER, M.A., of the Royal Military Academy, Woolwich. Original Edition, in 1 vol., Illustrated. 1s. 6d.
- \* \* \* *In ordering the above, be careful to say, "Original Edition," or give the number in the Series (32) to distinguish it from the Enlarged Edition in 3 vols. (Nos. 168-9-70.)*
60. *LAND AND ENGINEERING SURVEYING*, a Treatise on; with all the Modern Improvements. Arranged for the Use of Schools and Private Students; also for Practical Land Surveyors and Engineers. By T. BAKER, C.E. New Edition, revised by EDWARD NUGENT, C.E. Illustrated with Plates and Diagrams. 2s.
- 61\*. *READY RECKONER FOR THE ADMEASUREMENT OF LAND*. By ABRAHAM ARMAN, Schoolmaster, Thurleigh, Beds. To which is added a Table, showing the Price of Work, from 2s. 6d. to £1 per acre, and Tables for the Valuation of Land, from 1s. to £1,000 per acre, and from one pole to two thousand acres in extent, &c., &c. 1s. 6d.
76. *DESCRIPTIVE GEOMETRY*, an Elementary Treatise on; with a Theory of Shadows and of Perspective, extracted from the French of G. MONGE. To which is added, a description of the Principles and Practice of Isometrical Projection; the whole being intended as an introduction to the Application of Descriptive Geometry to various branches of the Arts. By J. F. HEATHER, M.A. Illustrated with 14 Plates. 2s.
178. *PRACTICAL PLANE GEOMETRY*: giving the Simplest Modes of Constructing Figures contained in one Plane and Geometrical Construction of the Ground. By J. F. HEATHER, M.A. With 215 Woodcuts. 2s.
9. *PROJECTION*: Orthographic, Topographic, and Perspective: giving the various Modes of Delineating Solid Forms by Constructions on a Single Plane Surface. By J. F. HEATHER, M.A. [In preparation.]
- \* \* \* *The above three volumes will form a COMPLETE ELEMENTARY COURSE OF MATHEMATICAL DRAWING.*



Arithmetic, Geometry, Mathematics, etc., *continued.*

83. *COMMERCIAL BOOK-KEEPING*. With Commercial Phrases [and Forms in English, French, Italian, and German. By JAMES HADDON, M.A., Arithmetical Master of King's College School, London. 1s.
84. *ARITHMETIC*, a Rudimentary Treatise on: with full Explanations of its Theoretical Principles, and numerous Examples for Practice. For the Use of Schools and for Self-Instruction. By J. R. YOUNG, late Professor of Mathematics in Belfast College. New Edition, with Index. 1s. 6d.
- 84\*. A KEY to the above, containing Solutions in full to the Exercises, together with Comments, Explanations, and Improved Processes, for the Use of Teachers and Unassisted Learners. By J. R. YOUNG. 1s. 6d.
85. *EQUATIONAL ARITHMETIC*, applied to Questions of Interest, Annuities, Life Assurance, and General Commerce; with various Tables by which all Calculations may be greatly facilitated. By W. HIPSLEY. 2s.
86. *ALGEBRA*, the Elements of. By JAMES HADDON, M.A., Second Mathematical Master of King's College School. With Appendix, containing miscellaneous Investigations, and a Collection of Problems in various parts of Algebra. 2s.
- 86\*. A KEY AND COMPANION to the above Book, forming an extensive repository of Solved Examples and Problems in Illustration of the various Expedients necessary in Algebraical Operations. Especially adapted for Self-Instruction. By J. R. YOUNG. 1s. 6d.
88. *EUCLID*, THE ELEMENTS OF: with many additional Propositions and Explanatory Notes: to which is prefixed, an Introductory Essay on Logic. By HENRY LAW, C.E. 2s. 6d.
- \*.\* Sold also separately, viz. :—
88. *EUCLID*, The First Three Books. By HENRY LAW, C.E. 1s.
89. *EUCLID*, Books 4, 5, 6, 11, 12. By HENRY LAW, C.E. 1s. 6d.
90. *ANALYTICAL GEOMETRY AND CONIC SECTIONS*, a Rudimentary Treatise on. By JAMES HANN, late Mathematical Master of King's College School, London. A New Edition, re-written and enlarged by J. R. YOUNG, formerly Professor of Mathematics at Belfast College. 2s.
91. *PLANE TRIGONOMETRY*, the Elements of. By JAMES HANN, formerly Mathematical Master of King's College, London. 1s.
92. *SPHERICAL TRIGONOMETRY*, the Elements of. By JAMES HANN. Revised by CHARLES H. DOWLING, C.E. 1s.
- \*.\* Or with "*The Elements of Plane Trigonometry*," in One Volume, 2s.
93. *MENSURATION AND MEASURING*, for Students and Practical Use. With the Mensuration and Levelling of Land for the Purposes of Modern Engineering. By T. BAKER, C.E. New Edition, with Corrections and Additions by E. NUGENT, C.E. Illustrated. 1s. 6d.
94. *LOGARITHMS*, a Treatise on; with Mathematical Tables for facilitating Astronomical, Nautical, Trigonometrical, and Logarithmic Calculations; Tables of Natural Sines and Tangents and Natural Cosines. By HENRY LAW, C.E. Illustrated. 2s. 6d.
- 101\*. *MEASURES, WEIGHTS, AND MONEYS OF ALL NATIONS*, and an Analysis of the Christian, Hebrew, and Mahometan Calendars. By W. S. B. WOOLHOUSE, F.R.A.S., &c. 1s. 6d.
102. *INTEGRAL CALCULUS*, Rudimentary Treatise on the. By HOMERSHAM COX, B.A. Illustrated. 1s.
103. *INTEGRAL CALCULUS*, Examples on the. By JAMES HANN, late of King's College, London. Illustrated. 1s.
101. *DIFFERENTIAL CALCULUS*, Examples of the. By W. S. B. WOOLHOUSE, F.R.A.S., &c. 1s. 6d.
104. *DIFFERENTIAL CALCULUS*, Examples and Solutions of the. By JAMES HADDON, M.A. 1s.



Arithmetic, Geometry, Mathematics, etc., *continued.*

105. *MNEMONICAL LESSONS.* — GEOMETRY, ALGEBRA, AND TRIGONOMETRY, in Easy Mnemonical Lessons. By the Rev. THOMAS PENYNGTON KIRKMAN, M.A. 1s. 6d.
136. *ARITHMETIC*, Rudimentary, for the Use of Schools and Self-Instruction. By JAMES HADDON, M.A. Revised by ABRAHAM ARMAN. 1s. 6d.
137. A KEY TO HADDON'S RUDIMENTARY ARITHMETIC. By A. ARMAN. 1s. 6d.
147. *ARITHMETIC*, STEPPING-STONE TO; being a Complete Course of Exercises in the First Four Rules (Simple and Compound), on an entirely new principle. For the Use of Elementary Schools of every Grade. Intended as an Introduction to the more extended works on Arithmetic. By ABRAHAM ARMAN. 1s.
148. A KEY TO STEPPING-STONE TO ARITHMETIC. By A. ARMAN. 1s.
158. *THE SLIDE RULE, AND HOW TO USE IT*; containing full, easy, and simple Instructions to perform all Business Calculations with unexampled rapidity and accuracy. By CHARLES HOARE, C.E. With a Slide Rule in tuck of cover. 3s.
168. *DRAWING AND MEASURING INSTRUMENTS.* Including—I. Instruments employed in Geometrical and Mechanical Drawing, and in the Construction, Copying, and Measurement of Maps and Plans. II. Instruments used for the purposes of Accurate Measurement, and for Arithmetical Computations. By J. F. HEATHER, M.A., late of the Royal Military Academy, Woolwich, Author of "Descriptive Geometry," &c., &c. Illustrated. 1s. 6d.
169. *OPTICAL INSTRUMENTS.* Including (more especially) Telescopes, Microscopes, and Apparatus for producing copies of Maps and Plans by Photography. By J. F. HEATHER, M.A. Illustrated. 1s. 6d.
170. *SURVEYING AND ASTRONOMICAL INSTRUMENTS.* Including—I. Instruments Used for Determining the Geometrical Features of a portion of Ground. II. Instruments Employed in Astronomical Observations. By J. F. HEATHER, M.A. Illustrated. 1s. 6d.
- \*\* *The above three volumes form an enlargement of the Author's original work, "Mathematical Instruments: their Construction, Adjustment, Testing, and Use," the Eleventh Edition of which is on sale, price 1s. 6d. (See No. 32 in the Series.)*
168. } *MATHEMATICAL INSTRUMENTS.* By J. F. HEATHER,  
169. } M.A. Enlarged Edition, for the most part entirely re-written. The 3 Parts as  
170. } above, in One thick Volume. With numerous Illustrations. 4s. 6d.
185. *THE COMPLETE MEASURER*; setting forth the Measurement of Boards, Glass, &c., &c.; Unequal-sided, Square-sided, Octagonal-sided, Round Timber and Stone, and Standing Timber. With a Table showing the solidity of hewn or eight-sided timber, or of any octagonal-sided column. Compiled for the accommodation of Timber-growers, Merchants, and Surveyors, Stonemasons, Architects, and others. By RICHARD HORTON. Third Edition, with valuable additions. 4s.
196. *THEORY OF COMPOUND INTEREST AND ANNUITIES*; with Tables of Logarithms for the more Difficult Computations of Interest, Discount, Annuities, &c. By FEDOR THOMAN, of the Société Cr dit Mobilier, Paris. 4s. [Now ready.]

## LEGAL TREATISES.

50. *THE LAW OF CONTRACTS FOR WORKS AND SERVICES.* By DAVID GIBBONS. Third Edition, revised and considerably enlarged. 3s. [Just published.]
151. *A HANDY BOOK ON THE LAW OF FRIENDLY, INDUSTRIAL & PROVIDENT BUILDING & LOAN SOCIETIES.* With copious Notes. By NATHANIEL WHITE, of H.M. Civil Service. 1s.
163. *THE LAW OF PATENTS FOR INVENTIONS*; and on the Protection of Designs and Trade Marks. By F. W. CAMPIN, Barrister-at-Law. 2s.



### MISCELLANEOUS VOLUMES.

36. *A DICTIONARY OF TERMS used in ARCHITECTURE, BUILDING, ENGINEERING, MINING, METALLURGY, ARCHÆOLOGY, the FINE ARTS, &c.* By JOHN WEALE. Fifth Edition. Revised by ROBERT HUNT, F.R.S., Keeper of Mining Records. Numerous Illustrations. 5s.
112. *MANUAL OF DOMESTIC MEDICINE.* By R. GOODING, B.A., M.B. Intended as a Family Guide in all Cases of Accident and Emergency. 2s.
- 112\*. *MANAGEMENT OF HEALTH.* A Manual of Home and Personal Hygiene. By the Rev. JAMES BAIRD, B.A. 1s.
113. *FIELD ARTILLERY ON SERVICE.* By TAUBERT, Captain Prussian Artillery. Translated by Lieut.-Col. H. H. MAXWELL. 1s. 6d.
- 113\*. *SWORDS, AND OTHER ARMS.* By Col. MAREY. Translated by Col. H. H. MAXWELL. With Plates. 1s.
150. *LOGIC, Pure and Applied.* By S. H. EMMENS. Third Edition. 1s. 6d.
152. *PRACTICAL HINTS FOR INVESTING MONEY.* With an Explanation of the Mode of Transacting Business on the Stock Exchange. By FRANCIS PLAYFORD, Sworn Broker. 1s. 6d.
153. *SELECTIONS FROM LOCKE'S ESSAYS ON THE HUMAN UNDERSTANDING.* With Notes by S. H. EMMENS. 2s.
193. *HANDBOOK OF FIELD FORTIFICATION,* intended for the Guidance of Officers Preparing for Promotion, and especially adapted to the requirements of Beginners. By Major W. W. KNOLLYS, F.R.G.S., 93rd Sutherland Highlanders, &c. With 163 Woodcuts. 3s.
194. *THE HOUSE MANAGER: Being a Guide to Housekeeping.* Practical Cookery, Pickling and Preserving, Household Work, Dairy Management, the Table and Dessert, Cellarage of Wines, Home-brewing and Wine-making, the Boudoir and Dressing-room, Travelling, Stable Economy, Gardening Operations, &c. By AN OLD HOUSEKEEPER. 3s. 6d.

## EDUCATIONAL AND CLASSICAL SERIES.

### HISTORY.

1. *England, Outlines of the History of; more especially with reference to the Origin and Progress of the English Constitution.* A Text Book for Schools and Colleges. By WILLIAM DOUGLAS HAMILTON, F.S.A., of Her Majesty's Public Record Office. Fourth Edition, revised. Maps and Woodcuts. 5s.; cloth boards, 6s.
5. *Greece, Outlines of the History of; in connection with the Rise of the Arts and Civilization in Europe.* By W. DOUGLAS HAMILTON, of University College, London, and EDWARD LEVIEN, M.A., of Balliol College, Oxford. 2s. 6d.; cloth boards, 3s. 6d.
7. *Rome, Outlines of the History of: from the Earliest Period to the Christian Era and the Commencement of the Decline of the Empire.* By EDWARD LEVIEN, of Balliol College, Oxford. Map, 2s. 6d.; cl. bds. 3s. 6d.
9. *Chronology of History, Art, Literature, and Progress, from the Creation of the World to the Conclusion of the Franco-German War.* The Continuation by W. D. HAMILTON, F.S.A., of Her Majesty's Record Office. 3s.; cloth boards, 3s. 6d.
50. *Dates and Events in English History, for the use of Candidates in Public and Private Examinations.* By the Rev. E. RAND. 1s.



## ENGLISH LANGUAGE AND MISCELLANEOUS.

11. **Grammar of the English Tongue, Spoken and Written.** With an Introduction to the Study of Comparative Philology. By HYDE CLARKE, D.C.L. Third Edition. 1s.
- 11\*. **Philology: Handbook of the Comparative Philology of English,** Anglo-Saxon, Frisian, Flemish or Dutch, Low or Platt Dutch, High Dutch or German, Danish, Swedish, Icelandic, Latin, Italian, French, Spanish, and Portuguese Tongues. By HYDE CLARKE, D.C.L. 1s.
12. **Dictionary of the English Language, as Spoken and Written.** Containing above 100,000 Words. By HYDE CLARKE, D.C.L. 3s. 6d.; cloth boards, 4s. 6d.; complete with the GRAMMAR, cloth bds., 5s. 6d.
48. **Composition and Punctuation, familiarly Explained** for those who have neglected the Study of Grammar. By JUSTIN BRENNAN. 16th Edition. 1s.
49. **Derivative Spelling-Book: Giving the Origin of Every Word** from the Greek, Latin, Saxon, German, Teutonic, Dutch, French, Spanish, and other Languages; with their present Acceptation and Pronunciation. By J. ROWBOTHAM, F.R.A.S. Improved Edition. 1s. 6d.
51. **The Art of Extempore Speaking: Hints for the Pulpit, the Senate, and the Bar.** By M. BAUTAIN, Vicar-General and Professor at the Sorbonne. Translated from the French. Sixth Edition, carefully corrected. 2s. 6d.
52. **Mining and Quarrying, with the Sciences connected therewith.** First Book of, for Schools. By J. H. COLLINS, F.G.S., Lecturer to the Miners' Association of Cornwall and Devon. 1s.
53. **Places and Facts in Political and Physical Geography,** for Candidates in Public and Private Examinations. By the Rev. EDGAR RAND, B.A. 1s.
54. **Analytical Chemistry, Qualitative and Quantitative, a Course of.** To which is prefixed, a Brief Treatise upon Modern Chemical Nomenclature and Notation. By WM. W. PINK, Practical Chemist, &c., and GEORGE E. WEBSTER, Lecturer on Metallurgy and the Applied Sciences, Nottingham. 2s.

## THE SCHOOL MANAGERS' SERIES OF READING BOOKS,

Adapted to the Requirements of the New Code. Edited by the Rev. A. R. GRANT, Rector of Hitcham, and Honorary Canon of Ely; formerly H.M. Inspector of Schools.

### INTRODUCTORY PRIMER, 3d.

	<i>s.</i>	<i>d.</i>		<i>s.</i>	<i>d.</i>
FIRST STANDARD . . . . .	0	6	FOURTH STANDARD . . . . .	1	2
SECOND " . . . . .	0	10	FIFTH " . . . . .	1	6
THIRD " . . . . .	1	0	SIXTH " . . . . .	1	6

LESSONS FROM THE BIBLE. Part I. Old Testament. 1s.

LESSONS FROM THE BIBLE. Part II. New Testament, to which is added THE GEOGRAPHY OF THE BIBLE, for very young Children. By Rev. C. THORNTON FORSTER. 1s. 2d. \*\*\* Or the Two Parts in One Volume. 2s.

## FRENCH.

24. **French Grammar.** With Complete and Concise Rules on the Genders of French Nouns. By G. L. STRAUSS, Ph.D. 1s.
25. **French-English Dictionary.** Comprising a large number of New Terms used in Engineering, Mining, on Railways, &c. By ALFRED ELWES. 1s. 6d.
26. **English-French Dictionary.** By ALFRED ELWES. 2s.
- 25,26. **French Dictionary (as above).** Complete, in One Vol., 3s.; cloth boards, 3s. 6d. \*\*\* Or with the GRAMMAR, cloth boards, 4s. 6d.



French, *continued.*

47. French and English Phrase Book: containing Introductory Lessons, with Translations, for the convenience of Students; several Vocabularies of Words, a Collection of suitable Phrases, and Easy Familiar Dialogues. 1s.

## GERMAN.

39. German Grammar. Adapted for English Students, from Heyse's Theoretical and Practical Grammar, by Dr. G. L. STRAUSS. 1s.
40. German Reader: A Series of Extracts, carefully culled from the most approved Authors of Germany; with Notes, Philological and Explanatory. By G. L. STRAUSS, Ph.D. 1s.
41. German Triglot Dictionary. By NICHOLAS ESTERHAZY, S. A. HAMILTON. Part I. English-German-French. 1s.
42. German Triglot Dictionary. Part II. German-French-English. 1s.
43. German Triglot Dictionary. Part III. French-German-English. 1s.
- 41-43. German Triglot Dictionary (as above), in One Vol., 3s.; cloth boards, 4s. \*\*\* Or with the GERMAN GRAMMAR, cloth boards, 5s.

## ITALIAN.

27. Italian Grammar, arranged in Twenty Lessons, with a Course of Exercises. By ALFRED ELWES. 1s.
28. Italian Triglot Dictionary, wherein the Genders of all the Italian and French Nouns are carefully noted down. By ALFRED ELWES. Vol. 1. Italian-English-French. 2s.
30. Italian Triglot Dictionary. By A. ELWES. Vol. 2. English-French-Italian. 2s.
32. Italian Triglot Dictionary. By ALFRED ELWES. Vol. 3. French-Italian-English. 2s.
- 28,30,32. Italian Triglot Dictionary (as above). In One Vol., 6s. cloth boards, 7s. 6d. \*\*\* Or with the ITALIAN GRAMMAR, cloth bds., 8s. 6d.

## SPANISH AND PORTUGUESE.

34. Spanish Grammar, in a Simple and Practical Form. With a Course of Exercises. By ALFRED ELWES. 1s. 6d.
35. Spanish-English and English-Spanish Dictionary. Including a large number of Technical Terms used in Mining, Engineering, &c., with the proper Accents and the Gender of every Noun. By ALFRED ELWES. 4s.; cloth boards, 5s. \*\*\* Or with the GRAMMAR, cloth boards, 6s.
55. Portuguese Grammar, in a Simple and Practical Form. With a Course of Exercises. By ALFRED ELWES, Author of "A Spanish Grammar," &c. 1s. 6d. [*Just published.*]

## HEBREW.

- 46\*. Hebrew Grammar. By Dr. BRESSLAU. 1s. 6d.
44. Hebrew and English Dictionary, Biblical and Rabbinical; containing the Hebrew and Chaldee Roots of the Old Testament Post-Rabbinical Writings. By Dr. BRESSLAU. 6s. \*\*\* Or with the GRAMMAR, 7s.
46. English and Hebrew Dictionary. By Dr. BRESSLAU. 3s.
- 44,46. Hebrew Dictionary (as above), in Two Vols., complete, with 46\*. the GRAMMAR, cloth boards, 12s.



## LATIN.

19. **Latin Grammar.** Containing the Inflections and Elementary Principles of Translation and Construction. By the Rev. THOMAS GOODWIN, M.A., Head Master of the Greenwich Proprietary School. 1s.
20. **Latin-English Dictionary.** Compiled from the best Authorities. By the Rev. THOMAS GOODWIN, M.A. 2s.
22. **English-Latin Dictionary;** together with an Appendix of French and Italian Words which have their origin from the Latin. By the Rev. THOMAS GOODWIN, M.A. 1s. 6d.
- 20,22. **Latin Dictionary** (as above). Complete in One Vol., 3s. 6d.; cloth boards, 4s. 6d. \* \* Or with the GRAMMAR, cloth boards, 5s. 6d.

## LATIN CLASSICS. With Explanatory Notes in English.

1. **Latin Delectus.** Containing Extracts from Classical Authors, with Genealogical Vocabularies and Explanatory Notes, by HENRY YOUNG, lately Second Master of the Royal Grammar School, Guildford. 1s.
2. **Cæsar's Commentarii de Bello Gallico.** Notes, and a Geographical Register for the Use of Schools, by H. YOUNG. 2s.
12. **Ciceronis Oratio pro Sexto Roscio Amerino.** Edited, with an Introduction, Analysis, and Notes Explanatory and Critical, by the Rev. JAMES DAVIES, M.A. 1s.
14. **Ciceronis Cato Major, Lælius, Brutus, sive de Senectute, de Amicitia, de Claris Oratoribus Dialogi.** With Notes by W. BROWNRIGG SMITH, M.A., F.R.G.S. 2s.
3. **Cornelius Nepos.** With Notes. Intended for the Use of Schools. By H. YOUNG. 1s.
6. **Horace; Odes, Epode, and Carmen Sæculare.** Notes by H. YOUNG. 1s. 6d.
7. **Horace; Satires, Epistles, and Ars Poetica.** Notes by W. BROWNRIGG SMITH, M.A., F.R.G.S. 1s. 6d.
21. **Juvenalis Satiræ.** With Prolegomena and Notes by T. H. S. ESCOTT, B.A., Lecturer on Logic at King's College, London. 1s. 6d.
16. **Livy: History of Rome.** Notes by H. YOUNG and W. B. SMITH, M.A. Part 1. Books i., ii., 1s. 6d.
- 16\*. ——— Part 2. Books iii., iv., v., 1s. 6d.
17. ——— Part 3. Books xxi., xxii., 1s. 6d.
8. **Sallustii Crispi Catalina et Bellum Jugurthinum.** Notes Critical and Explanatory, by W. M. DONNE, B.A., Trinity College, Cambridge. 1s. 6d.
10. **Terentii Adelphi, Hecyra, Phormio.** Edited, with Notes, Critical and Explanatory, by the Rev. JAMES DAVIES, M.A. 2s.
9. **Terentii Andria et Heautontimorumenos.** With Notes, Critical and Explanatory, by the Rev. JAMES DAVIES, M.A. 1s. 6d.
11. **Terentii Eunuchus, Comœdia.** Edited, with Notes, by the Rev. JAMES DAVIES, M.A. 1s. 6d. Or the Adelphi, Andria, and Eunuchus, 3 vols. in 1, cloth boards, 6s.
4. **Virgilit Maronis Bucolica et Georgica.** With Notes on the Bucolics by W. RUSHTON, M.A., and on the Georgics by H. YOUNG. 1s. 6d.
5. **Virgilit Maronis Æneis.** Notes, Critical and Explanatory, by H. YOUNG. 2s.
19. **Latin Verse Selections,** from Catullus, Tibullus, Propertius, and Ovid. Notes by W. B. DONNE, M.A., Trinity College, Cambridge. 2s.
20. **Latin Prose Selections,** from Varro, Columella, Vitruvius, Seneca, Quintilian, Florus, Velleius Paterculus, Valerius Maximus Suetonius, Apuleius, &c. Notes by W. B. DONNE, M.A. 2s.

*Other Volumes are in Preparation.*



## GREEK.

14. **Greek Grammar**, in accordance with the Principles and Philological Researches of the most eminent Scholars of our own day. By HANS CLAUDE HAMILTON. 1s. 6d.
- 15,17. **Greek Lexicon**. Containing all the Words in General Use, with their Significations, Inflections, and Doubtful Quantities. By HENRY R. HAMILTON. Vol. 1. Greek-English, 2s.; Vol. 2. English-Greek, 2s. Or the Two Vols. in One, 4s.: cloth boards, 5s.
- 14,15. **Greek Lexicon** (as above). Complete, with the GRAMMAR, in 17. One Vol., cloth boards, 6s.

## GREEK CLASSICS. With Explanatory Notes in English.

1. **Greek Delectus**. Containing Extracts from Classical Authors, with Genealogical Vocabularies and Explanatory Notes, by H. YOUNG. New Edition, with an improved and enlarged Supplementary Vocabulary, by JOHN HUTCHISON, M.A., of the High School, Glasgow. 1s.
30. **Æschylus: Prometheus Vincit**: The Prometheus Bound. From the Text of DINDORF. Edited, with English Notes, Critical and Explanatory, by the Rev. JAMES DAVIES, M.A. 1s.
32. **Æschylus: Septem Contra Thebes**: The Seven against Thebes. From the Text of DINDORF. Edited, with English Notes, Critical and Explanatory, by the Rev. JAMES DAVIES, M.A. 1s.
40. **Aristophanes: Acharnians**. Chiefly from the Text of C. H. WEISE. With Notes, by C. S. T. TOWNSHEND, M.A. 1s. 6d.
26. **Euripides: Alcestis**. Chiefly from the Text of DINDORF. With Notes, Critical and Explanatory, by JOHN MILNER, B.A. 1s.
23. **Euripides: Hecuba and Medea**. Chiefly from the Text of DINDORF. With Notes, Critical and Explanatory, by W. BROWNRIGG SMITH, M.A., F.R.G.S. 1s. 6d.
- 4-17. **Herodotus, The History of**, chiefly after the Text of GAISFORD. With Preliminary Observations and Appendices, and Notes, Critical and Explanatory, by T. H. L. LEARY, M.A., D.C.L.  
 Part 1. Books i., ii. (The Clio and Euterpe), 2s.  
 Part 2. Books iii., iv. (The Thalia and Melpomene), 2s.  
 Part 3. Books v.-vii. (The Terpsichore, Erato, and Polymnia), 2s.  
 Part 4. Books viii., ix. (The Urania and Calliope) and Index, 1s. 6d.
- 5-12. **Homer, The Works of**. According to the Text of BAEUMLEIN. With Notes, Critical and Explanatory, drawn from the best and latest Authorities, with Preliminary Observations and Appendices, by T. H. L. LEARY, M.A., D.C.L.
- |              |                                     |   |
|--------------|-------------------------------------|---|
| THE ILIAD:   | Part 1. Books i. to vi., 1s. 6d.    | Part 3. Books xiii. to xviii., 1s. 6d.      |
|              | Part 2. Books vii. to xii., 1s. 6d. | Part 4. Books xix. to xxiv., 1s. 6d.        |
| THE ODYSSEY: | Part 1. Books i. to vi., 1s. 6d.    | Part 3. Books xiii. to xviii., 1s. 6d.      |
|              | Part 2. Books vii. to xii., 1s. 6d. | Part 4. Books xix. to xxiv., and Hymns, 2s. |
4. **Lucian's Select Dialogues**. The Text carefully revised, with Grammatical and Explanatory Notes, by H. YOUNG. 1s.
13. **Plato's Dialogues: The Apology of Socrates, the Crito, and the Phædo**. From the Text of C. F. HERMANN. Edited with Notes, Critical and Explanatory, by the Rev. JAMES DAVIES, M.A. 2s.
18. **Sophocles: Œdipus Tyrannus**. Notes by H. YOUNG. 1s.
20. **Sophocles: Antigone**. From the Text of DINDORF. Notes, Critical and Explanatory, by the Rev. JOHN MILNER, B.A. 2s.
41. **Thucydides: History of the Peloponnesian War**. Notes by H. YOUNG. Book 1. 1s.
- 2, 3. **Xenophon's Anabasis; or, The Retreat of the Ten Thousand**. Notes and a Geographical Register, by H. YOUNG. Part 1. Books i. to iii., 1s. Part 2. Books iv. to vii., 1s.
42. **Xenophon's Panegyric on Agesilaus**. Notes and Introduction by LL. F. W. JEWITT. 1s. 6d.

*Other Volumes are in Preparation.*







