VIII. *An Account of the* Kang, *or* Chineſe *Stoves, by Father* Gramont, *tranſlated from the* French.

Read Jaa. 31, 1770. THE greateſt of all maſters is want. It is a ſpur to genius, gives wings to induſtry, and points out ſuch reſources as neither learning nor curioſity would ever have contrived. This it is which has taught the Chineſe to make uſe of ſea coal to warm their houſes, and to procure to themſelves the benefit of its heat without being annoyed by its offenſive ſmoak. This diſcovery of the Chineſe might perhaps be of uſe in the great city of London, and thoſe parts of England, where this fuel is burnt in rooms. The warm concern the Royal Society has always ſhewn for whatever affects the lives or welfare of the community, induces us to hope for a favourable acceptance of a model of the Chineſe Kang, which we apprehend may be conducive to thoſe beneficent purpoſes; we therefore have added ſuch explanations as will give an inſight into the theory of it, that it may be made known, and improved upon.

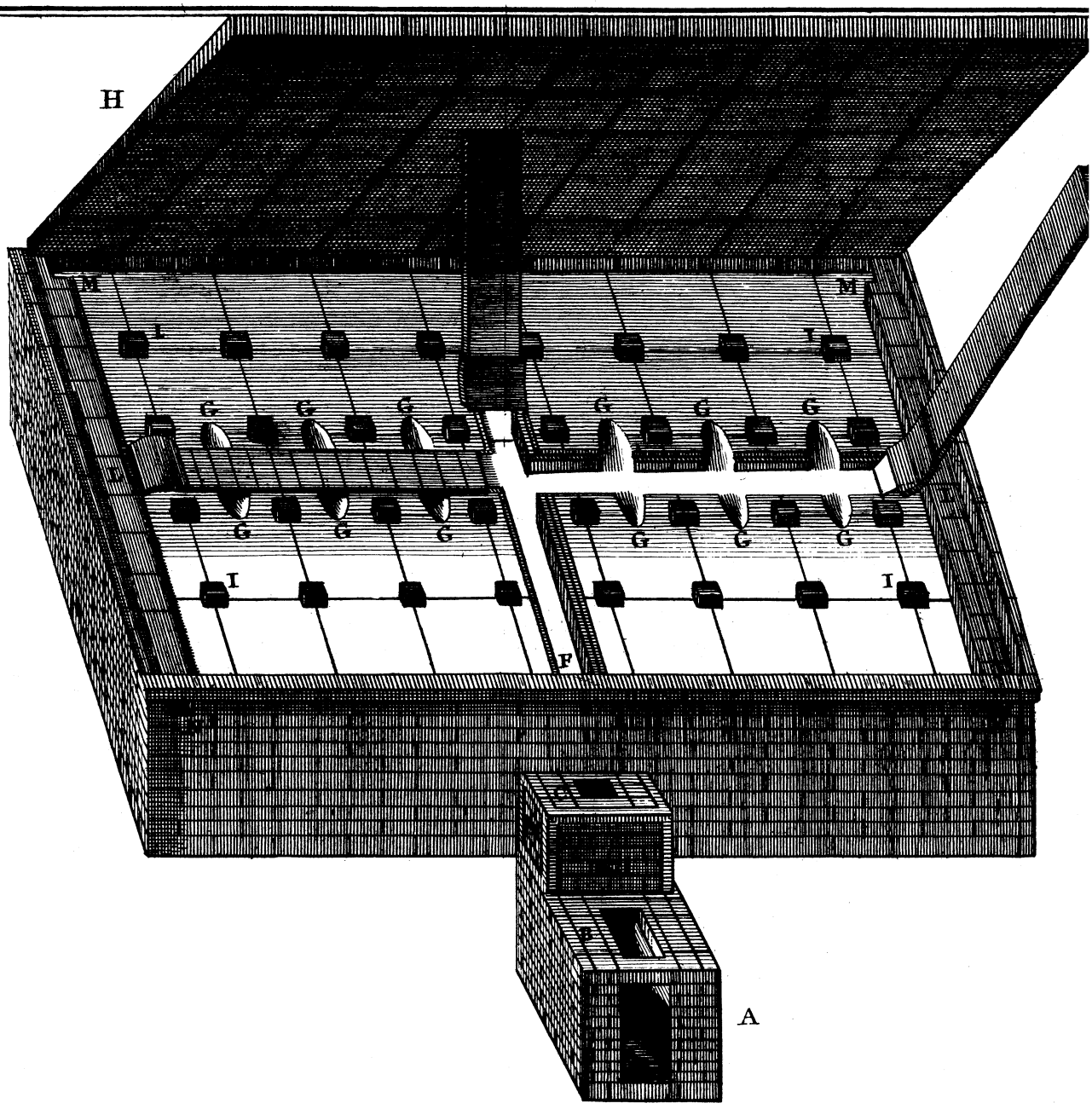
May the illuſtrious and celebrated Royal Society conſider this trifle as a token of our profound reſpect, and accept it as a ſmall acknowledgement of our gratitude for the favours beſtowed upon us, wretched and afflicted as we are! As we have the honour to write to gentlemen eminent for their learning, we

we ſhall only relate and deſcribe what is moſt eſſential.

1. A Kang is a kind of ſtove, that is heated by means of a furnace, which caſts all its heat into it. Many kinds of ſtoves, ovens, and furnaces, have indeed been contrived beyond ſea, which are ſomewhat like this; but the Chineſe ſeemed to have found means to unite all their conveniences and uſes in the Kang. They are of various ſorts, the *Kang* with a pavement, or *Ti-Kang*; the *Kang* for ſitting people, or *Koa-Kang*; and the chimney *Kang*, or *Tong-Kang*. As they are all made upon the ſame principle, we ſhall confine ourſelves to the deſcription of the *Kao-Kang*, from which the model (Tab. iii.) is taken.

The parts of a Kang are, 1. a furnace; 2. a pipe for the heat; 3. a brick ſtove; 4. two funnels for the ſmoke.

The furnace is proportioned to the ſize of the ſtove it is intended to heat. A is the aſh hole. B the cellar. C the furnace. D the ſlit, or mouth, that conveys the flame and heat into the ſtove. E The pipe or conductor for the heat. F begins at the mouth of the furnace, and forms a channel which falls in a right angle upon a ſecond, that goes quite through under the middle of the floor; and this laſt pipe has vent holes, G, here and there. The ſtove is a pavement made of bricks, H, which being ſupported at the four corners by little ſolid piles, I, leaves a hollow ſpace between them and the under pavement, where the heat remains pent up, and warms the floor. The ſmoke funnels are at both ends of the ſtove L, with a little opening M upon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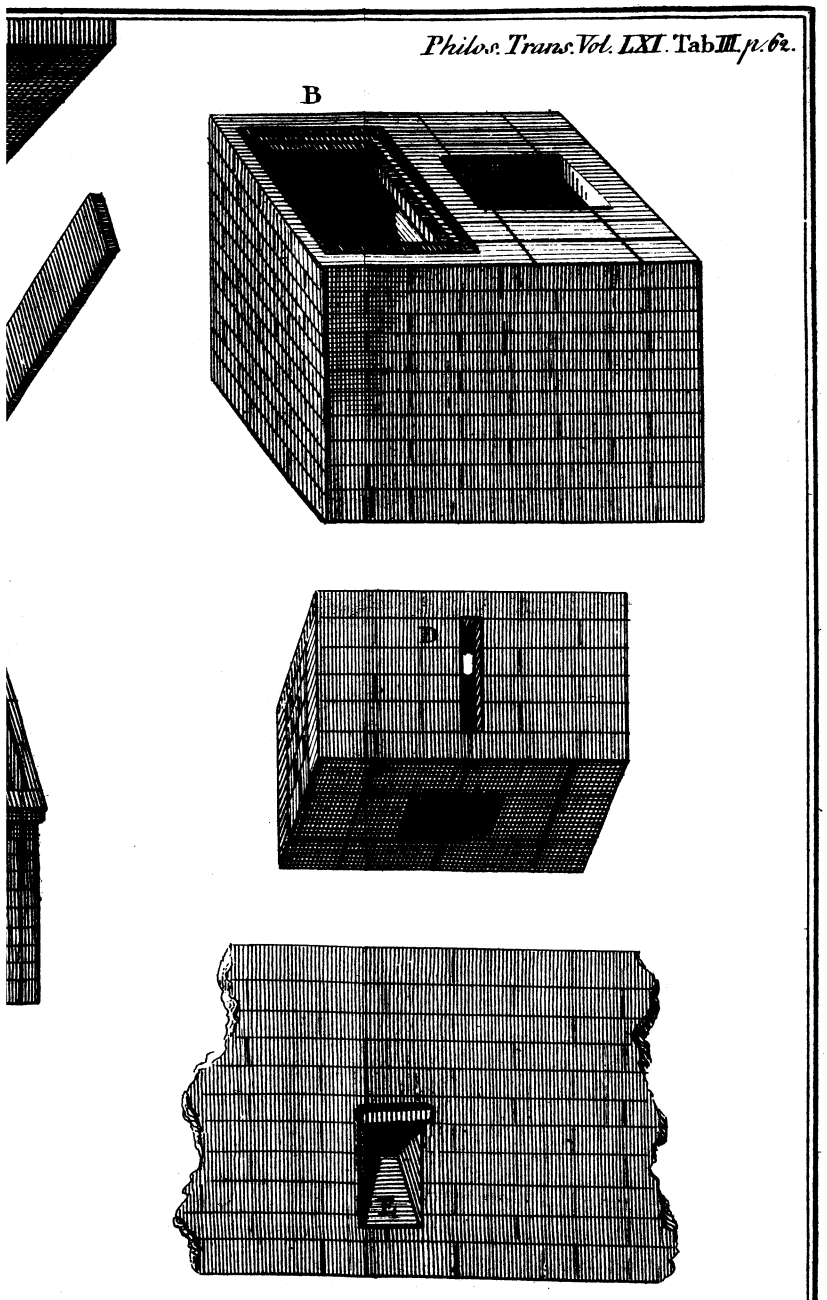

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the ſtove, and another N outward, which carries off the ſmoke.

Nothing can be more ſimple than the effect reſulting from the aſſemblage of all theſe parts. The heat of the furnace, impelled by the outward air, and attracted by the rarefied air of the ſtove, ruſhes through the ſlit, aſcends into the tube, ſpreads through the ſtove by the vent holes, heats the bricks, and from them the whole room. The ſmoke, which has a free paſſage, is carried off by the funnels.

2. Admitting this deſcription, which explains the model; let us next conſider what is requiſite for the conſtruction of a good Kang. The furnace may be placed either in the room itſelf, or in the next room, or without doors. The poor, who are glad to make the moſt of the firing that warms the *Kao-Kang*, on which they ſit by day, and ſleep by night, place the furnace in the ſame room; the middling ſort put it in an adjoining room; the rich and great have it on the outſide, and moſt commonly behind the north wall. The furnace muſt be much below the level of the ſtove, that the heat and flame may aſcend with the greater impetuoſity into the conductor, and not drive up the aſhes. The furnace is in the form of a cone, ſomewhat arched, that the activity of the heat and flame may be all impelled into the ſtove, and not fly off when the aperture at the top is left open. Note, that the two little moveable ſlips are planks, that take up occaſionally, when people want to go down into the cellar and empty out the aſhes. The opening in the furnace is narrow, and the lower end of the conductor muſt go quick up into the

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ſtove. The conductor is to be walled in very cloſe on all ſides with bricks, and well cemented with mortar made of quick lime. That which the Chineſe uſe is made with one part of white lime to two of black. The black lime, of which we ſend a ſample, is found at the entrance of the coal pits, and ſeems to us to be no other than coals diſſolved by rain waters. We can atteſt that this ſubſtance mixed with white lime makes excellent mortar, nearly reſembling cement. It is proof againſt rain and ſun, and is uſed here to cover and ſhelter whatever is expoſed to the weather. We ſhould rejoice if this hint could prove uſeful to the Britiſh nation. If their country affords black lime, they are poſſeſſed of a great treaſure.

The ground or flooring of the ſtove may be of beaten clay, or, what is infinitely better, bricks placed edgewiſe, or large paving tiles.

The funnel for the ſmoke, or rather the two funnels, muſt be made with great care. Some make them terminate in little chimneys, that carry off the ſmoke above the roof. In the model, they open into the room, as the city poor have them; but in the country, and in gentlemen's houſes, they are on the outſide.

It is of conſequence that the little piles which ſupport the great ſquare bricks of the floor be very ſolid, and the bricks very thick and perfectly ſquare. The Chineſe bind them with a ſort of cement made of white and black lime, tempered with *Tong Yeou*, which is a kind of varniſh. We are apt to think walnut or linſeed oil boiled would do as well.

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As ſoon as the Kang is compleated, fire is kindled in the furnace, to dry it quick and even. Great diligence muſt be uſed in examining it, in order to ſtop up all the little holes through which the ſmoke might eſcape. The wealthy, to make their Kang neater, and to moderate its heat, oil the bricks of the floor, and light the fire, to make the oil penetrate deeper, and to dry them the faſter. This oil is again the *Tong Yeou*, and may be ſupplied with walnut oil.

3. The *Ti Kang*, or paved Kang, is made like the *Kao Kang* juſt deſcribed; the only difference is, 1°, The pipe for the heat goes on riſing from the mouth of the furnace to the further end of the room. 2°, It does not communicate with a ſecond pipe, as in the model. 3°, The vent holes that convey the heat into the ſtove are all made narrow next the furnace, and go widening towards the ſtove. 4°, The funnels for the ſmoke always terminate without doors, or end in the little chimneys. 5°, In the Emperor's palace and thoſe of princes, the ſtove is covered with two rows of bricks, to confine the ſmoke, and to moderate the heat.

Note, That the bricks in the royal apartments are two feet ſquare, and four inches thick. They coſt near a hundred crowns apiece; and are ſo beautiful, good and ſolid, that you can have no conception of any ſuch thing beyond the ſeas. They are grey; but this is owing to the Chineſe manner of baking their bricks and tiles, which comes nearer to that of the antients than ours. Theſe bricks when coloured and glazed appear as fine as marble. The

Tong-Kang, or the *Kang* built in the wall, differ from the *Ti-Kang* only by its perpendicular poſition; the theory is the ſame.

4. The Kang is heated by lighting a fire in the furnace. The ſmoke and even the flame ruſhes violently into the pipe, and is carried off by the vent holes all through the ſtove, where, being pent up, it heats the bricks of the pavement in the ſpace of five or ſix hours: when a Kang is thoroughly heated, very little fire is required to keep it warm, though here the thermometer is almoſt all the winter at 9, 10, and even 12 or 13 degrees below the freezing point (in Reaumur's thermometer); and although all the rooms are on the ground floor, and have nothing but windows, and thoſe paper windows, all over the front, which is commonly to the ſouth, the warmth of the Kang is ſufficient to keep up their temperature at 7 or 8 degrees above froſt, with very little fire conſtantly kept up. It ſeldom riſes to more than 4 or 5 degrees in the Emperor's apartments, owing to the double row of bricks, but the warmth is very gentle and very penetrating.

As a Kang is heated by a furnace, any kind of fuel will do, *viz.* wood, charcoal, ſea coal, furze, &c. The Chineſe make the moſt of every thing. In the palace they burn nothing but wood, or a kind of coal which neither ſmoaks nor ſmells, and burns like tinder. The generality of people burn ſea coal: the poor in the country make uſe of furze, ſtraw, cow dung, &c.

A great ſaving may accrue from the following obſervation; the Chineſe, to ſave coals, pound them to the

the ſize of coarſe gravel, and mix them with one third, or even an equal quantity, of good yellow clay. This mixture being well kneaden, they make it up into bricks, which ſtrike a greater heat than wood, and come incomparably cheaper. The ſea coal thus tempered is far leſs offenſive; and beſides, the Chineſe, in order to draw off the noiſom vapours of the air, conſtantly heated by the coal fire, always keep bowls of water in the rooms, and renew them now and then. The gold fiſhes that are kept in theſe bowls are both an ornament and amuſement. In the palace, the Emperor's apartments are decorated with flower pots, and little orange trees, &c. The Chineſe philoſophers pretend that this is the beſt way to ſweeten the air, and abſorb the fiery particles diſperſed in it. They likewiſe leave two panes open night and day at the top of each window, to renew the air, which they think is too much rarefied by the heat. Theſe particulars may appear too trifling to be laid before the Royal Society; but, as they relate to the preſervation of their fellow citizens, we hope the worthy members will make allowances in favour of the motive.

5. The Kang is attended with many advantages and conveniencies. 1°, The rich and great are not expoſed to the troubleſome attendance on a fire in the chimney, and enjoy all its benefits. 2°, The poor uſe all ſorts of fuel without any other expence than what the kitchen requires, and have the comfort of ſitting warm by day, and lying warm by night. The fire in the furnace ſerves to dreſs victuals, and to heat the ſtove. The poor go further ſtill: they encloſe within the brick work of the Kang a veſſel, either

of copper tinned, or of iron, which ſupplies them with hot water for their tea. This water evaporates in the night, moiſtens the air of the room, and abſorbs the noxious particles of the ſea coal. We cannot forbear dwelling upon theſe little œconomical obſervations, as our aim is public utility. The Chineſe are wont to ſay, The Emperor can build a palace, and cannot make a ſhrub; one word from his mouth makes a nobleman of a mere citizen, but all his wiſhes and prayers cannot prolong the lives of his favourites one ſingle moment.

It is not our part to point out what uſe might be made of the Chineſe Kang beyond the ſeas; but we apprehend that the *Ti-Kang* might be a profitable improvement for hoſpitals, manufactories, &c. and a pleaſing one for the rich. The *Tong-Kang* properly managed would do very well in upper rooms, and would afford warmth for the bed-chamber, and fire for the dreſſing-room. The *Kao-Kang* ſeems leſs adapted to the cuſtoms and manners of Europe, but induſtry might find ſome uſe for it in the country. Should the Kang be rejected on account of its novelty, ſome hints might ſtill be taken from its conſtruction for the uſe of ſeveral kinds of handicraft.

The Chineſe ſea coal may give ſome inſight into the formation, qualities, uſes, and nature of this ſingural foſſil; but this would require a ſeparate paper. All we ſhall here obſerve is, that, as far as we can judge from the ſamples we have ſeen, it ſeems for the moſt part to be a ſtone diſſolved by the waters, and impregnated with ſulphur. Its hurtful qualities proceed from a mixture of antimony, copper, iron, &c.

&c. The beſt coal, and that which burns fierceſt, is gloſſy, hard and brittle. The Chineſe are very fond of that ſort that flies, and ſnaps in the fire, to burn in their forges, becauſe it contains a great deal of ſalt-petre. When the flame is blue, it is very fierce, but it is too dangerous, as the ſulphur is too predominant.

Peking, 22 Oct. 1769.

P. S. If we have expreſſed ourſelves improperly, which would not be very ſurprizing, conſidering how little we are verſed in theſe matters, and how little time we can ſpare for Europe, we are ready to retract whatever may be thought amiſs, and to give what further informations may at any time be deſired. Whoever has ſo loved the Chineſe for Chriſt's ſake as to come and ſeek them in this far country, has not diveſted himſelf of his attachment to Europe, and will ever be ſolicitous for the welfare of thoſe he has left behind, and endeavour to promote it, both by their prayers, and imparting whatever may conduce to alleviate the miſeries of this ſhort life.

In what a ſtriking light do we here ſee the vanity of the world, the intoxication of philoſophy, and the wretchedneſs of thoſe who know nothing of Jeſus Chriſt! Learning, vice, and idolatry, go hand in hand in the ſanctuary of policy; which knows nothing but the Creator of the world, whom the Chineſe worſhip on their knees, and diſhonour in their lives.

As there is room left in the box that contains the model, we have put in ſome little ſpecimens of ſea coal.

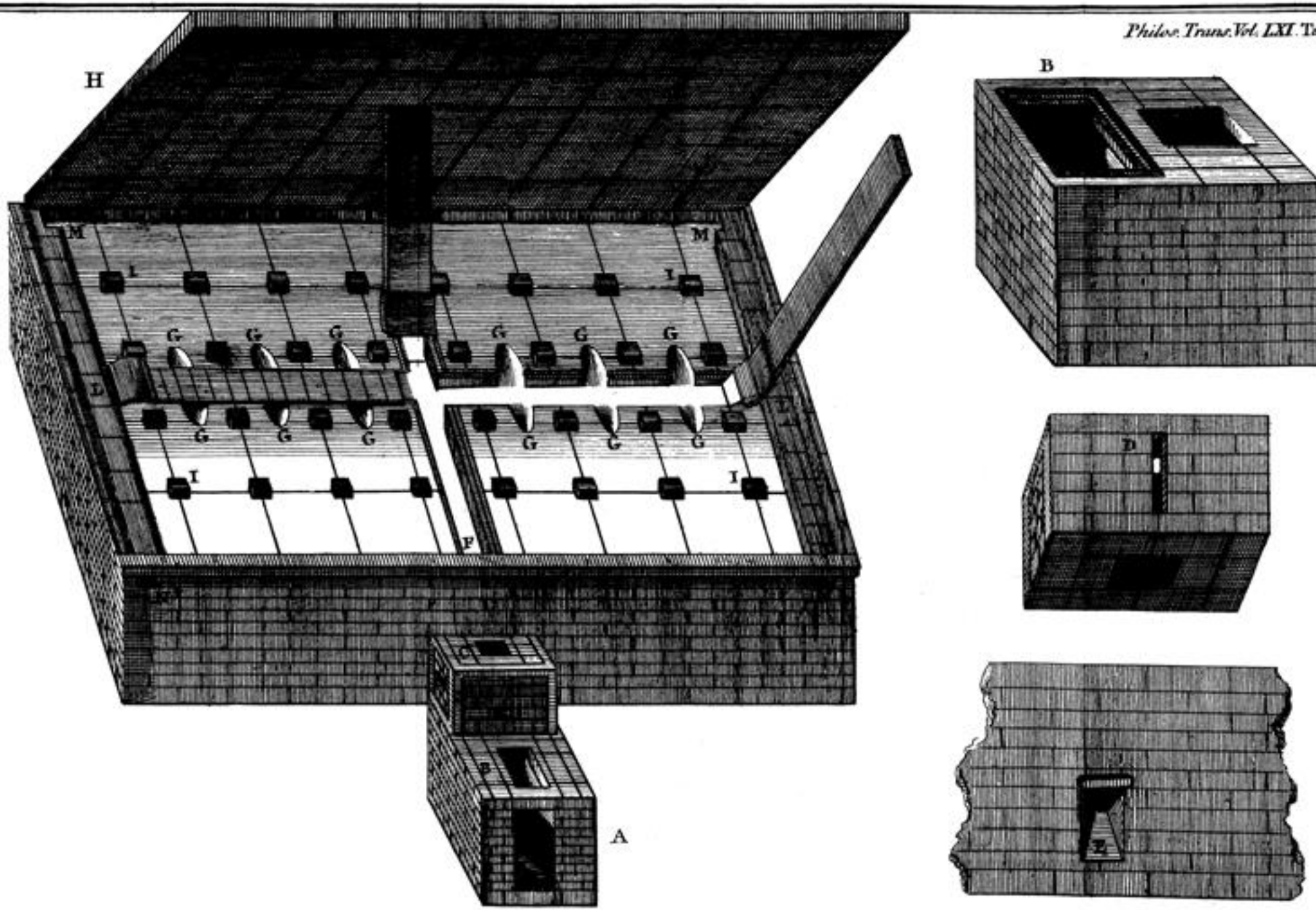
N° A. 1, 2, 3, different ſorts of ſea coal, or rather ſtones diſſolved, and turned to coals.

N° B. 1, 2, ſea coal, ſuch as is burnt here. N°. 2 is the beſt. N° 3. is the ſame coal turned to black lime. This you may be convinced of, by diſſolving it in water, and mixing it with white lime.

N° C. 1, 2, 3, 4, ſeveral degrees of bad coal, which produces a dangerous ſmoke that occaſions fainting fits. N° 4. is the worſt, and is laid by for the uſe of forges, whenever it is found.

N° D. is a kind of Clinker, extracted from the aſhes of ſea coal. That which produces the greateſt quantity of it is reckoned the beſt.

If the Society ſhould be deſirous of further informations concerning the ſea coal, we muſt beg to be favoured with particular queſtions; but let it be remembered, that we are not within reach of ſuch helps as chemiſtry would afford, nor can elucidate the matter by experiments.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