do not, however, wish to establish the utility of the method I propose, on the merits of this second-hand application of it, but mainly upon its application under and upon the stones, at the time of laying them. Nothing else will produce a level and permanent pavement with the materials at present in use, and consequently without increase of expense. With regard to the improvement of these materials, it is certain that the more exactly the stones are cut, the better; but this I apprehend must be regulated by the prescribed latitude of expense: it would be well to take off their convexity, by a few good chips from the top or crown of the stones that are much worn. But let them be wrought with the most mathematical nicety, it will avail nothing in the end, if they are laid according to the soft, uncompressed method of the London pavers. If we would have an even pavement, we must either have recourse to the deep beds of cement, or the huge stones I have described in the beginning of this article, with all their expensiveness and other inconveniences; or we must apply to the method and materials already in use, the only process which will remedy their evident defects, and produce the wished-for result. As to the earth in which the stones are laid, I should prefer a mixture of broken gravel, dry rubbish, and a little chalk; but this arrangement also, must depend on the expense. The quantity of oxide and carburet of iron which forms under the pavement, produces a strong tendency in the subjacent mass to indurate and agglomerate, which would be very greatly accelerated by the pressure I recommend.

It now only remains for me to refer to the principal, or only, objection which I can anticipate, might be made to the use of my machine; which is, the supposed injury it might occasion to the gas and water pipes. It will be very easy to prove in half an hour, by experiment, that no such injury can occur. Cast iron pipes, at the depth of two feet, would not sustain any injury from the utmost efforts of the engine, especially if any care had been taken to lay the finer portion of the earth or gravel in immediate contact with them. But this precaution, I affirm, will be by no means necessary, if the pipes are from two to three feet from the surface, which surely is not an unreasonable depth.

On the Management of the Bellows, Tuyeres, and Fuel, in Smiths' Forges.—By THOMAS GILL, Esq.

We have already treated at some length on these important subjects, still, however, much remains to be said thereon, and we shall accordingly continue to add, from time to time, such additional facts as may come to our knowledge.

We mentioned (see Vol. II. page 59) that Mr. Duncan Campbell uses a wider aperture to his bellows and tuyere than is usual, and that his tuyere is an inch in diameter, and widens towards the forge fire; to this we may add that he has fitted other tubes to his tuyere, by which he can occasionally contract its bore, according to the kind

of work he is employed upon; thus, for small work, as nails for instance, he contracts it to a bore of only half an inch, and has also an additional tube of three quarters of an inch in diameter.

He was much perplexed lately, at being unable to excite his fire with his usual readiness, in order to heat an article of some bulk, and long laboured at his bellows with all his might, but in vain; at last he recollected, that in making some nails he had contracted the tuyere to half an inch only, and accordingly he removed the contracting tube, and widened it to an inch, when he readily brought his heat up.

Mr. E. Hazard informed us lately, that in employing the *Anthracite*, or stone-coal, in the United States, as fuel in smiths' forges, it is necessary to increase the bore of their tuyeres to an inch and a quarter in diameter, when there is no difficulty in using it. This information may prove the means of enabling us to bring the *immense beds of anthracite in South Wales* more generally into use.

Mr. W. Mason confirms the superior efficacy of *wide bellows-pipes and tuyeres*, in heating large masses of iron or steel in forge-fires. He has used them so large as *an inch and a half in diameter*, and with the most beneficial effect, in quickly bringing his axle-trees, &c. to a welding heat all through, without, as usual, burning away their exterior surfaces. Neither is the *striker* who blows the bellows so much exhausted, by the great labour of working them to bring up his heats, as to nearly unfit him for exerting his strength with the hammer, as is commonly the case; on the contrary, the bellows with wide nozzles and tuyeres, are worked with much greater ease, than those with the usual narrower ones. There will indeed, be some difference found, in the *heats being brought up much quicker with the wide tuyeres*; but that, surely, can be no objection, either to an industrious workman or his employer.

Mr. Mason informed us, that he was much pleased to witness lately, the superior management of his fire, by a *twisted gun-barrel forger*. He spread a considerable quantity of fresh *Staffordshire coal* over the whole extent of his hearth, having previously broken it into small lumps; and so contrived it, that he always reduced it to the state of *coke* or *cinder*, before it formed his forge-fire; thus producing its best effects, in heating the barrels to a welding heat. He was continually bringing fresh coal gradually forwards towards the fire, so as, by degrees, to consume the bituminous parts of it, and finally convert it to the state of coke.

In the use of *sea-coal*, or that which possesses a *caking* or *binding property*, owing to the excess of bitumen it contains, and which admirably fits it to form *hollow-fires*, Mr. Mason states, that it is absolutely necessary to feed those hollow-fires with such coal, previously reduced to the state of coke or cinder; as, otherwise, great injury is produced in the fire, from the sulphur and bitumen contained in the coal.

The following accident occurred, owing to the want of attention, or of the requisite knowledge, in a smith at Cambridge, who was lately repairing an axle-tree. Mr. Mason, to whom it belonged, had not

turned his back, to speak to another person, above a minute or two, before he heard a violent hissing noise, and found that the smith had nearly burnt the axle in two.

No doubt the bellows-pipe, and tuyere, of his forge, were both of them too small; or else this accident would hardly have occurred. The blast being always *much sharper* from such causes, and acting *partially* upon the bodies to be heated by it. [Tech. Repos.]

On preserving Turnips and their tops, as winter food for Sheep and Cattle. By the Rev. T. C. MUNNINGS. Extracted from the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.

It has long been considered, by those who are engaged in farming, as a material desideratum, to defend and secure turnips from that host of foes with which they have to contend, and more particularly to preserve them from the injurious effects of frost, in order to receive the full benefit of them as winter and spring food for sheep and oxen.

Dr. Martyn indeed mentions some methods which have been pursued for the attainment of such an end; but as none of them have been admitted into very extensive practice, it may be presumed that they have been abandoned, on account of the difficulty of executing the prescribed work; on account of the expense attending it; or on account of its being inefficacious.

It has *twice* been my lot to be most flatteringly noticed by the society, for my successful efforts in the cultivation, and for the protection and preservation of turnips during the winter months; it is my earnest wish to give as succinct, but at the same time as clear an account as I can of my experiments for such purposes.

It must be understood, in the first place, that my turnips are *drilled* at the distance of alternate furrows, that my ridges are set out precisely the width of fifteen feet, and that each ridge contains exactly eight rows of turnips. This being the case, I have at various times within the last four years made use of the following methods of *preserving turnips during winter months*.

The first and most simple which I shall mention, was only with a narrow-set double-breasted plough, drawn by one horse, to plough between the rows, and throw earth each way upon the apples of the growing turnips. The advantages of this mode were, a partial ploughing of the land in the early part of the winter, and a preservation (almost perfect) of the turnips for spring consumption.

The second mode which I next invented (I say next invented, because the first mode differs from the Northumberland practice only in the circumstances of my turnips growing upon a flat surface, instead of the tops of two furrow work, and therefore more easily defended with a plough) was first executed by casting away the alternate rows for autumnal consumption; thus leaving rows somewhat