the gate of the monastery, he found it surrounded by a number of women, each «f whom carried a small basket of provisions. He returned thanks to heaven for having mi­raculously interposed, by inspiring the good people with pity for the distress of his friars. But when he expressed to them his wonder how they came all to be moved as if by mutual agreement with these benevolent sentiments, they told him it was no such thing; that they looked upon him and his countrymen as a pack of infernal magicians, who by their sorceries had enslaved the country, and had bewitched their good cacique, who hitherto had treated them with kindness and attention, as became a true wor­shipper of the sun ; but that the preceding evening at sun­set he had ordered the inhabitants of such and such vil­lages, about six miles off, to come that morning with provi­sions to this nest of wizards. The superior asked them in what manner the governor had warned so many of them in so short a time, at such a distance from his own residence. They told him that it was by the trumpet; and that every person heard at his own door the distinct terms of the order. The father had heard nothing ; but they told him that none heard the trumpet but the in­habitants of the villages to which it was directed. This is a piece of very curious information ; but, after allowing a good deal to the exaggeration of the reverend Jesuits, it cannot, we think, be doubted that the Peruvians actually possessed this stentorophonic art. For we may observe that the effect described in this narration resembles what *toe now know* to be the effect of speaking trumpets, while it is unlike what the inventor of such a tale would naturally and ignorantly say. Till speaking trumpets were really known, we would expect the sound to be equally diffused on all sides, which is not the case ; for it is much stronger in the line of the trumpet than in any direction very oblique to it.

About the middle of the seventeenth century, Athana­sius Kircher turned his attention to the philosophy of sound, and in different works threw out many useful and scientific hints on the construction of speaking trumpets ; but his mathematical illustrations were so vague, and his own character of inattention and credulity so notorious, that for some time these works did not attract the notice to which they were well entitled.

About the year 1670, Sir Samuel Morland, a gentleman of great ingenuity and science, directed his attention to this subject, and proposed as a question to the Royal Society of London, What is the best form for a speaking trumpet? which he called a stentorophonic horn. He accompanied his de­mand with an account of his own notions on the subject (which he acknowledged to be very vague and conjectural), and an exhibition of some instruments constructed accord­ing to his views. They were in general very large conical tubes, suddenly spreading at the very mouth to a greater width. Their effect was really wonderful. They were tried in St James’s Park ; and his majesty, King Charles IL, speaking in his ordinary colloquial pitch of voice through a trumpet only five and a half feet long, was clearly and most distinctly heard at the distance of 1000 yards. An­other person, selected we suppose for the loudness and dis­tinctness of his voice, was perfectly understood at the dis­tance of four miles and a half. The fame of this instru­ment soon spread. Morland’s principles were refined, consi­dering the novelty of the inquiry, and differed considerably from Father Kircher’s. The aerial undulations (for he speaks very accurately concerning the nature of sound) en­deavour to diffuse themselves in spheres, but are stopped by the tube, and therefore reundulate towards the axis like waves from a bank ; and meeting in the axis, they form

a strong undulation a little farther advanced along the tube, which again spreads, is again reflected, and so on, till it arrives at the mouth of the tube greatly magnified, and then it is diffused through the open air in the same manner as if all proceeded from a very sonorous point in the centre of the wide end of the trumpet. The author distinguishes with great judgment between the prodigious reinforcement of sound in a speaking trumpet and that in the musical trumpet, bugle-horn, conch-shell, &c. ; and shows that the difference consists in the violence of the first sonorous agitation, which can be produced by us only on a very small extent of surface. The mouth-piece diameter, therefore, of the musical trumpet must be very small, and the force of blast very considerable. Thus one strong but simple undulation will he excited, which must be subjected to the modifications of harmony, and will be augmented by using a conical tube.@@1 But a speaking trumpet must make no change on the nature of the first undulations ; and each point of the mouth-piece must be equally considered as the centre of sonorous undulations, all of which must be reinforced in the same degree, otherwise all distinctness of articulation will be lost. The mouth­piece must therefore take in the whole of the mouth of the speaker.

When Sir Samuel Morland’s trumpet came to be gene­rally known on the continent, it was soon discovered that the speaker could be heard at a great distance only in the line of the trumpet ; and this circumstance was by a Mr Cassegrain *(Journ. des Sçavans,* 1G72, p. 131) attributed to a defect in the principle of its construction, which he said was not according to the laws of sonorous undulations. He proposed a conoid formed by the revolution of a hyper­bola round its assymptote as the best form. A Mr Hase of Wittemberg, on the other hand, proposed a parabolic conoid, having the mouth of the speaker placed in the fo­cus. In this construction he plainly went on the principle of a reflection similar to that of the rays of light; but this is by no means the case. The effect of the parabola will be to give one reflection, and in this all the circular undu­lations will be converted into plane waves, which are at right angles to the axis of the trumpet. But nothing hin­ders their subsequent diffusion ; for it does not appear that the sound will be enforced, because the agitation of the particles on each wave is not augmented.

The subject is exceedingly difficult. We do not fully comprehend on what circumstance the affection or agitation of our organ, or simply of the membrana tympani, depends. A more violent agitation of the same air, that is, a wider oscillation of its particles, cannot fail to increase the im­pulse on this membrane. The point therefore is to find what concourse of feeble undulations will produce or be equivalent to a great one. The reasonings of all these re­storers of the speaking trumpet are almost equally specious, and each point out some phenomenon which should cha­racterise the principle of construction, and thus enable us to say which is most agreeable to the procedure of nature. Yet there is hardly any difference in the performance of trumpets of equal dimensions made after these different methods.

The propagation of light and that of elastic undulations seem to require very different methods of management. Yet the ordinary phenomena of echoes are perfectly explicable by the acknowledged laws either of optics or acoustics ; still however there are some phenomena of sound which are very unlike the genuine results of elastic undulations. If sounds are propagated spherically, then what conies into a room through a small hole should diffuse itself from that hole as round a centre, and it should be heard equally well

@@@, Accordingly the sound of the bugle-horn, of the musical trumpet, or the French horn, is prodigiously loud, when we consider the small passage through which a moderate blast is sent by the trumpeter.