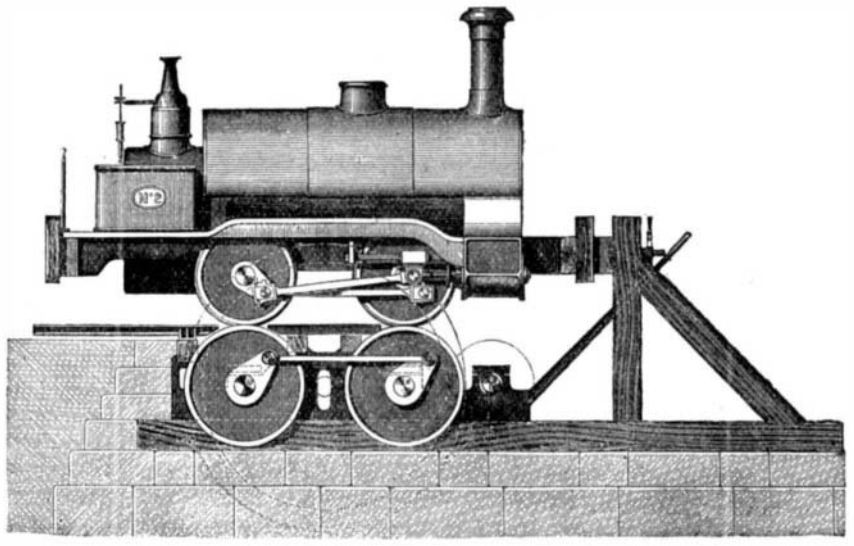
WORKING STEEP GRADIENTS BY LOCOMOTIVES.

We illustrate herewith a noyel system of working trains on steep railway gradients by locomotive engines, patented by Mr. Graham Stevenson, of Airdrie, and Mr. John Reid, of the Provanhall collieries, near Glasgow, Scotland. The apparatus has just been erected at the collieries named.

The incline selected for the first application of this system leads downwards from the main rails of the Caledonian Railway to two pits about three quarters of a mile distant, with an average gradient of about 1 in 13, and ranging between 1 in 11 and 1 in 15. About six years ago Mr. Stevenson's firm constructed two powerful tank locomotive engines to work this incline, the steepest, perhaps, with one exception, worked by locomotive power in the kingdom. The traffic from the pits has so increased of late as to make it impossible for the engines to overtake it, and the construction of a third engine, or some other means of assisting the two, came to be a matter for consideration. With the latter view it was proposed to erect a small stationary engine, working a wire rope; but in place of a stationary engine, the idea of stationary gearing, which might be acted on by one of the locomotive engines, occurred to the patentees, and this idea has been put into practical operation. Since that time the machinery has been inspected at work by a large number of engineers and and colliery proprietors, many of whom have expressed decidedly favorable opinions regarding it.

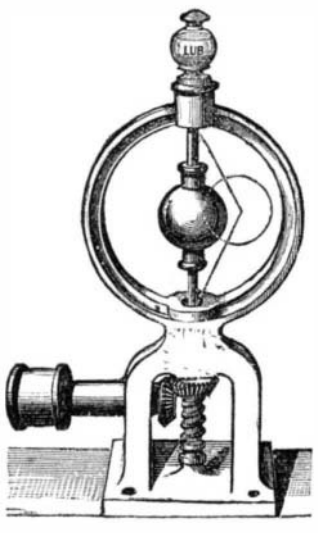


WORKING STEEP GRADIENTS BY LOCOMOTIVES.

Our engraving is a side elevation, showing a locomotive in the position for actuating the winding gearing. The winding drum and its gearing are mounted in suitable bearings on framing fixed in a stone-cased excavation below the line of rails on which the locomotive is brought to the spot. The shaft of the winding drum has fast on it a spur wheel, in gear with a pinion on an intermediate shaft, which has also fast on it a pinion in gear with a pinion on one of a pair of shafts. These shafts have wheels fixed on them, with their uppermost parts at the level of the rails, and with cranks on them connected by rods. The rails are cut away at the parts where the tops of the wheels are; and when the locomotive, having two pairs of coupled wheels, is run into position up against a buffer bar, and secured there by a screw, its four wheels rest on the four wheels below, the entire weight of the locomotive serving to impart driving power by adhesion. Then on the locomotive being made to drive its own wheels, these, acting frictionally on the wheels below, drive the winding gearing. The rails form part of a siding, while the winding drum is on the line of the incline. When the train is brought to the top, the locomotive is freed from its anchorage, runs out, and engages the trains on the level, disposing of it as desired. In lowering the empty trucks down the incline, the pinion is disengaged, and the drum controlled by the friction strap and lever. The amount of work capable of being performed with the new arrangement is four times greater than before, when the delays consequent on running the locomotives up and down the incline, shunting, coupling, sanding, etc., are taken into account, the cost of labor remaining the same, while the wear and tear of the rails and engines is very greatly diminished.

MEIN'S PATENT GOVERNOR.

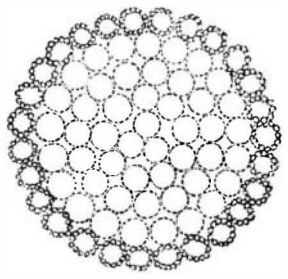
This governor depends for its action on the same principle that operates if we pass a cord through a bullet and cause the bullet to revolve in a plane; the cord being held at each end, these ends will be pulled toward each other. A heavy ball is made up of two half balls united by a horizontal central pin; each half ball is fixed to a rod; the top rod terminates in a ball carried in a socket in the top of the frame just under the lubricator; the bottom rod ends in a plain jaw, which takes hold of a rod guided in the frame, and fitted with a miter wheel sliding on a feather as shown; on this rod is a collar and spiral spring to aid gravity; the fork to the throttle lever takes into the collar at the bottom. If the ball were perfectly symmetrical when it was caused to revolve on its axis, it would not diverge in any way; but the center of gravity not coinciding with that of rotation, the ball diverges and tends to assume the position shown in the dotted lines, the halves of the split ball turning on each other



This is a very simple governor, neat in appearance, cheap, and sensitive. It has been fitted in some important mills, and is, we have reason to believe, giving much satisfaction.

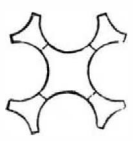
Swedenborg as a Chemist.

According to the views held by Swedenborg, the particle of water is built up in this way: The natural point constitutes the beginning of all things, in the same way that the geometrical point constitutes the beginning of geometry, and is thus a medium between the infinite and the finite. The natural point is described as being produced immediately from the infinite, its exact nature being scarcely conceivable; it consists, however, of pure and total motion, and analogy might lead one to compare it with a spiral force. Unfortunately for this theory, it happens that in all arguments as to the origin of matter it is precisely this medium between the infinite and the finite, this natural point, which constitutes the point in dispute. We do not see that its comparison to a spiral force gets over the difficulty. The next steps also depend entirely on the imagination. One point is held in equilibrium by another, and hence we have a species of concrete motion, or a motion which is local and gyratory, and thus distinguished from the all-prevading motion of the infinite; at least, this is the way we understand the author. This complex motion is termed an active finite, and its complexity is increased by a second process of development, whereby the first active finites are held in mutual equilibrum, and a second finite is produced, and so on up to the fifth. In Swedenborg's view the particle of water is reduced to a further development, wherein the sixth step is reached, and its character may be illustrated by the annexed diagram.



It will be seen that the particle of water is round, and that the sphericity is the natural outcome of the theory of its development. The individual particles of water are held to be arranged in the fluid quadrilateral pyramidal position, wherein each particle is separated from the other by the penetrating and dispersive power of heat, shown in the second engraving. In the deepest parts of the sea, where the solar heat does not penetrate, this perfectly fluid position of the particles cannot be maintained, and they accordingly assume a fixed quadrilateral pyramidal position, easily imagined by bringing into close contact four of the above circles, and imposing another circle on the center to cover the space intervening.

The partilces of water being thus arranged, an increase in pressure results in the breaking up of some of the aqueous particles, of which the component parts go to fill up the cavities and spaces of the remaining, intact, particles of water. According to Swedenberg, this disintegration or decomposition gives rise to the salts and metals, and the character of the new substances produced depends on the shape of the interstices. Thus, for instance, salt owes its acidity to the spiculæ which surround a body formed by the juxtaposition of spheres. The shape of the particle of common salt, according to this theory, consists of one cube and several triangles: to be in perfection, it ought to consist of one cubical body with eight triangles or points, as shown in the third engraving.



Variety in the characters of salts is produced by the breaking off of one or more of these points, so that the less number of spiculæ will give rise to a salt possessing less acidity, because there is a similar number of spiculæ to produce acidity. The spiculæ of these bodies are consequently the acids, and the body without any points would be without taste or acidity, and would constitute some kind of earth. When heat is applied to a salt, an acid is supposed to be produced by the volatilization of the points, while the stoma remains behind and forms the earth. The author does not explain why the points are volatile, and not the body, which we should expect to be equally so, seeing that it is supposed to have been produced contemporaneously with the points by the disintegration of like particles of water.

The different kinds of acids are held to be produced by the conjunction in various matters of one or more of the acid spiculæ, which is the simplest or first kind of acid. Niter is supposed to consist of a central volume of subtle fiery matter around which are disposed the acid particles. Swedenborg's theories of oil, sal ammoniac, and lead are developed by a like method of reasoning without facts, and with a full flow of imagination; but we think the example we have given will afford a sufficient illustration of the author's views.—*Chemist and Druggist.*

American Leather Belting Abroad.

Our English contemporaries are very unhappy over the introduction of American products into their country. Almost every trade journal that comes to us from abroad has something to say about our encroachments upon their manufacturing interests. The last *British Trade Journal* says:

"It is certain that the Americans are actively bestirring themselves at the present time, with a view to getting certain of their manufactures into the British market. Their iron and hardwares have already got a footing—and in the latter case a by no means despicable one—here; their cotton manufacturers have made the first sign of advance towards a region hitherto dominated by Manchester; and it would seem that the leather trade is now to feel the influence of American competition. It will interest Birmingham and Walsall to know that the first invoice of leather belting has recently been shipped by a New York firm, who, we are told, work up in their Brooklyn manufactory ten thousand hides per annum. The order for the shipment referred to was placed by our great gun manufacturer, Sir William Armstrong, and included two belts of unusual dimensions, one being 2 feet 8 inches wide and 94 feet long, and the other 18 inches wide and 123 feet long, and of double thickness. Leather belting is largely manufactured, as is well known in the centers of the trade, in this country, and as regards material and workmanship could scarcely be surpassed. We can only suppose, therefore, that an English firm was led to place an order for such goods in America by some advantage on the score of price. The American manufacturers deserve all credit for the enterprise and energy they are showing in their efforts to compete with British makers in their own market. What possible chance could they have of doing so successfully, we ask, if their goods were saddled with such import duties as British manufactures have to bear before they can reach the American consumer?"

MOORE'S PULLEY BLOCK.

We annex an illustration of Moore's 7½ tun pulley blocks, with which two men can lift a load of 8 tuns. It represents a front view of the apparatus showing the internal gearing, which is of 20 inches outside diameter. In these blocks two revolving disks are mounted face to face upon a shaft. The meeting face of each disk is dished out, and the periphery of each dished recess is formed into an internal toothed wheel. One disk has a tooth less in number than the other, but both have the same pitch diameter. When the disks are mounted on the shaft, the space formed by the meeting of the two recesses is occupied by a pinion of smaller pitch diameter than that of the internal disk wheels. This pinion is mounted loose upon an eccentric forged in one with the shaft passing through the disks, and is carried round by the revolution of the shaft and eccentric. In revolving, the pinion rolls round the periphery of the internal wheels, and in one complete orbit the faces of the two disks move a distance equal to the pitch of one of the disk teeth, owing to the gradual displacement of the odd tooth. A chain wheel is cast on the back of each disk, and from the cross head and hook to which the weight to be lifted is attached two chains pass, one to the right side and one to the left side of either disk chain wheel. The loose ends pass over and are connected at a convenient distance below the block, forming a loop, which rises as the weight is lowered, and *vice versâ*. The eccentric shaft is made to revolve by a hand chain wheel keyed to it, the wheel being worked by an endless hand chain, and the machine is supported in a frame with a suspending hook at the top, to attach to a beam or other means of support. The differential power is obtained by the gradual displacement of the odd tooth in the revolution of the pinion. The disks are perfectly free to move either way round in the frame, but the weight, coming half on the right side and half on the left, perfectly balances the block and keeps the lifting chain plumb and fair. One advantage of this system, among many which it possesses is that the weight cannot run down when left suspended.