PERPETUAL MOTION.

NUMBER XI.

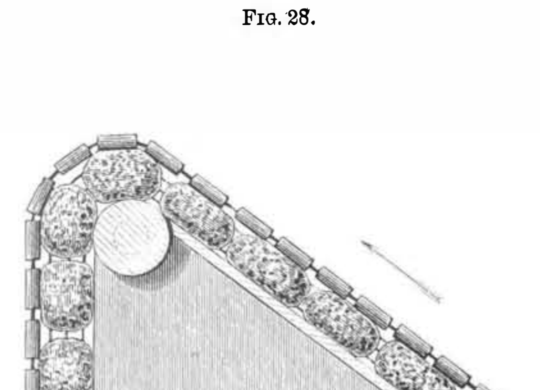
No less a person than Sir William Congreve, M. P., and inventor of the famous Congreve rocket, figured in his time as a believer in, disputant upon, and inventor of a perpetual motion. So sure was he that he had discovered the long sought principle upon which self-moving machines could be constructed, that he patented his device, although we believe he never claimed to have succeeded in getting it to work. Nevertheless, he obstinately maintained that it would work, in spite of the mathematical demonstrations, of the absurdity of his views, made by several eminent mathematicians.

Fig. 28 shows this device. As will be seen, it is based on a principle hitherto not mentioned in this series of articles, viz: the power of capillary attraction.

Three horizontal rollers are fixed in a frame; an endless band of sponge runs round these rollers, and carries on the outside an endless chain of weights, surrounding the band of sponge, and attached to it, so that they must move together; every part of this band and chain being so accurately uniform in weight that the perpendicular side will, in all positions of the band and chain, be in equilibrium with the hypothenuse, on the principle of the inclined plane. Now, if the frame in which these rollers are fixed, be placed in a cistern of water, having its lower part immersed therein, so that the water's edge cuts the upper part of the rollers, then, if the weight and quantity of the endless chain be duly proportioned to the thickness and breadth of the band of sponge, the band and chain will, on the water in the cistern being brought to the proper level, begin to move round the rollers in the direction of the arrow, by the force of capillary attraction, and will continue so to move.

On the perpendicular side of the triangle, the weights hanging perpendicularly alongside the band of sponge, the band is not compressed by them; and its pores being left open, the water, at the point where the band meets its surface, will rise to a certain hight above its level, and thereby create a load, which load will not exist on the ascending side, because on this side the chain of weights compresses the band at the water's edge, and squeezes out any water that may have previously accumulated in it; so that the band rises in a dry state, the weight of the chain having been so proportioned to the breadth and thickness of the band as to be sufficient to produce this effect. The load therefore, on the descending side, not being opposed by any similar load on the ascending side, and *the equilibrium of the other parts not being disturbed by the alternate expansion and compression of the sponge,* the band will begin to move in the direction; and as it moves downwards, the accumulation of water will continue to rise, and thereby carry on a constant motion, provided the load be sufficient to overcome the friction on the rollers.

FIG. 28.



Now, to ascertain the quantity of this load in any particular machine, it must be stated that it is found by experiment that the water will rise in a fine sponge about an inch above its level; if, therefore, the band and sponge be one foot thick and six feet broad, the area of its horizontal section in contact with the water would be 864 square inches, and the weight of the accumulation of water raised by the capillary attraction being one inch rise upon 864 square inches, would be 30 lbs., which, it is conceived, would be much more than equivalent to the friction of the rollers.

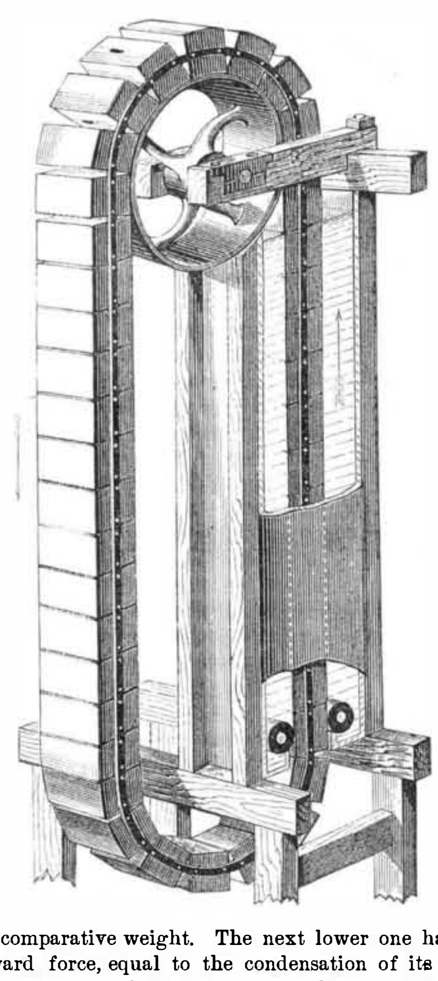
Now, the fallacy in this plausible argument is found in the words italicised. The equilibrium of the parts of the chain *is* disturbed at the moment the chain moves downward to compress the ascending file of sponges, and just enough disturbed to counterbalance the increase of weight on the perpendicular side. It is somewhat astonishing that a man of Sir William Congreve's ability, should not have seen this at once, and still more astonishing that he should have disputed it when pointed out to him, which he did vehemently. Writing upon this subject, he says:

"For my own part, not being able to see any reason why the machine should not act, I confess that my faith is sufficiently strong to have induced me to take out a patent, and I am determined to use my best exertions to give mankind the benefit of this discovery, should it turn out, as I sincerely believe it will, a source of perpetual power without expense."

Fig. 29 is a diagram sent us by Mr. Wm. B. Cooper, of Philadelphia, who writes as follows in regard to it:

"Having seen in your issue of 7th Jan., a diagram of an attempt at perpetual motion, by H. Leonhart, I send you the enclosed diagram and description, which appears to me to correct the errors in his. The diagram represents an upright tank, through which passes a number of floats connected by a band of elastic rubber attached to their ends, leaving just enough space between them to secure action on each by the water. They are each of the same weight as an equal bulk of water at the surface, therefore the upper one in the tank

FIG. 29.



has no comparative weight. The next lower one has a unit of upward force, equal to the condensation of its bulk of water, and so on, each adding a unit to the upward tendency, until we come to the last, the pressure on which is altogether downward to the amount of the entire column of water; but we already have a number of opposing upward forces, and when we look on the other side and see the thirteen active weights, it seems clear that there will be a large surplus weight, over and above the opposing weight and the friction of the rollers and upper wheel.

"Of course mercury or any other liquid could be substituted in place of water.

"If you can, by the enclosed rough diagram and description, comprehend my meaning, I would consider it a special favor if you would point out the error, if any."

The mistake of this inventor is in supposing the upward pressure of the floats, added to the weight of the floats outside the tank, will more than equal the weight of a water column having a base equal to the lower side of one of the floats, and a hight equal to the depth of the tank. If the floats be made of material more compressible than water, they would tend to sink rather than rise in the tank, but if made of material less compressible, the amount of upward face which could be obtained by their compression would be far less than the weight of water in the interstices between the floats. The downward effective pressure on the lower float in the tank would be the difference between this buoyancy and the weight of water in the interstices between the floats. The weight of the floats outside the tank is exactly balanced by the downward pressure of a bulk of water equal to that displaced by the floats in the tank, therefore if any motion should take place at all, it would be in an opposite direction from that expected, and would only continue till enough water had passed out of the bottom of the tank to bring the parts of the machine in exact balance.

W. MATTIEU WILLIAMS ON THE BESSEMER PROCESS.

From Nature.

In the first place, the pig iron is melted in a suitable furnace, usually in that form of furnace known as the "cupola." The melted iron is run from this by means of movable troughs into the "converter," which is a pear-shaped spouted vessel, lined with fire-clay, "ganister," or other refractory substance.

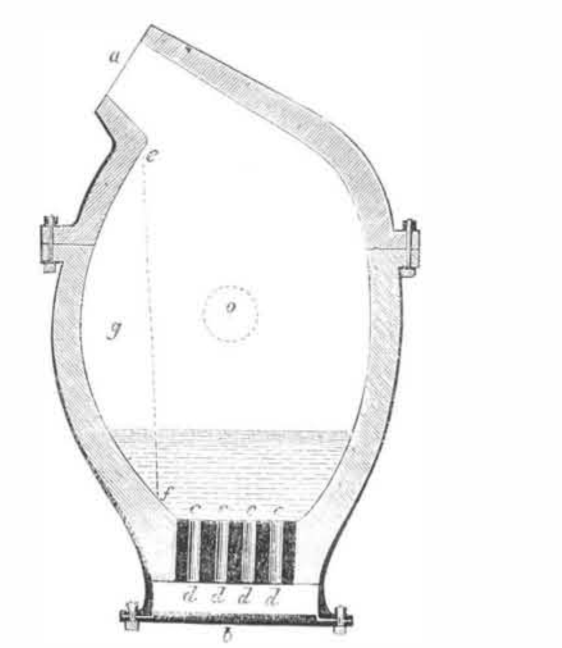
This pear-shaped vessel is truncated at the lower end, and thus a flat circular bottom is formed. This bottom, which is readily detached and renewable, is fitted with longitudinally perforated fire clay cylinders, shown in section at *cd cd cd cd,* each perforation or clay tube being about one half or three quarters of an inch in diameter, and all communicating with the space, *d d,* into which opens the blast tube from a powerful blowing engine. The number of these blast holes varies from fifty or sixty to a hundred or more, according to the size of the converter.

The converter is mounted on trunnions so arranged that it may turn on a transverse axis crossing about the middle of the vessel, as shown by the dotted circle, *o,* The turning is effected by hydraulic machinery, controlled by levers readily worked by a man who stands on a platform in full view of the converter. In order to receive the charge of melted iron, the converter (the lining of which has been previously raised to a bright-red heat) is turned over so that the dotted line, *e f,* becomes horizontal, and corresponds to the surface of a full charge. The belly, *g,* of the converter is so curved that it shall in this position retain the whole charge without any of it reaching the blast holes at *f*, or the mouth at *e,* and yet allow the whole charge to be readily "teemed" by turning the converter a little further down.

When the full charge is thus received in the belly of the converter, the blast is turned on, after which the converter is turned to the upright position, as shown in the figure, and the melted metal then stands directly over the perforated bottom. All the fluid metal above the openings is now resting upon a bed of air, and is only prevented from falling through by the blast being maintained at a pressure exceeding the falling force of the column of liquid above it. It would fall through these orifices into the blast-way and do serious mischief should the blast be stopped or slackened for an instant, or should the converter be turned upright or overcharged, before the commencement of the blast. An accident of this kind but rarely happens, though it is by no means an unknown casualty.

The "blow," as it is termed, now commences; the hundred streams of air tear through the pool of melted iron, and a huge flame roars furiously from the mouth of the converter. At irregular intervals magnificent cascades of brilliant coruscating sparks are belched forth, and the dazzling spray as it dashes against the walls of the flame shaft rebounds with redoubled splendor, each glowing globule being shattered by the shock, and bursting into rescintillating fragments. The loud-bellowing blast roars on monotonously, but the flame becomes brighter and brighter continuously, and grows in length and breadth as it increases in brilliancy, until at the end of about ten minutes it attains its maximum, when its splendor is painful to the eye, and yet so fascinating that few who see it for the first time can turn their dazzled eyes away. The spark eruptions still burst upwards from time to time, and still dash against the brickwork and the ground, and still reverberate in fiery splinters, but their appearance has changed. They are now no longer red hot, or yellow hot, or white hot, but have a curious purple luminosity different from anything one has ever seen before. If it be day time, and the sun shining, the sunlight out of doors has a sickened partial-eclipse aspect when viewed directly after gazing at the flame, and at night the ordinary gas lights appear red and smoky.

After five or ten minutes continuance of this maximum splendor, the flame is seen to contract somewhat, and presently the ponderous vessel turns a very deliberate summersault, the flame disappears, but the uninitiated spectator is startled



by a new display; for as the converter rolls smoothly over, it disgorges a continuous stream of sparks which its rotation spreads out in a fan-shaped volley, extending from end to end of the building, and reaching the roof, descends in a broad sheet of fiery hail. This is the transformation scene which concludes the first part of the performance; for now the dazzle of the flame and the roar of the blast ceases, and a general lull intervenes.

The trough from the cupola is now swung round to the mouth of the converter, a red glow is seen to creep along it, and starry sparks dance above as it advances. This is the spiegeleisen coming from its cupola by the same path as conducted the main charge. The spectator should now change his position, and, if possible, find a standing place from which he may look into the mouth of the converter. At first he will distinguish nothing but a yellow glare, but by steadily fixing his gaze, he will presently, and rather suddenly, distinguish the surface and limits of the pool of melted metal. He will see that as the spiegeleisen pours into it, a furious ebullition takes place. At the same time a great mass of pale blue flame issues from the mouth of the converter, but with a quiet, leisurely waving, that contrasts curiously with the previous roaring jet of white flame. This flame has but very little intrinsic luminosity, yet at night it lights up all the surrounding objects with a singular brilliancy, a sort of