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IMPROVED GOVERNOR.

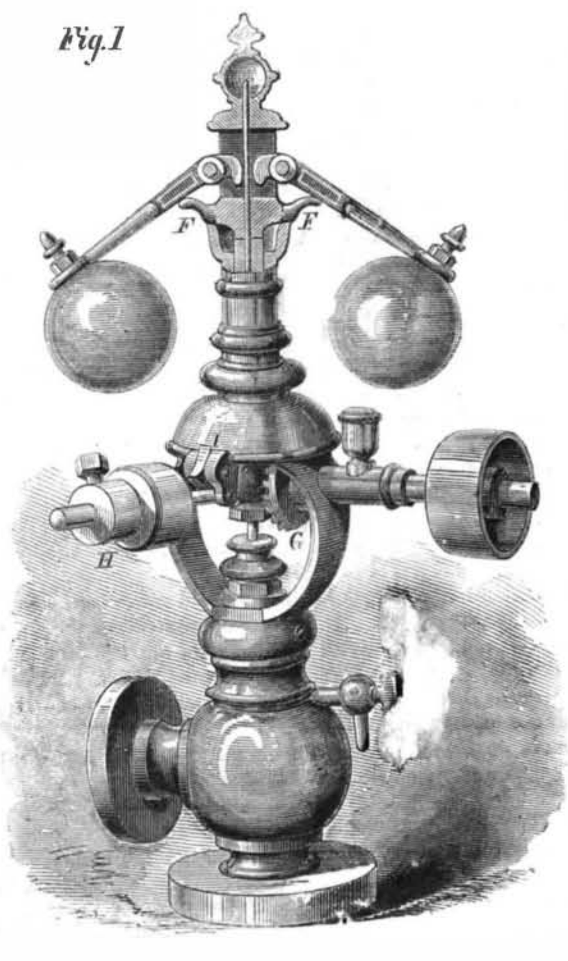
The new steam governor represented in the annexed engravings is claimed to give a perfect regulation of speed under all circumstances, and especially in case where, a variety of machinery being used, frequent stoppings and startings of the engine are rendered necessary. Its action is such as to allow of the use of iron contractible valves, thereby admitting to the cylinder, it is stated, the greatest possible boiler pressure at each stroke of the piston, thus increasing the power and, at the same time, effecting a saving of fuel, etc. The valves are balanced and, with the seat, are of such metal as will best sustain the cutting action of the steam. We are informed that they may readily be removed and replaced. A self acting safety stop action is also provided, which is operated by the falling of the governor balls; and an improved lubricating arrangement, allows of the admission of a constant stream of oil to the piston and valve.

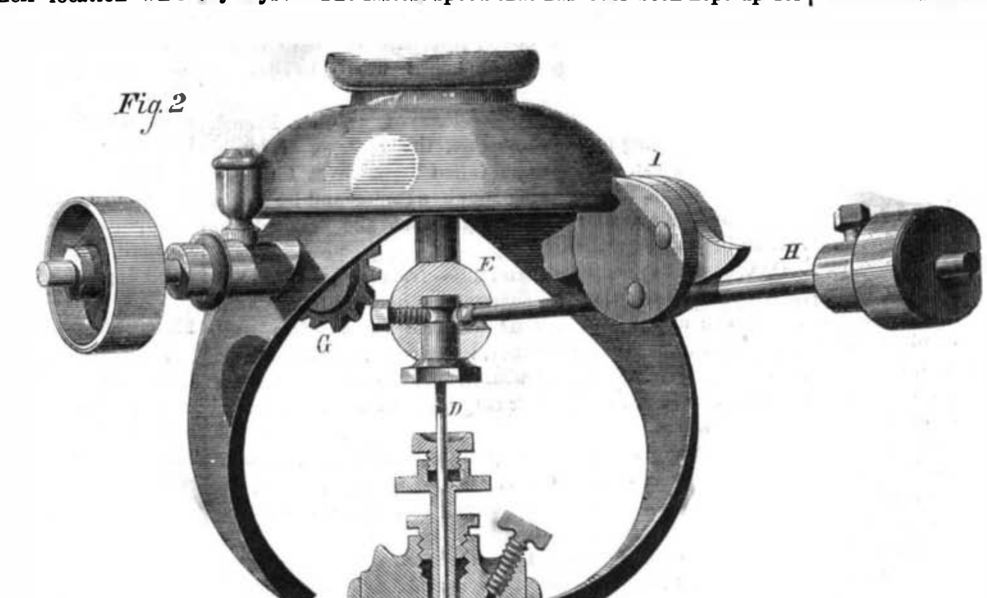
Fig. 1 is a perspective view of the device, and Fig. 2, a sectional view of the lower and essential portions. Within the steam chamber, A, Fig. 2, is a cylinder pierced with two sets of ports, B B. Within this is the double hollow valve, C, in which is made a row of corresponding perforations. It will be noticed that, in the position shown in the engraving, the apertures in the valve nearly correspond with the upper row of ports in the cylinder, while the lower set of openings in the latter are left unobstructed by the bottom of the valve being above them. No explanation is necessary to show how both sets of ports are closed by suitable placing of the valve, C. The latter is, in fact, in two parts, divided by the row of apertures, and both affixed to the rod, D. This rod is in two portions, the lower of which enters a screw nut, and the nut, in turn, enters a ball, E, secured to the upper part of the rod. By this means the latter may be shortened or lengthened, and the valve, C, raised or lowered, as desired. Upon the upper portion of the rod are placed stops, F, Fig. 1. The balls and levers are suitably connected to the revolving head and actuated by bevel gearing at G. When the governor belt breaks, the balls fall, strike against the stops, F, and thus, by pushing down the rod, D, close the valve, C, and stop the engine. The arrangement of the balls is also such that they fall, fully half the distance between their location while working and when at rest, before acting on the stops and shutting off steam, thus giving a wider opening to the valve when a heavy load is thrown on the engine when operating at low boiler pressure.

A lever and weight, H, is connected with the valve rod by means of the ball, E, for the purpose of balancing the balls and holding the valve in position. A hook lever, I, is adjustably connected with the frame of the governor so as to form a stop for the lever, H, and prevent its weighted end rising, the object being to prevent the valve closing on its seat and shutting the ports.

J is the lubricating and K the condensing chamber, the latter being provided with a suitable valve through which the oil passes to the rod, D, and thence down to the engine cylinder. It is claimed that the supply of oil is perfectly regulated.

Patented through the Scientific American Patent Agency, July 16, 1872, and August 26, 1873, by Mr. A. Matson. For further particulars address Matson and Brothers, Moline, Ill.





MATSON'S IMPROVED GOVERNOR.

Seventy-five Miles an Hour by Railroad—Success of the Pullman Palace Cars in England.

In England the passenger cars are short, stumpy things, rarely exceeding thirty feet in length, and a little over six feet high inside. Mr. Pullman has lately built and sent over to London, for trial, a train of his splendid drawing room cars, and our English cousins, among whom were the principal railway magnates, have been riding back and forth in them for some time past, on the Midland Railway. The appearance of these cars in England has made quite a sensation, and they are spoken of in the highest terms of praise. The *English Mechanic* gives the following description of one of the trials, when the cars were run for a distance of one hundred and twenty-nine miles at the rate of over sixty miles an hour, and for a portion of the way at the rate of seventy-five miles an hour. Our cotemporary says: "The fastest speed that has ever been kept up for long together, was run on Tuesday, March 17, 1874, with a party of engineers, etc., and two of the new Pullman cars. The train was timed very fast, so as to see if they shook about; the train stopped twice, as it was thought better to examine the carriage axles; but the tender would carry enough water for the whole distance. The trial was from Derby to London. The two cars are as long as four ordinary five-compartment carriages. The engine had the steam brake, and the cars and tender had the new air brake, which is being fitted to all Midland trains. The air brake will stop a heavy express of twenty five carriages, running seventy miles an hour, in 290 yards. The distance from Derby to London is 129 miles. It is all on the block system, and all trains were shunted for this special express. The train left Derby at 2:30 P.M., passed Trent at 2:40, 9½ miles; arrived at Wigston at 3:7, 33½ miles; left there at 3:12, stopped at Bedford at 4:0, 79½ miles; left at 4:3, arrived at London at 5 P.M., 129 miles; running time 142 minutes; but this does not show the speed, as the three stops and three starts took six minutes. Speed was reduced to twenty-five miles an hour over thirteen junctions, which each took a good minute, leaving the time as 123 minutes for 129 miles, which averages over a mile a minute all the way. In one case, on a level piece of line, sixteen miles was run in 13½ minutes, about 75 miles an hour, and twenty miles was run in 19 minutes. The cars ran as steady as tables at 75 miles an hour.

"Dimensions of the engine that ran: Driving and trailing wheels, 6 feet 8½ inches; leading, 4 feet; barrel of boiler, 11 feet 9½ inches long, 4 feet 4 inches diameter; tubes 1¾ inches across; inside cylinders, 17 by 24 inches; leading wheels outside bearings; driving and trailing wheels inside bearings; steam 140 lbs.; heating surface, 13,000 square feet; blast pipe, 4½ inches. Weight on driving wheels, 15 tuns; the side rods work on the bosses of wheels inside the outside frames; the tender carries 2,050 gallons of water, and three and a half tuns of coal. (Thirty-five lbs. a mile are burnt with an express of 26 carriages.) In this trial trip she burnt 18¾ lbs. a mile."

Speaking of another trial of the Pullman cars, *Iron* says: "Four cars were run, two being drawing room and sleeping cars, and two parlor cars. Each car is 51 feet 6 inches long, 8 feet 10 inches wide, 13 feet in extreme hight from the rails, and 8 feet 6 inches from the floor to the center of the ceiling. It is supported upon two four-wheeled bogies by a double set of springs, half volutes and half elliptical, and by joints which prevent any lateral oscillation being conveyed to the body of the car. The couplings are automatic, being a pair of immense hooks which, when once linked, cannot be loosened, but by operating levers worked from the Miller platform, with which each end of each car is furnished. This platform resembles, in appearance, the platform of an ordinary tramway car. The buffers are central, and brought by the coupling close up to one another, so as to make of the train a complete whole, in which there is no unpleasant jerk when it begins to move. In fact the start was quite imperceptible.

"The greatest novelty to an English passenger is the facility afforded for passage from one end to the other of the train. To accomplish this a central space in each car is left unfurnished with seats, just as in the tramway cars, but here the resemblance ceases. The Pullman parlor cars contain each seventeen comfortable armchairs, in two rows, capable of being turned half round and tilted. Two small compartments, for families or private parties, are at one end, and two more at the other, fitted as lavatories. The drawing room and sleeping cars are fitted with double benches in lieu of armchairs, in the recesses of which, at a minute's notice, can be adjusted small tables, so as to convert the interior into something resembling a coffee room, with the unusual peculiarity of softly cushioned seats. The tables removed, a pulling out of the seats fills up the eight recesses with so many mattresses. A kind of cupboard above each contains bedding, and its door, moreover, forms, when open, the basis for another bed or berth. Partitions and curtains are also furnished, so that the utmost privacy is secured. Private rooms and lavatories form part of the sleeping cars, while in each there is also contained a small room with a stove for warming the car by means of hot air pipes.

The minor details of the cars are too numerous to mention, though their neatness and ingenuity deserve notice. The windows, with convenient blinds and plated bolts to regulate their opening, are a pleasant contrast to those we usually see. The lamps—six in each car—are extremely elegant, as is also the metal work—that which is decorative being bronze, and that which is plain nickel-plated. The black walnut woodwork, carved and gilded, and the neat Brussels carpet on the floor, cause the crimson velvet cushions and chairs to stand out perhaps a trifle too prominently, but with excellent effect, while the bright plated metal fittings, occasional looking glass, and the sides (almost all windows) give the interior of the cars not only a luxurious but a comfortable appearance.

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THE EFFECTIVE POWER OF STEAM ENGINES.

It is rather the exception than the rule that manufacturing establishments have abundance of motive power. In those using steam power, a false economy in first cost is almost universally practised in purchasing insufficient boilers. An increased consumption of fuel is the result, which, for various reasons, becomes greater from year to year, until the losses from this cause aggregate a fearful rate of interest on the amount intended to be saved. In many instances, from one fourth to one half of the fuel would be economized by the introduction of boilers of proper proportions for the power required. From how many smokestacks throughout the land can great volumes of smoke, as black as midnight, be seen, at almost all times, rolling upward, carrying with them the most valuable portions of the fuel! Each one of these advertises a great waste, which is generally produced by the boilers being too small. The amount thus lost on an average coal-burning Mississippi river steamer would be abundantly sufficient to furnish gas lights for a city of ten thousand inhabitants. When steam boilers are of suitable proportions and furnaces properly constructed, this waste should not occur. A genuine fear of loss of fuel from too much boiler surface is quite common with proprietors, but it is very rarely that such actually occurs. It is safe to provide twenty per cent more boiler than cylinder horse power, while equal power in each will often serve the purpose; and yet it will, in most instances, be found that the cylinder considerably exceeds the boilers in measurement

Of equal importance is the size and construction of the steam engine cylinder. The naked rule that a certain pressure upon the number of square inches surface of the piston head will give the definite horse power, if followed out, will always cause failure. Omitting, for the present, the amount of friction, let us point out the principal reasons why this is so: It is well established that the economical use of steam forbids that the cylinder should be entirely filled at each half revolution with steam at the full boiler pressure. For this reason the flow of steam into the cylinder should be cut off at some portion of the stroke, and be allowed to exert itself expansively. There are two systems of accomplishing this: In the ordinary engine, by means of the slide or other valve, closing the steam supply port at a fixed point; the other, as in the Corliss type, through a governor acting upon the steam supply valve, cutting off steam when sufficient has been admitted to accomplish the number of revelutions per minute required. With the first-named engines, that regular speed may be had, it is necessary to use a governor. The principle upon which this governor always acts is that of securing less than boiler pressure in the cylinder by throttling the steam pipe, and rendering it impossible for the full pressure to reach the piston head. If a pressure gage be connected with the cylinder of an engine using a governor, less pressure will be registered than that shown by the boiler steam gage. When the pressure of steam in the boiler and cylinder becomes the same throughout the stroke, the governor is no longer of service, regularity of speed ceases, and the revolutions become less than those required.

With the Corliss type of engines, the full boiler pressure enters the cylinder at the commencement of the stroke, and the motion of the governor determines at each half revolution where steam is to be cut off, that proper speed may be maintained. When the full pressure is necessary for the whole stroke, this engine fails the same as the other, a considerable margin of power being always essential. Very little additional power is gained in any engine by allowing the steam valve to be open at over half stroke, and much less is lost in the crank and by dead centers than is generally supposed. From the above suggestion, the necessary failure of engines, when expected to yield the full boiler pressure power, in actual use is made quite apparent. If, besides allowing amply for friction, a further allowance of twenty-five or thirty per cent is made for the governor and for a reserve, sufficient power in engines will generally be provided. The omission to do this has caused many advertisements of "a good second hand engine for sale, having been replaced by a larger one." Some engine builders practice deception by claiming to secure, by patented improvements, great accessions in results. These pretensions are usually unfounded, and should not be allowed to reduce the sizes of cylinders.

Inattention to the temperature of feed water for boilers is entirely too common. When the escape steam of the engine can be brought into water heaters, no water should be supplied to boilers at much less than boiling heat. A heater that does not furnish it and a pump that fails to force it in at that heat should be thrown out at once.

We shall next week comment on the effective power of turbine water wheels.

COMPARTMENT SHIPS.

It will be remembered that last year a large and splendid French steamer, plying between New York and Havre, the Ville du Havre, was sunk in mid ocean, in the night time, by collision with a sailing vessel. A large number of lives were lost. The side of the ship was torn open, and the water poured in so rapidly that, in twelve minutes, the vessel went down. It was alleged that the doors in the dividing compartments of the ship were open at the time of the collision, and that influx of water was so rapid and unexpected as to prevent the closing of the doors, otherwise the ship would have floated much longer, and might finally have been saved.

We have now to record the loss of another French steamer, belonging to the same line, the Europe. Happily no lives were lost. This vessel sailed from Brest for New York, March 28, encountering rough weather and leaking a little from the start. It was alleged that she scraped her bottom in passing the bar.

On the fifth day out, a thousand miles from land, the leak had increased so much that the commander decided to leave the vessel, and all on board, four hundred in number, were transferred to a passing steamer, the Greece, and brought to New York. When finally abandoned, the Europe had 17 feet of water in her hold. Her cargo was valued at two millions of dollars.

The Europe was an iron ship: Length, 410 feet; breadth of beam, 44 feet; depth of hold, 37 feet; tunnage, 4,585; her engines were of 1,000 horse power, and she was divided into seven compartments.

It is now common in the construction of iron ocean steamers to subdivide the hull into compartments, each of which is intended to be watertight, so that, if leakage occurs in one, the others will not necessarily be affected.

It is obvious that, if the vessel were divided into a sufficient number of strong independent compartments, the chances of sinking by leakage or collision would be very much reduced. In fact there are many examples on record of vessels saved by means of compartments. On the other hand, large numbers of compartment ships have gone down, but of these it has too often appeared that the partition; were weak or leaky, or ports between them were left opens or the compartments were too large. In a 400 feet ship, it is not customary to have more than seven compartments. But experience seems to show that this is too small a number. The engine and boiler space now required is much smaller than formerly, and there seems to be no good reason why an increased number of compartments should not hereafter be provided.

As an example in this direction, we may refer to the new British war steamer Inflexible, which is to have 127 water-tight compartments.

For mercantile service, it would be unnecessary to employ so many compartments as this, but it is plain that the number might be considerably increased and the risks of disaster correspondently diminished.

After the above was written, the sad tidings came of the loss of another ship belonging to the same line, the Amérique. This vessel was almost similar, in size, power, and construction, to the Europe. The Amérique sailed from New York, April 4, and encountered a hurricane, near Brest, April 14, when the captain, acting under the impression that his ship was aleak, signaled another vessel, transferred passengers and crew, and abandoned the Amérique. The next day (April 15) she was found floating in the trough of the sea, by the captain of another steamer, who, on boarding, found 6 feet of water in the middle compartments, all the others being free. The Amérique's pumps were started, and she was then towed to Plymouth, England, vessel and cargo saved in good condition. The value of compartments is well illustrated in this instance. It is now believed that the abandonment of the Europe was unwarranted, and, as in the case of the Amérique, was an act of bad seamanship.

A TREE THAT KEEPS A STANDING ARMY.

Among the varied means of defense developed by plants in their ceaseless struggle for existence, there is perhaps none more wonderful or effective than that of a species of acacia which abounds on the dry savannahs of Central America. It is called the bull's horn thorn, from the strong curved thorns like bulls' horns, set in pairs all over the trunk and branches. These no doubt help to protect the tree from the attacks of browsing animals; but it has more dangerous enemies in the leaf-cutting ants and other insects. Against these the tree maintains a numerous standing army, for which it provides snug houses stored with food, nectar to drink, and abundance of luscious fruit for dessert.

When first developed, the thorns are soft and filled with a sweetish pulp, much relished by a species of small springing ants, never found except on these trees. Making a hole near the point of one of each pair of thorns, these ants eat out the interior, then burrow through the thin partition at the base into the other thorn, and treat it in the same manner. The hollow shells thus formed make admirable dwellings, none of which are left untenanted, as any one may discover by disturbing the plant, when the little warriors swarm out in force and attack the aggressor with jaws and stings.

The leaves of the plant are two-winged, and at the base of each pair of leaflets, on the mid rib, is a gland which, when the leaf is young, secretes a honey-like liquid, of which the ants are very fond. This ensures their constant presence on the young leaves, and their most zealous service in driving off other insects.

A still more wonderful provision of solid food is made for a similar purpose. At the end of each of the small divisions of the compound leaflet, there grows a small fruit-like body, which, under the microscope, looks like a golden pear. When the leaf first unfolds, the little pears are not quite ripe, and the ants are continually employed going from one to another to see how they come on. As these fruit-like bodies—which appear to have no other use than as ant food—do not all ripen at once, the ants are kept about the young leaves for a considerable time. When an ant finds one sufficiently advanced, it bites the point of attachment, then, bending down the prize, breaks it off and bears it away in triumph to the nest.

These ants, a species of *pseudomyrma*, are found, as already noticed, only on these trees; and that the trees really keep them as a body guard seems evident from the fact that, when planted in localities where their little protectors do not exist, they are speedily defoliated by leaf cutters, which let them severely alone on the savannahs, while their honey glands and golden pears offer no attractions to the ants of the forest

Apparently both acacias and *pseudomyrmas* have been mutually modified in the course of time, until they are now quite dependent on each other for support and protection.

PROGRESS OF UNDERGROUND RAILWAYS IN LONDON.

The length of underground railways now in operation in London is about twenty miles, and they are being extended in various directions. From a recent number of *Iron* we learn that the extension of the Metropolitan Railway from Moorgate street under Finsbury circus is proceeding with rapidity. The Metropolitan Inner Circle Railway is to be completed from Aldgate. One new branch is to extend from the Metropolitan Railway, Queen Victoria street, under Friday street, Cheapside, curving northeasterly under Philpot and Rood lanes, by Cullum street, under Fenchurch street to Aldgate, under that street, Whitechapel, Mile End, and Bow Road, to the North London Railway station at Bow. Another branch is from the line just described under Duke street, Houndsditch, to Roper's Building, to the Metropolitan extension, to Meeting house yard, under Petticoat lane, Middlesex street, with a curved junction to unite with the Metropolitan proper. Two more junctions will be made with the East London line at Stepney and the North London at Bow. All of these lines will be underground, the tracks being from 25 to 40 feet below the surface. The total length of the new lines is about five miles.

A NEW COMET.

The discovery of a new bright comet is announced by the Academy of Sciences, Vienna, in 21 hours 23 minutes right ascension south, 6 degrees 56 minutes declension. An observer at Yonkers, N. Y., states that it is nearly globular, about two minutes in diameter, with a decided condensation toward the center. In brightness it is above the average, but it does not in other respects present any notable difference from objects of its class. Its position at 4 o'clock A. M., of April 14, was approximately: Right ascension, 21 hours, 16 minutes, 31 seconds; south declination, 5 degrees, 15 minutes. Its motion is toward the north and east.

An observer in this city states, April 17, that it rises at 2 A. M., east one half south. Half an hour earlier on April 24. It is a telescopic object.