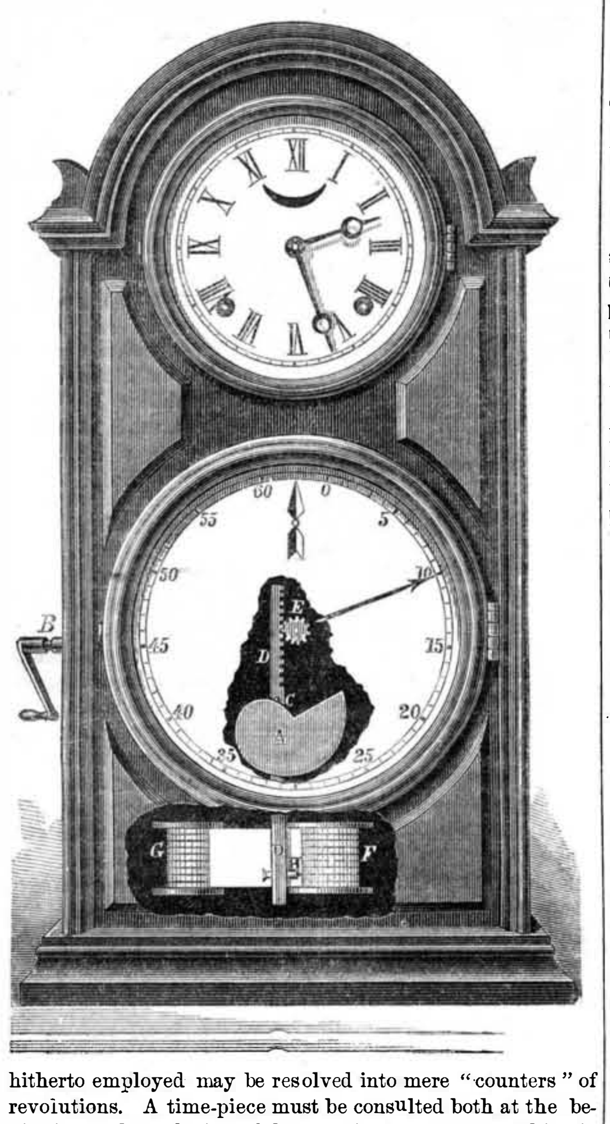
THE VELOCIMETER--A NEW AID IN MECHANICS.

Modern machinists have long recognized the importance of knowing, as precisely as possible, what a machine is doing, while in motion, without waiting for ultimate results. The engineer must have his steam gage to inform him at all times the quantity of operative pressure in the boiler, and the applications of the dynamometer are made with the sole view to determine the motive power of machinery at the time of application.

Various contrivances have come into use for indicating the speed, that is to say, the number of revolutions performed within a given time, in the running of machinery. But all



hitherto employed may be resolved into mere "counters" of revolutions. A time-piece must be consulted both at the beginning and conclusion of the counting process, or nothing is ascertained as to the running rate. Prior to the invention which we are about to explain to our readers, nothing was ever patented in this country which proposed to indicate of itself, at all times, the running rate of machinery while in motion, so that, whenever glanced at, it would inform the observer how fast the machine was then running.

The invention referred to was patented through the Scientific American Patent Agency Nov. 26, 1867, to Mr. Edward A. Lewis, of St. Charles, Mo. It is about the size of an ordinary clock—it may be larger or smaller, according to taste—and may be connected with any running machinery either by immediate contact or in a remote part of the buildings occupied. It has two dials, placed similarly to those on calendar clocks; one an ordinary time dial, with clock movement, and the other for indicating the running speed of the machinery. Its operative principle consists in a continually repeated division of time into minute periods—say of one to three seconds each—with corresponding divisions of the running movement of the machinery. The rate of speed in each of these divisions is shown on the dial by an index pointing to figures expressing, for standing machinery, the number of revolutions per minute; for locomotive engines, the number of miles per hour. Thus, the fractional period being three seconds—if a wheel makes exactly three revolutions in that time, the index will point to the figures "60" on the dial, showing sixty revolutions per minute—and will stay at those figures so long as the machinery continues to run at the same rate. The index does not move at all except when the speed is changed. Then it will move to the proper point, whether faster or slower, and there remain until another alteration is made in the speed. When the machinery stops the index recedes to "0."

The mechanism by which these results is attained may be comprehended by a reference to the accompanying engraving. A is a volute cam, or eccentric, which is caused to rotate from left to right by connection with the running machinery through the crank shaft, B. This connection is, however, so controlled by the clock movement above, that the cam moves only three seconds at a time, when it stops and returns quickly to its starting position. At C is a projecting pin in the rack bar, D, which rests on the periphery of the cam, and is thus caused to rise as the cam revolves from left to right, operating the pinion, E, which carries the index on the dial. Now it is obvious that the faster the machinery is running the higher the rack, D, will rise in the period of three seconds, and *vice versa*. When the three-second movement is accomplished, the rack and pinion are held in position by a ratchet arrangement not shown in the engraving, while the cam returns to its starting point and makes another like revolution. If the speed continues the same as in the preceding three seconds, the index will of course remain pointing at the same figures. If the speed be increasing, the index will be pushed further along. If it be decreasing, the release of the ratchet hold on the pinion, E, at the instant of the termination of the cam's three-second movement, permits the index to recede until the pin, C, again rests on the periphery of the cam, by which the diminished speed is indicated on the dial. Thus the index will always remain stationary, until there is a change in the speed of the machinery.

But the performances of this ingenious instrument do not stop with the mere indications of speed. It also records it; so that one may know at any time afterward the exact speed that was being made at any previous minute. The cylinder, F, by connection with the clock movement, is caused to revolve once per hour, winding upon itself a strip of paper from the spool, G. This paper is ruled with horizontal and perpendicular lines, similarly to that used on the steam indicator. A pencil, H, is fixed in the rack-bar, D; this marks the passing paper higher or lower as the speed is greater or less for the time being. The perpendicular lines indicate the minutes of time, while the horizontal ones represent the velocity. As placed in the engraving, the pencil mark would indicate a speed of ten miles per hour of the locomotive (supposing that to be its application) for as many minutes as there are perpendicular lines over which it passes. When the locomotive stops, the pencil will descend to the lowest horizontal line, and will there make its continuous mark, reporting the exact duration of the stoppage.

This registering apparatus is so arranged that it may be locked up within the instrument, and made inaccessible to any one but the key holder. The paper may be replaced daily or oftener. Railroad officers may thus have in their possession an exact history, as to speed and stoppages, of the movements of every train upon their road.

The dial represented in the engraving is the one designed for use on locomotives. For standing machinery the figures run up to 120, or higher if required.

An instrument of this kind is to mechanics what double-entry book-keeping is to business, a means whereby work may be done understandingly and accurately. By its use all machinery designed to be controlled by personal supervision may be made to perform its work with great uniformity, and its speed regulated with great accuracy.

As a legal evidence, in case of collisions on railways, or other accidents, its record would be of great value. Locomotive engineers are often placed in very unpleasant circumstances, by the testimony of persons incompetent to judge of the rate at which a train is moving at the time an accident occurs. This record would not only serve to protect them from such injustice, but would also keep them in check from exceeding the proper rate in crossing bridges, trestles, etc., since not only the rate at which they were running, but the precise time at which they were running it, could be accurately determined.

This instrument will prove an important addition to the means now in the hands of mechanical engineers, for the estimation of the performance of machines.

Further information may be obtained of the inventor, Edward A. Lewis, St. Charles, Mo.

AERIAL NAVIGATION.

NUMBER ONE.

There has probably been no age or generation since the earth has been inhabited by man in which the art of flying has not been a subject of study and research, if not of experiment. The apparent ease and pleasure with which the birds travel through the atmosphere cannot but induce in the hearts of human beings an earnest desire to partake of this delectable recreation; and this desire induced in one of the ancient kings the exclamation, "O that I had the wings of a dove," etc. The employment of artificial wings was the subject of experiment by hundreds of people before the nature and properties of hydrogen gas were discovered. The ponderability and inertia of atmospheric air must have been manifest at the earliest periods, being especially indicated by the locomotion of the feathered part of creation; but to what extent the science or art of aerostation had progressed prior to the founding of the Grecian Empire, history has not informed us; and even down to the sixteenth century there has been nothing recorded on the subject other than the most puerile and frivolous contrivances of wings, and the modes of operating them, by means of compound levers, springs, and cranks.

About 300 years before the Christian era, a Roman named Archytas, constructed a machine that would rise and fly "a considerable distance" through the air, by means of wings operated by springs, but as neither drawings nor description are given by historians, we are left to conjecture its peculiar mechanism. But this brief item of history serves to show that flying was a desideratum in those days as well as in more modern times.

In 1670, a man named Lana endeavored to produce an aerial float by pumping out the air from a delicately-made hollow metallic globe; but he soon discovered that if his globe was made so thin that its weight would not exceed that of the volume of air which it was capable of containing, whatever might be its dimensions or size, the external atmospheric pressure was sure to crush and collapse it before the internal air was all drawn out.

This method has recently been discussed by scientific men, but practically considered it is so absurd as not to merit a moment's serious thought.

Many experiments were made with light paper balloons (this word signifying globular, or pear-shaped bags) inflated with heated smoke or rarefied air; but no person attempted an ascension until 1783. The peculiar properties of hydrogen gas, and the mode of producing it, were discovered in 1766, and many experiments were made with it on a small scale. But it was not then expected that it would ever be produced in sufficient quantity to inflate a large balloon. Light paper balloons were exhibited, and many curious fancy figures, representing eagles and other animals floating in the air; and small illuminated balloons were sent up at night, but most of these were made to ascend by means of hot air.

In 1782, two brothers, Stephen and Joseph Montgolfier, after making many experiments on a small scale, attempted to inflate a large paper balloon with hydrogen gas, but failed on account of the escape of the gas through the pores of the unvarnished material. They then constructed a large paper balloon, seventy-four feet high and about fifty feet in diameter. This balloon had an opening at the bottom of fifteen

feet in diameter. Around this opening was arranged and fastened a gallery of wicker work, three feet wide, and around the outer edge of this was a balustrade of the same material, three feet high. This gallery was for the purpose of holding the passengers, fuel, etc. At the center of the large bottom opening was a wire grate, supported by wires, upon which the fire was made; and above the balustrade several port holes were made through the sides of the neck of the balloon for the purpose of feeding the fire with straw from the gallery outside. With this balloon, M. Pilatre de Rozier made several ascents to the hight of two or three hundred feet, while it was fastened with ropes of that length; and on the first of November, he, in company with the Marquis d'Arlandis, decided to make an aerial voyage. Accordingly, the balloon was prepared, with an ample supply of straw in the gallery, and Arlandis and Rozier stationed on opposite sides of the gallery, trimmed the straw fire, and at a given signal, the balloon was released from its moorings, and left free in air at 6 minutes to 2, on November 1, 1783; so this was the beginning of aerial sailing; it cannot properly be called navigation, as the voyagers had no control over the movements of the vessel. These adventurous balloonists sailed off gently for two or three miles till they came to a river, when the balloon turned up stream and descended nearly to the water; but another bundle of straw upon the fire lifted them up very suddenly, and, catching another current, they proceeded three miles further, and came down safely in about an hour from the time of starting, after having had sundry small holes burnt through the balloon by the sparks from the straw fire.

Rozier was killed in company with Laine his companion in an attempt to cross the channel from France to England in a hydrogen balloon in June, 1785. The balloon taking fire they were precipitated upon the rocks, thus becoming the first martyrs to the science of aerostation.

Prior to the successful experiment of 1783, a balloon of moderate size had been inflated with hydrogen gas, and, permitted to ascend from Paris. It arose to a great hight, and continued in the air about an hour, in which time it traveled a distance of thirty miles. In December of the same year, two gentlemen named Charles and Roberts, made an ascent from Paris, in a balloon inflated with hydrogen gas, and traveled nearly thirty miles. This balloon was constructed under the superintendence of M. Charles, and was a truly wonderful production for that time. The balloon was nearly 100 feet in diameter, being made of varnished silk, and the upper part was covered with a net, from which a series of cords descended below the bottom of the balloon, and supported a car made of basket work, eight feet long, four feet wide, and three feet deep. The top of the balloon was also furnished with an efficient valve, for regulating its descent. This balloon appears to have been equal in all respects, to any of modern construction, no noticeable improvement having been made in balloons during the eighty-six years that have elapsed since that date.

From this time the attention of many inventors was turned