This little motor, when developing a maximum of energy with a single element, produced a force of 90 grammes at a speed of 5 revolutions a second. With two elements a speed of 12 revolutions a second was obtained and a power of 420 grammes. With three elements the power was 1 kilogramme.

In working with two elements, if the speed is reduced to 5 or 6 revolutions a second, the power is also reduced, and, on the other hand, if the speed becomes greater than that which corresponds to the maximum power, the working force is correspondingly reduced. For example, if the speed obtained is 14 or 15 revolutions a second, the power is only 375 grammes. The manner in which this trial balloon acted, and the speed obtained with the propellor, afford a very satisfactory outlook for the aerial navigation, as it must be remembered that in balloons the surface does not increase with the volume, consequently the results obtained with larger balloons would be still more favorable.

In working condition an electric motor equal to 6 horse power and weighing 320 kilogrammes, with 900 kilogrammes of secondary elements, would easily carry 1,200 kilogrammes when attached to in a hydrogen balloon of 2,000 cubic meters, elongated in shape like those used in 1852 by Giffard, and in 1872 by M. Dupuy de Lôme. This balloon would be 40 m. long by 13·50 m. wide across the center, and its ascensional force would be about 3,300 kilogrammes. It would weigh, with all its accessories, 1,200 kilogrammes ; so there would remain for the voyagers and for ballast over 1,000 kilogrammes. In calm weather this balloon, worked by an armature of 5 to 6 m. in diameter, would obtain a speed of 20 kilogrammes an hour, and in windy weather would be powerful enough to move out of the direct line of the air current.*

Of course, this balloon could only go for a limited time, but that could easily be decided by experiments, in which results even more favorable might be obtained by making the motor and piles especially light for this purpose.

Until now no balloon has ever been really steered, that is, has never returned to its point of departure after having navigated the atmosphere at the will of its pilot. Necessarily such voyages can only take place in calm air and during a short time ; but the essential point is that they have succeeded at all ; and no physicist can deny that the electric motor and the secondary piles have solved the problem of aerial navigation.

MEASURING THE POWER OF BELTS.

The *Mechanical Engineer* mentions a simple, and, it thinks, effective device for measuring the power of driving belts, without going into any tedious dynamometric calculations. An ordinary two-part champ, with a hook on one plate, is secured to the belt, and to the hook is attached a common spring balance such as icemen use. The other end of this is in turn fastened to the nearest wall or timber that will give a direct pull. The engine is then started, and the reading of the spring balance at the moment the belt slips is the actual resistance or tension of the belt per minute, gives the total foot-pounds transmitted by it for the time reckoned. This will, it is thought, prove a very useful device for parties hiring power, as there cannot be any question of accuracy of calculation, any theories of width of belt per horse-power, or any error of any kind, because the actual dead pull of the particular belt in question under test, with all its perfections or imperfections as they actually exist, is given.

Spontaneous Combustion.—The most frequent instances of this happen with cotton rags or waste, that may have been more or less saturated with oil. Few people are aware of the ease with which these materials originate fire. Two or three bushels of rags wet with linseed oil, the drying oil such as painters use, left in a heap, have been known to char in the interior within little over an hour, and then, after smoking awhile, and being placed where there was a slight current of air, burst suddenly into a blaze. Painters rags are probably quicker at this performance than the waste used in oiling machinery and in printing offices ; but there is plenty of evidence to prove that even the heavier oils thus thinly spread in cotton stuff, will heat, if in a mass, and start a fire. One of the largest printing and lithographing establishments in Boston is obliged, by the terms of its insurance policies, to take out of and away from the building, every night, all the oiled rags used about the machinery during the day time.

* Of course the idea of guiding balloons against strong winds belongs to Utopia ; but for short voyages, such as escaping from a city during a siege, it would be very valuable to be able to steer the balloon.

Architecture, etc.

TESTS OF CONSTRUCTIVE MATERIAL.

One of the most interesting exhibits both to the engineer and mechanic as well as to the general visitor, at the Fair of the Massachusetts Charitable Mechanic Association now in progress at Boston, is that sent from the Watertown Arsenal. The exhibit consists of materials which illustrate the results of tests made by engineers in the service of the government upon a machine specially constructed for the purpose. The arrangement of the exhibit is such that each article tells its own story, while those persons who are sufficiently interested to desire the particulars may learn them from a pamphlet near at hand. The exhibit consists of three groups of objects, which have been ruined respectively by tensile strains, bursting strains and compression. One of the objects most likely to attract popular attention is a steel wire cable of the kind being employed in the East River Bridge. The diameter of this cable is 1⅞ inches, and the strain to which it is submitted was 150,000 pounds, or 75 tons. The cable itself remained intact with this severe test, but the bail of the socket parted, which shows like many others of the Watertown experiments, that in constructions of this class the weakest point frequently lies, not in the cable itself, but in its fastenings or fittings. A hammered iron bar 5 inches in diameter was broken by a tensile strain of nearly 723,000 pounds, or 36,900 pounds per square inch. Under this tension the bar parted with a loud report. The fracture shows a crystalline structure. A smaller wrought iron bar was broken asunder by a tensile force of 51,340 pounds per square inch. This bar drew down at the place of fracture, and shows a fibrous structure at the break. In the group which contains specimens destroyed by compression, two iron columns of different forms give some idea of the relative value of the shapes shown in supporting great weights. A latticed iron column some 10 feet long, of a pattern quite familiar to all who are acquainted with bridge work was ruined by a pressure of 574,500 pounds. A circular flanged column, known as the "Phœnix" pattern and of much smaller size and weight, sustained nearly 50,000 pounds more than the weight above given. Tests of this kind have determined definitely the value of the latter form, but its liability to deterioration from oxidation upon the inside detracts somewhat from its value in practical use. An 8-inch column of the "Phoenix" pattern which has been subjected to a test for compression, shows, by the perfect symmetry of its present crushed form, how perfectly it is adapted for supporting weights.

A much needed lesson to builders is splendidly illustrated by pine columns, which have in some instances supported remarkable pressure. The first of these columns, originally 12 feet long, yielded to a pressure of 190,000 pounds the weak spot being a large knot, which acted as a wedge and caused the destruction at less than the proper figures. Another of these columns is a stick 12 feet in length, tapering from about 7⅝ in. to nearly 6½ in. in diameter. This stick, being practically perfect, has shown its weakest point to be at the smaller end, for it is at that point that the crumbling of the fibers has taken place. As an argument againt the prevalent custom of turning down wooden columns at the end, this test stands unquestioned. A seasoned hard-pine girder 11 inches square and 10 inches long, when tested, bore the astonishing load af 751,000 pounds—a conclusive proof of the value of such timber for columns.

As an example of bursting strain, a model one-third size of the breech of a 10-inch cannon is shown in the centre of the section. This cannon was partly filled with beeswax, and a close-fitting steel plug was forced into the aperture. Under a pressure of 599,000 pounds, the model being a stout casting 2 ft long by 11 inches outside diameter, was fractured in every direction. Several other interesting tests of steel bars, cast bars, boiler plates, etc., complete this display. It is a graphic method of showing facts that are of interest to every thinking man. It is a popular presentment of facts frequently published in technical journals, but not easily accessible to the average reader.—*Metal Worker.*

FLOOR BUILDING.

So few of the floors constructed in new houses are, says the *Building News*, equal to their work, that the attention of architects and builders might be profitably called to the subject. In going over some of the newly-erected houses in the suburbs of London, it is not infrequent that one finds dwelling house floors which have sunken so much in the centre as to destroy the comfortable assurance that they are safe. These instances