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THE BALANCE DYNAMOMETER.

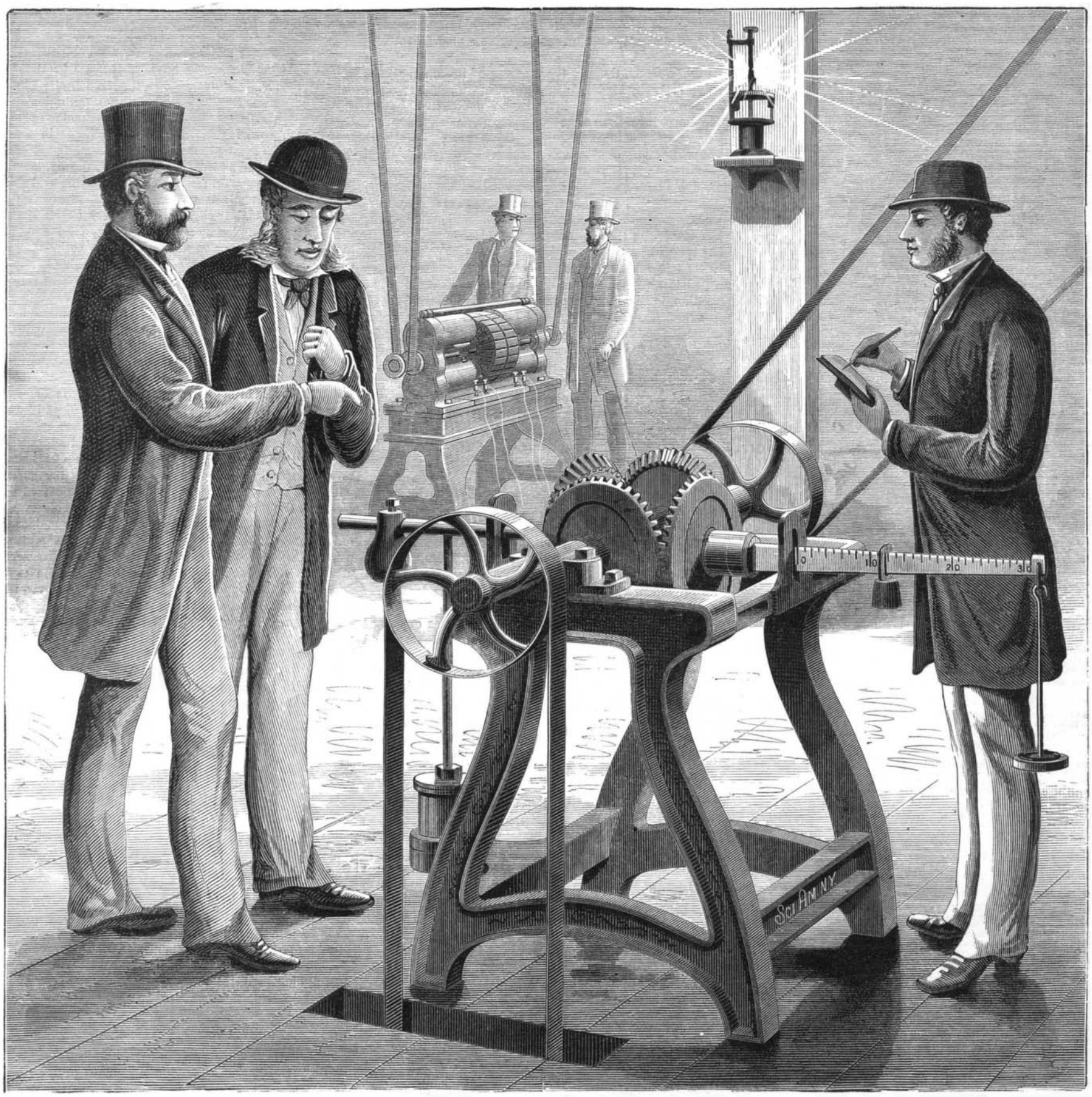
Although many forms of dynamometers have been devised, none of them are more simple or more reliable than the one invented more than thirty years ago by Mr. Samuel Batchelder, of Boston.

This instrument, which is of great value in practical mechanics, is exceedingly simple and is fully adapted to its object. It is made of suitable dimensions and strength for the degree of power to be measured, and when it is used it is placed in the line of communication between the motor and the machinery to be moved; the power exerted on the machinery may be exactly measured by means of the steelyard and weight, which form a part of the machine. There is also connected with it an index to show the number of revolutions of the drum for a given time, which being observed, together with the weight, the data are obtained for computing the number of pounds which would be raised 1 foot high per minute by the power exerted at the time upon the dynamometer and transmitted through it to the working machinery.

Our large engraving represents the dynamometer in actual use in connection with dynamo-electric machines, while the cuts, Figs. 1 and 2, page 132, exhibit the details of construction. In these figures A A and B B are two pairs of belt pulleys, each pair consisting of a fast and loose pulley. The machine receives its power from the prime mover by a belt on the pulley, A, and the power is transmitted to the machine which is the subject of experiment by a belt from the pulley, B. The first pulley, A, and the bevel wheel, D, are fast upon the shaft, C, which revolves in bearings, I. The bevel wheel, F, is connected with the pulley, B, by a sleeve, K, which is capable of turning on the shaft, C. The bevel wheels, D F, are geared together by the bevel wheels, E E, which run upon a cross shaft having a boss, G, through which the main shaft passes freely. It is evident that if this cross shaft is not retained in its place by some adequate force, the motion of the bevel wheel, D, will only cause the cross shaft to move round upon the shaft, C, and the wheels, E, will roll upon the wheel, F, without communicating motion to it or to the pulley, B; but if the wheels, E, and the cross shaft are held stationary, the motion of the pulley, A, will be communicated to the pulley, B, through the bevel wheels, and the force there applied to retain the shaft, G, and wheels, E, in place will indicate the power transmitted through the dynamometer. The amount of power is ascertained by means of a graduated scale beam, H J, connected with the shaft of the wheels, E, by straps, *a*.

The weight, M, fastened to the shorter arm of the graduated beam by a set screw, affords a means of balancing the beam when the machine is at rest, and the weight, W, like that of a common balance, moved on the graduated arm of the lever, will indicate the strain upon the belt. The num-

[*Continued on page* 132.]



BATCHELDER'S BALANCE DYNAMOMETER.

The winding engines for the cable are each 30 horse power, and wind in at a rate of 30 turns per minute, the average length of a turn on the barrel being nearly 20 feet. The cable weighs 4,400 pounds, and has a proved strength of 200,000 pounds.

The captive balloon ("Geant") of Mr. Henry Giffard in 1867 had a capacity of 5,000 cubic meters, and its ascent was 300 meters (984 feet). She carried up 12 persons at a trip The size of the present one may be repeated for the sake of comparison, the cubic capacity being 25,000 cubic meters, its load 50 persons, and its elevation double that of the former.

The first question that naturally presents itself to the mind of every one who contemplates making an ascension is: "What would happen should the cable break?" Such an accident is scarcely within the range of possibility. Still, everything should be foreseen; supposing it should break! Well, the aerial voyager would have a more extended excursion, that is all The double bottom of the car is provided with bags of ballasting, grappling irons, and guide ropes, and the aeronauts chosen by M. Giffard as Captains are MM. Eugene and Jules Godard and Camille Dartois. The names of these aeronauts are as popular as their ability is proverbial. In case of an accident their knowledge and coolness may be relied upon. But no accident will happen; this is very certain.

As a further provision against such a barely possible event, however, the captive balloon is provided with certain pieces of apparatus that are found in ordinary balloons, but in this case in a greatly improved form.

Balloons are furnished at their upper part with a wooden valve, formed of two flaps which open from the exterior to the interior by means of a cord which is under the control of the aeronaut; these close automatically under the action of rubber straps which extend over their upper part. The hermetical closing of these flaps is rudely effected by means of a mixture of tallow and flaxseed, which is applied to the grooves and joints of the valve. Aeronauts give this mixture the barbarous name of "cataplasm." M. Giffard has modified all these parts of the aerostatic valves. The one situated at the upper part of the balloon is formed of a large metallic disk 22 inches in diameter, furnished on its upper side with a circular metallic projection which, resting against a crown of India rubber, produces a hermetical sealing. The disk of the valve is made to press against the rubber crown by means of spiral springs. The valve may be opened by the aeronauts by means of a cord which hangs down as far as the car. The valve is mounted in the center of a circle of very thick stuff, which, with the material of the balloon, is clamped between two circles of wood held together by bolts. The whole apparatus is protected from the elements by a sheltering tent made of a solid framework of wood, mounted on springs, and covered with canvas. The lower valve is formed of a large metallic disk 32 inches in diameter, held in place by very delicate springs. This disk opens automatically, under a very weak pressure, to allow the escape of the excess of gas due to dilatation. This valve, like the upper one, is mounted in a collar of thick material, which supports, in addition: (1) the tube through which the balloon is inflated; (2) a metallic piece through which the cord of the upper valve passes; (3) a glass "bull's-eye" through which the interior of the balloon may be examined; (4) a manometer. Around the large circle of the valve has been fixed a series of layers of India rubber to prevent the balloon from "bagging" under the action of the wind, and to keep it always distended. The spring balance which unites the balloon to the cable is suspended in the center of the annular space surrounded by the gallery of the car. This balance is formed of two steel cylinders united by light iron springs. Four vertical dials indicate, by means of hands, the amount of traction in kilogrammes to which this species of dynamometer is submitted. The aeronauts and voyagers in the car may always know during the ascension the excess of ascensional power of the balloon and the force with which the wind is acting on the cable.

A Source of Hard Times.

Speaking of the vast—and to a great extent avoidable—destruction of property by fire in this country, the *Fireman* says that fires are increasing, both in numbers and destructiveness, far more rapidly than the increase of wealth and production. It is computed that from an annual loss by fire in 1868 of $35,000,000, the annual loss, exclusive of exceptional fires such as Boston and Chicago (if they may be called "exceptional"), has increased to $100,000,000. The full significance of this statement cannot be realized unless analyzed. This loss is the irremediable loss of human product and industry. It is the conversion of human blood, brawn and muscle, necessary to create $100,000.000 of value, into ashes and smoke. Assuming the labor that produced this value to be worth $3 per day, this loss is the loss of more than the combined labor of 100,000 men for one entire year. Then, too, it must be remembered that this is surplus production. It has been accumulated by producers after earning livelihoods for themselves and families, and paying their share of the cost of government and their proportion of the burdens of society. It would require, then, the labor of 100,000 men for 20 years to replace by surplus production this annual loss. It is not only so much wealth subtracted from the resources of the country, but it is the loss of the productive power of so much capital.

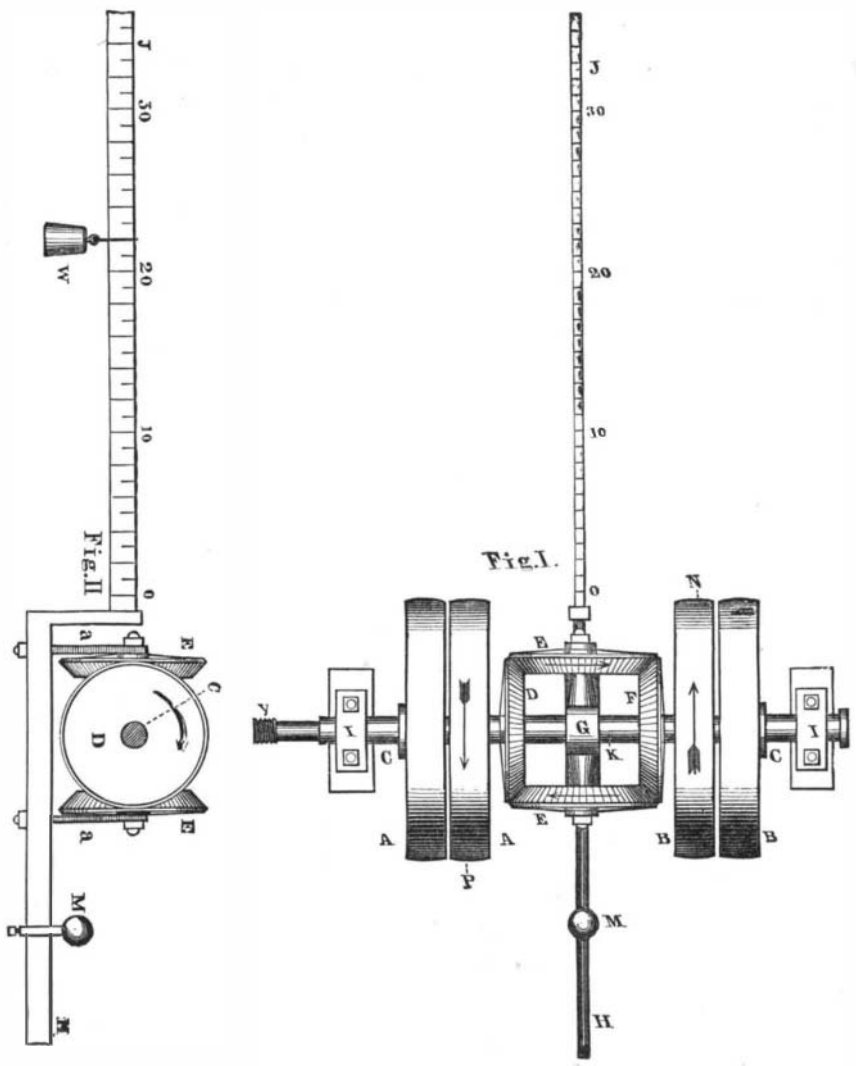
THE BALANCE DYNAMOMETER.

[*Continued from first page.*]

ber of pounds thus indicated multiplied by the number of feet through which the belt moves per minute will give the number of pounds raised one foot high per minute. The product divided by 33,000 gives the horse power expended in driving the machinery.

A worm, Y, on the end of the shaft, C, is made to move an index which shows the number of feet through which the belt or surface of the pulley moves in a given time.

In graduating the arm of the balance, J, the division marked 0 is the same distance from the center of the shaft as the periphery of the pulleys. The balance arm is divided into spaces equal in length to the semi-diameter of the pulleys, and they are marked 0, 10, 20, 30, and so on. The weight, W, will be double that of the strain on the belts. The plunger attached to the steel-yard and operating in the water box, as shown on the first page, was applied by Mr. James B. Francis, of Lowell, for preventing sudden vibration when the instrument is used in connection with machinery, when the strain is variable.



BATCHELDER'S BALANCE DYNAMOMETER.

This dynamometer has recently been used by Mr. Samuel Webber, of Manchester, N. H., for weighing the power of spinning and other machinery. A report relating to these tests is contained in his *Manual of Power*. The instrument is also used in connection with dynamo-electric machines by Professor John Trowbridge, of Cambridge.

A Veteran Inventor.

Mr. Samuel Batchelder, the inventor of the dynamometer described in this number, is a resident of Cambridge, Mass., and is now ninety-four years old. He has been engaged in the cotton manufacture for seventy years, having been owner, in part, at New Ipswich, New Hampshire, of the second cotton mill that was built in that State, about 1808.

This was previous to the use of power looms at Waltham, yarns only being made, which were woven into cloth upon hand looms, in farm houses; shirting, gingham, checks and ticking being thus manufactured. Pillow cases were also made without seam, the selvages being closed and the bottom woven in, forming a bag of the same kind as those now in extensive use for grain.

The Hamilton Mills, at Lowell, were built under the direction of Mr. Batchelder from 1825 to 1830 for the manufacture of twilled goods (jeans and drillings), which had not previously been made on power looms; he also built and managed the York Mills at Saco, Maine, from 1831 to 1846. Since that time he has acted as treasurer of the Portsmouth, the York, and the Everett Mills, the latter having been established by himat Lawrence, Mass., in 1860, and he continued in active business, making frequent visits from Boston to the mills, until he was eighty-six years of age.

He has made many improvements in the practical operations and machinery of the cotton manufacture, one of which was the "drawing frame stop motion," which was patented in England, and is now in general use in all cotton mills; also the use of steam for drying the sizing of the warps in dressing frames; the dyeing of cotton in the lap for mixed goods.

In 1863 he published a volume upon the "Early Progress of the Cotton Manufacture of the United States." His contributions to the newspapers in relation to the tariff, labor, manufactures and various other subjects of general interest are very numerous, and have been continued to the present time.

New Agricultural Inventions.

Mr. George W. Fawks, of Prairie Hill, Mo., has patented an improved Portable Hay Ricker for raising hay upon ricks. It is simple in construction, and is so constructed that it may be readily drawn from place to place, as required.

Mr. William H. Hall, of Tiffin, Ohio, has invented an improved wire toothed Hay Rake, which is lighter, stronger, more convenient, and less liable to break and get out of order than rakes constructed in the usual way.

An improved Grain Steamer and Drier has been patented by Mr. Fredrick A. Hoffmann, of Baldwin City, Kan. The object of this invention is to furnish, for the steaming and drying of grain and middlings, an improved apparatus by which the burrs may be supplied continuously with properly steamed and dried grain, without removing the apparatus, and without any choking of the same by the grains or middlings in their passage to the burrs. By using the apparatus, flour of a greater degree of whiteness and with a lighter bran is obtained, with less waste in the sweepings.

Mr. Charles E. Adamson, of Humboldt, Neb., has patented an improved Wagon Rack, which is so constructed that it may be readily adjusted to adapt the wagon for use for carrying wood, stone, lumber, corn in the ear or shelled, all kinds of grain, thrashed or unthrashed, small stock, hay, stalks, etc.

Mr. Leonard A. Cooper, of Winthrop, Mo., has patented an improved Corn Planter, Marker, and Cultivator, of simple construction, by which, in connection with the seed dropping devices, the rows are marked and the ground cleared of weeds.

An improved Stock Pump has been patented by Mr. Summit R. King, of Mason, Mich. The object of this invention is to furnish a mechanism which will enable the stock to pump water for themselves, thus rendering the use of a windmill or an attendant unnecessary.

New Article of Commerce.

A new and valuable member of the group of elastic gums is found in the sap of the bully tree, which flourishes on the banks of the Orinoco and the Amazon. It is called *balata*, and ranks between caoutchouc and gutta percha in useful qualities. It resembles gutta percha so closely in its general properties that much of it is shipped from Guiana and sold yearly for gutta percha—although it has many points of superiority. It is tasteless, gives an agreeable odor on being warmed, may be cut like gutta percha, is tough and leathery, is remarkably flexible, and far more elastic than gutta percha. It becomes soft, and may be joined piece to piece, like gutta percha, at about 120° Fah., but requires 270° Fah. before melting. It is completely soluble in benzole and carbon disulphide in the cold. Turpentine dissolves it with the application of heat, while it is only partially soluble in anhydrous alcohol and ether. It becomes strongly electrified by friction, and is a better insulator of heat and electricity than gutta percha. Caustic alkalies and concentrated hydrochloric acid do not attack it; but concentrated sulphuric and nitric acids attack it as they do gutta percha.

The Restoration of the Patent Office.

The committee of experts appointed by Secretary Schurz to select from the fifteen plans submitted for the remodeling of the portion of the Patent Office destroyed by fire has adopted the plan of Mr. Vrydagh, of Terre Haute, Indiana. The plan embraces the addition of an attic story. The upper portion of the building, which has been used as a museum for exhibition of models and curiosities, will be remodeled and made into office rooms, as more are necessary, and the new attic story will be used for a model room.

A Practical Resumption of Specie Payments.

To the Editor of the Scientific American:

It may interest your "hard money" readers to know that this Company, on its regular pay day, August 15, paid all its employees in gold coin.

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Stamford, Conn.