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INTERNATIONAL CO-OPERATION IN THE ADVANCEMENT OF SCIENCE.

There is a growing appreciation of the fact that the secrets of science, as they are from time to time revealed, are not, or should not be, considered as the property of the individual, but that they belong to the race at large. This is evident from the increase in the number of societies for the promotion of science, some of which take a name which indicates that this advancement is the special object of their endeavor. Closely allied to these are the specific technical and engineering societies, at whose periodical meetings the experience and discoveries of the members are recorded, and subsequently published for the benefit of the general public. In addition to the monthly or quarterly meetings of the local branches, there are the great annual gatherings of the technical and scientific societies, in which the chosen representatives of the local societies meet to discuss the progress of the year, and present such new theories and laws as have been proposed or discovered.

It would be difficult to overestimate the service that has been done to science, whether pure or applied, by these annual conventions. In reading the reports of proceedings, especially the proceedings of the annual conventions, we have often been impressed with the fact that the authors of two different papers upon the same or related subjects will frequently supply each other with the missing link in their arguments. Separated, perhaps, by many thousand miles of distance, they have attacked the problem from two different points of view, and the half truths which each investigator had discovered, and which promised separately to remain an unsolved problem, dovetail together at the convention into a complete demonstration. Co-operation is the very life of successful scientific research; for genius is scarce, while industrious mediocrity is plentiful. There are, doubtless, multitudes of searchers in the fields of science who are carrying fragments of disjointed truths which, if gathered in one place and pieced together, would make a valuable addition to the ascertained truths of science.

It is true there are the columns of the scientific press, which have undoubtedly proved the most effective of all means for the exchange of ideas, the record of discovery, and the spread of scientific knowledge; but the general congress or convention has the advantage that it is not local in its scope or effect; that the attention of the scientific world is centered upon it in the expectation of hearing the very latest and most important scientific facts; and that in the various meetings there is an opportunity for the verbal exchange of ideas for question and answer, and for detailed and exhaustive debate. There is an incidental but very real value, moreover, in the scientific congress in the fact that it brings the members of widely separated districts into contact, and introduces that element of personal sympathy and regard which is one of the most promising features of our modern civilization.

It was a natural step from the National to the International Congress. Within the past few years several of the latter have been organized, and in nearly every case they have grown steadily and accomplished good work. The arguments for the National are doubly strong for the International Congress: for the wider differences of climate, character, opportunities and methods of research which exist among nations give the annual reunion of their leading scientists a special value. For, undoubtedly, the system or general drift of scientific research undertaken by any people will be modified by its national temperament. In Germany, we might expect that the theoretical tendency would be predominant; in England and America, the practical; and it is in the personal intercourse of the representatives of these separate schools that we naturally look for special results, which could never be independently achieved.

The time is certainly ripe for the establishment of a great international association for the advancement of science. The various national associations have shown by their recent fraternal exchange of courtesies that they are prepared for it and are fully alive to the benefits which it would confer. They are selecting their places of meeting near the national border lines, in order that the interchange of visits may be facilitated. We learn that the American Association will meet next year at Detroit, and that it will adjourn to Toronto to assist in welcoming the visiting British Association.

This body has responded by inviting the officers of our gathering to attend as honorary members, and throwing its doors open to all the members and fellows. The same spirit is shown across the water, where the Association Française pour l'Avancement des Sciences has chosen Boulogne as its meeting place, and in response to its suggestion that the British Association should meet at some town on the opposite coast, the latter body has chosen Dover for its gathering in 1899. The mention of the year 1899, the closing year of the century, naturally suggests that the opening year of the twentieth century would be a fitting time for the first meeting of an international association. It will be the year of the great Parisian Exposition, which will be certain to attract a large number of scientists from both hemispheres, and the intervening national meetings will give ample opportunity for founding the association and concluding all necessary arrangements.

The New Methydric Sphere.

An Italian inventor named Corzetto, says La Fance Militaire, has constructed an apparatus which he calls a "methydric sphere," and by means of which he professes to be able to descend to any depth in the sea. In his experiment at Spezzia he stored some two thousand cubic feet of compressed air in his apparatus, which he entered with two friends, and which was then lowered to a depth of some thirty feet. As after the expiration of nine hours the "sphere" had not yet been seen to reascend to the surface, a message was sent to the admiral in command of the Naval Department, who at once sent a diver to the spot. The "sphere" was found still resting on the sea bottom, but the diver heard nothing in answer to his knocks. Some barges having been brought to the spot by a tug, the "sphere" was hauled up with ropes, and as soon as it emerged its door was opened, and the inventor appeared with a livid face and half asphyxiated. His two companions were unconscious, but were quickly resuscitated. They had remained eighteen hours under water. The inventor explains that so far all his experiments were successful, but on this occasion when he intended to return to the surface the air pressure at his command proved insufficient to expel the water ballast, of about two tons weight, which had so far kept his appliance submerged, and hence they had to remain where they were until rescued. At any rate, three persons were enabled to remain under water for eighteen hours, and this experiment may not be without significance as regards the much discussed problem of submarine navigation.

Some Beginnings in Science.

The modern plan of instruction offered by the University of North Carolina more than one hundred years ago was the work of a committee of six. Two of this committee were graduates of Princeton, one a graduate and ex-professor of the University of Pennsylvania, two had been students of Harvard, but their education at Cambridge had been interrupted by the Revolutionary War, and the sixth was an eminent lawyer. The names of these men were Samuel McCorkle, David Stone, Alfred Moore, Samuel Ashe, Hugh Williamson, and John Hay. The course planned by this committee in 1792 gave great prominence to the scientific studies, especially those which could be applied to the arts. The report further recommended the purchase of apparatus for experimental philosophy and astronomy in which must be included a set of globes, barometer, thermometer, microscope, telescope, quadrant, prismatic glass, electrical machine, and an air pump. The ancient classics were made elective, the degree of Bachelor of Arts being obtainable without the study of either Latin or Greek. In 1800, however, Latin was made a required study, and an election allowed between French and Greek; and in 1804 Greek was added to the required studies. It is remarkable that this scheme, adopted in 1792, is almost identical with that adopted by Congress for the colleges to be formed under what is known as the Agricultural and Mechanical College Land Act of 1862. But its interest for us to-day lies in the fact that it led to the establishment of the first astronomical observatory in the United States, to the first geological survey by public authority in America, and to the first equipment for the teaching of electricity.—Appletons' Popular Science Monthly.

The Success of Our Anniversary Number.

The Semi-Centennial Anniversary number of the SCIENTIFIC AMERICAN, issued last July, of which we printed 175,000 copies, has been so nearly sold up that the price of single copies by mail has been advanced from 10 cents to 25 cents each. The number was most generously noticed and commended by the press of the country, some three thousand different publications extending to us their congratulations, of which we have been heartily appreciative. The edition consumed 78½ tons of paper, and required for its printing the work of eighteen presses, day and night, for two weeks, costing to produce over twenty thousand dollars; but the resumé of our progress in the arts and sciences for half a century which was thus presented in that issue of 116 pages forms something quite unique in the domain of weekly periodicals. The number is already classed as a valuable addition to many libraries, as much of the matter it contains is nowhere else to be found in such convenient and available form. Persons unfamiliar with the processes of making and circulating a metropolitan newspaper may be interested in the fact that two hundred and sixty sacks of the largest size, containing the anniversary issue and weighing more than eleven tons, were sent through the mails in a single day. As we cannot furnish copies after our present limited supply is exhausted, it behooves every one desiring a copy to obtain it without delay. With the order remit 25 cents.

The Removal of the Iron Gates of the Danube.

With the imposing ceremonies which marked the opening of the Lower Danube to navigation on September 27 of this year, one of the most stupendous and difficult engineering works of modern times was put in practical operation, and the "Iron Gate," which have hitherto barred the great natural inland waterway between Western Europe and the East, were at last unlocked. This was not the first time that man had attempted to open a passage; for there are indications that the Roman engineers had studied the problem nigh upon eighteen hundred years ago, and made a partial attempt at its accomplishment. Indications of a road and a canal can be found at the Iron Gates, where the natural obstructions are most formidable. A Latin inscription bearing date A.D. 101 tells how the emperor "had a road made here by cutting away the rock and putting in supporting beams." Through all the centuries intervening between the Roman ascendency and the nineteenth century nothing of importance was done in the way of improvement, and it was not until the year 1830 that Paul Vársárhely drew up an elaborate plan, upon which all subsequent improvement was based, and succeeded in getting a small portion of it carried out, by the blasting of a canal 104 feet wide and 394 feet long in one of the worst parts of the rapids.

The present successful attempt to open the Danube owes its inception to the Berlin treaty of 1878, which intrusted the work to Hungary, who undertook to bear the expense in consideration of a right to levy tax on the river navigation. The plans of the present work were drawn up by two Hungarian engineers Wallandt and Hozspotzky. The work was let on May 23, 1890, to a German company, the government being represented by the aforementioned engineers, who had charge of construction. The date of completion was December 31, 1895, a remarkably brief time when we bear in mind the uncertainty and magnitude of the work. At the very outset it was found that the peculiar formation of the river bed, the sharp projecting rocks and their intense hardness, necessitated the construction of special plant for its removal. The tools which had done good service at Suez, Panama, and the St. Lawrence River were found to be worthless here, as may be judged from the fact that "in three days in the early operations $5,950 worth of black diamond points were ruined; the great percussion drills were shattered, and at low water the boats bearing the drills were caught on the jagged rocks." Nearly two years were consumed in the manufacture of new apparatus, and then the work of blasting the channel began in earnest. In some cases the bed of the river was laid dry for excavation by building solid stone dams and pumping out the water. Where this was not possible, the removal of the rock was accomplished by shallow boats, carrying heavy drop chisels, weighing from 8 to 10 tons, which were let fall with sufficient force to break up the rocky bed ready for removal. In similar fashion the holes for dynamite blasting were drilled by a row of tools operated from boats.

The barest recital of the details of the blasting operations, which extended over more than sixty miles of the river's length, shows the magnitude of this work—by far the greatest of its kind ever undertaken. The figures speak for themselves, and we give them without comment. A few miles below the island of Moldova is the first cataract, and here 9,679 cubic yards were blasted under water to make a canal 197 feet wide and 2,624 feet long—the minimum depth throughout the whole sixty-two miles being ten feet. Nine miles below this is the second canal, one and one-half miles long, which necessitated the removal of 86,328 cubic yards. Five and one-half miles further down 61,476 yards were removed to make a canal one and one-fourth miles long. Then the projecting point of Greben Mountain, which made the river too narrow, had to be cut away, which meant the removal of 522,300 yards, and just beyond it three stone dams were built because the river was too wide and the water shallow. Two and one-half miles below this a bank of hard rock crosses the river, and here 4,185 yards were blasted out to make a canal 4,265 feet long, and moreover a dam two miles long was built to narrow the channel and increase the depth of water. Six miles below this point the mountains close in upon the river until the banks are only 328 feet apart, and the water deepens to 164 feet. It is here that the Roman engineers have left an enduring monument in the road along the rocky bank. Seven and one-fourth miles below are the most treacherous cataracts, known as the Iron Gate of the Danube, where, after a strip of the bed of the river had been dammed and pumped dry, 497,040 cubic yards of rock were blasted out and a canal 262 feet wide and ten feet deep was built. Two great dams, respectively one and three-quarters and one and a half miles long, were also constructed.

In the whole distance a grand total of 1,635,000 cubic yards was excavated, of which 915,600 yards were removed under water. The work was carried out under the superintendence of forty engineers of the company and several others who represented the state. Nine thousand workmen were continuously employed on the works, and in addition to these were the artisans who were engaged at the shops in the manufacture and repair of plant. The boats which were equipped with four drills blasted out 84·7 cubic yards in a day of twenty-four hours, and the boats equipped with drop chisels averaged 82 cubic yards per day. The blasts, at times, were very heavy, as much as thirteen tons of dynamite being used in a single charge, the cost of one of the larger explosions having risen as high as $7,600. The under-water charges, however, were usually small, with a view to producing debris of a suitable size for removal by scoops and grapnels. The whole work cost $10,000,000, and the blasting operations caused the loss of fully two hundred lives.

Previous to the opening of the canal the passage of the Iron Gates was impracticable for an average of one hundred and seventeen out of the two hundred and twenty-five days of navigation in the year for boats drawing more than 5 feet of water; and from the Iron Gates up to Bazios the river was at no time navigable by boats drawing more than 6 feet. The canal will now give Vienna an unobstructed outlet to the sea for boats drawing 10 feet of water.

The formal opening was the crowning success of the Hungarian Millennium, and the various nationalities, Hungarians, Servians, Roumanians, etc., who were interested in its construction, are justly proud of their great engineering achievement. Fuller details of this great work, with illustrations, will be found in the current issue of the SUPPLEMENT.

The Relative Performance of the St. Paul and the Lucania.

The Marine Journal, of New York, and the Shipping World, of London, have recently been engaged in a discussion of the relative performance of the St. Paul, of the American, and the Lucania, of the Cunard line. The Marine Journal, commenting on the remarkable speed shown by the American boats this year, states that it has "been besieged with communications asking" it "to compute and publish the time the Lucania should allow the St. Paul in their record-breaking trip, worked out by the rule which governs steam yacht racing." The work of computation was intrusted to the well known civil and marine engineer, Charles H. Haswell, author of "Haswell's Mechanic's and Engineer's Pocket Book."

From a calculation based upon Mr. Haswell's formula, $\sqrt[3]{\frac{GC}{T^{\frac{2}{3}}}} = V$, where G represents the grate surface; C, the air pressure; T, the gross tonnage; and V, the relative speed of the two ships, he finds that the Lucania has 1·043 times the relative speed of the St. Paul. He then says: "As my formula may not be accepted, I further submit a comparison of their capacities by their tonnage and indicated horse power;" and from this he finds that the Lucania has 1·32 times the ratio of power to tonnage of the St. Paul. Assuming that the speed varies as the cube root of the power, he finds that the relative speeds should be $\frac{\text{Lucania}}{\text{St. Paul}} = \frac{1·323}{1·206} = 1·097$ in favor of the Lucania. Mr. Haswell then says: "In a recent passage the speeds were, Lucania 21·37 miles per hour, and St. Paul 21·08 miles per hour, hence $\frac{21·27}{21·08} =$ 1·01, consequently, with 1·097 times the capacity, the speed of the Lucania was only 1·01 times that of the St. Paul, evidencing an advantage in the latter in proportions of hull, water lines and application of power. Mr. Haswell finally arrives at 10 hours 58 minutes as the allowance, based upon the above calculation, which the Lucania should make to the St. Paul, if they both started from Southampton. If they both maintained the average speeds, 21·37 and 21·08 knots per hour, of the trip in question, the Lucania would be in first by 1 hour 59 minutes, but she would lose the race on time allowance by 8 hours and 59 minutes.

The Shipping World in reply claims that Mr. Haswell's formula $V = \sqrt[3]{\frac{G\ C}{T^{\frac{2}{3}}}}$ is similar to the "displacement coefficient" formula of the British text books, which by a transposition of its members becomes $V = \sqrt[3]{\frac{K\ P}{D^{\frac{2}{3}}}}$, when K is a constant, P = power, and D = displacement. The writer claims that Mr. Haswell's formula takes T (gross tonnage) as proportional to the displacement, "whereas there is little or no relation between them," inasmuch as "in these high-sided passenger ships, the body above water can be made of very varying forms, and the ratio

$$\frac{\text{tonnage due to deck houses}}{\text{under-deck tonnage}}$$

can be considerably altered. In the St. Paul this ratio is higher than in the Lucania, and to that extent the latter is penalized by his rule." The same writer points out that if in the case of the St. Paul the gross tonnage, which is 11,629, be represented by x + y, where x = gross tonnage below upper deck and y = gross tonnage above upper deck, we "cut off the deck houses, etc., and place an equal weight in the hold," then "the new tonnage is x, and by Mr. Haswell's rule the speed of the ship is a function of x and not of x + y, although the weight and form driven are exactly the same." He further takes exception to the phrase "speed of vessel is as the cube root of the power of propulsion," for the reason that "when the speed exceeds the limit at which wave-making resistance becomes important in proportion to frictional resistance, the resistance will vary by a higher power of the speed." This he claims in the case of "vessels of the form and dimensions of the St. Paul and at these high speeds would vary as (speed).[4]"

Without following out the writer's argument any further we give his conclusion, which is that "with equally clean bottoms, draughts not purposely lightened, no detention, and the same weather, the Lucania is just that much better than the St. Paul that she was designed to be."

We think that the expert of the Shipping World has yet to prove his last statement. At the same time it is certain that no reliable basis of comparison could be reached unless a run were made under the same conditions. If both boats had just come off the dry dock, if their displacements and indicated horse power were accurately known, if they kept sufficiently close together to insure their meeting with the same condition of tides and weather, and if both were burning the same quality of coal, no doubt a satisfactory time allowance could be estimated. It is only just to point out that on the trip in question 21·08 miles per hour was the record seagoing speed of the St. Paul, whereas 21·37 was 0·64 knot below the record seagoing speed of the Lucania.

There is one point of comparison however in which we think the St. Paul would show a decided superiority, provided the oft-quoted daily fuel consumption of the two ships is correct. This would be in a comparison of the two ships on a basis of speed, displacement, and coal consumption. According to the daily press—we cannot ascertain how far the figures are official—the Lucania burns 540 tons per day against 310 tons consumed by the St. Paul. We think that if the two ships were tested on this basis, not even the higher speed of the Lucania and her greater displacement would offset her enormous consumption of fuel. It is just here that the high boiler pressure (200 pounds to the square inch) of the St. Paul and her quadruple expansion engines show to such great advantage over the lower pressure and smaller range of expansion of the Cunard boats.

The subject is of great interest, and if the officials would publish the average indicated horse power, the displacement and the general condition of the two ships in connection with a passage made at full speed, say from the same latitude off the coast of Ireland to Sandy Hook, it would be possible to arrive at a very close estimate of their relative performance.

There is no guesswork in the science of ship design as carried out in such notable yards as those of Messrs. Cramp & Sons and Laird Brothers. The St. Paul and the Lucania were each designed for a special class of work; and it would probably be found that each ship was approaching very closely to the estimated performance, with a balance on the score of economy in favor of the St. Paul.

Sundry Errors in Estimating the Cost.

The estimated cost of the Manchester ship canal was $28,750,000. Nearly $80,000,000 was spent before the canal was ready for business. The international commission reported in 1856 that the cost of digging the Suez Canal would certainly not exceed $40,000,000. It had cost $94,500,000, to say nothing of Egypt's gratuitous building of lighthouses, dredging of the harbors, advance of money without interest, and gift of forced labor, the whole amounting to $20,000,000 more. Engineers spent a year collecting data for their report on the Congo railroad, which they asserted could be built for $5,000,000. They now say that the total cost will be from $12,000,000 to $15,000,000. The egregious underestimate of cost of the Panama Canal nearly swamped that enterprise before wholesale stealing completed the ruin. The forts on the Meuse River, estimated at $4,500,000, cost $16,000,000; the Corinth Canal cost $12,000,000, instead of the estimated $6,000,000; a harbor and a railroad on the island of Reunion cost $13,500,000 instead of $6,800,000; the Senegal railroad, which was to be completed for $2,600,000, absorbed $9,000,000, and the Langson railroad, in Tonkin, which was to open a conquered province for an expenditure of $500,000, bled the French treasury to the tune of $4,367,790.—Army and Navy Journal.

The Centennial of Gas Lighting.

The one hundredth anniversary of lighting by gas occurred in July. The first practical trial was made by Murdoch, in Birmingham, England, in July, 1796. It failed, however, to attract attention, and the next attempt was not made until 1802, when several buildings in Birmingham were illuminated with gas upon the receipt of the news of the peace of Amiens. Gas was introduced in London as late as 1807. Murdoch, although not the inventor of illuminating gas, did much to secure its introduction.—Elektrotechnische Rundschau.

Lieut. Wise's Escape.

Lieut. H. D. Wise, stationed at Governor's Island, who has been experimenting with man-carrying kites, had a narrow escape on October 21 from being a victim of his own experiments. The kites used were of the well known Hargrave type which we have before described. They are flown three at a time. The half inch rope was attached to a windlass to take up the strain.

Attached to the cable, about a foot below the lowest kite, was a pulley, from which was rigged a boatswain's chair, one end of a line through the pulley block being attached to the chair and the other being left free. The purpose of this was to enable the observer to take his seat after the kites had been raised to a point where they would be steady. The pulley rope was 2,500 feet long and capable of sustaining a weight of 900 pounds, while the kites were planned to lift a weight of 186·9 pounds. The lieutenant weighs about 130 pounds.

As the kites were raised, the chair was held down on the ground, while the other end of the rope was payed out along with the kite cable, until the kites had attained a height of 200 feet. They were then held taut, and the chair and lanyard were carried to a point immediately beneath them.

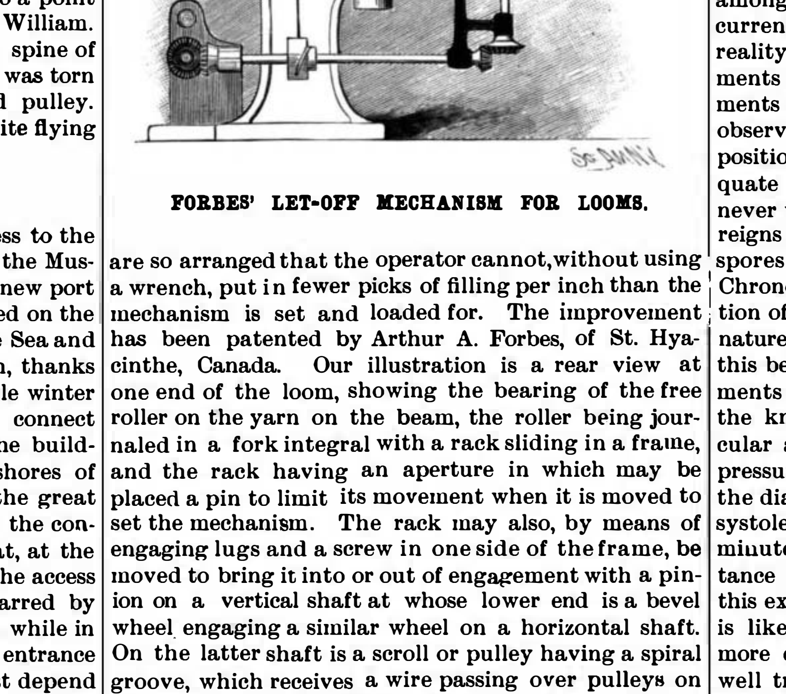
The lieutenant seated himself in the chair and was about to make the free end fast, after which the kites were to be permitted to ascend, carrying the observer up with them. Just at that moment there was a slacking of the cable, the pulley fell to the ground, and the kites, tumbling and diving, gradually settled to a point back of Fort Columbus, just south of Castle William. It was found on examination that the central spine of the lowest kite had broken and the kite itself was torn in pieces. This had released the cable and pulley. Lieut. Wise has been conducting interesting kite flying experiments for some time.

A New Port for Russia.

Russia has at last determined to secure access to the Atlantic, and work is actually being begun by the Muscovite government for the construction of a new port and city at a place called Ekatrinograd, situated on the Murman coast of Lapland, between the White Sea and the Norwegian boundary, and at a point which, thanks to the Gulf Stream, is free from ice the whole winter through. A line has likewise been begun to connect by rail the new port with St. Petersburg. The building of this new city and port on the dreary shores of Russian Lapland bids fair to prove one of the great events in Russian history, comparable only to the construction of St. Petersburg, by Peter the Great, at the mouth of the Neva. At the present moment the access to all Russia's ports in the north could be barred by the powers holding the entrance to the Baltic, while in the same way it is the power commanding the entrance to the Dardanelles upon whom the Czar must depend for access to his ports in the southern portion of his empire. The possession of a great port opening out upon the Atlantic will vastly increase the importance of Russia as one of the great maritime powers of the world.

CLAY PIPE BINS FOR WINE CELLARS.

The illustration represents a method of storing wine in cellars designed to be a great improvement upon shelving and metal racks. Clay pipe wine bins, such as shown in our illustration, have been known in England for some years past, where the price of such clayware bottle racks is about fifty cents per dozen. The pipes, being separate, are easily transported and stacked in any required position, though in new buildings they can be built into the wall, thus giving a foot more of room in the cellar each way. The crushing resistance of these pipes has been proved to be over sixteen tons per square foot. The advantages claimed for them are simplicity, cheapness, firmness, durability, freedom from corrosion, adaptability to spaces of irregular form and odd corners, and a great number of bottles can be stored in a given space. Each bottle, having a separate chamber, is protected from currents of air and sudden changes of temperature, and the breakage of one bottle cannot affect another. Being porous, the tubes will absorb water sprinkled over them, and the evaporation that ensues will materially reduce the temperature; so that when wines and aerated waters are required to be kept cool, the tubes may become a simple and ready form of refrigerator. Weeping bottles can be detected at a glance, each tube being longer than the bottle. Any clay that will make a good drain tile will do equally well for these tubes.

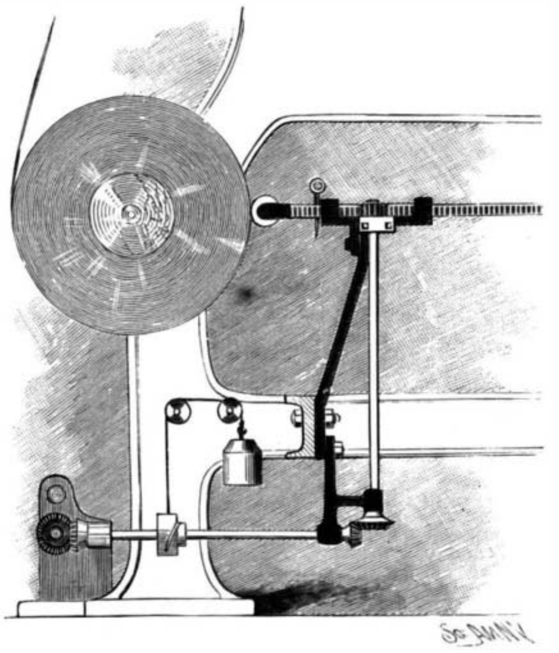


HONEYCOMB WINE BINS OF VITRIFIED CLAY PIPE.

THE quantity of oxygen abstracted from the atmosphere by an acetylene gas flame is much less than that required for the combustion of ordinary lighting gas. For a given illuminating power the acetylene flame raises the temperature less than does that of lighting gas.

AN AUTOMATIC LET-OFF MECHANISM FOR LOOMS.

The illustration represents a mechanism whereby the reduction of tension called for in consequence of the unwinding of the yarn from a loom warp beam, and consequent change in diameter and power of purchase, can be governed automatically and correctly, from a full to an empty beam, with one setting of the mechanism, on the weight and lever principle. The mechanism has no connection with any running or moving part of the loom except the free roller which bears against the warp on the beam, and all the parts



FORBES' LET-OFF MECHANISM FOR LOOMS.

are so arranged that the operator cannot, without using a wrench, put in fewer picks of filling per inch than the mechanism is set and loaded for. The improvement has been patented by Arthur A. Forbes, of St. Hyacinthe, Canada. Our illustration is a rear view at one end of the loom, showing the bearing of the free roller on the yarn on the beam, the roller being journaled in a fork integral with a rack sliding in a frame, and the rack having an aperture in which may be placed a pin to limit its movement when it is moved to set the mechanism. The rack may also, by means of engaging lugs and a screw in one side of the frame, be moved to bring it into or out of engagement with a pinion on a vertical shaft at whose lower end is a bevel wheel engaging a similar wheel on a horizontal shaft. On the latter shaft is a scroll or pulley having a spiral groove, which receives a wire passing over pulleys on the loom leg to a weight attached to its other end. The other end of the shaft is connected by bevels to a shaft extending longitudinally of the loom, and on the latter shaft is a pinion engaging a loose pinion on a parallel shaft above. On this upper shaft are pulleys, not shown in the illustration, to each of which is connected one end of a friction band encircling the head of the beam, there being a friction band for each head, and on the shaft are also rigidly secured parallel arms or levers on which runs a car propelled by a chain from the loose pinion, and the car may be locked so that the operator cannot interfere with the weight. The arrangement is such that, upon a proper adjustment, the predetermined position of the car always corresponds to the proper position of the free roller relative to the center or axis of the beam, and the leverage exerted by the weighted car always has a predetermined relation to the distance of the roller from the center of the beam. When the roller has come in contact with the yarn, it gradually follows the reduction in thickness which ensues as the yarn is reeled off the beam, and simultaneously the car travels on the levers to gradually reduce the pressure of the friction bands upon the beam heads. The mechanism is designed to suit any unusual make of loom and comply with the requirements for any class of goods.

"Chronophotography."

"Chronophotography," or that branch of instantaneous photography which faithfully records movement phases, claims more attention than it has hitherto received in connection with its application to medical subjects. M. Marey, the eminent French physicist and physiologist, was among the first to elaborate the chronophotographic method and to extend it to fields of interest in medicine. Everybody is familiar with the zoetrope, an instrument which, when set revolving, portrays some moving figure—e. g., a horse in full gallop. Formerly the pictures—each of which represented a different stage of movement—were drawn by hand, but now by the introduction of photography the zoetropic representation of motion has been brought to a beautiful degree of perfection. The application of chronophotography to the study of the vital processes of the movements concerned is extremely interesting. Thus a very accurate observation of the movement of the blood in capillary vessels may be observed, and among the facts brought to light is that the circulatory current, though appearing very swift to the eye, is in reality a very sluggish stream. Very curious movements also may be observed in zoospores. "The movements of the zoospores may be followed throughout by observing in a series of photographs the successive position they occupy in the mother cell. But no adequate description could be given to those who have never watched the phenomenon of the activity which reigns within the cell, and only ceases when all the zoospores have succeeded in effecting their escape." Chronophotography has also afforded fresh information of a most important and interesting kind as to the nature of physiological movement, and particularly has this been so in the case of the analysis of cardiac movements by this means. Thus experiments have led to the knowledge of the order and sequence of the auricular and ventricular movements from the changes in pressure which they express. It has been shown that the diastole of the ventricles coincides exactly with the systole of the auricles. Obviously the study of such minutely accurate observations is of the utmost importance to medical science, and we are glad to find that this extremely delicate method of recording movement is likely to become of more general interest and of more extended application now that an excellent and well translated little work on the subject* has been published, which we strongly recommend to the notice of our readers.

The Destruction of the Colosseum.

The Colosseum was made to stand forever. If we gaze at it from the east side, where it appears still intact, we are forced to exclude the possibility of a spontaneous collapse of such a substantial structure. Yet the repeated concussions of the earth in the fifth century may have caused a crack or rent like the one which cuts the Pantheon on the side of the Via della Palombella. If such an accident occurred in the Pantheon in a solid wall fifteen feet thick, built by such an experienced architect as Hadrian, it is even more likely to have happened in the Colosseum, the outer belt of it being of stone without cement, and pierced by three rows of arcades and one row of windows. The equilibrium once destroyed, the results are obvious, especially if we remember how quickly arborescent plants and trees take root and prosper in the dry soil of an abandoned building. The stones on the edges of the crack must have been lifted or wrenched from their sockets by the roots wedging themselves into the joints and acting as levers. Readers familiar with the vignettes of the Colosseum of the sixteenth and seventeenth centuries will remember how exactly they represent this process of disintegration of the edges, stone by stone. When Pius VII determined to build the great buttress to support the edge of the outer belt on the side of the Via di S. Giovanni in Laterano, he was obliged to employ convicts serving for life, promising them a reduction in the term of imprisonment if they succeeded in propping it up. The danger was such that the forest of timber used in the scaffolding could not be removed while the masons were progressing with their work, but had to be left embedded in the thickness of the supporting walls.—Prof. Lanciani in the Atlantic.

* Movement. By E. J. Marey, Professor at the College of France, Director of the Physiological Station. Translated by Eric Pritchard, M.A., M.B., B.Ch. Oxon. With 200 illustrations. London: William Heinemann. 1895.