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Proceedings of the British Association. Abstracts of papers. Capacity of crania. Left-handedness. An equatorial mounting for a three foot reflector. On simplification of graphic formulæ. Detection by the microphone of sounds accompanying the diffusion of gases through a thin septum. Historical national names. The microphone. Platinum pictures.

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IMPROVEMENTS IN SUGAR MAKING WANTED.

A short time since the attention of inventors was called by us to a prize of 100,000 francs ($20,000) offered by the authorities of Guadeloupe for a process that would obtain fourteen per cent of sugar from canes. Through the kindness of U. S. Consul Charles Bartlett, Point à Pitre, Guadeloupe, we are able to add a few important particulars.

In reply to a communication from Mr. Bartlett relative to an improved American cane mill, which would increase the yield of juice from 20 to 30 per cent above the mills in use on the island, the administration replied that improvements of that sort were not what the Council had in view when the premium was offered. What is called for is a process of treating the juice which shall bring the yield of sugar up to 14 per cent. All the expenses of transit, fitting up of the apparatus on the island, and others connected with the experiments are to be borne by the inventor, the colony providing only for the expenses of a special commission to make the requisite tests.

The prize is worth trying for in itself: yet it would be small compared with the total profit the successful inventor would reap from his patents in Cuba and elsewhere, particularly our own land. The sugar industry of this country is comparatively undeveloped; and there is no reason why we should not supply ourselves with this necessary commodity. The notion that cane sugar can be profitably produced only in hot and unhealthy regions seems to be a mistake. According to an official report from our consul at Hamilton, Canada, an Ohio man has raised this season, on a farm near that city, five acres of sugar cane, which has been pronounced equal to any ever grown in the Southern States. The cane attained a height of thirteen feet, and yielded an abundant saccharine product. It is believed that the cultivation of sugar cane will soon become an extensive industry in that region; and if successful there, it should succeed in many parts of the States, away from the miasmatic valley of the lower Mississippi.

The experiments in sugar making from cornstalks and sorghum, which Dr. Collier of the Department of Agriculture has been carrying on in Washington, are worth noting in this connection. The aggregate weight of the cornstalks used was 11,237 lbs., and the weight of sorghum 13,958 lbs. The weight of the juice from the cornstalks was 2,773 lbs., and from the sorghum 4,963 lbs. The specific gravity of the cornstalk juice was 10·54; that of the sorghum juice 10·58. The percentage of juice in the cornstalks as they came from the field was 24·68; the percentage of the sorghum, 35·56. Thus 2,571 lbs. of cornstalk juice yielded 382 lbs. of sirup, and 4,355 lbs. of sorghum yielded 660 lbs. of sirup. This sirup contains 75 per cent of its weight of sugar. The mill used in these experiments was an indifferent one, and the sorghum was in small stalks. Better results would have been reached had the stalks been larger. Dr. Collier says he is satisfied that there is not a farmer in the country who cannot rely upon results 50 per cent greater than he has secured, with a better mill.

Since the cultivation of beets for sugar was begun, the percentage of sugar in the root has been more than doubled. Like care in the getting and perfecting of the more hardy varieties of sugar cane might very largely increase the saccharine product, so that our cooler and more healthy climates might easily compete with the best sugar countries of the tropics. And it is quite possible that with a vastly increased product of sweet corn for summer use and for canning, there might be developed an even more profitable sugar product from the stalks. In this way two valuable crops could be reaped from the same ground, at one time, with a very slight increase of labor. The corn leaves would have no small value also for fodder, and possibly the pressed stalks would yield a fair revenue for fiber.

The field for improvement in this direction is not only wide, but extremely promising. Our farmers, mill-makers, and chemists will do well to work it.

DUST EXPLOSIONS.

Apropos to the discussion concerning flour mill explosions we are informed that the burning of the large fertilizer manufactory in the town of Lake, near the Chicago Stock Yards, in January, 1874, was due to a like cause, that is, the ignition and explosion of fine dust.

The building was of wood, one story, 75 x 100 feet, with a wooden addition about 20 feet square. In the main building the fertilizer was manufactured from the blood and tank stuff received from the neighboring packing houses; mixed together they were fed into a long revolving cylinder of iron, through which flame constantly passed, and were delivered as a fertilizer containing from 15 to 18 per cent moisture. The fertilizer was then fed into a pulverizer, which reduced it to a fine powder, and blew it through a long tin pipe (into which hot air from a heater was also admitted) into cylindrical sieves or bolters of different grades, which terminated the pipe and which were located in the 20 foot square building. After the material had passed through the bolters it contained but from 6 to 8 per cent of moisture. The bolting room always contained hot air, hot steam, some ammoniacal gases, and the fine floating dust of animal matter.

About a week before the destruction of the works one of the workmen entered the room, with a lantern, to clean the bolters; as the dust soon settled on the lantern glass and obscured the light he opened it to take the lamp out that he might see better; an instantaneous explosion followed, and he was thrown down, and his hair, face, hands, and clothes badly scorched. The force of the explosion was, however, expended through the open door, and no further damage resulted.

A week after this occurrence, on another occasion of the clogging of the bolters, the intelligent foreman of the factory entered the room with the lantern, with two of the workmen, and repeated the interesting performance of exposing the naked light, with disastrous results; the explosion shook from the beams and rafters of the buildings the long accumulation of dry fertilizer dust, which was at once ignited by the burning gas, and the whole building was instantly filled with flame and burned to the ground.

From this it is evident that the dry dust of animal as well as that of vegetable matter will take fire and generate gas with explosive rapidity, provided the necessary conditions are presented, that is, sufficient and intimate mixture with air, and the temperature of a burning lamp. In this case the conditions were complicated by the presence of steam and ammoniacal gases, which, however, contrary to what would have been predicated of them, apparently excited no preventive influence.

A SECOND MATTHEW VASSAR.

Two years ago, Mr. J. C. Jacobsen, a wealthy brewer in the neighborhood of Copenhagen, Denmark, set aside the sum of a million Danish crowns—$275,000—for the support of a laboratory for scientific research. The money is vested in the hands of five persons, nominated by the Danish Royal Academy of Sciences. Part of the annual revenue is to be expended in keeping up the splendid laboratories attached to the brewery and devoted to chemical and physiological researches, with a view to establishing as complete a scientific basis as possible for the great industries of brewing and malting; the rest, after the death of the donor and his wife, will be expended in the advancement of the various natural sciences—mathematics, philosophy, history, and philology. The laboratory is fitted up in the most liberal manner, and already excellent work has been done in it. The first report of such work has just been published in Copenhagen, and contains papers on the following subjects: "On the rotatory power which beer wort exercises on polarized light, and on its variations during fermentation," "Estimation of extract," and "Estimation of alcohol in beer," by M. J. Kjeldahl; "Researches on some factors which affect the propagation of the low yeast of *Saccharomyes cerevisiæ*;" "On the influence which the introduction of atmospheric air into fermenting wort exercises on fermentation;" and "Researches on the influence of temperature in the production of carbonic acid on barley germinating in darkness," by M. R. Pedersen.

From the nature of their occupation our successful brewers are compelled to become interested in science, if not actually scientific. At every stage in the varied processes of beer making a high order of chemical knowledge is valuable, indeed almost indispensable; and with every year's advance, scientific brewing becomes more and more essential to success. Properly conducted the business is very profitable; and so commerce, the iron trade, and other paying industries have furnished the means for many munificent gifts to science and education. We may reasonably expect that there will be among our wealthy brewers not a few who will emulate Mr. Vassar and Mr. Jacobsen, and build lasting monuments to their honor by the endowment of institutions for the advancement and diffusion of knowledge. There are several fields of scientific research the cultivation of which might be greatly helped by the establishment of working laboratories after the Danish model; and we have several millionaire brewers who might provide them handsomely out of a single year's profits. As a class the brewers are notably freehearted and generous in regard to public improvements and the like. They owe much to practical science, and, we are confident, will sooner or later make many praiseworthy acknowledgments of the debt.

POISONOUS HATS, GLOVES, STOCKINGS, AND CLOTHING.

It is not long since several cases of arsenical poisoning were traced to the wearing of scarlet and blue stockings. Next came a somewhat remarkable case in which the mischief was traced to a highly colored hat lining. More recently English and German papers, medical and other, have called attention to dangerous gloves. In the London *Times* a writer describes the poisonous effect of a pair of the fashionable "bronze green" silk gloves, when worn by a member of his family. After wearing them a day or two the patient was attacked with a peculiar blistering and swelling of both hands, which increased to such an extent that for three weeks she was compelled to carry her hands in a sling, suffering acute pain, and being, of course, unable either to feed or dress herself. Inquiries among the writer's friends discovered three other ladies similarly afflicted.

A German medical journal reports a case of serious poisoning by a pair of navy blue kids. Dress goods of woolen, silk, and cotton have been found to contain arsenic in dangerous quantities; so also gentlemen's underclothing, socks, hat linings, and the linings of boots and shoes. Professor Nichols, of the Massachusetts Institute of Technology, reports the examination of a lady's dress which contained eight grains of arsenic to the square foot. In Troy, N. Y., lately, the death of a child was attributed to arsenic sucked from a vail which had been thrown over the child's crib to keep off flies.

At this rate it will soon become necessary to test for arsenic all goods purchased before venturing to wear them; or else the label—"warranted to contain no poisonous dye"—

will have to be adopted by all honest and reliable makers. Hitherto, we believe, the retail dealer has not been held legally responsible for damage done in this way. We do not know that he can be—except on the charge of dispensing poisons without a license. Evidently, however, something should be done to put a stop to the rapidly increasing evil. If the obnoxious tints cannot be secured safely as well as cheaply, then they ought to be prohibited, and another process of dyeing made imperative. Our young chemists will find a fruitful field for the exercise of their inventive powers in the production of the needed dyes.

THE PAUPER TRIBE.

The difference between poverty and pauperism, though wide as the world, is too often overlooked. The best of men may become poor; may honorably reach the point of actual destitution; indeed, it has not unfrequently happened that the world's best benefactors have experienced extreme poverty, sometimes by resolutely pursuing the course which has ultimately brought them to the highest financial and industrial as well as moral success. No combination of circumstances, however, no matter how disastrous, could make such men paupers. The pauper is made of very different material: he is what he is too often by preference, very often by inheritance.

Last year Dr. Hoyt, Secretary of the New York State Board of Charities, visited sixty-four poorhouses, containing 13,000 public paupers. Less than one fourth were of American parentage. In fifty-five cases investigated the pauperism extended to the second generation on the father's side, and in ninety-two cases to the third generation on the mother's side. Three hundred and ninety-seven had pauper fathers; one thousand three hundred and sixty-one had pauper mothers; and so on. Their pauperism was hereditary. The close relation of criminality with inherited pauperism —the more forceful members of such families preferring to seize what they want rather than beg for it—is shown in the history of the well known "Jukes" family, which, in one hundred and fifty years, furnished this State with eight hundred and thirty criminals of baser types, besides many imbeciles, lunatics, and other undesirable characters.

Professor Brewer, who has given much study to the pauper and tramp problem, is confident that wherever the genesis of paupers is thus looked into there will be found abundant evidence of a pauper tribe well established among us, and perpetuating its instincts in its descendants. For this class no mawkish sentimentality will answer; they need strict justice. The class as a class must be rooted out by resolute treatment. The chain of criminal entailment must somehow be broken in them or they will breed a moral pestilence. Against such outlaws, "for whom," as a contemporary has said, "childhood has no sanctity, hospitality no safeguard, and property no rights," only vigorous measures will suffice. There is enough of honest poverty, through flood and fire and sickness, to furnish occupation to the charitable without the burden of voluntary pauperism, the effect of which is too often to steel the hearts of the sympathetic against all poverty and distress. The honest seeker for employment is confounded with the professional tramps, of whom the most charitable of communities are becoming heartily sick. In justice to the deserving poor—and there is always a large class which, through no fault of their own, may become poor—the pauper tribe should at least receive no encouragement.

For many years in this country the single fact that a person was in need of food or clothing or shelter was held to be a valid reason for giving what was asked. The country became in consequence a perfect paradise for the pauper tribe. They fared so well that multitudes brought by adverse circumstances to poverty were tempted over the line into pauperism; and many others lingered on the verge, passing their time between unwilling labor, pauperism, and petty criminality. Out of these has grown a class of criminal vagrants, now by far the worst disturbers of the public peace and the public moral health.

Indeed, the Indian problem, bad as it is, is a trifle compared with that arising from the existence of the pauper tribe. The Indian is on the frontier; the vicious tramp is everywhere. And it is safe to say that, year by year, the life and property destroyed by the tramp tribe exceeds that due to Indian depredations. If we are justified in spending millions in Indian wars, in placing upon reservations and trying to civilize the one class of savages, much more justifiable must be the taking of measures, national in scope and magnitude, to control and reclaim if possible the other. Nothing short of this, we fear, will ever rid us of the pest.

PUBLIC SANITATION.

Formerly, Galveston, Texas, was accustomed to have an epidemic of yellow fever every three or four years. The last and worst the city ever suffered from was in 1867. At that time the level of the city was low, and there was standing water under nearly all the older houses. Seeing that the fever spread most rapidly and was most fatal where the stagnant water stood, it was ordered that the grade of the city should be raised four feet, and that the space beneath every house that had water under it should be filled with sand. At the same time the system of surface drainage was improved, and strict sanitary regulations were adopted and enforced. The result has been that Galveston is one of the cleanest cities in the United States; and, though made a place of refuge for yellow fever victims, the disease has failed to spread there. The value of such sanitary care was particularly tested in 1873, when the disease was very fatal in Memphis, Shreveport, and in Texas. The healthfulness of the city this summer is attributed more to its perfect sanitary condition than to the quarantine that has been maintained against infected ports. It is now eleven years since the fever was epidemic in Galveston, and the citizens believe that with proper attention to sanitary precautions they need never suffer again as they did in 1867. In view of these facts a contemporary remarks that it "will probably be found, when the history of the present epidemic in the South is written, that in every city which has suffered the soil had been prepared for the introduction and spread of the disease by the neglect to observe sanitary rules. The yellow fever would certainly lose many of its terrors if every Southern city was kept as clean as Galveston."

Setting aside the terrible cost of the present epidemic in suffering and death, because it is incalculable, the computable cost in direct contributions, and indirectly through the cessation of Southern industry and the derangement of Northern trade, would probably suffice to keep every one of the fever smitten cities in proper sanitary condition for a whole generation. Indeed it would pay the business interests of New York alone to assume the expense of keeping the fever districts clean. So large is our share of the penalty an epidemic imposes, so intimate, in fact, are the social and commercial relations of the most widely separated parts of our great country, that one part cannot suffer without hurting all. Accordingly it may be a reasonable question whether public sanitation might not be made a national matter, that the influence of unsanitary local customs, conditions and prejudices might be more successfully combated and eradicated. The loss entailed by preventable sickness and death throughout the country—preventable by means already at our command—doubtless amounts to more every year than the cost of our State and National governments; and it would pay the people as a whole to insist on higher sanitary standards and more efficient public sanitation for every community.

As evidence of increasing interest in this direction, we may mention the Yellow Fever Commission, made possible by the generosity of a lady in this city. The commission will be composed of eminent physicians, North and South, including the President of the American Public Health Association. The great object of the inquiry will be to discover measures for the prevention of future epidemics; and it is to be hoped that the subscriptions for the furtherance of the work will be so generous that too limited means may not lessen the scope and thoroughness of the commission's labors.

A HORSE'S MOTION SCIENTIFICALLY DETERMINED.

A short time since the SCIENTIFIC AMERICAN briefly noted the fact that Mr. Muybridge, of San Francisco, had perfected an automatic electro-photographic apparatus, by means of which he had succeeded in recording the action of horses in motion. Mr. Muybridge courteously responded by forwarding a series of instantaneous photographs, showing with absolute accuracy the motions of horses when walking, trotting, and running. From these we have selected two series, the first showing the movement of the horse "Abe Edgington," while walking at a 15 minute gait; the second showing the same horse while trotting at a 2:24 gait. These —omitting the driver and his sulky—we have had enlarged and skillfully engraved, as shown in the illustration on the first page.

In taking the negatives of these photographs, Mr. Muybridge employed a series of cameras, operated by electricity, and so placed as to fix with absolute accuracy the several phases in the continuous action of the horse while making one stride. The exposure for each negative was about the two thousandth part of a second. The vertical lines on the background are twenty-eight inches apart; the heavy horizontal line represents the level of the track; the others mark elevations of four, eight, and twelve inches respectively. These lines are necessary for the analysis of the movement of the horse.

It will be seen that the walking horse always has two feet on the ground, and, for a brief interval in each stride, three feet. The positions of the feet shown in Figs. A and E indicate a stride of 4 feet 4 inches. When trotting at a 2:24 gait, the stride of the same horse is over 18 feet.

Figs. 1 to 12 show the latter motion. In Figs. 4 and 5, and again in 9 and 10, the horse is entirely off the ground, literally flying through the air. In his analysis of the stride, Mr. Muybridge notes that with this stride, moving at a 2:24 speed, the horse is entirely in the air about half the length of the stride, and for a brief interval he has one foot alone upon the ground. The relative time that a horse is on or off the ground is probably dependent upon his length of limb and stride, and rate of speed.

The limit of our space forbids any attempt to follow the movements and positions of the four feet throughout the stride, further than to note that the figures from 1 to 6 depict half a stride, the remaining figures the other half.

The most careless observer of these figures will not fail to notice that the conventional figure of a trotting horse in motion does not appear in any of them, nor anything like it. Before these pictures were taken no artist would have dared to draw a horse as a horse really is when in motion, even if it had been possible for the unaided eye to detect his real attitude. At first sight an artist will say of many of the positions that there is absolutely no "motion" at all in them; yet after a little study the conventional idea gives way to truth, and every posture becomes instinct with a greater motive than the conventional figure of a trotting horse could possibly show. Mr. Muybridge's ingenious and successful efforts to catch and fix the fleeting attitudes of moving animals thus not only make a notable addition to our stock of positive knowledge, but must also effect a radical change in the art of depicting horses in motion. And every one interested in the physiology of animal action, not less than artists and horse-fanciers, will find the photographs of Mr. Muybridge indispensable.

Our drawings, though admirable and instructive as such, are necessarily inferior to the photographs in scope and variety of detail; and they lack also that element of indisputable accuracy which belongs to the sun pictures. However truthful, an artist's work cannot have the convincing force of a photograph. Six series of cards have been published, with from eight to twelve positions each, illustrating the single strides of trotting, cantering, running, and walking horses. They may be had of Muybridge, photographer, 417 Montgomery St., San Francisco, Cal.

We would suggest that for popular use the photographs should also be mounted on strips for use in the zoetrope. By such means it would be possible to see not only the successive positions of a trotting or running horse, but also the actual motions of the body and legs in passing through the different phases of the stride.

IMPROVED EDUCATION.

The reign of cram in primary schooling is seriously threatened, and Boston leads the revolt. Henceforth, if success attends the effort, the Boston public school teacher will teach, not simply hear recitations as heretofore; and the pupils will acquire knowledge after the normal method of childhood, by being taught, by seeing and thinking, instead of by the memorizing of words from books. Language will be taught by talking-lessons with and about pictures, plants, animals, everyday life and experience. Oral instruction will also be given upon form, color, measures, animals grouped by habits, vegetables, minerals, hygiene and the human body. The metric system will be taught from the metric apparatus. No spelling books will be used, the reading books taking their place. In the grammar grade, grammar, as generally studied, has been abolished with the spelling book. In the stead of parsing and other technical work, lessons will be given in composition, in the use of capitals, in letter writing and in the arrangement of sentences. Much of the time formerly devoted to geography will be given to natural philosophy and physiology. Oral instruction will be an important feature of all the classes, and in the lowest two it will predominate. In the lower classes the subject for oral instruction will be natural history, plants from May to November, animals from November to May, trades, occupations, common phenomena, stories, anecdotes, mythology, metals and minerals. In the upper classes, physiology, life in the middle ages, biographical and historical sketches, and experiments in physics.

This method labors under one serious, we fear fatal, difficulty—the teachers will have to know something. Their knowledge will have to be real "live" knowledge, not dead verbiage; and they will need to know a good deal about the natural, social and industrial life that the children come in contact with out of doors and at home. Such knowledge is not to be gained from books; and it is hard to turn a book student into a practical observer. We sincerely hope, however, that the teachers of Boston will succeed in their difficult task, and demonstrate to the rest of the world the feasibility of this promising and long needed reform.

The American Institute Fair.

The annual exhibition of the American Institute is now in complete working order, and offers more than its usual array of popular attractions. Though no startling novelties are presented, the general character of the display is somewhat above the average.

Naturally the late advances in methods of generating and applying electric energy make their electrical department specially prominent, the electric light, the new Wallace and Weston motors, Edison's electric pen and carbon telephone being among the chief attractions. There is also an exhibition of the Phelps telephone.

Some attractive and interesting steam and caloric engines are shown in the machinery building, with the usual display of pumps, rock crushers, grinding apparatus, and the like. Light wood-working machinery is well represented, the display of iron-working machines being rather meager. The exhibition of agricultural machinery and implements is good, though not abundant. The same may be said of the fruit and vegetables. The silk looms in operation attract a fair share of popular interest. Among sewing machines the chief novelty appears to be the Wardwell two-spool lock stitch Seamstress. The "noiseless rails" exhibited by Louis Leypoldt should attract a very large share of attention; if they can silence even a part of the clang of elevated roads they will prove themselves a public benefaction of no mean order.

On the whole we do not know a more instructive and enjoyable resort for our citizens han this exhibition, and now that the elevated road makes it more easily accessible than ever before, it should excel its previous years' successes in popularity and influence.