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No. 827.

For the Week Ending November 7, 1891.

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DANGERS OF LARGE FLY WHEELS.

The bursting of the 68 ton fly wheel of the great engine in the Amoskeag mills, Manchester, N. H., furnishes additional evidence, if such were needed, to prove that with the means now at hand the possibility of flaws in large castings cannot be determined with certainty. In his testimony before the coroner's jury, the superintendent of the mill said: "The remnants of the fly wheel show very many internal flaws where the iron is drawn badly by shrinkage in cooling, all of which it was impossible to discover without destroying the wheel; sounding would not show the flaws. If you join two cubes of iron of equal size, one solid, the other filled with these shrinkage flaws, the parts would vary largely in weight; such tests would be impracticable in castings as large as the integral parts of this fly wheel." According to the testimony the wheel was moving at its usual rate, the same being 61 revolutions a minute, and this is strange enough when we consider that it had been in use over eight years for about three months of each year, water power being employed in the interim. This, like all big wheels, was composed of segments bolted together, and, of course, it is possible that the trouble began on the rim, the bolts loosening and the component parts of the wheel, or those of imperfect make, being unable to withstand the shock of the wrenching that followed.

In another recent fly wheel catastrophe, that in the power house of the Electric Street Railway Company, of Cincinnati, O., the wheel, a twenty ton one, suddenly flew apart and at a time when, so far as the engineer could see, there was not any undue acceleration of the engine's movements.

In this case there were no casualties, as at Manchester, and hence no inquest. The investigation that followed was conducted by interested persons who, notwithstanding the declaration of the engineer, who was present at the time, attributed it to a sudden withdrawal of the load and the consequent racing or "running away" of the engine. The fact that the automatic cut-off, operated by the governor, was found to be intact might fairly be accepted as helping to sustain the assertion of the engineer, because, had the engine been relieved of its load, this automatic cut-off would undoubtedly have held the engine to within a few turns of its normal speed. It would seem, therefore, as if this, too, might be a case of defects in casting.

A recent inquiry among the makers of these big fly wheels failed to discover one among them who knew of any test for large castings by which the presence of flaws, the result of air bubbles in moulding or improper cooling, could be discovered. About a year ago there was a report that a French inventor had devised a means of doing this by electricity, the apparatus being called a "schiseophone." It was said for it that it would indicate the presence of flaws in steel rails that the ordinary hammer test could not be relied upon to discover, or, to put it more correctly, that the human ear is not sensitive enough to read the warning that may be given in the hammer test when put to large castings. Nothing, however, seems to have come as yet of all the promises made for this invention. Till such or similar means are found to discover flaws in segments for large fly wheels, it is not safe to use them in the vicinity of workrooms, as at Manchester.

Luminous Paints in all Colors.

A German contemporary gives the following series of receipts for these paints, which may prove useful. All of these paints can be used in the manufacture of colored papers, etc., if the varnish is altogether omitted, and the dry mixtures are ground to a paste with water. The luminous paints can also be used as wax colors for painting on glass and similar objects, by adding, instead of the varnish, 10 per cent more of Japanese wax and one-fourth the quantity of the latter of olive oil. The wax colors prepared in this way may also be used for painting upon porcelain, and are then carefully burned without access of air. Paintings of this kind can also be treated with water glass.

For orange luminous paint, 46 parts varnish are mixed with 17·5 parts prepared barium sulphate, 1 part prepared Indian yellow, 1·5 parts prepared madder lake, and 38 parts luminous calcium sulphide.

For yellow luminous paint, 48 parts varnish are mixed with 10 parts barium sulphate, 8 parts barium chromate, and 34 parts luminous calcium sulphide.

For green luminous paint, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts chromium oxide green, and 34 parts luminous calcium sulphide.

A blue luminous paint is prepared from 42 parts varnish, 10·2 parts prepared barium sulphate, 6·4 parts ultramarine blue, 5·4 parts cobalt blue, and 46 parts luminous calcium sulphide.

A violet luminous paint is made from 42 parts varnish, 10·2 parts prepared barium sulphate, 2·8 parts ultramarine violet, 9 parts cobaltous arsenate, and 36 parts luminous calcium sulphide.

For gray luminous paint, 45 parts of the varnish are mixed with 6 parts prepared barium sulphate, 6 parts prepared calcium carbonate, 0·5 part ultramarine blue, 6·5 parts gray zinc sulphide.

A yellowish-brown luminous paint is obtained from 48 parts varnish, 10 parts precipitated barium sulphate, 8 parts auripigment, and 34 parts luminous calcium sulphide.

Luminous colors for artists' use are prepared by using pure East India poppy oil, in the same quantity, instead of the varnish, and taking particular pains to grind the materials as fine as possible.

For luminous oil-color paints, equal quantities of pure linseed oil are used in place of the varnish. The linseed oil must be cold-pressed and thickened by heat.

Tobacco and Physical Health.

Dr. J. W. Steaver, College Physician and Instructor in Athletics at Yale University, reports that he has made a comparative study of the users and non-users of tobacco in the senior class during the past four years, and from his measurements he sums up his statistics as follows:

Average increase in lung capacity in *users* of tobacco, 0·15 liter; *non-users*, 0·25; or an increase of 66 per cent greater for non-users.

Inflated chest measurements, in *users*, 0·0304 meter; *non-users*, 0·0364, or an increase of 19 per cent greater for non-users.

Height, in *users*, 0·0169 meter; *non-users*, 0·0202, or an increase of 20 per cent greater in non-users.

Weight, in *users*, 0·4 kilogramme; *non-users*, 0·5, or an increase of 25 per cent greater for non-users.

With regard to the possible effect on scholarships, the statistics are: Of those who received junior appointments above dissertations, 95 per cent have not used tobacco; of those above colloquies, 87½ per cent have not used tobacco; of all who received appointments, 84·3 per cent have used tobacco; of the entire class, 70 per cent have not used tobacco.

Dr. Steaver says that these figures accord with statistics that he has kept for the past eight years, the greatest percentage of gain always being on the side of those who do not use tobacco. The greatest variation in the two years' widest part has not been more than 4 per cent. Some of the students who are classed among the non-users do smoke, but not oftener than once a week, or at such long intervals that the tobacco is apt to have little or no effect on them. Dr. Steaver states that the prominent athletes do not smoke or otherwise use tobacco as a rule, Calhoun being the only exception in college. All the candidates for the crew abstain from tobacco.

Preparing Waterproof Cloth.

These methods may be divided into two groups. In some, a precipitate of salts of the fatty acids is produced upon the tissue itself; in others, the cloth is saturated with melted or dissolved substances, which, when they are once solidified on the fiber, have the property of repelling water. If any of the former class of methods is selected, the cloth is passed into a special machine, in which it is saturated with aluminum acetate; it is dried and passed into a soap beck. It is necessary in this operation to produce a basic compound. For this purpose, there are employed equal weights of salts of aluminum and of lead. Care must be taken not to introduce too large quantities of free acid with the aluminum sulphate, since the latter contains always a certain quantity of sulphuric acid, which, during desiccation, displaces the acetic acid. To avoid this inconvenience, there are added per liter from 10 to 80 grms. of soda. The most favorable temperature is 50 deg. Heating by direct steam must be avoided. For preparing the soap bath the author utilizes the fact that an aqueous solution of soap forms true solutions with mixtures of fat and wax, resins, mineral oils, and even caoutchouc. To this end he takes a ten per cent solution of gum Paraguay in oil of turpentine. The proportions to be employed for a square meter of cloth are 30 grms. tallow soap, 25 Japan wax, 1·5 gum Paraguay, 1 grm. good varnish. The wax is first melted, the gum and the varnish are added, and then for each kilo. of the solid gum there are added 0·5 grm. of a solution, saturated in heat, of potassium sulphide (liver of sulphur). The mixture is stirred and boiled, when sulphureted hydrogen is liberated. A boiling solution of soap is added, when the bath is fit for use.—*Em. Doring, in Romen's Journal.*

Detection of Copper in Distilled Water.

Distilled water, the purity of which has been ascertained by the ordinary methods, becomes colored yellow on dissolving in it potassium iodide. A closer examination admits of the detection of infinitesimal quantities of copper, which neither ammonia nor potassium ferrocyanide had revealed. The presence of this impurity occasions the yellow coloration of the solution of potassium iodide in the water. The reagent gives a feeble yellow coloration with 1 part in 200,000 parts of water. The liquid must not contain any other substance capable of decomposing the iodide and liberating iodine.—*Herman Thoms, in Pharm. Centralhalle.*

Pushing the Work for the World's Fair.

From a recently issued report of the Department of Publicity and Promotion of the Columbian Exposition to be held in Chicago in 1893, it is apparent that a much greater amount of work has been already done than is generally known. It is stated that all of the great buildings have been contracted for and are under construction, and on several of them work is proceeding night and day, all being pushed to completion by large forces of workmen. Insurance is placed and increased on the buildings as their construction proceeds. It is the intention to carry insurance aggregating $300,000,000 on the buildings and exhibits. The following statement of the exposition's finances is made by the report: Resources—Stock subscriptions, $5,608,110; city of Chicago bonds, $5,000,000; prospective gate receipts, $10,000,000; concessions and privilges, $1,500,000; salvage, $1,000,000; interest on deposits, $270,035; total, $23,135,145. Of the subscriptions already received, 60 per cent has been called for, and considerably more than $3,000,000 has been paid in. The number of subscribers is over 30,000. The $5,000,000 in city bonds is certain to be realized in full, as Chicago's credit is excellent. The gate receipts, concessions and privileges, and salvage are necessarily prospective, and the amounts given are of course estimates. It is believed they are moderate.

The amounts thus far appropriated by the States and Territories to secure their proper representation at the fair are as here shown:

Arizona	$30,000	New Hampshire	$25,000
California	300,000	New Jersey	20,000
Colorado	100,000	New Mexico	25,000
Delaware	10,000	North Carolina	25,000
Idaho	20,000	North Dakota	25,000
Illinois	800,000	Ohio	100,000
Indiana	75,000	Pennsylvania	300,000
Iowa	50,000	Rhode Island	25,000
Maine	40,000	Vermont	15,000
Massachusetts	75,000	Washington	100,000
Michigan	100,000	West Virginia	40,000
Minnesota	50 000	Wisconsin	65,000
Missouri	150,000	Wyoming	30,000
Montana	50,000	Total	$2,695,000
Nebraska	50,000		

The following States have appropriations pending in their legislatures. The sums they are endeavoring to raise are:

Alabama	$100,000	Oregon	$100,000
Arkansas	100,000	South Dakota	80,000
Florida	100,000	Tennessee	50,000
Georgia	100,000	Texas	300,000
Kansas	100,000		
Total			$1,030,000

The foreign nations and colonies that have so far determined to participate in the exposition, and the amounts they purpose to expend, are the following:

Argentine Rep	$100,000	British Guiana	$15,000
Austria-Hungary	168,000	British Honduras	7,000
Bolivia	150,000	Cape Colony	10,000
Brazil	445,000	Trinidad	10.000
Chili	100,000	Guatemala	120,000
Colombia	100,000	Honduras	20,000
Costa Rica	50,000	Japan	500,000
Danish W. Indies	10,000	Mexico	750,000
Ecuador	125,000	Nicaragua	20,000
France	400,000	Peru	100,000
Germany	250,000	Salvador	30,000
Great Britain	125,000	Cuba	25,000

This partial list foots up thirty-one nations and fourteen colonies, and appropriations aggregating $3,630,000. The United States government has appropriated thus far $1,500,000, of which $400,000 is available for its building alone.

RULES FOR EXHIBITORS.

L. W. Robinson, chief of the department of machinery, has formulated the rules. They have not been officially approved by the Director-General, but with a few minor modifications they will probably stand as follows:

A limited quantity of steam and water power will be furnished for the purpose of exhibiting machinery in operation, the quantity of each to be definitely settled at the time of allotment of space. Any excess will be charged for at a fixed price. Demands for such excess must also be settled at time of allotment of space.

Exhibitors will not be allowed to exhibit any kind or class of goods except those specified in the application.

Exhibitors must be manufacturers of machinery and not dealers only.

Exhibitors must provide showcases, shelvings, counters, fittings, countershafts, pulleys, beltings, etc., at their own expense.

Exhibitors are required to furnish the following information and a drawing to the scale of one-fourth inch to the foot of the plans and distribution of the objects they wish to exhibit. If machinery, actual horse power required. Cubic feet of steam used per hour at a pressure of 150 pounds. Diameter of steam and water pipes. Diameter of discharge drain pipes. The main shafts will make 120 and 240 revolutions per minute. Dimensions of space required must be given in feet and inches, without including any allowance for passageways. What per cent of labor performed by females in the production of articles exhibited. Whether the applicant is a producer or manufacturer.

By special arrangements the installation of heavy articles requiring foundation should begin while the building is under construction.

The floor of Machinery Hall will support 250 pounds per square foot. The heaviest single piece received must not weigh more than 30,000 pounds, as facilities will not be provided for handling heavier weights.

The steam pressure supplied will be 150 pounds to the square inch. Those wishing to secure lower pressure may do so by using a reducing valve.

Water pressure will be that due to a head of 225 feet, or a pressure of 98 pounds to the square inch and a head of 40 feet, or a pressure of 175 pounds to the square inch.

The line shafting will be 16 feet from the center of the shaft to the floor.

Driving pulleys are limited to thirty-six inches in diameter.

Exhibitors of steam and other machinery who desire to offer the exhibits for use by the Exposition Company should send their applications as soon as possible.

Such exhibitors may select their own men to operate this machinery. Their wages will be fixed and paid by the Exposition Company.

The Exposition Company will defray the necessary expenses of exhibitors, loaning them machines, tools, etc., for use beyond that which they would have incurred as exhibitors simply, wear and tear excepted.

Platforms, counters, ornamental partitions, show cases, etc., will be at the expense of the exhibitors and must not exceed these dimensions: Show cases, fifteen feet above the floor; counters, two feet ten inches; platforms, one foot; partitions, fifteen feet.

All exhibits of machinery in motion must be inclosed by a railing two feet and six inches in height to come inside the space. No signs will be allowed to extend over the passageway and no signs will be allowed made of muslin, linen, canvas or paper.

No fire will be allowed in Machinery Hall except by special permission. Not more than a day's supply of oils or other inflammable substances will be permitted in Machinery Hall, but a suitable place for the storage of these materials will be provided.

No steam or water pipes will be permitted to extend over the passageways except when specially provided.

Exhibitors not desiring to employ attendants or watchmen may leave their exhibits in the care of the department, which will assume the responsibility of their cleanliness.

Toning Ferro-Prussiate Prints.

The intense blue color of the ordinary blue print gives unnatural effects in prints from photographic negatives, also in architectural drawings where views and elevations of buildings are reproduced. The following method of toning such blue prints has been found to be easy of application, and to give tones varying from a brilliant blue through violet blue to neutral tint and warm shades of gray, according to the intensity of the action of the bath. The paper employed may be common blue print paper, sold ready for use in rolls, or the specially made paper sold in packages of cut sheets by the dealers in photographic supplies. The solar printing is carried out in the usual manner. The best results are obtained with dark prints, as the intensity of the color is somewhat reduced by the toning process. The following baths are employed:

BATH A.

Muriatic (hydrochloric) acid	3 to 4 drops.
Water	16 oz. (1 pint).

BATH B.

Aqua ammonia	5 to 10 drops.
Water	16 oz. (1 pint).

BATH C.

	Apoth. weight.
Alum	2 oz.
Tannic acid	1 drachm.
Water	16 oz. (1 pint).

The prints are immersed face downward in bath A until all the soluble salts contained in the paper are dissolved and removed, then dipped into bath B until the negative turns a violet blue and the whites are clear, care being taken that the immersion in the ammonia be not continued too long, as the definition of the picture may be injured. The prints are transferred from the ammonia bath, placed face upward in a tray filled with bath C, and exposed to bright sunshine for from five to ten minutes, until no increase in the strength of the picture can be noticed. The pictures are finished by toning in bath B until the desired shade of color is obtained, the picture becoming first a brilliant blue, then violet, and finally, by prolonged action, bluish gray or neutral tint. The toning may be varied by a second immersion in the tannic acid bath C, followed by a second toning in bath B. After toning the prints are dried in the sunlight in the usual manner. The above process is specially applicable to prints from photographic negatives, enabling the amateur in the field, provided with a printing frame, some sheets of prepared blue print paper, and the above easily procured chemicals, to test the printing quality of his negatives, with results only slightly inferior in detail and definition to those obtained by the complicated process of silver printing.

Disinfection.

According to Behring, lime has about the same germicide value as the other caustic alkalies, and destroys the cholera spirillum and the bacillus of typhoid fever, of diphtheria, and of glanders, after several hours' exposure, in the proportion of 50 c.c. *normal-lauge* per liter. Wood ashes of lye of the same alkaline strength may therefore be substituted for quick lime.

It must not be forgotten that we have a ready means of disinfecting excreta in the sick room, or its vicinity, by the application of heat. Exact experiments made by the writer and others show that the thermal death point of the following pathogenic bacteria and of the kinds of virus mentioned is below 60° C. (140° F.): Spirillum of cholera, bacillus of anthrax, bacillus of typhoid fever, bacillus of diphtheria, bacillus of glanders, diplococcus of pneumonia (M. Pasteuri), streptococcus of erysipelas, staphylococci of pus, micrococcus of gonorrhea, vaccine virus, sheep pox virus, hydrophobia virus. Ten minutes' exposure to the temperature mentioned may be relied upon for the disinfection of material containing any of these pathogenic organisms—except the anthrax bacillus when in the stage of spore formation. The use, therefore, of boiling water in the proportion of three or four parts to one part of the material to be disinfected may be safely recommended for such material. Or, better still, a 10 per cent solution of sulphate of iron or of chloride of zinc, at the boiling point, may be used in the same way (three parts to one). This will have a higher boiling point than water, and will serve at the same time as a deodorant. During an epidemic of cholera or typhoid fever such a solution might be kept boiling in a proper receptacle in the vicinity of the hospital wards containing patients, and would serve to conveniently, promptly, and cheaply disinfect all excreta.—*Jour. Amer. Med. Asso.*

The Measurement of Velocities of Projectiles.*

BY CAPTAIN H. CAPEL L. HOLDEN, R.A.

The author stated that as gunpowder making and gunnery had developed into branches of science, more accurate methods of obtaining the characteristic qualities of the explosive were required. The instruments used for determining the velocity of a projectile may be divided into two classes: 1. Those used for determining its velocity in the bore of the gun; 2, those used for measuring its velocity outside the bore. All chronographs comprise two principal organs, one for measuring time, and the other for recording the motion of the projectile. Clocks, pendulums, and tuning forks have been employed for the former, while electrical devices have been universally adopted for the latter, except in the oldest instruments. For recording the motion of the projectile by electrical means some sort of interruption in the circuit is used. When the movement in the bore has to be registered, a continuous wire is placed in the gun, the current through which is temporarily interrupted by the passage of the shot, this interruption furnishing the means of record. To obtain the record after the projectile has left the gun, upright frames placed in the path of the projectile have wires stretched over them in such a manner that, on the projectile passing through the frame, the wire carrying the current is broken. After briefly describing the principal chronographs which have been used, Captain Holden described in some detail those now employed at the proof butts of the Inspection Department of the Director of Artillery.

At the time the early Boulenge instruments were introduced, the highest muzzle velocity was about 1,000 ft. per second; now the velocities are nearly double this amount, and will probably reach 3,000 ft. per second. As an example, to show the degree of accuracy to which time has to be measured in order to obtain the velocity of a projectile to a foot per second, the following was given: With a shot whose mean velocity between two screens placed 180 ft. apart is 1,800 ft. per second, a variation of 1 ft. above or below 1,800 ft. per second is represented by a decrease or increase in time of only 0·0005 of a second approximately. Such accuracy can only be obtained by a careful elimination of the sources of error in the instrument used. The muzzle velocity is obtained from the recorded velocity by means of Bashford's tables, a factor being employed which varies with the form of head of the projectile.

RECENTLY at the Occidental Mill one-half of a log was sawed, which was 10 feet 3 inches in diameter. It was worked up into 3,900 feet of lumber. While this is not a remarkable thing in redwood logs, still a whole log that yields 7 800 feet of lumber is deserving of honorable mention.—*Eureka (Cal.) Standard.*

* Abstract of a paper read before the Iron and Steel Institute