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Contents.

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TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT,

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CRIMINAL NEGLECT IN RAILWAY MANAGEMENT.

On the evening of January 13, an Albany express train on the Hudson River Railroad, drawn by two locomotives and bound for New York, was stopped by an accidental or unauthorized application of the air brakes just after the train had passed a sharp curve and a deep rock cut near Spuyten Duyvil Station, at the upper end of New York Island. The rear of the arrested train was shortly after run into by a regular train known as a Tarrytown special, also bound for New York. The rear car of the express train was wrecked by the collision and quickly fired by an overturned stove. Several passengers were instantly killed, and others, caught and held by wreckage, were suffocated or burned alive. In all eight lives were lost, including that of Senator Wagner, inventor of the drawing room cars which go by his name.

A very careful investigation of the conditions and causes of the disaster was made by a coroner's jury, largely composed of civil and mechanical engineers, resulting in a verdict which is quite exceptional in its sweeping condemnation of the conduct of the trainmen and the managers of the road, who were individually held responsible for the loss of life through their criminal neglect of duty.

Specially remarkable and encouraging are the findings of the jury relative to the culpability of the superintendent of the road and the officers of the New York Central and Hudson River Railroad Company: the former in neglecting to provide efficient safeguards against accident at a peculiarly dangerous part of the road; the latter in neglecting to provide suitable implements for the rescue of passengers in danger, and proper means for extinguishing fires on the trains, and in not establishing the competency of their employes by proper mental and physical examinations to test their qualifications for the responsible and critical duties imposed upon them.

"And, as a further expression of their opinion, the jury affirm that, with the experience of fifty years of railroad management, and with the appliances in general use for the prevention of like disasters, there appears to be no palliation whatever for the criminal carelessness and disregard for human life exhibited by the employes of the company. The conduct of these employes removed this calamity from the chapter of accidents, making the result of destructive agencies at work as much a certainty as the discharge of a piece of artillery. The only surprise is that the slaughter was not greater. It could not well have been less."

The evidence by which the justness of this verdict was supported and made imperative was not only overwhelming in its sufficiency, but it clearly indicated a general indifference to the safety of passengers on the part of the conductor and the rear brakeman of the express train, and the superintendent of the road, that is little less than appalling.

It remains to be seen whether the action of the grand jury and the courts in criminal proceedings against the guilty parties will be such as to discourage similar misconduct and neglect of duty by railway officials and servants in the future.

The safety of the arrested train in an unusually dangerous position devolved upon a train man who could not read, and who testified that, out of forty-five or fifty similar stoppages of the train while he had been rear man, he had gone back to flag following trains not more than four or five times, and then without instruction from the conductor of the train. This time he did not go back, and the disaster was an immediate result.

After the collision the loss of several lives might have been prevented had the train carried water buckets or other means of extinguishing fire, or axes to enable those unhurt to open the side of the burning car and release those who were wounded or caught in the wreckage. Or the fire itself might have been prevented had the heating apparatus of the car been of a safer sort. Still better, all liability to collision under such circumstances might have been prevented (at least not left to the hazard of an incompetent and negligent trainman) by the use of inventions well known to railway managers, or which would be well known were it not their deliberate policy to refuse to consider patented inventions (the use of which would involve payment of royalty to the patentees) unless personally interested in the patents.

It is too much to expect that the action of the courts in this case will be such as to convince railway managers and superintendents of the impolicy of the course they now pursue with respect to inventions designed solely to increase the safety of passengers. But one natural effect of easily avoidable slaughters like that at Spuyten Duyvil is to render the public impatient of delays in the adoption of safety appliances; and while it would not be wise to dictate what specific devices shall or shall not be used on the railways, laws may be passed, in consequence of such accidents, so increasing the penalties for killing or maiming passengers where well known precautions have not been taken to prevent such disaster, that railway managers will not dare to run the risk of not employing them.

SOLID PETROLEUM.

The conversion of petroleum into a solid and safe substance for transportation seems to be attracting considerable attention in foreign countries where no pipe lines exist. A St. Petersburg paper says: How shall we transport petroleum? is to-day the most important question for all branches of the naphtha industry, and no less so for the consumers who live at a distance from the wells. All the methods of transporting petroleum hitherto in use, whether in wooden or paper barrels, in iron pipes, or iron caissons that are placed on ships or cars, possess disadvantages which are sufficiently well known, especially as regards leakage and evaporation, and also the great danger from fire.

These misfortunes which afflict so severely both dealers and consumers and increase the cost of an article of such importance in domestic economy, have been banished at a single stroke by the discovery of a German named Dittmar, who has succeeded in converting liquid petroleum into a solid substance. As early as 1872 the idea arose in America of solidifying petroleum so as to put it into a more suitable form for transportation, and in that year no less than twelve patents were taken out for this object without any single one of them being found practical. What a range such a discovery would cover, as would change petroleum into a solid wax-like body, can scarcely be conceived of, especially for the Caucasian naphtha industry, where there is a lack of suitable wood for making the barrels, which has a very serious effect upon the industry. The Moscow *Zeitung* also contains a thorough discussion of the new invention.

Solid petroleum has not yet come into market because the patents have not yet been issued, but a company has been formed in Russia for carrying out the invention. The cost of conversion is not to cost over six kopecs per pud, while the barrels, which will then be superfluous, increase the price of petroleum by 55 kopecs, but the leakage, which would no longer take place, is included in this. It may be added that solid petroleum can be readily converted into the fluid form for pouring into lamps.

To this and other remarks that have appeared in the technical journals the Russian *Pharmaceutical Zeitschrift* adds the following explanations from the pen of E. Johanson. He found that petroleum when heated would take up a certain quantity of dry soap, and that the solution on cooling would form a jelly, which when ignited drops off in pieces that soon go out like burning sealing wax. Dilute acids, like acetic acid, restore the fluid condition (evidently owing to a decomposition of the soap). In this way he explains all that has been asserted and claimed for the solid petroleum.

Only one and a half per cent of soap is required to form a gelatinous mass like opodeldoc, but with three per cent of soap it is much more firm. In this operation there separates a small quantity of liquid products that do not become solid, and which probably consist of the lower boiling constituents of petroleum. The presence of these in the solid mass is, of course, dangerous, and still more so because it always has to be liquefied before it is used. The contents of the wooden boxes used in transportation will soon ooze through the wood and becoming mixed with air will give off explosive vapors. On this account the author comes to the conclusion that the advantages of solid petroleum are entirely imaginary, as being a tedious, troublesome, expensive, and dangerous operation.

THE STOCK CAR COMPETITION.

A pamphlet report of the "Doings of the American Humane Association," at its annual meeting last fall, gives in full the report of the judges on the $5,000 prize offered by the association for an improved cattle car. It will be found an interesting if not an instructive document to all who took an interest in the competition or retain an interest in the questions of humanity, health, and economy involved in the transportation of live stock.

It will be remembered that the judges decided that none of the designs offered in competition met the conditions of the award, and accordingly no prize was given. The money which had been subscribed for the purpose, with accrued interest, remains in the hands of trustees to be used in aiding the introduction of improved stock cars and in such other ways as may best secure the end desired by the subscribers to the fund.

The principal fact brought out by the competition and the investigation of cattle car patents that it called out, was that inventors had already pretty thoroughly covered the ground; in other words, when cattle suffer hunger, thirst, and other injury on the way to market it is not for lack of devices to prevent such injuries, but because the inventors of improved cars and appliances have not been able to get the railway companies to use them.

The report mentions a number of plans and models which were submitted for an opinion of their value, with a distinct provision that they were not in competition, their owners holding them at a higher figure than $5,000. Besides these 636 different competitors submitted 710 models and plans. A large portion of the models and drawings were very crude, but some were finely finished and executed. Every State and Territory in the Union was represented, except the Territories of Washington and New Mexico. England, Russia, and Switzerland were also represented, while the Dominion of Canada contributed liberally. Illinois sent 51 models and 18 plans; Pennsylvania sent 47 models and 27 plans; New York sent 43 models and 15 plans; Ohio sent 37 models and 18 plans; Indiana sent 21 models and 13 plans; Massachusetts sent 19 models and 26 plans; Michigan was the seventh, Iowa eighth, Missouri ninth, and Minnesota tenth in the number of contributions. Among the competitors were eight women, from the same number of States. One competitor was a young lad of fourteen years; and one model was sent by a man who stated that he had never even seen a railroad train in his life! Seven competitors were preachers.

To test the originality of the plans and models they had to be first compared with the descriptions and claims of the 111 patents upon stock cars and appliances granted since the

first stock car patent was issued to Lee Swearingen, May 29, 1860. All these patents were critically analyzed, and abstracts were made of their peculiarities. The improvements shown in them were chiefly on partitions or stalls; on feed troughs; on water reservoirs and water mains; on food bins and hay racks; on food lofts; on stanchions for securing the animals; on different methods of tying them; on double decks, for smaller animals; on sprinkling apparatus for keeping the animals cool, and a large number of minor devices. The list of the more important contrivances given in the judges' report indicates the thoroughness with which inventors had considered the problems involved, and suggests the thought that had the committee made these investigations before the prize was offered and published the results in their first circular, as an indication of work to be avoided, they would have saved the judges a vast amount of labor, and the competitors for the prize a vast amount of fruitless effort in reinventing what others had already patented. The same inventive effort more intelligently put forth might have yielded much more that would have been novel and useful.

Incidentally, we may remark that perhaps the chief source of disappointment and waste of time experienced by inventors may be found in their lack of knowledge of what previous inventors have done. Reinvention may be a good school for the young inventor, but it does not pay as a business. The proverbial "poor devil of an inventor" is usually a man who continually exercises his wits—sometimes very ingeniously—in working out problems already solved or proved insoluble. Such unsuccessful inventors almost always skip the first step in profitable invention, which is to find out exactly what needs to be done and whether the thing is worth doing.

The next work of the judges was to treat the competing plans as they had treated the pre-existing patents. It was soon found that the material to be dealt with contained comparatively few leading ideas, and these were in lines already well worked out. Many had peculiar, often ingenious arrangements, noticeable mainly for their impracticability. Lack of novelty, however, appears to have been the principal cause of failure to win the prize. A number of the non-competing devices would seem to have shown more positive elements of merit, especially those for improved methods of feed and watering. These the inventors were unwilling to part with for the amount of the prize. Of the rest the judges say:

"That after rejecting all designs which did not meet the conditions in other respects, and those which were manifestly impracticable, and those which consisted merely of old and well known devices, it was found that of the remainder there were absolutely none which had not been in some way shown, described, or covered in the patents already granted. There were very many ingenious devices presented (many of them, *of themselves*, patentable) and many designs which were undoubtedly new and original with the competitors who sent them to us; but the stubborn fact remained, that, behind them all were the broad, underlying claims of some patent or patents, rendering it manifestly imprudent for the American Humane Association to purchase any one of them."

They add, "as their deliberate conviction, forced upon them against their will, that it is hardly possible for any inventor, no matter how skilled he may be, to invent a successful stock car, in which stock can be properly separated so that they can lie down and rest, and in which they can be fed and watered, while in motion, without such car infringing on some one or more of the patents granted previous to February 1, 1881, or even previous to January 1, 1881."

The competition, however, the judges think, was not without good results in drawing attention to the subject of the crying need of kinder treatment of live stock in transit. It remains to be seen whether public opinion will be strong enough to induce or compel the great stock-carrying companies to make use of existing appliances, which would appear to be sufficient to do away with most of the evils complained of by the association.

PLATING COTTON WITH SILK.

A method of depositing silk upon cotton or linen thread, not unlike that of electroplating iron or brass wire, has been devised by Hosemann and Ungenad. Instead of silk, wool or feather down may be deposited upon the thread, from an alkaline solution, without the aid of pressure or electricity. Thread prepared in this way not only looks like silk, wool, etc., but can be dyed, bleached, and dressed like real silk or wool. Silk can also be deposited upon silk, or wool upon wool, so as to improve the quality. Even colored silk, wool, or down can be deposited.

The silk solution is prepared, says the *Deutsche Industrie Zeitung*, by putting 2 or 3 pounds of silk waste and ravelings into 100 pounds of clear caustic soda or potash solution of about 36° Baumé. On warming the solution the silk rapidly dissolves. It is next diluted with more or less distilled water, according as a heavy or light layer of silk is to be deposited on the thread. In the first silk bath, in which the yarn or fiber that is to be treated is brought, it is advantageous to dissolve a little good tallow, then boil it up and stir well.

The wool solution is made in the same way. Stiffening like gelatine can be put into the bath at the same time. If colored wool or silk is dissolved it will be deposited in the same color, of a bright shade, upon the fiber, and thus color it too. After the material that is to be covered has been in the solution a certain length of time, it is taken out and dried, and these operations repeated several times, beginning with a strong solution, and each time using a weaker one. Finally the goods are left for two hours in a strong bath of sulphuric acid, being moved around in it, and then carefully rinsed out into water. The solutions may be used cold, lukewarm, or hot, according to the character of the fiber. If the operation is begun in a hot bath, a cooler one is used next, and lastly a cold one. Yarn and fabrics which have been covered with silk are afterwards pressed hot, beaten, stretched, etc., as is customary with silks, in order to bring out the gloss and luster.

By this process dull, lusterless, and low price silks can be greatly improved by treating them with a solution of handsomer silk of better luster. If silk is repeatedly treated with this solution of silk its weight can be considerably increased. The precipitated silk adheres firmly and permanently to all kinds of fibers. Fabrics or fibers of flax and cotton, when treated with the solution of wool, acquire the appearance, touch, and feel of carded wool, while China grass and hackled flax has the appearance of worsted.

A very peculiar effect can be obtained by treating it first with a solution of silk and then with wool solution or the reverse. In one case we get a silken surface dotted with dull spots of velvet, and in the other a velvety surface with silky glitter. By selecting suitable solutions of each the two can be mixed and applied together. Feathers and down can be dissolved and then precipitated together from the alkaline bath upon spun fibers and yarn just as silk and wool are. In these feather solutions the textile fibers become covered with small lamellæ and particles which give it the appearance of real feathers. The introduction of this method of converting cotton into wool would afford a new use for woolen shoddy. P. N.

MARINE ECONOMY.

In an article published in the *Journal of the Franklin Institute*, Chief Engineer Isherwood shows that the yacht-built steamer Dispatch, lately purchased for the United States Navy, has such proportions of hull that "no engine power was expended in overcoming the resistance of the water to displacement by the progress of the vessel. That is to say, the difference between the power exerted by the fore body of the vessel in raising the displaced water from the center of gravity of the greatest immersed transverse section of the vessel to the general water level, and the power exerted upon the after body of the vessel in the direction of its motion by the ascending column of water caused by the forward movement of the vessel, were sensibly equal."

It appears from the elaborate description of the Dispatch given in this article, that she is extremely sharp and has a long after body and two bilge keels. Her length is 174 feet, breadth 25½ feet; mean draught of water 12 feet, greatest immersed transverse section exclusive of bilge keels 186½ square feet, displacement 552¼ tons; total immersed or wetted surface 5,516 square feet. It will be observed that her length is equal to 6·82 times her breadth.

She has 100 square feet of grate, and 2,214 square feet of heating surface in her boilers which are of the internal furnace horizontal tubular type.

Her engines are condensing vertical and direct acting, having two cylinders 33½ inches diameter by 33 inches stroke of piston, fitted with link reversing gear and an independent adjustable slide cut-off valve. It will be observed that her cylinders were "square." The volume of steam required to fill the clearances and steam passages is 6·97 per centum of that which is required to fill the cylinders with the pistons in place. She has a four blade true screw, 11 feet diameter with a pitch of $19\frac{9}{10}$ feet.

The average performace of the Dispatch in the waters of the Potomac River and Chesapeake Bay under the conditions of ordinary practice, and embracing the whole of her steaming from November 8, 1880, to March 30, 1881, are given in a table, from which it appears that with steam at $49\frac{1}{3}$ pounds per gauge, vacuum 25½ inches, cutting off at 0·112, about one-ninth of the stroke from the commencement, she made $9\frac{9}{10}$ knots per hour, her screw making 59½ revolutions per minute, and losing 15 per centum of its speed in slip. This is the average for 358 hours' steaming in smooth water, when she displaced slightly more than the above first statement, viz., 559 tons, including bilge keels. The cost in fuel was 3·9882 pounds of anthracite per indicated horse power per hour. The speed of this fine model was not as great as one would be led to expect from the statement of Mr. Isherwood above quoted and his description; neither was it as great as at an official trial made with her in Chesapeake Bay, of four and a half hours in one direction, and then four and a half hours in the opposite direction in straight lines, to ascertain her maximum speed in smooth water and its cost in fuel. On this trial a speed of 10¾ knots was attained with cut-off at the same point and throttle wide open; cost in fuel about the same as in practice. The results of the trial as well as of her practical operations are rather disappointing, since she appears to be of such perfect proportions none could be more so, indicating that there is something wrong about her screw. Still, accurate and complete data from unbiased sources are very scarce and very valuable to the engineer.

Mr. Isherwood's remarks upon the results relate almost entirely to the great cost of the power in fuel, which reaches four pounds almost per horse power per hour.

"The cause," he says, "will be found, as might be expected, in the enormous cylinder refrigeration due to the work of expansion by steam of high initial pressure largely expanding, the point of cutting off being a little beyond one-ninth of the stroke of the pistons from the commencement. Under these circumstances, when saturated steam is used with simple engines having cylinders of very moderate dimensions, without steam jackets, as in the Dispatch, the cylinder condensation is excessive and entirely defeats the economy which might be obtained from the same measure of expansion employed with superheated steam in steam jacketed cylinders of large dimensions. In fact, saturated steam cut off at one-ninth of the stroke of the piston, in cylinders like those of the Dispatch, produces no greater economy than if it was used with very much less expansion."

It must be borne in mind, however, that although the steam was cut off at about one-ninth of the stroke, yet owing to the volume of nearly seven per centum of the whole cylinder volume of steam in the parts and clearances the steam was expanded only 5·88 times, as stated in the tables of data.

The great importance of cylinder condensation is shown by the following astonishing statement: "The results from the indicator diagrams show that during about the first ninth of the stroke of the pistons, about 57½ per centum of all the steam entering the cylinders was condensed by their surfaces; including, of course, the surfaces in the steam passages up to the valves."

This is somewhat less strange when, after some discussion, it is shown that "when the pistons reached the end of their stroke the steam supplied by the re-evaporation was sufficient to leave only 22 per centum of the quantity generated in the boilers condensed; so that a large portion of the expansion part of the indicator diagram was due to this re-evaporation."

It seems to be rather an important omission in discussing the grade of expansion that the item of ports and clearances is not given a more important place. Whatever effect this would have had on the above conclusions it certainly shows the important difference in this case between expanding the steam nine times due to cut-off without parts and clearances and a little less than six times when their contents are included.

It will appear perhaps that these cylinders, being very short, ought to be kept at a higher temperature than would obtain in larger and narrower ones, with the same piston speed, initial pressure, and grade of expansion, but it is also a fact that it is impracticable to reduce the value of the ports and clearances for short cylinders to the same ratio of the cylinder volume that is possible in longer ones, which is a very important consideration when discussing the matter of expansion.

A Fog Bow before Sunrise.

The phenomenon of the ordinary rainbow is familiar to every observer of nature. White fog bows, or "fog eaters," as they are called by the sailors, are frequently visible in localities favorable for their formation; and they are generally regarded as indications of clearing weather.

A fog bow was observed, writes Mr. H. C. Hovey, on the morning of the 8th of January, from my residence on Fair Haven Heights, near the estuary of the Quinnipiac River, and about 100 feet above the sea level. No rain was noticeable in any quarter, but the valleys were filled with fog, above which the hill tops stood like islands. At exactly ten minutes before sunrise (due at 7 : 26 A.M.), on looking northwest I saw a brilliant arch of prismatic colors spanning the East Rock Range, the highest point of which is 350 feet above the sea. As the sun arose the arch diminished in height and vividness, and by the time the orb was visible in the morning sky, the fog bow had vanished.

How the Aurora is Formed.

In a recent lecture by Professor W. Grylls Adams, recently published, the following theory is propounded to account for the observed interrelation of earth currents, magnetic storms, aurora and sun spots. Professor Adams assumes the sun to be a magnet, and infers that changes in his magnetism affect the magnetism of the earth. Further, the sun and moon, by dragging the atmosphere toward them as the earth revolves, may cause that friction between air and earth, and also that evaporation, which together may generate the supply of positive electricity in the air and negative in the earth. "Again," he says, "these tides in the atmosphere will cause the mass of it to lag behind the revolving solid earth, and at a height of thirty or forty miles we have a layer of air which, for air, is a comparatively good conductor of electricity. Here, then, we have, not a lagging of the magnet behind the conductor, but a lagging of the conductor behind the magnet, and hence, according to the laws of Faraday, we may expect a current or a gradual heaping up of electricity in the air in the opposite direction to the earth's crust." Thus, the regular tidal-waves in the atmosphere would cause the gradual transfer of positive electricity from the poles toward the equator, either as a current or a mass of air statically charged. "When the air is charged up to discharging point we may get the sudden discharges, such as the aurora, in the air and the earth current in the earth; and since the conducting layer of air approaches nearer to the earth in the colder polar regions, possibly within twenty miles of the earth's surface it may be found that the discharge of the aurora may even take place from earth to air by gradual, slow discharge, aided, as it may be, by the state of moisture of the air, and by change of temperature and other causes."