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 noncompeting 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, redering 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 3/10 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 49⅓ pounds per gauge, vacuum 25½ inches, cutting off at 0·112, about one-ninth of the stroke from the commencement, she made 9 7/8 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."