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(Illustrated articles are marked with an asterisk.)

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Scientific American Supplement

No. 1109.

For the Week Ending April 3, 1897.

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SECTION SEVEN OF THE AMENDMENTS TO THE PATENT STATUTES.

In a recent issue we commented editorially upon a bill embodying certain amendments to the patent statutes of the United States which had been signed by the retiring President in the closing hours of his administration. Our readers may or may not have noticed that, although we discussed the provisions of each amendment in detail, we were careful to place by itself, and publish without any comment, a certain section 7 which reads as follows:

"That in every case where the head of any department of the government shall request the Commissioner of Patents to expedite consideration of an application for a patent, it shall be the duty of such head of a department to be represented before the Commissioner, in order to prevent the improper issue of a patent."

Our silence with regard to this section was due to a reluctance to make any criticisms which might have been based upon a misconception of its real scope and purpose; for we are free to confess that at the first reading it appeared to be a most foolish, ill-considered, and unnecessary measure.

We eagerly sought for enlightenment as to the interpretation of this measure, being unable to grasp its full meaning ourselves. We were unable to obtain any explanation of the meaning of the amendment at the Patent Office; the chairman of the committee which formulated the original bill was no better informed, and we were finally referred to the author of the section in question. Briefly stated, it provides that where the head of a department undertakes to hasten a decision upon a patent application, he shall also take upon himself the responsibility of seeing that the Commissioner of Patents does his duty and does not issue the patent improperly. As it has been explained by the author of the amendment, "He (i. e., the head of a department) should be represented by his law officer or otherwise, as he may choose, in order to prevent the improper issue of a patent which, being issued, may become a burden upon the government."

While we are satisfied that this amendment was drawn up with the best of intentions and a desire to protect the interest of the country at large, we think it possesses features which are strongly objectionable and which have probably been overlooked in the haste with which the bill was finally pushed through.

The amendment certainly seems to take the form of a vote of lack of confidence in the Commissioner of Patents and the work of the Patent Office. If the Commissioner of Patents is not qualified to prevent "the *improper* issue of a patent," who is? And, if he is not so qualified, it must be either because of his incapacity or partiality. If he is incapable of judging what is proper or improper in his own department, are we to suppose that the head of some other department or his irresponsible clerk would be more capable?

There is a further objection to the amendment in the fact that it places the head of a department in the anomalous position of being plaintiff and defendant at one and the same time. In one breath, as a supposed friend of the case, he urges that it be taken up for consideration, and in the next he is instructed to put obstacles in the way of the grant of a patent. The application is no longer a matter to be determined between the client's attorney and the Commissioner; but it must be argued in a triangular fashion between the attorney, the Commissioner, and a third somebody, whose claim to standing in the case is the fact that he has asked for its early consideration, and is there "to prevent the improper issue of the patent."

To appreciate this amendment at its full value, one has only to consider the history of the bill up to the time when section 7 was added. The bill was drawn up by a committee of the highest authorities and most distinguished practitioners of patent law—a branch of the law, be it said, which is admitted to be particularly complex and abstruse. The amendments carried the sanction of the American Bar Association, and they were only drawn up in their final form after extensive correspondence with patent solicitors and others specially learned in this branch of law. They then received the careful consideration of the House committee; were passed by the House, and forwarded in due course to the Senate. Here, at the eleventh hour, without the knowledge of the gentlemen of the bar who formulated the bill originally and without consultation with any who were likely to possess any special knowledge of such matters, this amendment was inserted, and the friends of the bill deemed it wisest to accept the amendment in order to avoid the defeat of the whole bill.

Looked at from any point of view, it is difficult to see what good this amendment can work to the government or to anyone else. It is certainly advisable that the heads of departments should be kept well advised as to the progress of invention in those fields with which the government is especially concerned; and it has been the custom of inventors to seek the advice of heads of department and their aid in hastening the hearing of such patent applications as might affect the interests of the various departments. In this respect, as far as it legitimately could do so, the government stood as the friend of the inventor and would-be patentee.

Section 7 of the amendments, however, will change all this at a stroke, and inventors will in the future hesitate to disclose their plans to heads of departments who, if they considered that a patent would "impose a burden upon the government," would use every effort to secure its defeat.

THE UNDERGROUND TROLLEY IN NEW YORK CITY.

The street railroad commission of New York has granted the application of the Metropolitan Traction Company to operate its lines by the underground trolley system—a change which will affect some forty miles of railroad lines in New York City.

It is a well known fact that the problem of transportation in New York presents special difficulties which arise from the nature of the site upon which the city is built. All the elevated and surface systems of transportation run mainly in parallel lines from north to south along the full length of the island. By far the greater part of the travel is in a north and south direction, and although the different arteries of travel lie but a block distant from one another, there is at all times of the day more or less crowding, and during the "rush" hours the congestion is attended with great discomfort and more or less delay. As the important change which is contemplated by the Metropolitan Traction Company is directed primarily to relieving the traffic upon the Broadway cable road, the lines which are to be electrically equipped are those which lie immediately to the east and the west of this road, and extend from the Harlem River south through the whole length of Manhattan Island.

The present Eighth Avenue horse car line will be equipped throughout with the new system. Commencing at the Harlem River, the new line will run on this avenue to Fifty-ninth Street, where there will be a cross line of the same construction from First to Tenth Avenue. From Fifty-ninth Street the new line will continue on Eighth Avenue over the present route to a terminus at Canal Street and Broadway. Another branch will start from Fifty-ninth Street and run down Sixth Avenue to West Broadway. At Fulton Street it will be carried east to Church Street, and through Church Street to a terminus in Battery Place. The company has announced that the first part of the work to be undertaken will be the Sixth and Eighth Avenue lines below Fifty-ninth Street, and it is expected that they will be in running order by the middle of the autumn. The company intends to put in the same system on the Fourth and Madison Avenue line, which runs from the Harlem River to the Post Office. It will also construct a line on Amsterdam Avenue, from Manhattan Avenue to Sixty-fifth Street and through Sixty-fifth Street to Eighth Avenue.

It will be seen that the proposed system will give a greatly improved service between the northern and southern portions of the city. It will give a parallel service on each side of Broadway which cannot fail to relieve the congestion, especially in the lower city. The cross line at Fifty-ninth Street will very materially contribute to the convenience of cross town travel, inasmuch as passengers from Amsterdam Avenue and Eighth Avenue can cross over to Madison Avenue and continue down on the east side of the city, and on the other hand, passengers from the Harlem district over the Madison Avenue line can cross over at Fifty-ninth Street and continue down Sixth or Eighth Avenues to the shopping district, both of which journeys can be accomplished without change of car.

It is the intention of the company to push the work through with all possible dispatch, and have the whole forty miles of line in operation before the close of the year. If they succeed in doing this, it will rank as one of the most remarkable feats of railway construction on record of any kind, and will be entirely without a parallel in the records of street railway construction. The managers of the company claim that they will be able to build at this high rate of construction because of the comparative simplicity of the construction and the enormous force of men which they will crowd upon each section of the work.

It will be known to many of our readers that the Metropolitan Traction Company has been operating for some time several miles of underground trolley system on a branch known as the Lenox Avenue line. This was built largely for experimental purposes, and the designs for the present proposed extensions have been based upon the experience which has been gained in this way.

In its broad features the construction will be similar to the one mentioned, which was fully illustrated in the SCIENTIFIC AMERICAN for February 22, 1896. The main features of the new system are as follows: The conduit, which is placed in the center of the track, carries two conductors, one for the supply and one for the return current. It will be shallower than the one on Lenox Avenue, and from the interior of the conduit an open passageway, about 5 inches in width, will connect with the street surface and will be closed with the customary slot rails, leaving a narrow opening for the plow. The iron conductors will be of a T-shaped cross section and will be placed about six inches apart. They will be carried on every third yoke, and the yokes will only be about 70 per cent of the weight of those on Lenox Avenue line. The rails will be of the Crimmins type, which is designed to reduce the injurious effects from the wheels of street traffic. They will be exceptionally heavy, weighing no less than one hundred and seven pounds per yard, which is seven pounds heavier than the heaviest rail at present used on the trunk railroads of the country.

The estimated cost of the new lines completely equipped is between $6,000,000 and $7,000,000.

THE "ROTARY" STEAM ENGINE.

BY PROF. R. H. THURSTON, CORNELL UNIVERSITY.

The "rotary" steam engine, as it has been for a century called, is one of those seductive classes of mechanism which have been tantalizing the inventor and engineer for generations. From the time of James Watt, who a century and a half ago, nearly, devised this form of engine, it has been continually coming forward in shapes various, new and old, only to disappear promptly on being put to the test of daily operation under conditions permitting its exact performance to be ascertained. In Watt's patent of 1769, in its fifth claim, we read:

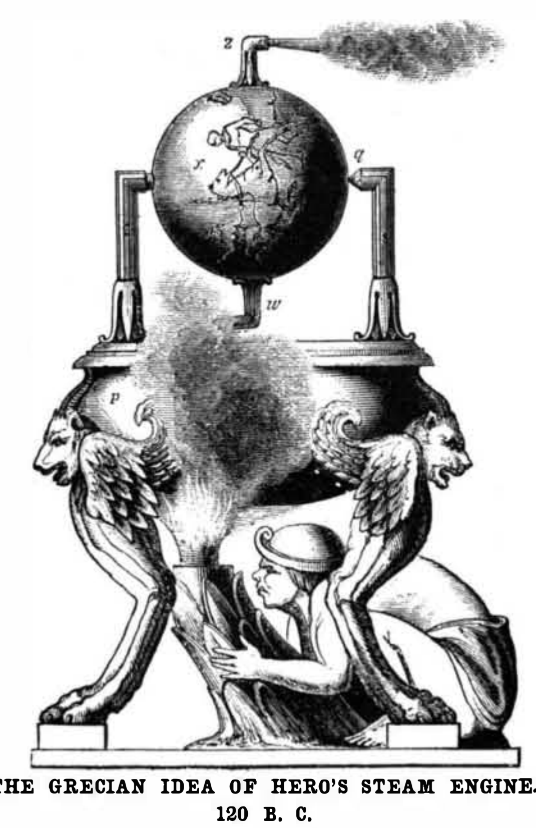
"5thly —Where motions round an axis are required, I make the steam vessels in form of hollow rings or circular channels, with proper inlets and outlets for the steam, mounted on horizontal axles, like the wheels of a water mill. Within are placed a number of valves that suffer any body to go round the channel in one direction only. In these steam vessels are placed weights, so fitted to them as to fill up part or portion of their channels, and yet capable of moving freely in them by the means hereinafter mentioned or specified. When the steam is admitted in these engines between these weights and the valves, it acts equal on both, and so as to raise the weight on one side of the wheel, and, by the reaction of the valves successively, to give a circular motion to the wheel, the valves opening in the direction in which the weights are pressed, but not in the contrary."

But far back of the days of James Watt are found the originals, the prototypes of the most successful of recent forms of rotary engines, of the steam turbines. Hero, of Alexandria, a century and more before the Christian era, published descriptions of the reaction steam wheel, and gave drawings showing its form and method of action. In 1629 Branca described the companion form, the "impact" steam turbine, which is to-day a favorite and successful machine in certain fields of work.*

Since the beginning of the century thousands of inventors have attacked the problem, and hundreds of such inventions have been made, not one of which has been successful in competition with the reciprocating engine in its own wide field. The steam turbines are coming into use in the special field of high speed machinery, mainly in driving electric machinery. Here, too, it is only the simplest of all these forms, and the most ancient of types, which are in any sense successful. The steam turbines seem to have come to stay. For this there exist interesting and special reasons, both theoretical and practical. The reasons for the failure of rotary engines as a class is a marked feature of the century of growth of the steam engine. Those reasons are readily discovered, as we shall presently see.

In the accompanying issue of the SCIENTIFIC AMERICAN SUPPLEMENT † will be found an historical review of the inventions of this class of engines, and its illustrations include practically every class of machine of this type yet produced, and even among these many resemblances will be noted, closely relating one to another. It will be seen that all come into one or another of these classes: (1) the simple system of gearing without valves, of which the now well known Holly engine and pump are typical examples; (2) the system in which the steam chamber revolves, and work is performed by reaction in a manner first investigated by Sir Isaac Newton; (3) the system in which the issuing jet of steam impinges upon the vanes of a revolving "steam wheel;" (4) that in which a rotary motion is given a wheel having fixed vanes, or some equivalent, by introducing sliding abutments and valves between which and the vanes of the wheel steam may be introduced and there may expand; (5) revolving wheels or disks, set eccentrically with the cylindrical casing, in such manner that sliding vanes, passing into and out of the wheel, may intercept the steam and compel it to act in such a way as to force the disk to turn. A wonderfully interesting collection, illustrating the ingenuity of the mechanic and inventor in a remarkable manner, is shown in the historical article referred to, and our readers will do well to study it minutely.

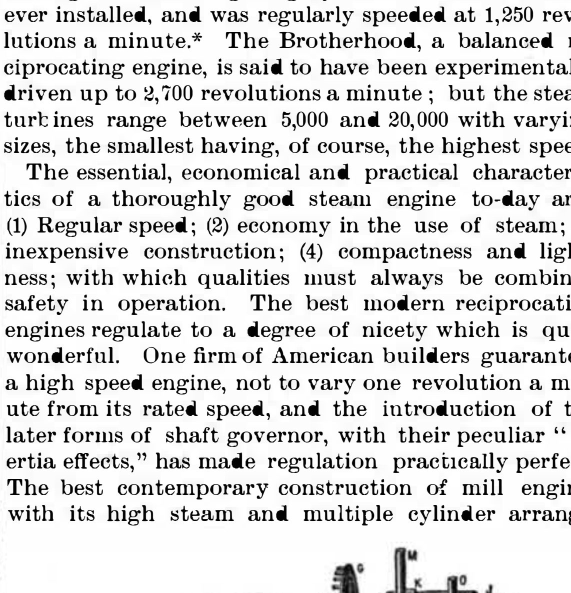
The claims made by inventors of the rotary engine usually are that it is superior to the reciprocating machine in simplicity, in its lower cost, its greater compactness, its less volume and weight as well, and, sometimes, that it is more economical of fuel. The latter claim need not be here discussed further than to say that it has no foundation in any case known to us. Fabulous claims are often advanced relative to the reduction of weight and volume effected by the use of these machines, and these are sustained in the case of the steam turbine, of whatever form; as its enormous speed of best effect permits corresponding reduction of size for a stated power. The other forms have not yet proved superior to the now common high speed engine; which, in fact, has probably attained a higher speed than is usual with the rotary engines. For many years, a small engine, designed by Captain Ericsson, was in



THE GRECIAN IDEA OF HERO'S STEAM ENGINE. 120 B. C.

operation at the Delamater Iron Works, in this city, driving an electric lighting system, one of the earliest ever installed, and was regularly speeded at 1,250 revolutions a minute.* The Brotherhood, a balanced reciprocating engine, is said to have been experimentally driven up to 2,700 revolutions a minute; but the steam turbines range between 5,000 and 20,000 with varying sizes, the smallest having, of course, the highest speed.

The essential, economical and practical characteristics of a thoroughly good steam engine to-day are: (1) Regular speed; (2) economy in the use of steam; (3) inexpensive construction; (4) compactness and lightness; with which qualities must always be combined safety in operation. The best modern reciprocating engines regulate to a degree of nicety which is quite wonderful. One firm of American builders guarantees a high speed engine, not to vary one revolution a minute from its rated speed, and the introduction of the later forms of shaft governor, with their peculiar "inertia effects," has made regulation practically perfect. The best contemporary construction of mill engine, with its high steam and multiple cylinder arrange-



BRANCA'S STEAM TURBINE, A. D. 1629.

ment, has brought down the consumption of steam to 12 pounds per horse power per hour. The costs of construction have become not far from $10 per horse power for such engines as are supplied our light and power stations. The weights of reciprocating steam engines have been brought down from the half ton of a half century ago, per horse power, to one-tenth that figure ordinarily; and in marine, and especially torpedo boat construction, to one-twentieth and even less; while the aeronauts are building, as in the cases of Maxim and of Langley, steam engines lighter for their power than the swiftest birds that Nature has produced in her ages of steady evolution. Six pounds per horse power is now regarded by these inventors as a heavy weight for their work. The birds weigh 25 to 50 pounds and sometimes more, as computed by the best authorities to date.

In all these respects the rotary engine has usually failed to satisfy the market up to the present time, and it would seem that the mechanical and kinematic possibilities have been fully exhausted in the endeavor to solve the problem in this way. No perfect regulation of the rotary engine has been made integral with either of the constructions illustrated by us; no rotary has reduced the cost of power in steam consumed below the figures attained by even the ordinary reciprocating machine; none has attained a higher maximum speed, the turbines excepted; none has been proved to have inherent possibilities of giving out power in larger proportion of work performed to weight or cost of the machine, when placed in competition with the reciprocating engine of similar commercial class.

The inherent difficulties meeting the inventor in this field are principally those of securing satisfactory regulation and especially of attaining a satisfactory economy of steam and fuel. A variable cutoff, adjustable by the governor. seems to be the essential feature productive of both economy and steady speed, and this has not been realized in such manner as to satisfy the market in this class of engines. Further, it seems practically impossible to avoid serious wastes by leakage in these engines, after a little wear, however carefully the machine may have been originally constructed. It soon loses its tightness, and steam pours past its valves and abutments.

The steam turbines, however, must be set apart from the other rotary engines, as possessing some peculiar and promising features, especially in respect to wastes of heat and steam. The common forms of steam engine waste enormously, especially in their smaller sizes, by the condensation of steam, at entrance, by the then comparatively cold cylinder wall, which is continually alternately heated and cooled by the prime steam and the exhaust. This fluctuation of temperature of the metal and of the water which is precipitated in the cylinder causes a waste of from twenty per cent, in the largest and best engines using dry steam, to fifty per cent, and often much more, of steam entering from the boiler; thus adding from twenty-five to one hundred per cent or more to the otherwise purely thermodynamic demand for steam and fuel. In the steam turbines, on the other hand, there is no such fluctuation of temperature of cylinder wall, and this machine is thus entirely free from the most serious, and often enormous, waste of the reciprocating engine. It is this fact which accounts for the remarkable economy often now attained with this class of engine, and once its speed is made satisfactory, or conveniently adaptable to ordinary machinery, it would seem that it might prove a formidable rival in many cases to the now standard forms of engine.*

Should this prove to be the fact, we shall have the singular and interesting spectacle of the world going back to the time of Hero, two thousand years, to find the simplest and cheapest and most economical of steam engines.

* "History of the Growth of the Steam Engine." R. H. Thurston. "International Series." New York, London and Paris. Pp. 8, 17, 100.

† The first of a series of articles upon the history, peculiarities and defects of the rotary engine will be found in this week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT, which article will be continued in the two issues following.—ED.

* "Stationary Steam Engines for Electric Lighting." New York: J. Wiley & Sons.

* The theoretically best speed of orifice is infinity for the "Hero engine" and about 1,000 feet per second for the single wheel guide curve turbine.

DIPHTHERIA IN COLD AND HOT COUNTRIES.

Dr. Schellong, of Königsberg, has recently published a valuable monograph in Virchow's Archiv on "Diphtheria in the Tropics." He admits the correctness of Trousseau's saying, that the disease in question is to be seen in all seasons and also in all climates. He shows, however, that this opinion is correct as far as mere distribution of the malady is concerned, but is otherwise misleading. Diphtheria is, in fact, very unusual in any tropical country, and when it occurs it is purely sporadic and always mild. Schellong has carefully investigated the sanitary records of low lying malarious plains in tropical islands and continents, but diphtheria has proved no more prevalent there than in high ground. The disease is very rare in the West Indies, Guiana, the coast of Brazil, tropical East and West Africa, Madagascar, Hindostan, and the Indian Archipelago. Hence dampness of the soil is not necessarily a cause of diphtheria, nor does it in any way promote its diffusion. It is not prevalent even in the poor districts of crowded tropical towns. On the other hand, it is frequent in the highland villages of Peru, and in subtropical districts and warm temperate climates—Havana, Jerusalem, Cairo, Santiago, Montevideo, the north of South Africa, and Brisbane, in Queensland. In temperate climates, south as well as north, it is almost universally distributed, the Cape, Adelaide, Sydney, Melbourne, Tasmania, New Zealand, and the south of Chile and Argentina being as little free from diphtheria as are the cities and villages of Europe, the United States, Japan, and northern China. As intense heat is experienced in summer in several of the places just mentioned, it would appear that perpetual heat is necessary to kill the germs of diphtheria, while a few weeks of cold keep it alive and allow the disease to be endemic even in Cairo and Brisbane. Schellong, who illustrates his monograph by means of a good chart, does not believe in racial immunity.—British Medical Journal.