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**Contents:**

(Illustrated articles are marked with an asterisk.)



## CLOSING OF THE VOLUME---INDEX AND TITLE PAGE.

We had at one time the impression that only a portion of our readers desired the index and frontispiece which are published at the close of each volume of the SCIENTIFIC AMERICAN. Acting on this idea, at the close of Vol. XVI., we notified our readers that the index and title page would be sent only when applied for. The applications were so numerous and general that we have concluded to print as a part of the next or closing number of Vol. XVII., the full index and title page. We were gratiffed to learn by the immense number of applications for the index after the close of last volume, that so large a proportion of our subscribers preserved their numbers for binding.

## THE "SCIENTIFIC AMERICAN."---COMMENCEMENT OF A NEW VOLUME.

With the issue of the next number, Volume XVII. of the SCIENTIFIC AMERICAN—New Series—will close. One year ago we enlarged the paper—nearly doubling its size—at a heavy expense, but without raising the price of subscription, confident that our endeavors to improve and beautify the paper, and benefit our readers, would be appreciated by them and result in a corresponding increase of the number of our subscribers. We were not mistaken, and the SCIENTIFIC AMERICAN continues to be, as for nearly a quarter of a century it has been, the best and most highly valued journal devoted to Science and Mechanics in the country. Its editorials are widely copied, both here and abroad; its published correspondence brings practical men, throughout the country and world, *en rapport* with each other; its illustrations and descriptions of new inventions make the mechanic acquainted with the improvements of others, and serve as valuable guides to the inventor; its replies to correspondents contains weekly a vast fund of valuable information on almost every practical subject, and its department for the young conveys knowledge which is of present interest, and may be of future benefit. In addtition to these departments, our Editorial Summary gives notices of mechanical novelties and recent scientific discoveries, culled with great care from various sources, not only from our domestic and English exchanges, but translated from French and German periodicals expressly for our columns. Our Mining, Manufacturing and Railway Items present from week to week a brief but comprehensive *resumé* of the events and discoveries in these departments. The list of foreign patents taken out by Americans, which is prepared for our columns weekly, and the complete official list of United States patents are of great value to the inventor, manufacturer and mechanic.

What the SCIENTIFIC AMERICAN has been the past year it will be hereafter, except that no efforts will be spared to improve in every department as opportunity offers and the progress of the times demands. Our aim is to encourage honest and persistent endeavor, to give counsel and advice where needed, to state our sincere opinion when requested, to defend the mechanic from unprincipled charlatans by exposing the fallacy of their pretensions, and to contribute, as much as lies in our power, to the assistance of inventors. The opinions of correspondents are respectfully considered, and their productions published when they possess such merit as makes them valuable to others. We shall not hesitate to expose the humbugs of pretenders, while we shall be no less earnest in the encouragement of honest seekers after truth.

## IMPROVEMENTS IN STEAM ENGINES SINCE THE TIME OF WATT.

So long as steam remains a mechanical power adapted to the uses of man, so long will the fame of James Watt endure as the grand improver of the mechanism through which that agent works. Still, it may be doubted whether the practice of ascribing all the benefits of the steam engine, as at present used, to the genius of Watt, and thus robbing later inventors of the credit due them, is borne out by the facts. The steam engine of the present day is a much greater advance on the best, constructed under Watt's supervision and from his plans, than his was on the crude attempts of Savary. Within the memory of living mechanics, the steam engine has undergone such a complete transformation, not only in outward form, but internal construction, as to be an almost entirely different machine. A stationary engine of thirty years ago would be a curiosity to our young engineers. The length of stroke as compared with diameter of the cylinder was enormous; the fly wheel was only a fly wheel, never a pulley; the valves were unbalanced; few engines "cut off" or used steam expansively, and the governor merely checked the inlet of steam to the chest, but did not govern the valves. All these important points have been the subject of comparatively recent improvements.

On the best engines now built the steam is used expansively, in one cylinder, by means of cut-off valves, and the action of the valves is governed directly and absolutely by the regulator or governor; so that the amount of steam admitted to act upon the cylinder piston is adjusted exactly or nearly so, to the work required of the engine—a most important, if not a radical, improvement. The immense pressure sustained by the old-fashioned valves, which had to be moved by purely mechanical force under a load denoted by the pressure of steam per square inch multiplied by the area of the valve, and against the immense friction of the surfaces of the valve face and seat, is now almost wholly annihilated by improvements in this part of the machine. The improved packings for piston and stuffing boxes, while diminishing friction in these parts, have added immensely to their efficiency, and in connection with the use of live steam cylinder jackets, have insured a great saving of steam, and, consequently, fuel. The condenser for low-pressure engines has been as much improved by comparatively modern inventions as any other part.

It is evident that Watt had an idea of these possibilities. For instance, he conceived the project of using steam expansively in one cylinder, but it was left to later inventors to perfect it. It would be unjust to those mechanics who have for the past twenty-five years made steam and the steam engine their study, to deprive them of the credit due them for increasing the efficiency of this great mechanical motor. James Watt was a great inventor, but he did not exhaust the possibilities of the steam engine by his inventions.

## PETROLEUM FOR STEAMSHIP BOILERS---THE RPEORT OF THE NAVY DEPARTMENT.

We have frequently alluded to the project of substituting petroleum for coal as a fuel for generating steam, and on pages 137 and 153, current volume, we considered the matter in two articles in which we treated on the comparative heating powers of petroleum and coal; their relative values as heat producers; relative cost; relative space occupied on board ship, and the dangers, real or supposed, of storing petroleum on board vessels. In subsequent articles we also considered the life of the petroleum apparatus as compared with the coal furnace, and the difference in the cost of labor. From these facts, fortified by figures which were eminently reliable, but which were as favorable as possible to petroleum, we deduced the conclusion that this substance could not safely and economically usurp the place of coal. This conclusion is fully sustained by the report of the Secretary of the Navy who says:

The act approved April 17, 1866, appropriated five thousand dollars for testing the use of petroleum as a fuel for marine boilers. An elaborate series of experiments has been made at the New York and Boston Navy Yards. The conclusion arrived at is that convenience, comfort, health, and safety are against the use of petroleum in steam vessels, and that the only advantage thus far shown is a not very important reduction in bulk and weight of fuel carried.

It would seem that this declaration is sufficiently explicit to satisfy the most sanguine advocates of petroleum as a substitute for coal. We have had no personal nor pecuniary interest in this question, our only desire being to present the plain facts without wishing to do an injury to any experimenters. It may be that some cheaper material than coal, less bulky, and more easily managed, may in the future be discovered, but we have yet to see the proofs that petroleum is the substance destined to supersede coal.

## PATENTS.

The rapid increase during late years in the number of patents annually granted for new inventions, is something astonishing. Statistics in an old Patent Office Report at hand show that, during the first fifty years after the establishment of the Office, the number of patents issued for that entire period fell far below every annual issue for some years past, and a comparison of the list of claims published in the earlier numbers of the SCIENTIFIC AMERICAN, with the lengthy record which, week after week, now appear in our columns, is proof conclusive of the growth of business in this department.

The report of Secretary Browning for the year ending October 1st shows that 2,500 more applications were made this year than last, and over 5,000 more than on any previous year. The whole number of applications was 16,547. Of these, 12,879 were allowed, and 11,655 have been issued—an increase of about 3,000 over last year's issue. During the same time, 3,486 caveats were filed, 96 applications for extensions were received, and 82 extensions were granted

The Patent Office receipts for the year were $611,910.61, the expenditures $553,599.98, leaving a balance of 53,310.63, which, added to the balance on hand, makes the amount now in the treasury to the credit of the Patent Fund, $286,607.89.

## WOOD ENGRAVINGS---HOW THEY ARE MADE.

The art of engraving is one of the oldest, and its origin is lost in the mists of antiquity. Probably it was cotemporaneous with the origin of written language, and may have preceded it in point of time. A variety of substances are employed to receive the work of the engraver, but wood is now more extensively used than any other; and wood engraving has been brought to such perfection as to rival in delicacy of finish and richness of effect the best efforts of engravers on metals. Wood engraving is used entirely for the illustrations in periodicals and mainly for those in books, although occasionally specimens of steel plate engraving are inserted in very elegant and costly volumes. The woods employed are box, pear, apple, beach, maple, mahogany, and pine, of which box is infinitely the best. The large illuminated posters used by exhibitions are coarse engravings on pine or some other common wood, cut with the grain. Of course, no attempt at finish or elegance can be very successful with such material, yet the effect, when combined with judgment in the printing, is frequently quite imposing.

Box wood, on which the best engravings are cut, is the product of a shrubby evergreen, a dwarf variety of which is in common use here as borders to flower beds and gravel walks. The tree variety seldom passes in this country beyond the size to which the term shrub rather than tree could be properly applied, although we have seen one specimen at least fifteen feet high, the stem or trunk of which was over seven inches in diameter. In southern Europe, however, this size and even larger is quite common. The name box—Latin *buxus*—is from a Greek word which means also cup or vase, denoting its use in former times for the construction of drinking vessels. It is still largely employed for the manufacture of ornamental boxes and other specimens of the turner's art. But its principal value is its adaptability for engraving.

Large quantities are sent from Spain, the Levant, and the island of Majorca. A considerable quantity is brought also from Turkey. The wood is yellow in color, hard, heavy, very close and even grained, and susceptible of a high polish. Its specific gravity varies from 0·971 to 1·328. If the latter is taken as a standard, the specific gravity of box wood exceeds that of any other wood known to the arts, as ebony has a specific gravity of only 1·259, and guaiac of 1·302. The wood is prepared for use by steeping large blocks in water for 24 hours, after which it is boiled in water and then dried in sand or ashes.

It is brought to this country in logs or blocks, denuded of its bark, and for engraving purposes is sawed across the grain, squared, and planed to a true surface on each face. It is seldom obtained in pieces six inches square, although we have seen one specimen perfectly sound, and of excellent quality, which squared to seven-and-one-eighth inches. Most blocks, however, of such dimensions on which engravings are cut, are composed of from three to eight pieces, joined and secured in the most exact manner. The engravings prepared for the SCIENTIFIC AMERICAN are invariably cut on box wood, and not unfrequently one of the blocks contains eight or ten pieces.

The blocks when ready for the designer or artist are exactly the thickness or hight of the ordinary type—a shade less than fifteen-sixteenths of an inch, or, more correctly, twenty-nine thirty-seconds of an inch. The upper surface, which receives the design, is finished very smoothly, and preparatory to receiving the drawing is coated with flake white—that scraped from the faces of enameled cards being generally used. The artist transfers the outline of the design to the face of the block by means of a transparent paper on which the design is drawn. The drawing and shading is made by lead pencils of different qualities and a camel's hair pencil charged with sepia or India ink. When done by an artistic hand the drawings are very beautiful, presenting an elegance of appearance very difficult to reproduce on paper from the engraved block.

Although the engraver must follow the lines and shadings of the designer, the former, to be successful, must possess great skill, acquired only by practice, and use considerable judgment in carrying out the artist's ideas. The excellence of the engravings published in this journal testify to the talent of our principal artist, Mr. F. Louis Seitz, and our engraver, Mr. Richard Ten Eyck.

The engraving is done in the same manner and with tools similar to those employed in engraving on metals. Most of it is done entirely by hand, although sectional views and those portions which consist only of unshaded parallel lines are engraved by a simple machine called a "ruling machine."

During the progress of the work of designing and engraving, the blocks must be defended from damp atmosphere and the sun's rays. If the design is to be reproduced indefinitely it is usually considered best to make from the block one or more electrotypes, which, being of type metal coated with copper and mounted on wood, will last for years. In wood engraving the "whites" are cut away from the surface, leaving those parts which are to receive the ink and produce the impression, in relief. But occasionally the reverse course is adopted and the figures or letters are sunk into the wood and the ground is left, producing a black ground with white