# Scientific American.

'A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XIV.—No. 12. (NEW SERIES.) NEW YORK, MARCH 17, 1866. $3 PER ANNUM IN ADVANCE.


## Improved Bridge.

Public works, such as railroads, bridges, etc., naturally excite an interest in the public mind, and call attention in proportion to the magnitude and utility of the work in question. Any structure which serves the public convenience and guards the lives and property of our citizens, is watched with feelings commensurate with its novelty, magnitude, and utility.

The application of iron, either cast or wrought, in the construction of bridges, is comparatively of modern date The first structure of the kind was a cast-iron bridge over the river Severn, near Coalbrook Dale, Eng. This bridge was built by Darby, and consisted of ribs of cast iron supporting spandrel pieces of the same material, having a span of 100 feet. The work, at the time, was considered successful.

Rennie, a celebrated English engineer, built an iron bridge over the river Witham, at Boston, in Lincolnshire, England, of 100 feet span, with a rise or verse sine of only 4 feet. The same engineer also constructed, in 1819, a large bridge over the river Thames, known as the Southwark Bridge, consisting of three arches, all segments of a circle—the center one being 240 feet, and two side ones of 210 feet, each arch consisting of eight ribs of fifteen pieces each and tied by transverse braces, etc. Since that time numerous bridges have been built both of wrought and cast iron.

During the erection of the early iron bridges, and since that time, one great defect was found in all compound structures of wrought and cast iron, and points directly to the superiority of homogeneous structures. This defect consists in the difficulty of making wrought and cast iron act equally together in bearing the load. The strength of cast iron depends upon its rigidity and power to resist compression, while wrought iron, in the form of truss rods, etc., is intended to act by the application of tensile strength. It is therefore indispensable that the adjustment of the length of the bars during all the changes of temperature shall be strictly preserved—a condition physically impracticable by any known arrangement.

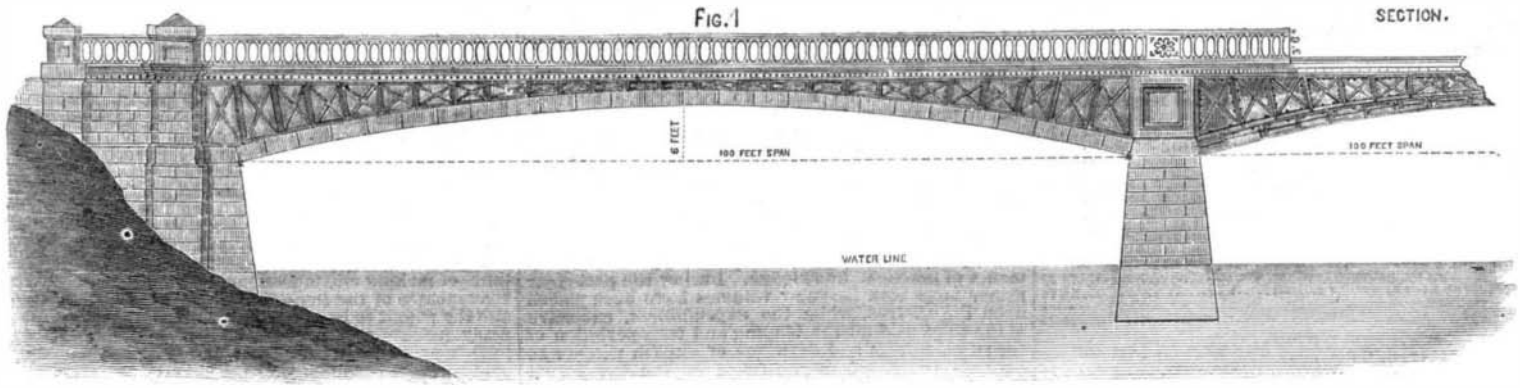
The improvement which is represented in the annexed engravings, consists in combining together a number of cast-iron boxes, banded together and filled with concrete, making a homogeneous mass, and so placing it together as to gain the greatest amount of strength from a given quantity of material.

It is claimed for this method of construction that it has greater strength, that a longer span can be made with continued safety, and at less cost than that of any other kind of iron bridge known. Its simplicity and comparatively small cost and ease of construction must commend it to every one. Fig. 1 represents an elevation and section of a bride of a 100-foot span; Fig. 2 a perspective view of some of the boxes showing the mode of fastening; Fig. 3 shows a section of three boxes; Fig. 3 shows a plan of the same with the straps keys, etc.

Haswell, in his work on "Engineering and Mechanics," page 276, states that cast-iron gun metal will bear a compression of 105,000 lbs. to the square inch, while wrought iron begins to yield at 40,000 lbs. Now to crush cast iron (taking the above figures) it would take a column of over six miles. So that cast iron, if properly braced, can be built on to almost any extent before it can be crushed. So, in the construction of this mode of bridge building, the parts are so arranged that every portion of it is completely braced and kept in place, making it the strongest construction in which iron can be used.

This bridge was patented by Rembrandt Lockwood, No. 293 Broadway, New York, on December 5, 1865. Patents have also been secured through the Scientific American Patent Agency in France, Belgium, and Great Britain.

FIG. 1




LOCKWOOD'S COMBINATION BRIDGE.

FIG. 2.

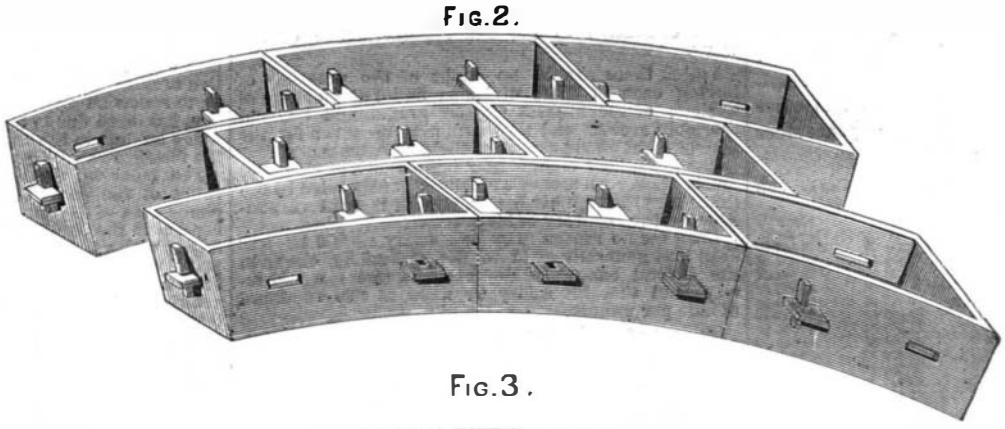
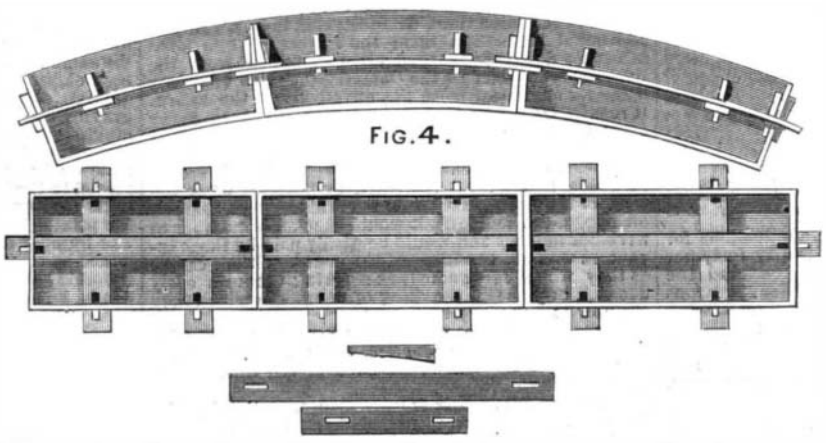


FIG. 3.

FIG. 4.



## Copper Ore Roasting—Sulphuric Acid.

We extract the following from an able lecture delivered before the Scottish Royal Society of Arts, by Dr. Stevenson MacAdam:—

"The large amount of sulphur which is burned off from metallic ores in Swansea and elsewhere, and which escapes into the atmosphere as sulphurous acid, and thereafter becomes, in part at least, sulphuric acid, has recently called forth the attention of scientific and practical men. In the neighborhood of works discharging such sulphurous smoke the ground is barren, scarcely any vegetation can be seen for miles, and even high chimney stacks are of little avail, as they merely carry away the sulphurous smoke, and distribute it over a wider and much more distant area.

One extensive firm of copper melters discharge in this manner into the atmosphere about 1,000 tuns of sulphuric acid every week, and it is estimated that annually there are burned off from the copper ores worked in Swansea about 70,000 tuns of sulphur, of the value of £455,000, and which might produce no less than upwards of 210,000 tuns of sulphuric acid, of the strength of oil of vitriol. Many of the manufactories of sulphuric acid hav begun to use the copper ore as a source of sulphur, and thereatter hand over the roasted ore to the copper smelter at Swansea. The ore is obtained in large

quantities from the Guadiana River, Fort Formosa, in Portugal, from mines which were worked by the Romans, and it is used extensively for making sulphuric acid in London, Newcastle, Bristol, and other places. This is an excellent instance of the sucessful and economic employment of a material in the arts and manufactures which was till lately, and in many places still is, a nuisance over extensive tracts of country. The smoke in a very modified condition occurs in all large towns, where much coal is burned and especially in manufacturing towns where the coal is often of inferior quality. In such towns, by themere burning of the sulphur in the coals, many gallons of sulphuric acid must be formed, and in rainy weather be washed down on the people."

## REPORT OF THE COMMISSIONER OF PATENTS

U. S. PATENT OFFICE, January, 1866.

SIR:—In accordance with the provisions of the fourteenth section of the act approved March 3, 1837, I have the honor to submit the following report of the operations of this office during the year 1865.

The receipts and expenditures of the office for the year, and the condition of the patent fund at its close, will be seen by a glance at the following statements:—

No. 1.

| | |
|---|---|
| Number of applications for patents during the year | 10,664 |
| Number of patents issued, including reissues and designs | 6,616 |
| Number of caveats filed during the year | 1,937 |
| Number of applications for extension of patents | 78 |
| Number of patents extended | 61 |
| Number of patents expired, Dec. 31, 1865 | 914 |
| Of the patents granted there were:— | |
| To citizens of the United States | 6,428 |
| To subjects of Great Britain | 82 |
| To subjects of the French Empire | 40 |
| To subjects of other foreign governments | 66 |

No. 2.

Statement of money received during the year, namely:—

| | |
|---|---|
| On applications for patents, reissues, etc. | $324,572 20 |
| For copies and for recording | 27,219 64 |
| Total | $348,791 84 |

No. 3.

Statement of expenditures from the Patent Fund:—

| | |
|---|---|
| For salaries | $100,032 54 |
| For contingent expenses | 75 244 43 |
| For temporary clerks | 97,453 37 |
| For withdrawals | 420 00 |
| For refunding money paid by mistake | 649 00 |
| For Judges in appeal cases | 400 00 |
| Total | $274,199 34 |

No. 4.

| | |
|---|---|
| Amount to the credit of the Patent Fund, Jan. 1, 1865 | $55 592 28 |
| Amount of receipts during the year | 348,791 84 |
| Total | $404,384 12 |
| From which deduct for expenditures | 274,199 34 |
| Leaving to the credit of Patent Fund, Jan. 1. 1866 | $130,184 78 |
| Surplus of receipts over expenses | $74,592 50 |

The unprecedented activity of the mechanical industry of the country since the close of the war for the suppression of the rebellion is strikingly manifested by a comparison of the business of this office for the last year with that of the previous years since the organization of the office:—

TABLE EXHIBITING THE BUSINESS OF THE OFFICE FOR TWENTY-NINE YEARS, ENDING DEC. 31, 1865.

| Years. | Applications filed. | Caveats filed. | Patents issued. | Cash received. | Cash expended. |
|---|---|---|---|---|---|
| 1837 | .... | .... | 435 | $29,289 08 | $33 506 98 |
| 1838 | .... | .... | 520 | 42,123 54 | 37,402 10 |
| 1839 | .... | .... | 425 | 37 260 09 | 34,543 51 |
| 1840 | 765 | 228 | 474 | 38,056 51 | 39,020 67 |
| 1841 | 847 | 312 | 495 | 40.413 01 | 52,666 87 |
| 1842 | 731 | 291 | 517 | 36,505 68 | 34,241 48 |
| 1843 | 819 | 315 | 531 | 35,315 81 | 30.766 96 |
| 1844 | 1,045 | 381 | 532 | 42,502 26 | 35,344 73 |
| 1845 | 1,246 | 452 | 502 | 51,076 14 | 39,345 65 |
| 1846 | 1,272 | 448 | 619 | 50,264 16 | 46,158 71 |
| 1847 | 1,531 | 553 | 572 | 63.111 19 | 41,878 35 |
| 1848 | 1,628 | 607 | 660 | 67,576 69 | 58,905 84 |
| 1849 | 1,955 | 595 | 1.070 | 80,752 78 | 77,716 44 |
| 1850 | 2,193 | 692 | 995 | 86,927 05 | 80,109 95 |
| 1851 | 2,253 | 760 | 869 | 95,738 61 | 86,916 93 |
| 1852 | 2,639 | 996 | 1,0.0 | 112,056 34 | 95,916 91 |
| 1853 | 2,674 | 901 | 958 | 121,527 45 | 132,869 83 |
| 1854 | 3,324 | 838 | 1,902 | 163,789 84 | 16 146 32 |
| 1855 | 4,435 | 905 | 2,024 | 216,459 35 | 179 540 33 |
| 1856 | 4 960 | 1 024 | 2,502 | 192 588 02 | 199 931 02 |
| 1857 | 4 771 | 1 010 | 2.910 | 196,132 01 | 211,582 09 |
| 1858 | 5,364 | 943 | 3.710 | 208 716 16 | 193,193 74 |
| 1859 | 6.225 | 1,097 | 4,538 | 215 942 15 | 210.278 41 |
| 1860 | 7,653 | 1,984 | 4.819 | 246,352 59 | 252,820 80 |
| 1861 | 4,643 | 700 | 3,340 | 137.854 44 | 221.491 91 |
| 1862 | 5.038 | 824 | 3 521 | 215,754 99 | 182.810 39 |
| 1863 | 6 014 | 787 | 4,170 | 195,593 29 | 189,414 14 |
| 1864 | 6,972 | 1,063 | 5 020 | 240,919 98 | 229,568 00 |
| 1865 | 10.664 | 1,917 | 6.616 | 348 791 84 | 271,199 34 |

It is here seen that the number of applications for patents received in 1865 exceeded, by nearly forty per cent, the number filed in any previous year, and the number of caveats filed exceeded those of any previous year by more than seventy-five per cent. The number of patents issued exceeded those issued in 1864, the highest previous year, by more than thirty per cent.

The receipts into the patent fund exceed those of any former year by more than thirty-six per cent, while the expenditures were only increased a trifle over eight per cent, and a considerable surplus is left to the credit of the patent fund. If the cases brought to the attention of the Office continue to be as numerous as at present, it will become necessary to make such additions to the examining and clerical force of the Office as will absorb a portion of the surplus earnings; while, on the other hand, if the anticipated resumption of specie payments should be attended with any general financial prostration, the receipts of the Office would undoubtedly fall below the rate of the present expenses.

When the Patent Office was first established as a separate Bureau, in 1838, the act provided for the appointment of a single examining clerk. The number has been increased by additional legislation, at successive periods, until, by the act of March 2d, 1861, the limit was fixed at sixteen examiners and the same number each of First and Second Assistant Examiners.

As will be seen by a reference to the comparative table given above, there was a material reduction in business of the Office immediately after the passage of the act just referred to, and it was found unnecessary until recently to appoint the full number of examiners allowed by law. But so rapid has been the increase of inventive activity, that it is now found impossible to prevent the examinations falling largely in arrears.

The number of applications in the hands of the examiners at the close of the year, on which no action had been taken, was 1,134.

I would therefore recommend that authority be given for the appointment of four additional officers of each of the several grades, if their services shall be found necessary to the examination of the applications presented.

By the act of May 27, 1848, the salary of the Examiners was fixed at twenty-five hundred dollars per annum, and by the act of March 3, 1855, that of the First Assistant and Second Assistant Examiners, was fixed at eighteen hundred dollars, and sixteen hundred per annum, respectively. The position of First Assistant Examiner is one of great importance and responsibility, as he is frequently called upon to decide upon the merits of applications in the absence of his principal, and it is also of almost daily occurrence that the pressure of work will be such as to force the Examiner to reply mainly upon the judgment of his Assistant. I am satisfied that the interests of the Office and of inventors generally would be promoted if the salary of the First Assistant Examiners were raised to two thousand dollars.

I would also most respectfully urge that the salary of the Librarian be raised to twenty-five hundred dollars per annum, the sum now paid the examiners. The library now contains upward of 15,000 volumes, exclusive of some 1,500 volumes temporarily in the rooms of the Agricultural Department. Although the number of volumes is not so large as may be found in many other public libraries, the works are almost exclusively of a scientific and technological character, and it is doubtful if there is another library in the country which is so nearly complete in all the departments of practical knowledge. During the past year rather more than 1000 new volumes have been placed upon the shelves, while the expenditures, exclusive of the sums paid for the binding and transportation of the specifications and drawings of English patents so liberally presented to the Office by the Great Seal Patent Office of England, have been less than $500.

The library is constantly visited by inventors from all parts of the country, as well as by persons engaged in the various branches of scientific investigation, and it is requisite that the Librarian shall be a man of broad culture and familiar with the contents of all the works under his care, as these cover the whole domain of practical science, it is manifest that the salary of the Librarian should be at least equal to that of a **principal examiner.**

In addition to the **examining corps**, the **administrative** and financial business of the Office requires a considerable force of clerks who are distributed into several divisions such as experience has shown to be most conducive to the rapid performance of the work.

I think there can be no doubt of the propriety of having each of these divisions under the charge of a clerk of the highest regular grade, and I would therefore recommend that authority be given for the appointment of six clerks of the fourth class.

The disbursing clerk is now ranked as a clerk of the fourth class. All money's received or expended by the Office pass through his hands, and he is held responsible for the accuracy of his accounts.

I can see no reason why his salary should be less than that generally paid to the disbursing clerks in the several executive departments, and I would recommend that his salary be fixed at two thousand dollars per annum.

The act of March 2, 1861, provided for the appointment of a Board of Examiners-in-Chief whose duty it should be to revise and determine upon the validity of decisions made by examiners when adverse to the grant of Letters Patent. An experience of five years has fully confirmed the wisdom of the enactment, but it has, at the same time, demonstrated the necessity of additional legislation upon the subject. While a fee of twenty dollars is charged upon an appeal from the Examiners-in-Chief to the Commissioner, no charge is made for an appeal from the examiners to the Board. It results from this that appeals are taken in many cases without a shadow of ground, and in contested cases, merely for the purpose of delay. During the year 1865, there were 495 appeals taken to the Board, of which number 166 remained undisposed of at the close of the year. If a fee of ten dollars were charged on appeal to the Board, it would check the number of frivolous appeals and would be gladly paid by those inventors who are confident of the justice of their claim, as they would recognize it as securing them an early decision in place of the delay of months to which they are now so generally subjected.

After consultation with many inventors and with solicitors in extensive practice, I am satisfied that the proposed amendment would be received with almost universal favor.

The published reports of this Office, with the descriptions and illustrations of patented inventions, are not only of great value to inventors and the country as indicative of the directions in which mechanical and scientific skill is pushing its way into new channels, but their general diffusion effects a very important reduction in the labor to be performed in this Office. By a study of the report, one who has perfected an improvement in some useful machine, is in many instances enabled to see at once whether his invention is novel, and if so, the particular feature which has never been the subject of a patent. Again, when an existing patent is referred to by the Office as a reason for the rejection of an application, the applicant is saved the time and expense required to obtain a copy of such patent, by its publication in the annual report. This is especially true of the latest reports, inasmuch as when a necessity is felt by the public for an improvement in some particular art or manufacture, the ingenuity of inventors in different parts of the country is stimulated into activity in that particular field, while at another period the excess of activity is turned into other paths.

This period of *two years* is recognized in several instances as the measure by which the rights of an inventor shall be determined, and I am convinced that if the same idea is extended to another case, not now within its scope, the occasion for much serious injustice will be removed. Under the existing law a patent is taken out in which the inventor makes a clearly defined claim to a particular feature.

The claim, it may be, does not cover all that is described in the specification or shown in the drawing, and whatever is thus left unclaimed may be used by any person unless protected by a previous patent. Some enterprising manufacturer, who is keen enough to recognize the value of that which the inventor did not deem it worth his while to appropriate, invests his capital and begins to furnish the public with a valuable article, and after this the inventor applies for a reissue of his patent and an extension of his claim, so as to give him the monopoly of that which he had before left open to the use of the world. If it appears upon examination that the original specification described the art or device in question, and that the holder of the patent was actually the original inventor, he is entitled to a reissue in such terms as to preclude the use of such device, except upon such conditions as he may grant. It would not be difficult, in this manner, to entrap a person into such an arrangement of his business, or employment of his means, as to leave him at the mercy of the inventor or to compel him to pay an exorbitant royalty, when the patent is reissued with a broader claim. In my opinion it would be a judicious amendment of the law and would prove an effective safeguard to the rights of innocent parties, if the privilege of reissuing a patent in such terms as to broaden the claim were restricted to the first two years of the life of a patent, bearing reissues for other purposes to be granted at any time, as at present.

The act of 1861 allowed applicants to pay a portion of the fee required for the issue of a patent at the time of making application, and the remainder at the convenience of the inventor whenever he might desire the patent to be engrossed. As it was found that many patents were allowed to lie indefinitely, it was further provided in 1863, that if the final fee were not paid within six months after the patent was passed and allowed, the invention should become public property as against the applicant. In 1865 it was further enacted that any person who fails to pay the final fee within the time limited, may make a new application for the same invention at any time within two years from the date of the allowance of the original application. Under this state of the law, cases have been brought to the attention of the Office in which inventors have been unable to pay the fee within six months or to file a new application within two years from the date of the allowance of their application by reason of absence from home in the service of the United States. To confiscate the property of an inventor because he has imperilled his life for the sake of his country, is so glaringly unjust that it needs but to be mentioned to secure the adoption of a remedy. I would suggest that whenever it be made to appear to the satisfaction of this Office, that a failure to pay this final fee, or to renew an application within the time limited by law, has been due to the absence of the inventor from home on duty in the army or navy of the United States, the forfeitnre shall be set aside and the patent issued.

The labor of the Office is much increased on account of the delay which has recently attended the publication of the annual reports, and the value of the reports to the public is much diminished by the late day at which they make their appearance. The heavy pressure upon the public printing office, occasioned by the increased business of all the executive departments growing out of the war which has now been happily terminated, has been one cause of the delay; and if this were all, it would not be expected that this Office should complain. But the most serious obstruction to an early issue is found in the state of the law, or rather, I might say, in the absence of any law on the subject. Although it has long been the settled practice of the Government to publish the list of patents with the illustrations, there is no law authorizing such publication except as the printing of each report is ordered after the same is submitted to Congress. Some time must then elapse before a contract can be made with the engravers, and it is usually April or May before the engraving can be commenced upon the patents of the previous year. It is worthy of consideration whether authority might not be given in advance for the preparation of the plates, so that the drawings could be placed in the hands of the engravers as soon as the patents are issued, and the whole work be prepared for the printer immediately after the close of the year. The number of copies to be printed might be determined by order of either House of Congress after the report is submitted in the same manner as now. If this course be adopted the public will be placed in possession of the information nearly, if not quite, a year earlier than they can under the present system, and the charge upon the Treasury will be in no measure increased.

Concurrent with the establishment of this Office was the adoption of the policy of disposing of the models illustrative of inventions in such a manner as should be conducive to a beneficial and favorable display thereof, the rooms in which they were arranged to be kept open during suitable hours for public inspection. The act also contemplated the exhibition of specimens of unpatented manufactures and works of art. The thirty years which have succeeded have seen the germ thus planted expand into magnificent proportions, until the saloons on the upper floor of the Patent Office are now among the chief public attractions of the seat of Government, and thronged daily by visitors from all parts of the country as well as from beyond the ocean.