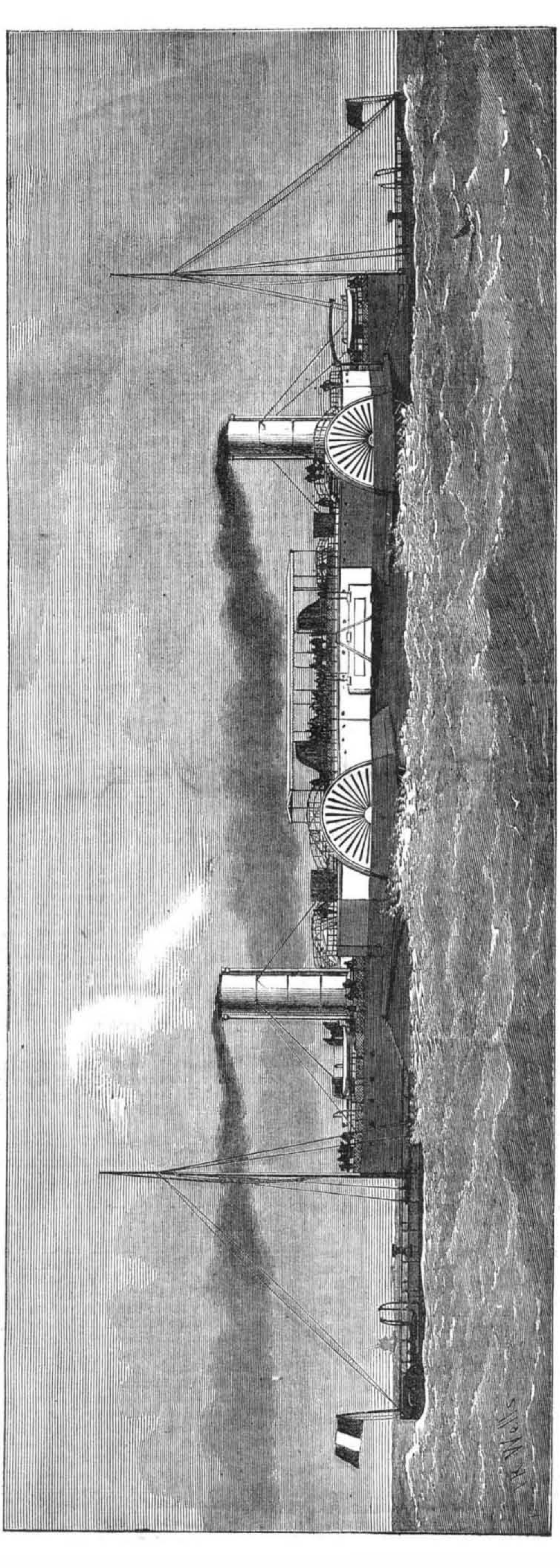

Fig. 1.—THE NEW SWINGING SALOON STEAMER BESSEMER.

THE BESSEMER CHANNEL STEAMER.

This steamer is now about to commence her regular traffic between England and France, and naval authorities will soon have their doubts as to the success of Mr. Bessemer's invention resolved. Whatever be the fate of the ingenious device of the renowned inventor, there can be no doubt but that the vessel is a magnificent experiment. The voyage is about 22 miles in length; and steamers of 400 or 500 tuns tuns burthen, and 300 or 400 horse power, have been hitherto found large enough for the traffic. But the Bessemer is 350 feet long and 40 feet broad, as large as many of the Atlantic steamers, although her tunnage is somewhat less than her dimensions would indicate, owing to the low freeboard at each end of the vessel, as shown in our first illustration. Her engines have already indicated 4,600 horse power, which aggregate is divided between two pairs of paddle wheels. Even if the suspended saloon does not answer all expectations, the new ship will be a great benefit to invalids, for she will shorten the time required for the passage to a little more than one hour. Our second illustration shows the general appearance of the deck of the steamer, with the promenade on the top of the oscillating saloon.

At a recent meeting at the Institute of Naval Architects, London, a discussion on this ship took place; and Admiral Sir Spencer Robinson stated that he was on board the Bessemer when she left Hull (where she was built), and the ship proved herself to be remarkably steady in a very heavy sea; and Mr. J. Scott Russell stated that Mr. Reed, the designer (who was present at the meeting), had succeeded in building a vessel of the maximum stability in a cross sea, besides endeavoring to gain an advantage by the use of the Bessemer saloon. All the speakers complimented the designer on the speed and behavior of his vessel, and anticipated very quick travel in her, without regard to wind or weather. It was stated by Mr. Scott Russell that it is in contemplation, by the French Government and the Northern Railway of France, to construct a deep water harbor at Calais, and so avoid the landing of passengers at half and low tides at the long wooden jetties which traverse the great width of sand that fringes the coast. This improvement would make a saving of perhaps 15 or 20 minutes in the journey from Dover to the Calais railway depot.

Mechanical Effects of Light--The Radiometer.

At a recent meeting of the Royal Society, at Burlington House, Mr. William Crookes, F.R.S., read a paper detailing his new discoveries on the action of light, and illustrated his remarks by experiments. It had long been supposed that no direct mechanical effects could be produced when luminous rays were allowed to fall upon one end of a most delicately balanced lever arm suspended *in vacuo*; but the author of the paper proved conclusively, by experiment, that not only heat, but also luminous rays, were capable of producing direct mechanical effects; so that, by the employment of a new instrument (called by him a radiometer), it was as possible to measure the intensity of the rays of light falling on it from either side as it was to measure the rays of heat with a thermometer.

The radiometer consists of four small pith disks, fixed at the extremities of two crossed arms of straw, balanced upon a pivot at the point where the straws cross each other, so that they can spin round on the pivot. The pith disks at the extremities of the four arms are white on one side, and blackened with lampblack on the other. The entire arrangement is inclosed in a glass bulb, from which the air is removed by the aid of a Sprengel's air pump. The disks and arms spun round rapidly when submitted to the action of light, but dark radiant heat had no effect on them. When submitted to the action of light, from which 95 per cent of the heating rays had been cut off, by means of the interposition of a plate of alum, the disks still rotated, though with slightly decreased velocity. Contrary to what might have been expected, it was the blackened surface of the disks which was repelled by light. In order to test Professor Osborne Reynolds' suggestion—that the effect of repulsion might be produced by residual vapor in the bulbs, and not directly by radiation—Mr. Crookes exhibited the same effects with a lever arm of platinum, suspended by an arm of platinum, the whole of which had been heated to redness again and again, during thirty-six hours of exhaustion by the Sprengel pump, so that it was difficult to suppose that any residual vapor, competent to produce the observed effects, remained in the bulb.

Mr. Crookes further stated that, in some refined experiments made by Dr. Balfour Stewart, at Kew Observatory, when rapid motion was obtained *in vacuo*, radiation was obtained outside; while in Mr. Crookes' experiments radiation was produced outside, and motion in the vacuum, so that the experiments appeared to be the converse of one another. The lever arms used in some of the experiments were suspended upon single fibers of glass, so thin that, when one end of the fibers was held in the hand, the other portion would float about like a spider's thread, and usually rise until it took a vertical position. The whole apparatus was of the most delicate description, and was made by Mr. Gimingham.

PETROLEUM OIL.—Good petroleum should be colorless or light yellow, or with the faintest tinge of violet. It should have no unpleasant odor, and at 59° Fah., should have a specific gravity not exceeding 0·804, or not less than 0·795. When shaken with sulphuric acid diluted with its own bulk of water, it should only color the acid a light yellow, becoming itself lighter in color by the treatment. At 95° Fah., it should not burn when a light is applied.

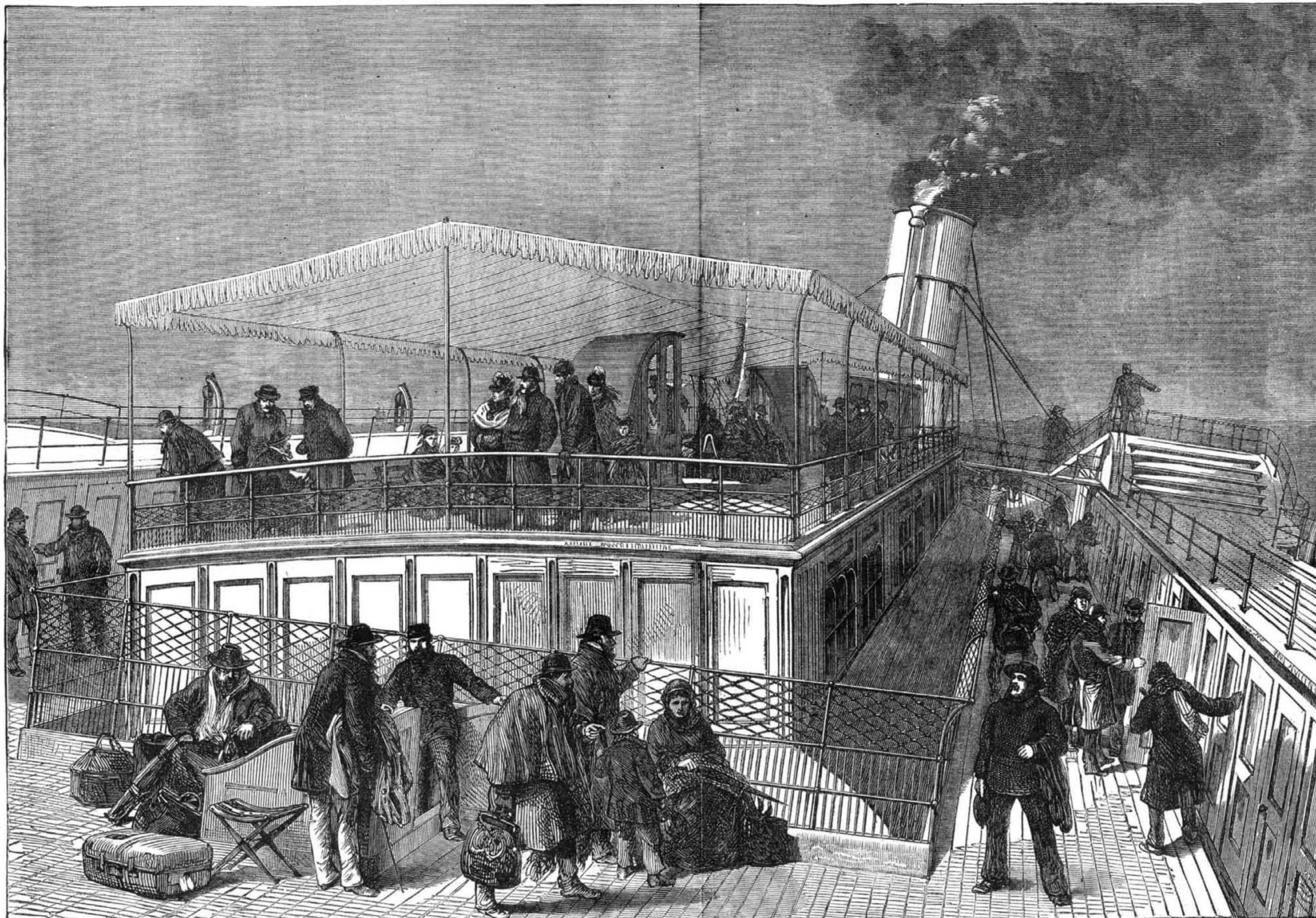

Fig. 2.—THE NEW SWINGING SALOON STEAMER BESSEMER.—THE DECK AND UPPER PART OF THE SWINGING SALOON

The International Exhibition of 1876.

English manufacturers have scarcely done with the Vienna Exhibition of 1873 before they are officially invited to take part in a similar international demonstration in 1876. This time, however, the scene shifts from the old world to the new—from Vienna to Philadelphia—the actual *raison d'être* of the exhibition being to celebrate the hundredth anniversary of American independence. For this purpose, a large part of Fairmount Park, one of the boasts of Philadelphia, has been allotted, and since many months engineers and contractors have been pushing on the work with untiring energy; for although a year has yet to pass before the exhibition opens, unceasing labor will be necessary to complete the task.

We shall in due time publish full drawings of the designs and construction of the various buildings, but we may take this opportunity of giving some idea of the scale of the exhibition. There will be five main structures—the Industrial Hall, the Machinery Hall, the Art Gallery, the Horticultural Pavilion, and the Agricultural Hall. Besides these, there will of course be the numberless smaller buildings in the park, which will spring up of necessity in all directions.

The main building is constructed chiefly of iron and glass, and in its general design bears a marked resemblance to the Great Exhibition of 1851. It lies about due east and west, and covers a rectangular area 1,880 feet by 464 feet in width. The greater part of this large building is only of one story, the hight being 70 feet. At the corners are four towers 75 feet high, and in the center of the building the roof, for the space of 184 feet square, is raised, and at each corner is placed a tower 120 feet high. The total areas of this building are as follow:

	Acres.
Ground floor	20·02
In galleries	0·85
In towers	0·60
	21·47

In the direction of its length, the building is divided into seven parts. In the center is a main avenue 120 feet wide and 1,832 feet long; on either side is an aisle 48 feet in width, then two more avenues each of 100 feet, and between them and the wall of the building on each side are two other aisles of 24 feet. Three transepts of the same width, and divided in the same way, break up this enormous hall, and destroy the monotony of a long, unbroken roof line.

The Machinery Hall is also on a grand scale, but neither its design nor construction call for special remark here. It is 1,402 feet long and 360 feet wide, with an annexe 208 feet by 210 feet, and the area covered is 12·82 acres, the available floor space being 14 acres, including the galleries. This building is divided into two main avenues, each 90 feet wide, with a central aisle, and one on each side, all 60 feet wide. In the center is a transept 90 feet wide. The annexe already mentioned is to be devoted to the exhibition of hydraulic machinery.

The Art Gallery resembles somewhat in general design the corresponding building at Vienna. It is built of granite, iron, and glass, so as to be practically fireproof. It is 365 feet long, 210 feet wide, and 71 feet in hight.

The Horticultural Building is a large and elegant structure of glass and iron, 383 feet long, 193 feet wide, and 72 feet high. The Agricultural Hall is also of great dimensions, and of some little architectural pretensions. The materials employed are wood and glass. The general plan consists of a long nave crossed by three transepts, and the leading architectural feature is a Gothic Howe truss. The nave is 820 feet long and 125 feet wide. The central transept is 100 feet in width, and the outside ones 80 feet, the hight being about 75 feet.

Such is a very general outline of the exhibition buildings, which, covering an area of about 50 acres, will be opened in Philadelphia in May, 1876, and to which English manufacturers are invited to come with their exhibits. It should be mentioned that it is not a government undertaking, but simply a public enterprise, to which, however, the government has lent its support by a payment of some $200,000. The responsibility of failure or success rests, therefore, with the promoters; but we believe we may say with certainty that American public spirit will carry through the exhibition to a triumphant conclusion, even if a pecuniary loss should be sustained. With this matter, however, we have little to do, but it is a question of paramount importance whether there exist sufficient inducements to English manufacturers to encourage them to come forward as they have done at previous foreign international exhibitions, or whether the probable disadvantages are too certain to justify their incurring the large expense and great trouble which must inevitably attend the representation of British industry.

It must be evident at once that the disadvantages, if not many, are at least serious. The distance to be traversed, and the cost attendant upon the transport of goods, are of themselves sufficient reasons to discourage many, and we think it is to be regretted that the English Commission can offer no facilities for free transport under government aid, such as will doubtless be afforded by some foreign governments. But the most serious objection is found in the existence of the prohibitive import duties, which rule in the United States, and which effectually check competition of foreign with native manufactures in many branches of industry. Again, the English manufacturer fears, and doubtless his fears have some good foundation, that any special merits possessed by the objects he exhibits will, unless protected by patent right, or by secret of production, be copied or improved upon by some appreciative American competitor. These objections must weigh most powerfully with a large number of manufacturers, and especially with those who would, under more favorable conditions, crowd the space allotted to the British section in the Machinery Hall.

On the other hand, the Philadelphia Exhibition offers strong inducements to exhibitors, above all to some of a certain class. The facilities afforded by the United States patent law have been taken advantage of by a large number of inventors, who, having thus secured their inventions, have every reason for gaining as much publicity as possible, and may do so, not only without fear that they will be grossly pirated, as was the case in the Paris and Vienna Exhibitions, but with the certainty that, if the invention is of such a nature as to create a demand in the United States, they will be able to make advantageous arrangements during the period of the exhibition, either for the sale of their American patents, or for the granting of licenses under them. British exhibitors will also be dealing with an English-speaking, appreciative nation, always eager to adopt anything of promise.

Another powerful inducement is found in the fact that English manufacturers will not contribute their exhibits only for the inspection of United States visitors. For a long while past American manufacturers have been pushing their trade with great success in the various countries of South America, and these countries will look with interest to the Philadelphia Exhibition as a means for making them better acquainted with the United States market. If English exhibitors refrain from contributing, they will lose the opportunity thus afforded of entering into direct and profitable competition, as the objection of prohibitive tariffs does not apply in this connection, and English makers can far outstrip those of the United States in point of price.

In all branches of the industrial arts, English exhibitors have strong reasons for being present, because not only can the producer in this country compete even in the face of the high duties, but the people of the United States, while they possess keen appreciation of the beauty of form and material, are not able either to originate, or even to imitate, high class productions of this nature. That this fact is well known amongst manufacturers is evidenced by the numerous and extensive applications for space in the Industrial Hall made to the English commission. The area originally allotted to Great Britain and her colonies in the building was 46,000 square feet, and already the applications have exceeded a space of 60,000 square feet for the United Kingdom alone, while Canada demands 30,000 feet, and all the remainder of our colonies have yet to be provided for. These applications, moreover, do not include those for hanging exhibits, and for these 27,000 square feet for carpets alone have been applied for. These facts indicate that in the Industrial Hall, at all events, this country will be powerfully represented.

Regarded from a higher point of view than that of immediate trade benefit, it may be urged that a powerful and concerted action on the part of British manufacturers may do much towards breaking down the barriers existing in the channels of free trade with the United States. No better way of appealing to the people of that country in favor of this object could be found than by thus convincing them of the cheap producing power of England: but we think that the chances of success are too remote to encourage our manufacturers into such united action.

Fortunately English exhibitors will have facilities for bringing forcibly under the notice of the American public the difference in cost between free goods and those subjected to existing duty, by marking on each exhibit the actual price, and that made necessary through protective policy.

Judging from present appearances, we believe that the space in the Industrial Building allotted to this country will be crowded to excess, while that in the Machinery Hall will be but scantily filled. The Agricultural Building will, as we gather from (in our opinion) the somewhat premature announcement of the English agricultural engineers, be left without any exhibits of machines and implements belonging to this class, and we fear that but little space will be required in the picture galleries for English paintings or statuary.

Upon one all important point English exhibitors have good reason to congratulate themselves. The government has wisely placed at the head of the British commission the man who, of all others, is best suited for the position, and in whom those who had to do with the Vienna Exhibition have learned to place perfect confidence. Mr. Philip C. Owen will find, we feel sure, a far less onerous and ungrateful task before him than that of 1873, and the liberal grant made by our Government will enable him to render more assistance to exhibitors, and to carry through his work in such a way as to reflect credit upon the country and himself.—*Engineering.*

Purification of Metals by Filtration.

If the substance of which a filter is composed has no attraction for the particles of the liquid to be filtered—that is, is not wetted by it—the interstices of the filter do not act like capillary tubes, and the liquid will not pass through. Mercury will not run through a very fine sieve of iron or copper wire unless the wire be amalgamated; and if this be done, although the meshes be very fine, the mercury will pass through easily, while any pieces of iron, copper, or amalgam will be retained on the filter.

Lampadius, formerly Professor of Metallurgy at Freiberg, Germany, has attempted to make use of this principle in purifying the easily fusible metals, and with what success the following will show: Tinned sheet iron, as thin as paper, was cut into strips six inches long and four inches wide. Five hundred of these were placed face to face and fastened in an iron frame, with wedges driven in to bring them closely together. This frame was luted into the bottom of a graphite crucible. Some impure Bohemian tin was melted in another crucible, and allowed to cool until crystals began to form on the surface, when it was dipped into the filtering crucible. The tin, which was still fluid, ran through almost chemically pure, while a pasty magma remained on the filter, which contained iron, arsenic, and copper chemically combined with iron.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for June, 1875.

Mercury.

On the 1st of June, Mercury rises at 5h. 53m. in the morning, and sets at 9h. 15m. in the evening. It is at its greatest elongation, east, on the 9th, and should be looked for after sunset, north of the point at which the sun disappears. On the 30th, Mercury rises at 5h. 32m. A. M., and sets at 7h. 51m. P. M.

Venus.

Venus is seen in the morning, rising on the 1st at 3h. 8m., and setting in the afternoon at 4h. 46m. On the 30th Venus rises at 2h. 47m. A. M., and sets at 5h. 48m. P. M.

Mars.

Mars rises on the 1st at 9h. 17m. P. M., and sets the next morning near 6 o'clock. On the 30th Mars rises near 7 P.M., and sets at 3h. 11m. the next morning.

According to the *Nautical Almanac*, Mars occults or hides from our view the star Σ *Sagitarii* on the 30th, at 1 in the morning. As Mars passes the meridian at 11 P. M., it will be in the southwest, when the occultation occurs, and, as its greatest hight above the horizon is but 20½° (in this latitude), it will not be very conspicuous; but the star is of the fifth magnitude, and a telescope of small power will show the phenomenon.

Jupiter.

Jupiter rises on the 1st at 3h. 11m. P. M., and sets at 2h. 17m. the next morning. On the 30th, Jupiter rises at 1h. 15m. P. M., and sets at 0h. 22m. the next morning.

On the 19th of June two of Jupiter's satellites will disappear by coming in front of the planet, and one by going behind the planet; so that for two hours a telescope (unless it be a powerful one) will show but one of the moons, and that the fourth, or the satellite farthest from the planet.

Saturn.

Saturn rises on the 1st just after midnight, and sets at 10h. 26m. A.M. the next day. On the 30th, Saturn rises at 10h. 9m., P.M., and sets at 8h. 24m. the next morning. The best time to look at Saturn is between 3 A. M. and 4 A. M., when it is about 34° in altitude and near the meridian.

Uranus.

Uranus rises on the 1st at 9h. 12m. A. M., and sets at 11h. 25m. P. M. On the 30th, Uranus rises at 7h. 25m. A. M., and sets at 9h. 35m. P. M.

Neptune.

Neptune can be seen to be a planet only by the use of the best telescopes, and at present is above the horizon almost wholly in daylight, so that it is useless to attempt observations.

Sun Spots.

The report is from April 20 to May 18 inclusive. The picture of April 20 shows, near the western limb, the pair of spots mentioned in the last report, one still distinct, the other divided into two smaller ones. On April 4 this group was seen on the very edge, while a small spot appeared, coming on. In the photographs of April 23 and 24, no spot is seen. On April 29 a large group, consisting of penumbra containing several spots and closely followed by two small ones, appeared coming on, while near the center of the disk was another small pair. The pictures of April 30, May 2, and May 3 show a change of motion and position of spots in the penumbra, independent of the motion across the disk.

Photographing was interrupted from May 3 to May 11 by clouds; and since that time till to-day, May 18, no spots have been visible with a glass of 2½ inches aperture.

Paint.

At a recent meeting of the Society of Engineers, a paper by Mr. Ernest Spon on "The Use of Paint as an Engineering Material" was read. The author, in the first place, considered the necessity for the use of paint, and then noticed the composition and characteristics of the pigments usually employed by engineers. White lead, he observed, should be of good quality, and unmixed with substances which may impair its brightness. It is usually adulterated with chalk, sulphate of lead, and sulphate of baryta, the latter being the least objectionable. Zinc white is not so objectionable as white lead, but is dry under the brush and takes longer in completely drying. Red lead is durable and dries well; but should chemical action commence, it blisters and is reduced to the metallic condition. Antimony vermilion was suggested by the author as a substitute for red lead, and its qualities enlarged upon. Black paints from the residual products of coal and shale oil manufacture, and oxide of iron paints, are generally used for iron work, for which purpose they are peculiarly suited. Allusion was also made to anti-corrosive paints, and to those containing silica. Referring to the oils used in painting, the author stated that linseed oil was by far the most important, and that its characteristics deserved careful study. It improves greatly by age, and ought to be kept at least six months after it has been expressed before being used. It may be made a dryer by sim-