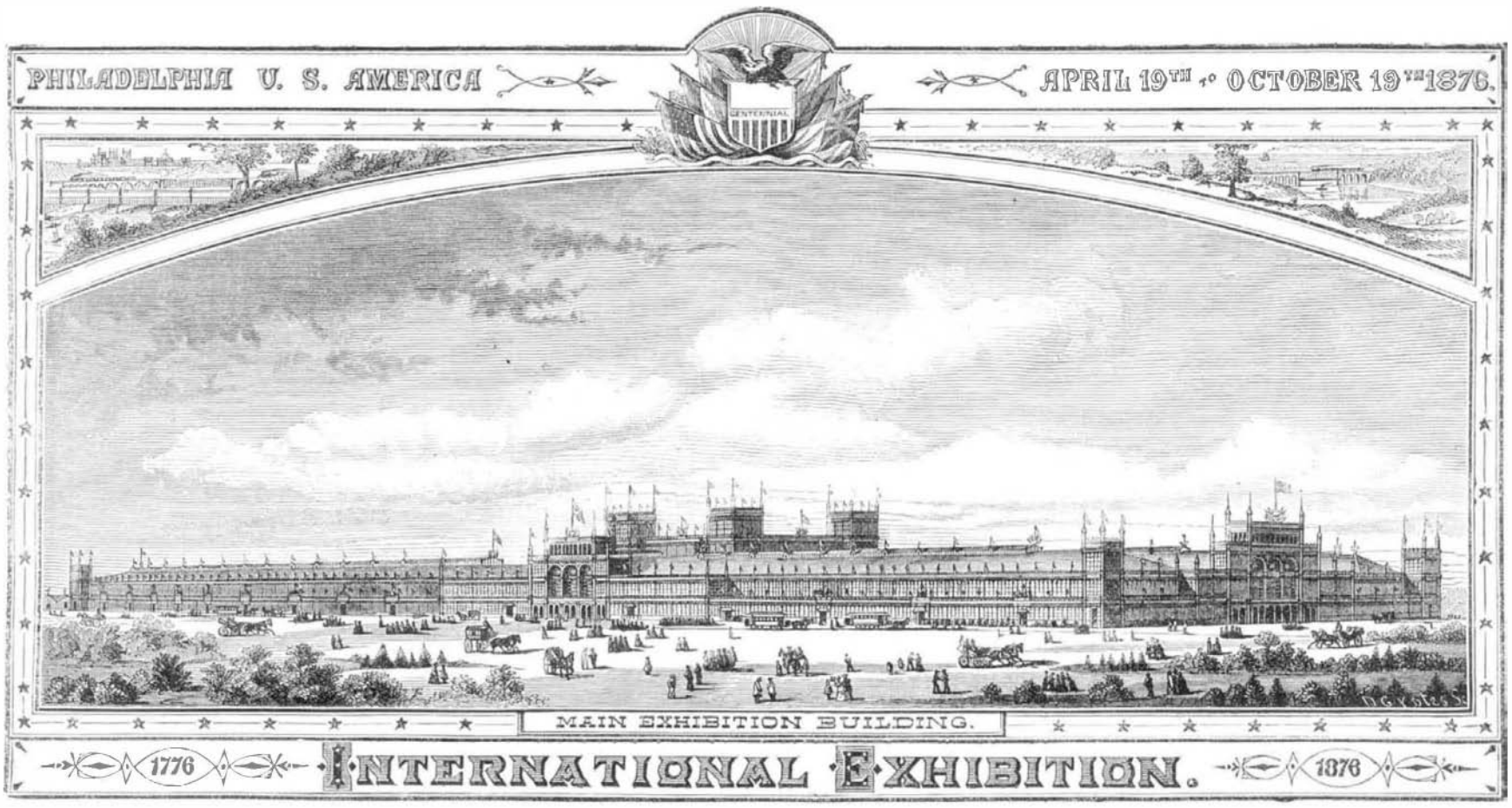
THE BUILDINGS FOR THE CENTENNIAL EXHIBITION.

The Commissioners who have charge of the arrangements for the Centennial Exhibition, to be held at Philadelphia in 1876, have recently given to the public definite details of the buildings to be erected in Fairmount Park for the purpose. The structures are five in number, the Main Building, the Art Gallery, and the Machinery, Agricultural, and Horticultural Halls. We publish herewith views of the first two, which give an excellent idea of their general appearance and proportions.



The Main Building is to be 1,880 feet long and 464 wide, covering 20 02 acres of space. The whole will consist of one floor only, except in the projections and towers, where galleries, giving additional space, will be provided, adding 1 45 acres to the available area. The great length of the building has rendered advisable the breaking of the roof lines by the addition of three transepts or cross avenues. The roof is chiefly of the hight of 70 feet from the ground, the towers at the corners being 75 feet high. The central portion, 184 feet square, rises to an elevation above the rest of the building, and is surmounted by four towers 120 feet high. The central avenue will be 120 feet wide, with another, 100 feet wide, on each side of it. The passages for promenade, between the long lines of exhibited articles, will be mainly 30 feet wide.

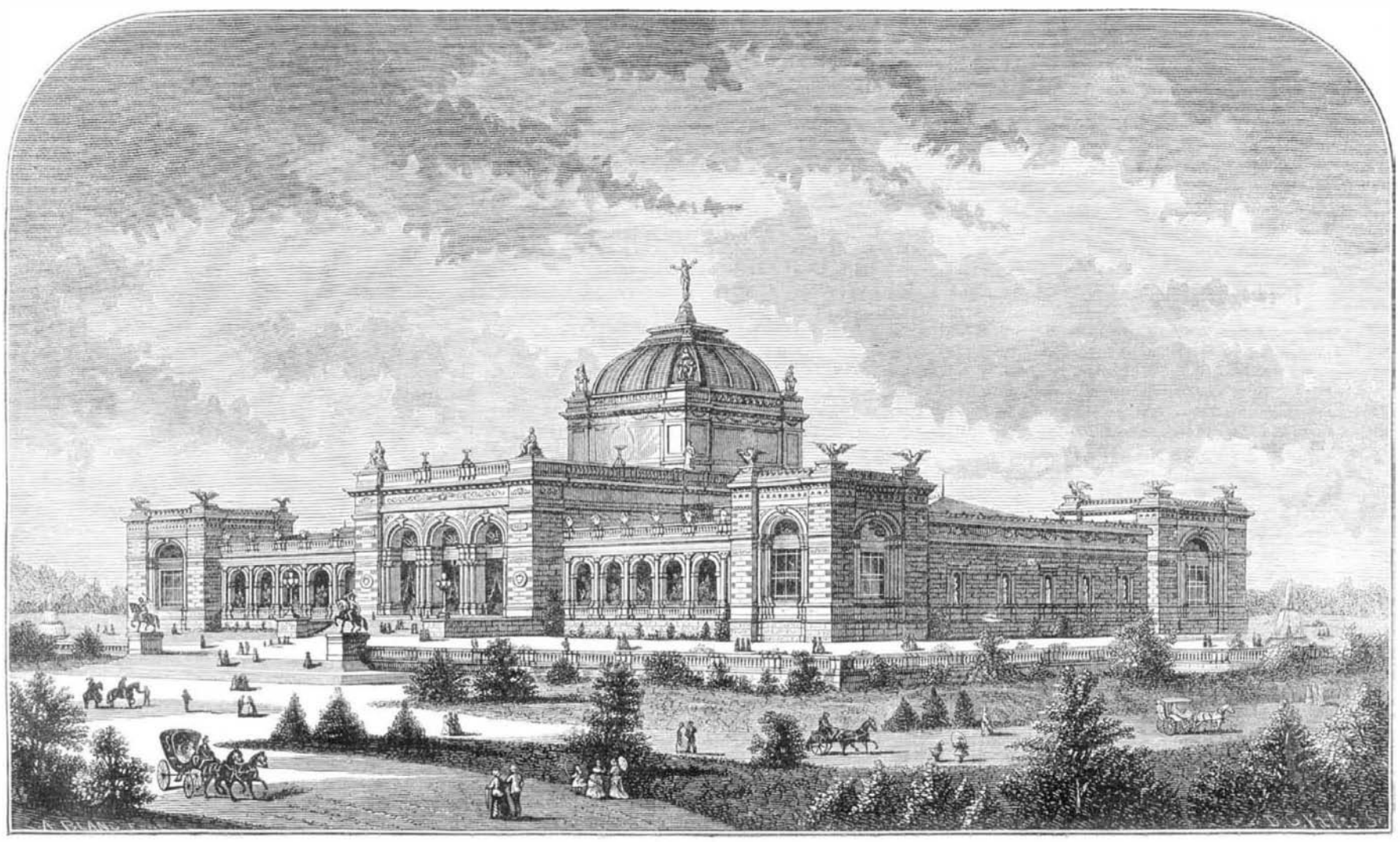
The foundations for this structure, which promises to be admirably light and convenient, as well as graceful in appearance, are to be piers of masonry, the superstructure consisting of wrought iron columns, with roof trusses of the same material. The columns are to be of rolled channel bars, with plates riveted to the flanges, and the roof trusses are straight rafters, with struts and tie bars. The columns are to be 24 feet apart; and timber paneling, to the hight of seven feet, is to be filled in between the outer columns. Above the paneling, glass sashes are to rise to the top of the building, portions of the sashes being removable for the purpose of ventilation.

The engineers and architects of the structure are Messrs. Henry Pettit, Consulting Engineer of United States Centennial Commission, and Joseph M. Wilson.

Every product exhibited in any part of the entire Exhibition will be considered as belonging to one of the following ten departments: 1. Materials in their unwrought condition, mineral, vegetable, and animal. 2. Materials and manufactures, the result of extractive or combining processes. 3. Textile and felted fabrics. Apparel, costumes, and ornaments for the person. 4. Furniture and manufactures of general use in construction and in dwellings. 5. Tools, implements, machines, and processes. 6. Motors and transportation. 7. Apparatus and methods for the increase and diffusion of knowledge. 8. Engineering, public works, architecture. 9. Plastic and graphic arts. 10. Objects illustrating efforts for the improvement of the physical, intellectual, and moral condition of man.

In the Main Building will be located portions of all of the above departments, except No. 6, which will be placed in the Machinery Hall, and No. 9, to which the Art Gallery will be especially devoted.

The departments will be arranged in parallel zones lengthwise of the building, the zones being of different widths, according to the bulk of the products exhibited in the particular department. The States and countries exhibiting will be arranged in parallel zones crosswise of the building, these zones also being of different widths, according to the amount of space required for the exhibits of each country. Between each department and each country will be passage ways distinctly marking the limit of each. The result of this dual system will be that any visitor or student, desiring to compare the products of the same kind from different parts



THE ART GALLERY FOR THE CENTENNIAL EXHIBITION.

of the world, may do so by passing through the building lengthwise, keeping in the zone devoted to the particular department; and any one desiring to examine only the products exhibited by any particular country or State may do so by passing through the building crosswise, in the zone devoted to the particular country or State.

THE ART GALLERY

is of a highly ornate design, and is intended to be the best and handsomest building yet erected on this continent for the purpose. It is to be constructed of granite, glass, and iron, and will be thoroughly fireproof. Its dimensions are 365 feet long, 210 feet broad, and 72 feet high, with a dome, surmounted by a figure of Columbia, rising to 150 feet from the ground.

The Central Hall will be 95 feet long, and the Pavilions, one at each end of the building, will be 45 feet. The Pavilions will be connected to the Central Hall by arcades, each 90 feet long by 40 feet high.

The lighting arrangement, the most important point in the construction of an art gallery, appears to be thoroughly efficient. From the east and west sides of the Central Hall extend the galleries, each 98 feet long, 48 feet wide, and 35 feet in hight. These galleries admit of temporary divisions for the display of paintings. The center hall and galleries will altogether, form one grand hall 287 feet long and 85 feet wide, capable of holding eight thousand persons, nearly twice the dimensions of the largest hall in the country. From the two galleries, doorways open into two smaller galleries, 28 feet wide and 89 feet long. These open north and south into private apartments which connect with the pavilion rooms, forming two side galleries 210 feet long. A corridor 14 feet wide opens into a series of private rooms. Mr. H. J. Schwarzman is the architect, and Mr. R. J. Dobbins the contractor.

It will be seen that the Commissioners have duly appreciated the magnitude of their undertaking, as well as the advisability of appealing to modern taste, culture, and refinement. If these two structures, the erection of which is being vigorously prosecuted, are finished as they are represented in our engravings, and the other three are equally worthy of their noble purpose, we shall as a nation, have something to be proud of in our Centennial Exhibition, and among our best exhibits will be the buildings themselves.

THE FRANKLIN INSTITUTE EXHIBITION.

No. II.

PUMPS.

The huge water tank in the southeastern corner of the building attracts crowds of visitors. Clustered around it is to be found almost every variety of steam and hand pump. All the steam pumps are in operation, and together discharge immense quantities of water. Among the exhibitors we notice Potter & Hoffman, C. A. Conde & Co., William Cramp & Sons, Henry C Hall & Co (pulsometer pumps), Cooper, Jones & Cadbury, J H Billington & Co., and last, but not least, Thomas Shaw. The pump shown by this gentleman is one of the largest ever exhibited, and deserves especial notice. He calls it a compound propeller pump, and he claims for it especially simplicity of construction: it contains no valves, and consists essentially of but three pieces, namely, the column pipe, shaft, and propeller; therefore it is economical, costing much less than any other equally powerful pump. Its enormous power is a feature peculiar to it. The one exhibited is a 20 inch pump, and lifts 10,000 gallons per minute; with a greater speed it can lift 14,000 per minute. A 7 inch pump yields 1,000 gallons, and an 8 inch pump, 1,200 gallons, per minute. It can be used either as a force or a lift pump; can be placed at any angle; will lift sand, mud, sticks, and dirt off sunken lands without serious hurt The hight to which the water can be lifted depends only upon the power employed. A serious difficulty was at first experienced in obtaining a bearing suitable to sustain without injury the enormous weight of the column of water, together with the shafts and propellers. This has, however, now been successfully met by Mr. Shaw's effective water bearing, which consists essentially of a cast iron beam resting on the top elbow of the pump, upon which pillars are secured, supporting a stationary disk carrying an ordinary stuffing box, penetrated by the propeller shaft. A dome rises from the stationary disk, and inside of this a second disk is attached to the propeller shaft and revolves with it. Water is forced below these two disks, under a pressure equal to the weight sustained. In this way the entire weight of the revolving machinery and the greater part of the water column is supported on a film of water on which the revolving disk floats. When too much water is forced between the disks, the revolving disk is raised and the surplus allowed to escape. The water is raised into a large tank 16 feet long, from which the water falls 10 feet to the tank below. The pump is driven by a beautiful engine built by Neafie & Levy, of Philadelphia.

IRON AND STEEL.

The Union Iron Company of Buffalo exhibit a heavy 15 inch beam weighing 66⅔ pounds per foot, 52 feet 6 inches long, rolled in one heat; and a light 15 inch beam, weighing 50 pounds to the foot, 60 feet 6 inches long, also rolled in a single heat.

The Midvale Steel Works, of Nicetown, Philadelphia, make a beautiful display of their manufactures of cast steel. Several cold twisted rails are exhibited, showing the excellent quality of the steel. Forgings of various forms are also to be seen. A steel axle made of Siemens Martin steel was submitted to the following tests: A weight of 1,640 pounds, falling 20 feet, was allowed to fall on the bar, placed on bearings three feet apart. The bar was reversed after each blow. The following deflections were observed: The first blow produced a deflection of 7 inches; the second, of ⅞ inch in the opposite direction; the third, 6⅝ inches in the opposite direction; the fourth, $1\frac{3}{16}$ inches; the fifth, 5½ inches and the sixth, 2½ inches, each in the opposite direction.

HEATERS AND STOVES.

In heaters and stoves a very large display is made. Liebrandt & McDowell exhibit, among other novelties, the Radiant Parlor Cook, Our Mutual Friend, and the Great Centennial Range. Samuel Kirby exhibits the Phœnix Double Heater, which he claims to be one of the most economical and powerful now in use. A small grate attachment serves as a consumer in cleaning clinkers from the fire. J. A. Lawson exhibits a combined self-feeding and surface-burning furnace, called the Pearl. It is designed especially for the consumption of anthracite. Other firms are adapted to bituminous coal and wood. Fuller, Warren & Co. exhibit a very beautiful open front Franklin stove, which they call the Howard. The cheerful, open fire is combined with economy and cleanliness. The Pennsylvania Heating and Ventilating Warehouse and Blacksmithery Works, of Philadelphia, exhibit one of D. Mershon's Sons' wrought iron airtight furnaces, adapted for all kinds of fuel. A novel application of a regulator is made, by which the fire can be regulated without going into the cellar. This is effected by simple levers and pulleys. Reynolds & Son, of Philadelphia, exhibit their wrought iron airtight furnaces. Among a number of forms we note especially the Centennial Furnace, arranged expressly for burning bituminous coal or coke.

MACHINE TOOLS.

Unquestionably the most interesting feature of the Exhibition is the display of machine tools. Among the prominent exhibits we notice those of the following firms: William Sellers & Co, W. B. Bement & Son, Van Haagen, Shoper & Bro., Faris & Miles, E. Harrington & Son, and many others. As it will be impossible in the limited space of a single letter to do justice to all these exhibits, we therefore select one of the most prominent, namely, that of William Sellers & Co., of Philadelphia. Among the many ingenious tools exhibited by this firm none attract more attention, both from experts and non-experts, than their automatic gear cutting and wheel-dividing machine, and indeed justly so, for it is a marvel of ingenuity. Its movements are entirely automatic, no manual labor whatever being required on the part of the operator, save the oiling of the machine. It is impossible to convey a clear idea, in a brief description, of the number of beautiful motions of the machine. The gradual advance of the cutter, its quick return and final stop, the automatic starting of the dividing mechanism which brings the wheel around to the exact position for the next tooth, must be seen to be fully appreciated; and when once seen, there is a kind of fascination about it that makes a visitor spend a length of time in examining its beauties.

Alongside of the gear cutter is one of their self-acting slide lathes for turning and screw cutting, the arrangements of which secure great convenience for working. The top of the shears is a plane surface. The saddle carrying the slide rest is guided on the front edge, the heads moving between the parallels. The cone pulley is furnished with five steps, giving fifteen rates of speed, rising proportionally from the slowest to the most rapid. The feed movement is especially novel. By means of an ingenious combination of friction disks, invented and patented by Mr. C. Sellers, the rate of speed is altered by the simple turning of a milled screw, no stoppage or change being necessary. The importance of this feature will be instantly recognized.

A nut shaper of entirely new design is also on exhibition. All six sides of the nut are finished at the same time, by means of a peculiar arrangement of cutters. A continuous stream of oil is supplied, to the surfaces cut, by a pump beneath, run by the machine. Nuts finished by this machine have a beautiful and characteristic appearance imparted to them. We also notice a radial drill, with adjustable arm capable of a five foot swing. The tool is so arranged that the spindle can be accurately adjusted to any point of the lathe, thus avoiding the moving of heavy work. A section of the latter is susceptible of vertical adjustment, thus adapting the machine to the performance of small work. The spindle is driven by a belt running horizontally, giving the remarkably smooth motion so characteristic of the Sellers' upright drills.

Another interesting feature of their exhibition is a lathe in which are two small grinding machines, one for drills and the other for straight edges and other hardened work requiring true surfaces. The drill grinder produces the required edge on the drill with no other labor than is needed to set it in the required position. Though a small tool, it deserves especial mention. The slotting machine is also remarkable for the originality and excellence of its construction. A vertical adjustment to the connection of the slotting bar enables it to be easily set for different hights of the work. The feed movements are readily controlled by the workman, without leaving a position favorable for watching his work. A number of other novelties are exhibited by this firm, among which might be mentioned their improved forms of Gifford injectors for feeding boilers, but want of space prevents any further notice.

Messrs. Riehle Brothers make a fine display of their scales and testing machines. They have on exhibition one of their 75 tuns upright testing machines for ascertaining the tensile strength of round, flat, or square specimens of any material from 18 to 32 inches long; also one of Professor Thurston's new testing machines.

Fairbanks & Ewing, of Philadelphia, have on exhibition a large number of their standard scales for different purposes, as well as scales graduated to the Russian, French, Chinese, Spanish, and other standard scales. Messrs. Howe, Fairbanks & Co. also make a fine display.

As an unusually fine specimen of wood work, we note the Union table, made by Samuel McCracken, of Philadelphia. It contains some 35,000 pieces of wood. Among the varieties employed are the following: oak, pine, walnut, coco, tulip, amboyna, lance, locust, mahogany, Hungarian and American ash, cedar, white holly, French walnut, satin, and rose. The American eagle is in the center, surrounded by thirteen stars, and in circles beyond this are stars and other devices. On the whole, the effect is a happy one.

A Bullock printing press and a machine for making envelopes, both in actual operation, draw large crowds of the curious. Working models of Chambers' and of the Excelsior brick machines are also exhibited.

The exhibition of drugs, dyestuffs, and chemicals is one of the most attractive features of that portion of the building on the left hand side of the main entrance. The Pennsylvania Salt Works, Powers & Weightman, Henry Bauer, John Lucas & Co., Harrison Brothers, and Rosengarten & Sons have exceedingly large displays.

Sheet Iron Gas Mains.

The Paris Gas Company have lately laid down a main 3·2 feet in diameter and 1,093 yards in length, from St. Maude to the Place du Trône. Hitherto sheet iron pipes covered with bitumen have not been applied to mains of that dimension, and it was important to ascertain how such pipes of a moderate thickness would answer beneath the public roads, where they would be submitted to the permanent and accidental pressure tending constantly to produce deformity.

The company had already adopted sheet iron pipes of 27 55 inches diameter, without any important deformity being produced, and it was only necessary to submit the 3·28 inches pipes to similar pressure to ascertain what effect it would produce, all theoretical calculation being deemed untrustworthy. A comparative trial was therefore made with the aid of an apparatus planned for the special purpose. A pipe of 27 55 inches diameter, of the ordinary thickness of 0·157 inch, and a pipe of 3 28 feet diameter, 0·197 inches thick, were laid in the ground in the mode adopted for the mains in Paris, the trenches having been dug in such a way that there was a space of 10 inches between each side of the tube and that of the trench, and that the filling-in above each pipe should be 3·28 feet in depth. The pipes in ordinary use are 13 12 feet in length; but in order to spread the weight over a large surface, pipes 19 68 feet long were adopted for the experiment, and one end of each was left open to allow of access to the interior.

The trial was made by placing on the soil above them pigs of lead, from four up to twenty tuns weight, which were supported on a platform composed of timber, and having a surface of 86 square feet. This platform was laid upon two pieces of timber, each 19 7 inches long and 9 85 inches wide, and placed 6 90 feet apart, which represented the tyres of the two wheels of one of the axles of a locomotive of forty tuns. The apparatus for the indication of the deformities produced consisted of a circular disk of sheet iron with nine radial rods, each supported by two small guides screwed to the disk, and provided with a spiral spring which kept its outer end pressed against the inner surface of the pipe. The guides of the rods were each provided with a set screw to hold the latter in place while the apparatus was being placed in the pipe. The only object of the rods at the lower part of the disk was to maintain the center of the latter in the axis of the pipe, and when the apparatus was in place both the guides of these lower rods were screwed firmly to the disk. Thus any alteration in the vertical diameter was measured from the center In the center of the disk was an opening 7 87 inches in diameter, fitted with a piece of iron covered with leather, which carried a circular piece of paper. Each iron rod on the upper part of the disk was fitted with a pointer held in a small tube by a spring, and provided with a copper button. When the apparatus was in its place a finger was pressed on each button, and the position indicated by pricking through the paper, the leather behind preventing the point of the needle being turned. When a load was laid on the platform above, the position of the pointers was again pricked through the paper, and the difference between the two marks showed the amount of deformity produced. The results obtained were then transferred to a diagram of the same section as the pipe itself.

By comparison of the diagrams obtained, it was found that, with a load of twenty tuns pressing on the pipes for 130 hours the 3·28 feet pipe had given way vertically to the extent of 2·85 per cent, and the smaller pipe of 4 30 per cent. The conclusion was that a pipe 3·28 feet in diameter and 0 197 inches thick offered greater resistance than a pipe 27·55 inches in diameter and 0·157 inch in thickness, which had already proved itself satisfactory in practice. It was found by further experiments that, when a pipe had once been deformed by a heavy load, it only recovered itself to the extent of a fraction of an inch when the load was removed. After these experiments a main 3 28 feet in diameter was laid from the gas works at St. Maude to the Place du Trône, and as the joints were made they were tried with compressed air under a pressure of 2·755 inches of the mercury manometer, the pipes themselves having been previously tested under a pressure of 75 pounds to the square inch. These trials revealed a few defects which were easily repaired. Since that time the main in question has been in use constantly, without exhibiting anything contrary to the results of the several experiments which we have above recounted.—*The Engineer.*