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THE CRAMP SHIP YARDS.

The Wm. Cramp & Sons Ship and Engine Building Company's yards and docks have been selected as the subject of the present article, owing to the great number of government and private contracts that are at the present time in course of execution.

The plant is the largest of its kind in the country, and the ingenuity of its general management and the efficiency of its machinery make it in many respects the model ship yard of America.

It has been brought before the public, especially of late, by its good work in building very large and very fast vessels for our navy and our merchant marine service. And there is reason for national pride in this striking proof that vessels of the first class may be constructed by American ingenuity in designing, by the skill of American workmen, and the use in every instance of American materials.

The history of this great industry may be considered to date from the days when William Penn was the patron of ship building on the Delaware. In the early colonial period it was found that timber suitable for ship building grew in great abundance in the vicinity of Philadelphia. And as a result of Penn's patronage and this important natural advantage, the industry was rapidly developed. These conditions prepared the way and made possible the great industry of the present day. The present firm was established by William Cramp in 1830. From that time to the present day the history of the company records a steady and uninterrupted growth. Times have changed meanwhile and a complete revolution has occurred in the methods of ship building; but throughout, the Cramps have kept abreast with the times.

Since the establishment of the works, the Cramps have built in all some 282 vessels. Of these, 21 have been United States steam men-of-war, 4 were steam cruisers for the Russian navy, 73 were ocean steamers of from 1,000 to 10,700 tons register, 54 were tugboats, besides other craft of a variety of designs. The ship yard at present covers 31 acres of ground. It is so equipped that five vessels of the largest kind may be constructed at the same time, and preparations are being made to increase the capacity to eight. In the past twenty years the company has increased their capital from $500,000 to $5,000,000. There are at present employed at the yard over 5,600 hands, and this does not include an enormous amount of labor employed by contributory industries upon which the ship yard depends for material in various stages of their work. The pay roll amounts to $54,000 per week.

The general arrangement of the ship yard may be readily understood by a glance at the bird's eye view we present in this issue. The docks, it will be seen, are naturally arranged along the river front, and directly in the rear of these are the various buildings and the stationary machinery. The buildings are built in the majority of cases of brick, or of steel frames covered with corrugated iron plates. The work of the yard is of necessity very carefully systematized, and a definite part is assigned to each building or section of the yard. If we take up the buildings and examine their equipments in the order in which they are used in the construction of a great vessel, it will be possible to obtain a clear idea of the entire plant. The work of building a vessel may, therefore, be said to commence in the building containing the administrative offices of the company, and the drafting department, a high building near the center of the engraving.

Standing between this and the docks is an immense structure, 1,164 feet long, with an average of 72 feet in width, and built partly three and partly four stories high. This building is provided with two mould lofts, each 240 feet by 50 feet. The floors are as smooth and clean as those of a dancing hall, and these are used for plotting the curves of the hull and the various cross sections from the drawings. Below these lofts are the regular joining and pattern shops, where the next part of the work is performed. The building also includes the shrive board and bending shop, where the iron and steel bars are shaped to form the ribs and framework of the vessels. The building furthermore includes a rolling shop, fitted with powerful machinery for rolling plates and bars of iron to the desired dimensions. Under this roof is a large machine and erecting shop, where the iron frames of vessels are assembled preliminary to constructing the frame of the hull on the stays. These shops include a number of furnaces and forges for heating the metal.

The framework or ribs of the vessel are next carried to the great docks to be placed in position. There are at present five of these docks, having each a length of 600 feet and a width of 70 feet, and capable of holding the largest vessels. When the frames are

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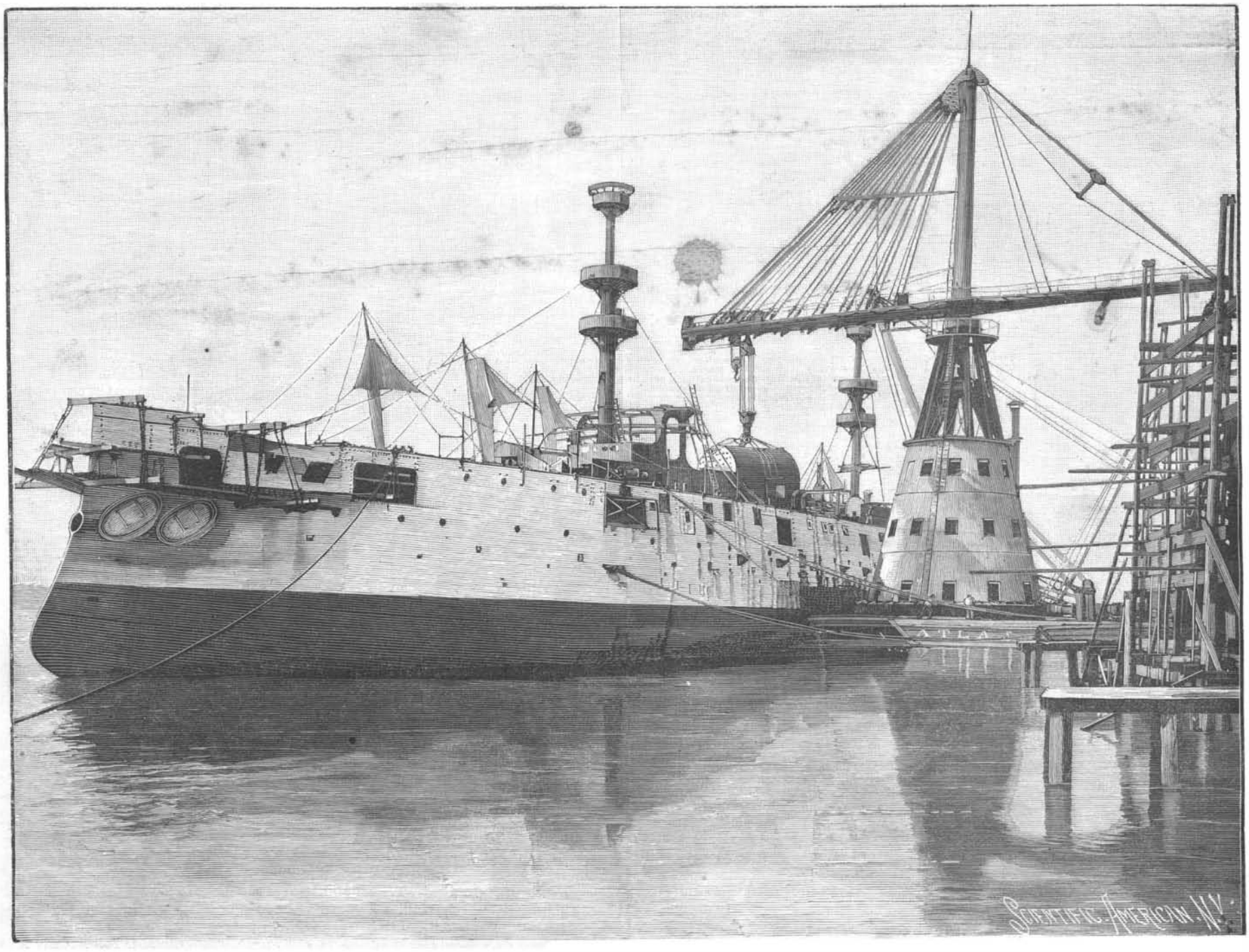

STEAM CRANE ATLAS PLACING A 70-TON BOILER IN THE HOLD OF A UNITED STATES CRUISER.

THE CRAMP SHIP YARDS.

(Continued from first page.)

"spaced" along the keel, they are held in position by a very complicated system of false work or scaffolding. To facilitate this work, a great number of railroad tracks have been arranged, so that the heavy pieces may be readily carried to any part of the yard. The Cramps own three small steam engines, and these are used especially for this purpose. In connection with this work an ingenious combination of the locomotive and the derrick is frequently used. The machine is operated by one man, and runs backward on the tracks, lowers and hoists, and turns laterally upon its tracks. The yard is also supplied with many forms of derricks, which are set up in convenient positions to be used in placing the heavy parts in position. A number of small forges may also be moved about to various parts of the ship to heat the bolts for riveting.

The lighter parts of this material are forged in the yard. The iron foundry for carrying out this work is the most extensive one in America, being 415 feet long by 264 feet wide. This is well equipped with much valuable machinery. The heavier parts of vessels, such as the steel armor plates, are made by special contract outside of the yard. The material used in constructing the vessels is stored in a special section reserved for it, comprising 10½ acres of space. This is provided with stationary and traveling locomotives and derricks for handling the heavy pieces. A special feature is an immense traveling crane moving over an area 350 feet long and 50 feet wide, and operated by a steam engine.

After the plates have been united to the steel frame of the hull, the work of putting in the boilers and other machinery is carried out. The boiler shop, which now comes in use, is the largest shop of its kind in America, and one of the largest and best equipped in the world. It is 387 feet long and 112 feet in width. An interesting feature of this shop are the two huge traveling cranes. These are run by electricity and move swiftly from one end to the other of the immense shop, often lifting and carrying boilers weighing 70 or 90 tons. The power house, which supplies the energy to operate these acres of machinery, is also one of the best equipped plants of its kind. It includes extensive hydraulic, pneumatic and electric plants, whose power is distributed through the ship yard by means of pipes or wires, as the case may be, and applied to the operation of portable drills, riveters, lighting, ventilation, blowing furnace fires, bending and shaping machines, moving derricks and various other uses.

The manufacture of various materials used in the ship yard includes an extensive brass foundry, fully equipped to produce every variety of brass, bronze, manganese bronze and white metal castings. There are extensive facilities for making castings and the complement of cranes and traveling machinery. Adjoining the brass foundry is an ordnance plant fully equipped for the manufacturing of breech-loading rapid-fire cannon up to and including 4 inch caliber, and for making projectiles of every variety required for them.

In connection with the yard is a large dry dock, 462 feet long by 70 feet wide, with a draught of 22 feet on the sill at mean high water. This is shown at the upper left-hand corner. The water front of this dry dock is 234 feet. Connected with this is a marine railway capable of hauling out vessels of 1,000 tons register. In addition to these facilities the Cramp Company is permitted to use the United States dry dock, at the League Island Navy Yard, for docking and repairing vessels too large for their own docks

To perform the work of handling heavy materials such as boilers, cannon, etc., a monster floating derrick has been constructed which is capable of lifting a weight of 125 tons. The Atlas as it is called is said to be the most powerful derrick in the world. It rests on a floating base and rises to a height of 110 feet. It affords a perpendicular lift of 60 feet, the overhang of boom being 35 feet. The first page illustration will give a good idea of the manner in which the derrick is used. The steamer lying beside the derrick is the well known man-of-war New York. The photograph was taken while the Atlas was in the act of lowering one of the 70 ton boilers to the hold. The work of raising the boiler, carrying it a distance of 80 feet and lowering it into position was accomplished in the remarkably short time of twenty-six minutes.

EQUATORIAL STAND FOR SMALL TELESCOPES.

BY GEO. M. HOPKINS.

One hour's use of an equatorially mounted telescope will convince the amateur telescopist who has been used to the altazimuth stand that the advantages possessed by the equatorial are very great. The ease with which an object may be followed, and the facility with which a star can be found, when the mounting is provided with graduated circles, which may even be crude, warrant the outlay if the stand be purchased, or the labor and expense, if the amateur should choose to make the stand with his own hands.

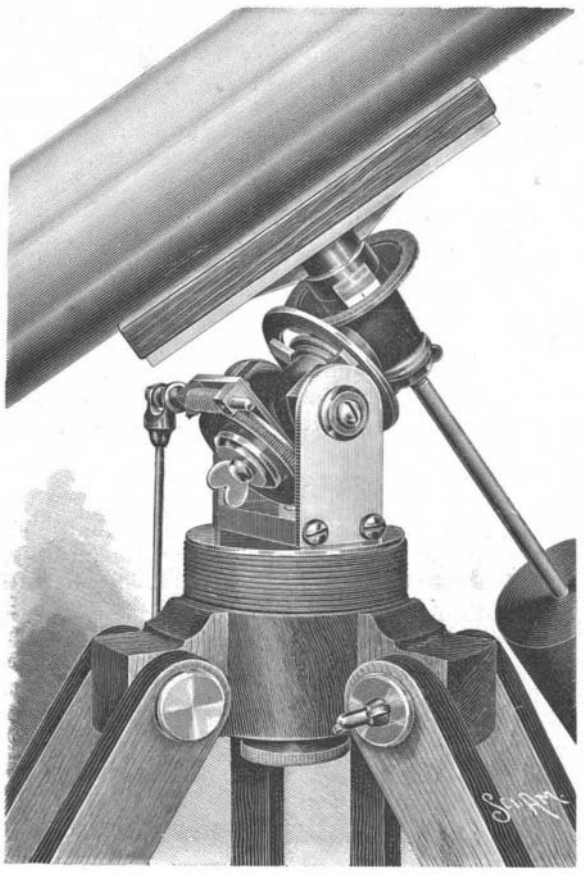

Fig. 1.—EQUATORIAL STAND FOR A SMALL TELESCOPE.

The writer, adopting the latter plan, constructed a very satisfactory equatorial stand using stopcocks for the two axes, as shown in perspective in Fig. 1 and in detail in Figs. 2 and 3, and although the construction may be readily understood by reference to the illustrations, a few words of explanation may be of service.

The telescope for which the stand was made has a three inch objective with focal length of 40 inches. The tube, which is of brass, is re-enforced by an internal plate, held in place by screws, and this plate receives the screws by which the attachment to the stand is made.

On the top of the wooden part of the stand rests a brass disk, which, together with the brass block, A, forms the base of the telescope support. To the ends of the block, A, are secured upright end plates, B, which are perforated near their upper ends.

Between the plates, B, is placed a three-fourths gas service cock, C, the ends of which are plugged, and the square ends of the plugs are turned, forming trunnions, which enter the perforations of the plates, B, but do not pass quite through. The trunnions are tapped to receive screws, on which are placed washers, which bear against the plates, B, and clamp them against the ends of the stopcock, which is faced off so that it is of exactly the same length as the block, A. The trunnions form the axis on which the telescope is tilted to adjust it for latitude, and one of the angles of the hexagon end of the stopcock is filed off even with the rounded upper end of the adjoining plate, B, and a line is drawn across the plate and stopcock when the polar axis of the telescope is parallel with the earth's axis, so that readjustment may be made without trouble.

The plug, D, of the stopcock, C, has a projecting end, having one flat side, to which is fitted the usual washer, a. This washer is turned down to receive the disk, b, which is soldered to the washer. The disk, b, is faced with wash leather. The end of the plug, D, which is threaded to receive the nut, when the stopcock is applied to its intended use, is covered with a piece of tubing soldered to the screw, and turned off to receive the worm wheel, E, which turns freely thereon.

To the end of the plug, D, is fitted a cap, F, which is held in place, and made to exert more or less pressure on the worm wheel, E, by the thumbscrew, c, which enters the end of the plug and bears on the cap. The cap, F, is perforated to receive two studs projecting from the end of the plug.

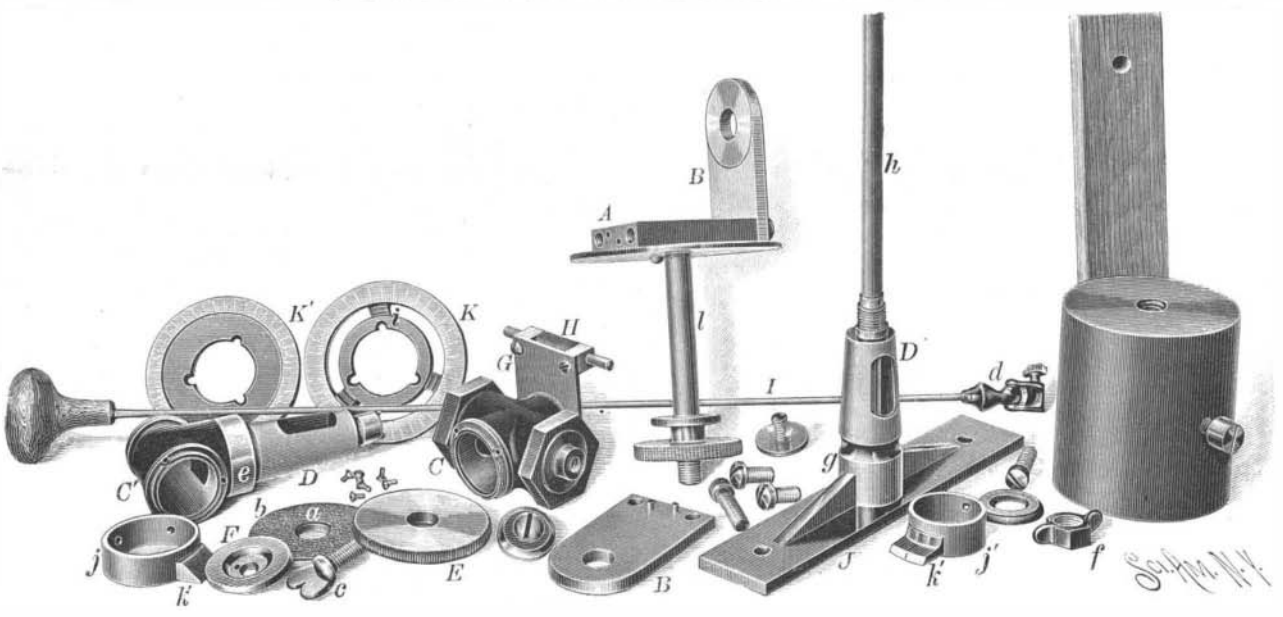

Fig. 2.—PARTS OF SIMPLE EQUATORIAL STAND.

On the smaller end of the stopcock casing is soldered a perforated plate, G, which supports the bearings for the worm, H. This worm engages the worm wheel, E, and its axis is prolonged beyond the bearings, to receive the universal joint, d, of the rod, I, this rod being of sufficient length to be easily grasped by the observer. The squared end of the plug, D, which is intended for receiving the key by which the plug is turned, is in this case turned and threaded to fit the bushing, e, inserted in one end of the stopcock, C'. The other end of this stopcock is cut off, and the opening thus left is closed by means of solder. The plug, D', of this stopcock is unchanged so far as the threaded smaller end and washer and nut are concerned, but the nut, f, is slotted in diametrically opposite corners to receive wings which are soldered therein. The square end of the plug, D', is turned and threaded to receive the boss, g, of the cross arm, J, attached to the telescope. The cross arm shown is built up of pieces of brass fastened together with screws and soldered. A casting would doubtless be simpler. The plug, D', is drilled axially to receive the counterbalance rod, h, which is screwed into the plug, as indicated in the sectional view.

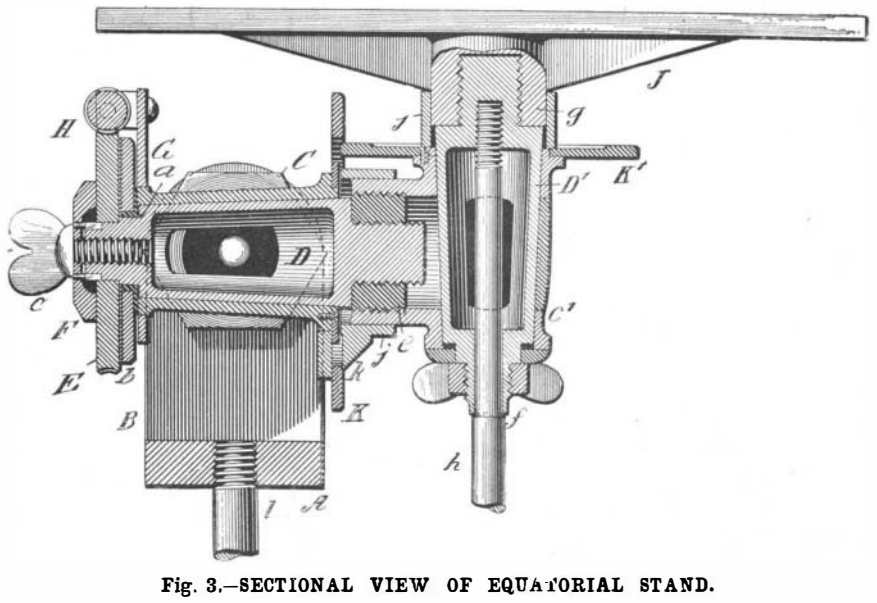

Fig. 3.—SECTIONAL VIEW OF EQUATORIAL STAND.

The larger ends of the stopcock casings are rebated to receive the graduated circles, K, K', secured in place by small screws.

Owing to the close connection of the parts, the circle, K, has an annular slot which cuts it into two concentric pieces, held in proper relation to each other by arms, i, soldered to the back of the circle.

This arrangement allows the circle, K', to swing freely.

The hexagon end of the stopcock, C', which receives the bushing, e, is turned to receive the ring, j, carrying