bore a small hole in the top of the lathe rest, into which a small pin may be placed to act as a fulcrum, against which the back of the chaser can be pressed to force the teeth into the cut. Inside or female threads are started by pressing the chaser teeth lightly against the bore of the work, and moving it forward at the same time, the thread being started (if a right hand one) at the outer end of the bore, which is rounded slightly off so that the chaser shall not catch. Much experience is required to enable the operator to judge the exact speed of chaser movement required for any particular pitch of thread.

Beginners should always stop the lathe and examine an inside thread as soon as it is struck, for it is an easy matter to cut a double female thread in consequence of moving the chaser too fast, nor will the error be discovered until the thread is finished and the male thread applied, which will not, in that case, enter.

Double threads are those in which the distance from one thread to another is one half only of the actual pitch of the thread. Their nature may be more clearly understood by supposing a thread of five to the inch to be started by a tool in a screw-cutting lathe, and then supposing the tool point to be moved laterally so as to cut another groove, to the same depth, in the center of the spaces between the thread first cut. If a chaser having ten teeth to the inch be then employed to finish the thread, we shall have a double thread possessing all the elements of distance from one thread to another, depth, angle, and strength of a thread of ten to the inch, although the pitch will actually be that of five to the inch.

Double male threads, to be cut by hand, can be most easily started by the chaser, moving it twice as fast as would be required for a single thread, rounding off the corner of the *bolt end and taking care to cut principally with the hindermost* teeth.

Taps and all other work requiring great accuracy in the depth and angle of the thread should be finished by a chaser, the work (if of wrought iron or steel) being freely supplied with oil until the finishing cuts are taken, when soapy water should be substituted, which will cause the chaser to cut clean and smooth, and give neatness and finish to the threads of the tap. *Engineering.*

IMPROVED BRIDGE CONSTRUCTION.

The engravings on pages 245 and 248, illustrate improvements in the construction of bridges of long spans, on the cantilever and suspension principle combined. We are indebted for the engravings and for the following description to the *Scientific American*. The whole bridge from A, to B, Fig. 1, is composed of the middle truss C, D, of 316 feet and of the two end or side trusses A, C, and B, D, each 296 feet long, in all 908 feet. The arches under and sustaining the side trusses constitute the bottom or compression chords. The clear span between feet of arches is 680 feet. The curved line A, B, C, D, is a chain which is under constant tension and which extends to an anchorage at each end, at E. The arches are hinged at E, and F, and the ends of the bridge sit on curved beds of rollers at G. The chords F, D, are cut at the intersections C, and D, and joints are there placed, also to serve as hinges. Within these four hinges the structure is free to move according to thermal demands, and hence to retain its rigidity. Fig 2, page 248, shows how this system repeats in spans when one is not enough to cross over the river. S, T, shows the grade line, P and Q, anchorage of the curved tension members in their opposite arches, and R, a pier on which the spans compound one-half their respective weights. The inventor calculates that the greatest strain that comes on this bridge of 680 feet span is less than that of a truss of 450 feet span of like requirements. High ratio of cost in long spans is avoided, in the system here advocated, by the crossing of the chords at C and E, cutting one truss, as it were, into loops of three, reducing the depth of trussing and *giving support to all by keystoning from underneath by tension* in place of above or overhead by compression. The dotted line I, I, Fig. 1, shows how a second grade line may be suspended from the trussing above, and through that below, the straight chords.

The arches are made ribbed to provide stiffness under passing trains, but the amount of material is but little increased thereby.

SHEPHERD'S SECTIONAL BOILER.

We give on page 249 illustrations from *Engineering* of a sectional boiler exhibited at the recent Manchester Mechanical and Industrial Exhibition.

As will be seen from the engravings, the boiler consists of a number of sections, each of which is cylindrical at the upper part of its length, where it is 24 in. in diameter, while below this is a tapered portion, as shown. Each section is 6 ft. 4 in. high over all, and the particular boiler we are describing is made up of fifteen such sections, each of which may be regarded as a complete boiler of about 3-horse power. The vertical seams of the sections are all welded, while the circumferential rivetted seams have drilled rivet holes, and the plate edges are turned for caulking. The top hand-hole block and cover are of malleable iron, and the workmanship is throughout of the best kind.

At their lower ends the sections are connected, as shown, to *cast-iron pipes through which the feed enters, and which* are in communication with the blow-off cock. At the upper ends the sections are similarly connected to the steam-collecting pipe; these pipes being fitted with the safety and stop valves, as shown. We may add that each of the cast-iron pipes is tested separately to 600 lb per square inch, and the wrought-iron sections to 300 lb. per square inch. It should also be noted that there are no stayed surfaces, the form of the sections rendering stays of any kind unnecessary.

The setting of the boiler is, as will be seen, of a very simple character, and is such as can readily be constructed by an ordinary bricklayer, while it does not involve any excavations. Thus the sections are simply arranged side by side in a brick chamber, having the firegrate at one end, and an opening to the chimney face at the other, the bottom of this chamber being formed by cast-iron floor-plates, which shut off the feed pipes and joints at the lower ends of the sections from contact with the hot gases. A chamber is thus formed below the cast-iron plates just mentioned, to which access can readily be had for an examination of the pipes and joints when necessary.

It follows from the mode of setting that the current of hot gases flows approximately at right angles to the heating surface exposed by the sections, while this heating surface is all vertical or so steeply inclined, that no deposit is likely to rest upon it. The arrangement of the boiler in fact gives every facility for the deposition of sediment where it can do no harm, namely, in the lower range of pipes which are not subjected to the action of the hot gases.

As regards the performance of the boiler we are describing, we may state that a long series of evaporative tests have been carried out by the makers, these trials extending over six months, the public being daily invited to witness them The trials were made with a boiler consisting of 2[illegible] sections, this boiler evaporating from a temperature of 57 deg. from 60 to 65 cubic feet of water per hour. The boiler was worked at pressures varying from 70 lb. to 120 lb. per square inch, and the water evaporated was carefully recorded by a register fitted on the water tank. The coal consumption varied according to the quality used, the evaporation varying from 7 lb. to 9½ lb. of water per pound of coal.

The various parts of the boiler are interchangeable, and this, combined with the very moderate weight of the sections, renders the boiler easily transported, and gives every facility for building up a boiler of any desired size. The interchangeability of the sections also facilitates repairs and renewals, it being possible to remove a section and replace it in two hours if necessary, or the remaining part of the boiler can be disconnected and continue working. Besides being fired in the ordinary way, these boilers are also being employed to utilise the whole heat from furnaces and annealing ovens, and for chemical and other purposes, and altogether form a very good type of sectional boiler.

An alloy found useful in filling defects in castings, consists of lead 9 antimony 2, and bismuth 1.

Frosted glass, useful for screens, &c., is made by laying the sheets horizontally and covering them with a strong solution of sulphate of zinc. The salt crystallises on drying.