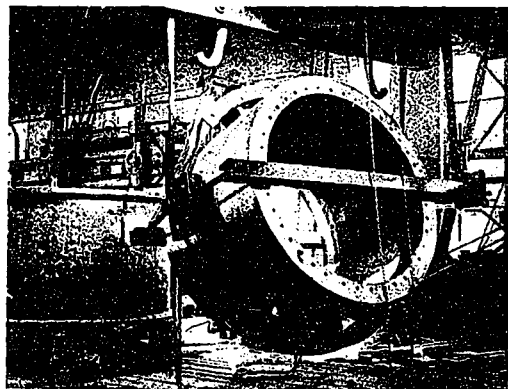


is considered that the length of a full size tension specimen in the test was over 300 in. it will readily be seen that accurate and interesting information should be obtained. The normal press and ram sections were ordinarily set up in pairs and connected by a test-head ring bolted up with temporary gaskets at each end. The hydraulic pressure was applied, as may be seen from the accompanying photograph, by a steam pump, located conveniently near. The pressures were recorded by at least three hydrostatic gauges of standard make, and accurate notes were made of the rate of loading, pressures, extensions, and all other information that might affect the results. The extensions of the steel castings were measured circumferentially by five steel tapes spaced equally up and down the casting. The tapes were accurately



DEVICE FOR TURNING PRESS AND RAM SECTIONS.

located and held to a constant tension by steel springs. The extensions were measured by a Vernier, graduated near one end of the tape, and matching a corresponding scale graduated at the crossing point near the other, so that readings could easily be made to the 1/100 part of an inch. The readings in all cases showed the greatest extension circumferentially on the middle tape, the extension decreasing gradually towards the flanges, where it was practically zero. The tape measurement also clearly showed which end of the casting had been uppermost in the mold when it was poured, the lower, and consequently the denser end, invariably showing the least stretch. The accompanying table gives the average of the results obtained in twenty-four tests. Probably the most remarkable result obtained in the whole of the forty-four tests was that on casting No. SB1, where the gauge pressure was run up to 2,200 lbs. per square inch. This pressure caused, in the walls of the casting, an average stress of 29,100 lbs. per square inch, and the middle tape showed an extension of 1 1/2 in. The permanent set resulting from this pressure was 1-3/16 in. circumferentially.

In order to study the effect of annealing steel castings the founders, The Penn Steel Casting and Machine Co., of Chester, Penn., offered to anneal a casting in order that we might subject it to a similar test. The test was applied with eminently satisfactory results. The extensions increased directly as the load. At 2,000 lbs. per square inch the elastic extension was only 1/2 in., and the permanent set was found to be practically zero. This proved conclusively that the annealing of the steel castings relieved the initial strains in the walls entirely, and left the metal in its theoretical condition.

The results obtained on the cast iron ram sections are no less interesting. They showed that in castings of this size the absence of a limit of elasticity in compression for cast iron cannot be ignored. In every instance, in the first twenty-four tests, a permanent set was obtained, and this permanent set was almost in pro-

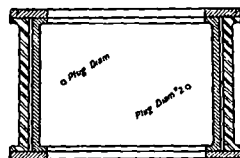
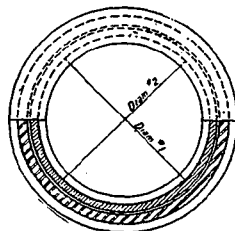
portion to the applied load. The deformations of the cast iron sections were measured on diameters by means of ordinary high-grade inside micrometers reading to 1-1000 in.

The temporary gaskets used during the tests were generally of leather, which appeared to adapt itself readily to the variations of the specimen during the test. In order to prove the tightness of the permanent gaskets, certain of the sections were set up two storeys high, the middle joint being made in exactly the same manner as the final joint in the field. This gasket proved itself absolutely tight at double the working pressure.

It was anticipated that considerable difficulty would be experienced by the porosity of the steel and iron castings. The tests showed the steel castings to be absolutely tight, while in a few cases the iron castings showed slight traces of oozing at the higher pressures. In these instances the tests were discontinued, and the sections allowed to stand two or three days under the pressure of com-

SUMMARY OF TESTS OF FULL-SIZED RAM SECTIONS

SECTION	DECREASE IN DIAM. No. 1 Inches	DECREASE IN DIAM. No. 2 Inches	MEAN DECREASE IN TWO DIAMS. Inches	REMARKS
W 1	.1330	.1040	.1255	Average decrease diametrically, .1176.
W 2	.1017	.0973	.0995	
W 3	.1096	.1421	.1258	Greatest decrease, one diam., Sect. W 10, .1656.
W 4	.1258	.387	.1223	
W 5	.1467	.151	.1460	Least decrease one diam., Sect. W 12, .0667.
W 6	.1370	.1368	.1369	
W 7	.1400	.3974	.1202	Greatest decrease, mean two diams., Sect. W 5, .1460.
W 8	.1983	.0930	.1456	
W 9	.0879	.1160	.1019	Least decrease, mean two diams., Sect. E 11, .0937.
W 10	.1246	.1674	.1450	
W 11	.1192	.1318	.1270	Greatest divergence from avr., one diam., Sect. W 12, .0509.
W 12	.1162	.0667	.0905	
E 1	.1070	.1340	.1203	Least divergence from avr., one diam., Sect. E 1 and E 6, .0011.
E 2	.1120	.1265	.1194	
E 3	.1356	.1222	.1289	Greatest divergence from avr., two diams., Sect. W 5, .0284.
E 4	.1190	.1187	.1189	
E 5	.1185	.0977	.1056	Least divergence from avr., two diams., Sect. E 12, .0099.
E 6	.1165	.1004	.1084	
E 7	.1050	.0991	.1023	
E 8	.0910	.1138	.1024	
E 9	.0995	.1105	.1050	
E 10	.1147	.0910	.1043	
E 11	.1112	.0762	.0937	
E 12	.1145	.1125	.1185	



SKETCH SHOWING WHERE DIAMETERS WERE TAKEN

pressed air at about 40 lbs. gauge pressure, when the tests were again resumed. In every case it was found that the intervening time had given the iron castings ample opportunity to tighten themselves. The tightening was probably due to the formation of oxide in the pores of the casting, which effectively closed these minute passages against the entrance of water.

The conclusions drawn from the whole series of tests on the presses were: 1st, it is possible to obtain steel castings in this form absolutely impervious to water up to 2,200 lbs. gauge pressure; 2nd, it is possible to get castings in which no flaws exist; 3rd, that a slight permanent set occurs at about 300 lbs. gauge pressure, although part of this may be due to self-adjusting of the tapes; 4th, that this permanent set is not increased appreciably by pressures up to 1,200 lbs. gauge pressure, or by repeated applications of the same. The foregoing conclusions apply to unannealed castings. The annealed castings possess all the virtues above referred to, with