

Confidence and respect, and the fruits of faithful service, came to him by natural law. He attracted the good opinion and esteem of those around him. He gained the applause to which the Roman orator assigns peculiar weight—"the praise of those who deserve praise;" and his declining days were spent in honourable ease, to which literary labour lent a zest, and foreign travel, and converse with men and books.

ROMAN WHEEL FROM THARSIS, IN SPAIN.

A PORTION of a Roman water wheel of wood was lately sent to me from the mines of Tharsis, in Southern Spain, in the ancient workings of which it was found. At the suggestion of Dr. Bruce, and with his kind assistance, I have set it up here for the inspection of the members of this Society, some of whom may, perhaps, be able to throw some light on the mode in which the motive power was supplied to these wheels. At present this seems to be unknown. They are not water wheels in the usual sense of the term. They are curious, as having been used as lifting pumps to draw the mine. During a yachting cruise last summer, I visited the mine, and with your permission I shall shortly lay before you the information I gathered on the spot regarding these wheels, several of which have been found *in situ* on the north side of the mine.

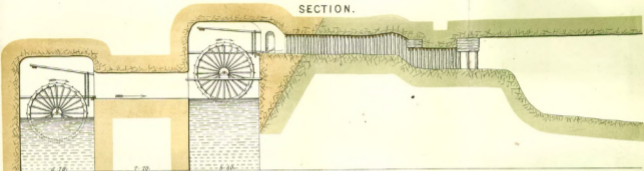
Where the outspurs of the range of hills called the Sierra Morena die away towards the sea, to the north of the Bay of Cadiz, there have been found some of the richest mineral deposits in Spain. In this district, iron, copper, lead, zinc, arsenic, antimony, bismuth, nickel, silver, and gold, have been found in quantities very much in the order in which I have given them. That this district is the Tarshish of ancient history there can be little or no doubt. The mine from which that wheel was taken is still called Tharsis; and in the same province of Huelva, a high hill near Rio Tinto still bears the name of Solomon, and close by a little village is named Zalomea. The mine of Tharsis is situated about thirty miles from the town of Huelva, which lies not far from the junction of the rivers Odiel and Tinto, and close by is the little town of Palos, and the convent of La Rabbida, from which Columbus sailed with his three small vessels to discover the new world. The galleries by means of which the Tharsis mine, in ancient times, was worked, are of two kinds, square and round. The square galleries are believed to be Phœnician, and the round Roman. I regret that I have

not succeeded in obtaining for your inspection any of the Roman coins found in the round galleries. Some of these, however, were of the date of Nero. Some of the wheels found are marked with Roman letters; one was marked T R S S E, but what these letters mean I cannot say. On the wheel before us I have only found two x's, which may have stood for 20. Until about 17 or 18 years ago the Tharsis mine seems to have remained for centuries unworked. In the old excavation, a lake of sulphurous water had formed, to which, from great distances, people afflicted with skin diseases came to bathe. A great demand having arisen for sulphur for the manufacture of sulphuric acid, attention was called to the forgotten mine. The healing waters of the lake were all pumped away, and a great mass or lode of mineral exposed, as stone is in an open quarry, to the extent of about a thousand yards in length. About six millions of tons of the mineral have been explored, but still the depth of the lode is unknown. As the depth increases the mass widens, and the richness of the mineral for copper appears to become greater, and it was from depths greater than the present workings that the ancients drew the ore they smelted on the surface. And it is most interesting to find that in the great heaps of ancient slags on the surface, there is hardly a trace of copper to be found, showing that the knowledge then possessed of the process of smelting must have been more perfect than any now known. It was in one of the deeper Roman galleries that the wheel before you was found. The preservation of the wood is no doubt due to its saturation with cupreous water. The saw and other tool marks are still quite visible. I submit a plan of some of the first found wheels, which will show the position in which they were placed. All the wheels found are of the same diameter, about fifteen feet, and they have always been found in double pairs, as shown in the plan. That is, two working side by side in one excavation, and to them the water was lifted by another pair close by. As I have said, the manner in which the motive power was applied is unknown. Some remains of little tags of rope have been found hanging to the outer edges of the wheels, and these seem to indicate that they were turned by manual power, by means of these tags of rope. That they were turned by slaves I think there can be no doubt, for I cannot believe that any freeman would have consented willingly to work in the miserable galleries in which the water wheels have been found. If the wheel before us dates from the age of Nero, as it probably does, it must be 1800 years old. Longfellow, speaking of the sculptured figures of the Middle Ages, says—

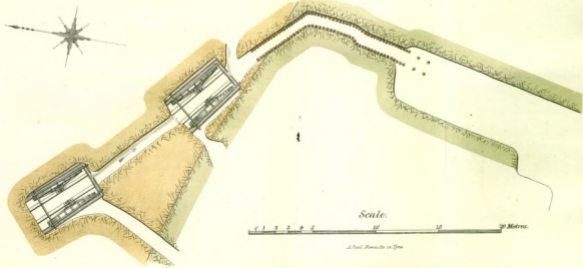
“And above cathedral doorways saints and angels carved in stone,
By a former age commissioned as apostles to our own.”

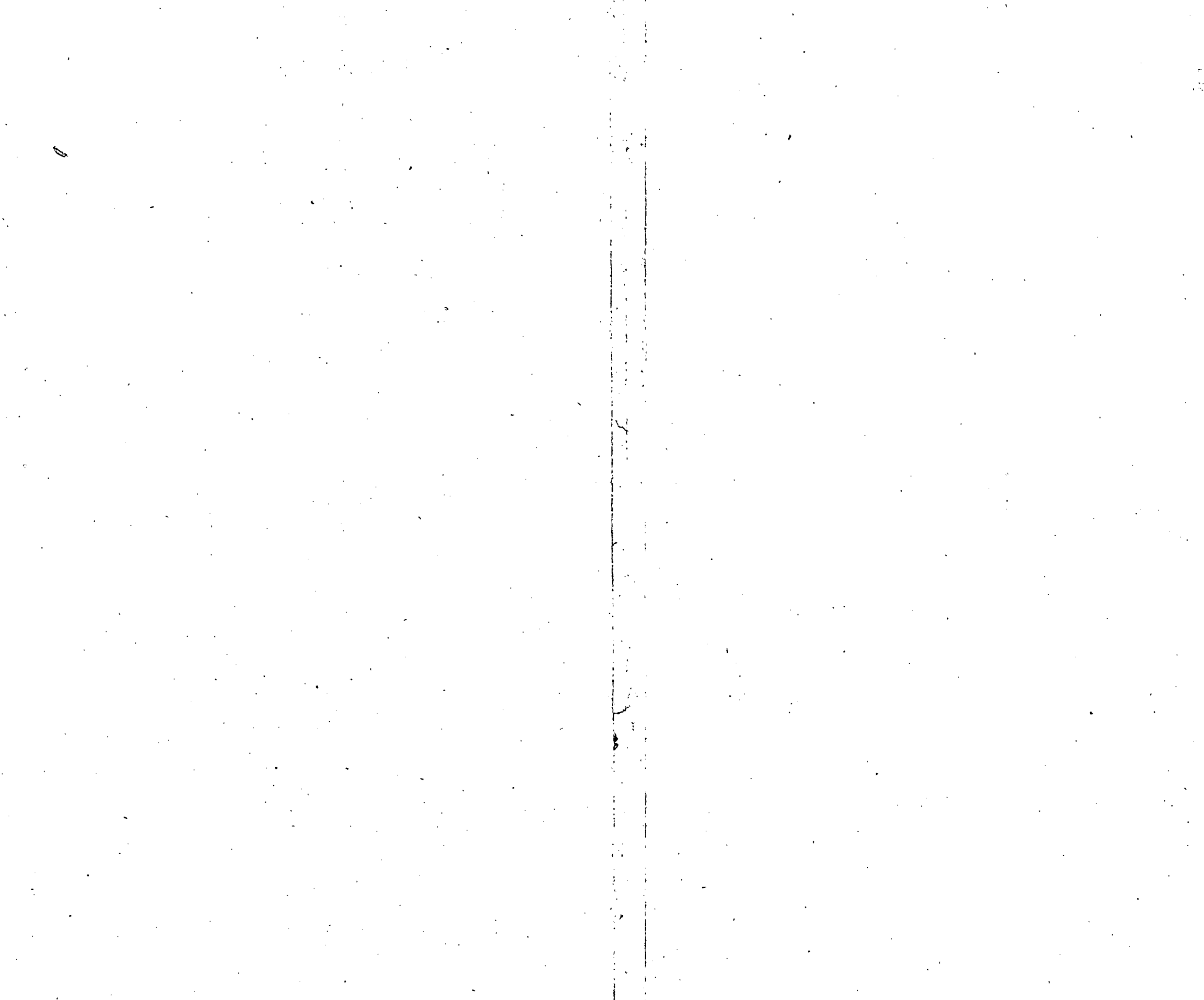
PLAN AND SECTIONS OF OLD ROMAN WATER WHEELS ON NORTH WALL OF LODE AT THE THARSIS MINES, 1867.

SECTION.

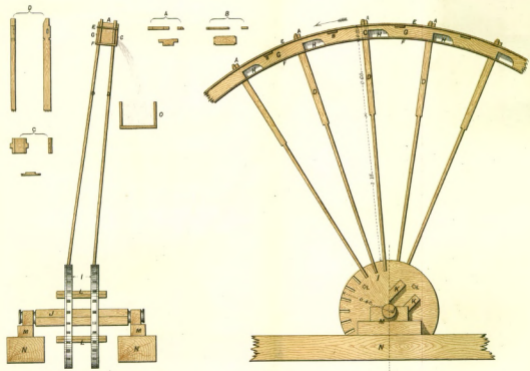


PLAN.



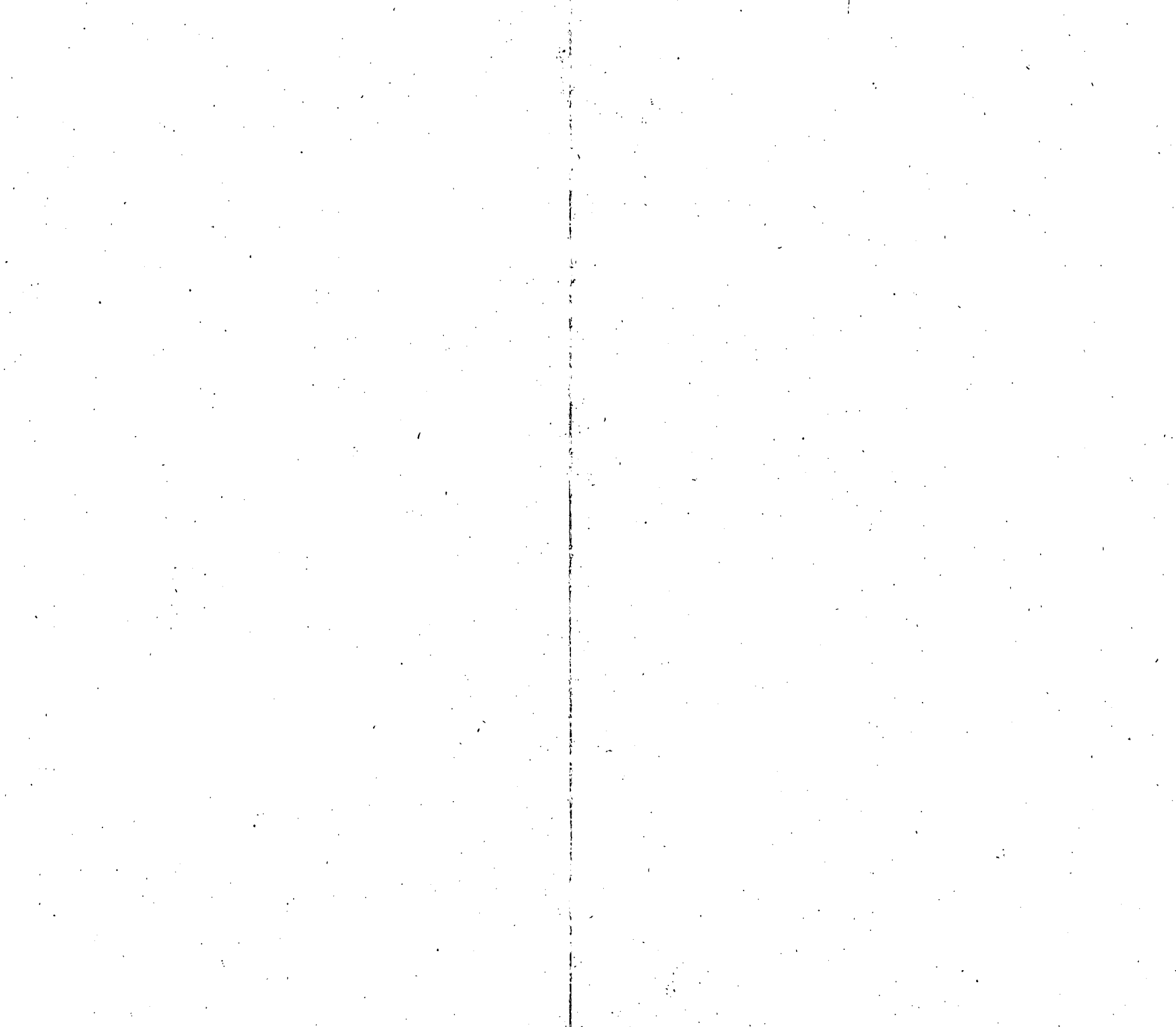


PLAN AND SECTIONS OF OLD ROMAN WATER WHEELS ON NORTH WALL OF LODE AT THE THARSIS MINES, 1867.



Scale. 1 SP. 2 Metres

A. Reil, *Monatshefte* vi. 57.



Is not that wheel, dug up after eighteen centuries, an apostle as well? —an *apostolus*, or messenger, sent down through all the ages since Nero's time to tell us how Rome, in pursuit of that wealth which, as the result of her enterprise, made her grandeur, overcame all difficulties of navigation and of transit, and how, like the burghers of Nuremberg, her citizens could boast "That their great Imperial city stretched its hand through every clime!"

ALEXANDER S. STEVENSON, F.S.A. Scot.

Description of the various parts of Old Roman Water Wheel found in the workings of the Tharsis Mines, and now placed in the Museum of the Castle.

- A Is fixed on to outside of lining of rim of wheel and to each set of arms, which projects a little beyond the lining. It is supposed to be that part of the wheel to which the workman either applied his strength or weight to cause it to revolve; the latter of these methods is probably the correct one, as the rope suspended from the wooden balk above would lead to the conclusion, that it was employed for the man to sling himself up to, and in this position by alternately using his feet as is done on a treadmill.
- B Is dovetailed to the sides of the rim, in the inside of the outside lining, and in the centre of the space between each set of arms; its use is for strengthening and joining the outside rim and holding the sides of the rim together.
- C Is the division piece which divides the rim between each set of arms into buckets; it is morticed through the arms, also checked to them.
- D Arms of wheel.
- E Outside lining of rim, $\frac{1}{2}$ inch thick \times $6\frac{1}{2}$ inches broad.
- F Inside lining of rim, $\frac{1}{4}$ " \times $6\frac{1}{2}$ "
- G Sides of rim $\frac{1}{2}$ " \times $4\frac{1}{4}$ "
- H Porthole for the ingress and egress of the water.
 - I Centre flange of wheel with sockets formed for the reception of arms, and square hole in centre for axle.
 - J Square axle, with round journals.
 - K Pieces to deepen and strengthen up the eye in centre flanges for axle.
 - L Four square pieces to stiffen up the centre flanges, &c.
- M Journal blocks and seats for axle to revolve in.
- N Beam on which journal blocks are secured and on which the whole wheel is carried.
- O Trough shoot for receiving and conveying away the water raised by the wheel.