Correspondence.

A Watch Puzzle.

To the Editor of the Scientific American:

An extensively advertised watch puzzle is being used to furnish publicity for a popular watch. The face of a watch is shown with the hour, minute, and second hands all on the same dial and so placed that the angle between any two of the hands is 120 deg. The question propounded is: "How soon will the hour, minute, and second hands again appear at equal distances apart? It looks easy. Can you do it?" It is not stated that the watch is of the split-second variety, hence the supposition that the second hand is directly connected to the train of gearing moving the other hands, and if this is the case the position of the hands shown is one in which it would be impossible for them to place themselves, unless the driving mechanism was somewhat irregular. If the watch is a split-second stop watch it can be so manipulated that at intervals of 21 9/11 minutes the three hands will either be at angles of 120 deg. or immediately superimposed.

In the illustration the position of the hand can be best defined by using the 60 one-minute spaces on the face of the watch as units. The hour hand has covered 14 6/11 spaces, the minute hand has covered 54 6/11 spaces and the second hand as shown has covered 34 6/11 spaces and is 1 9/11 spaces in advance of its proper position, if its movement occurs in the proper ratio with the movements of the hour and minute hands, its proper position being at 32 8/11 spaces if the movements of the hands occur in their normal ratio. If the second hand can be manipulated it would be possible to have the three hands an equal distance apart again after an interval of 43 7/11 minutes had elapsed, and their respective positions would then be as follows: The hour hand at 18 2/11 spaces, the minute hand at 38 2/11 spaces, and the second hand at 58 2/11 spaces; while if the second hand moved at its normal ratio with the other hands its position would be at 10 10/11 spaces.

Problems of this character which involve an infinite series of terms are solved by a very simple rule or formula.

The limit of an infinite descending geometrical series is $\frac{a}{l-r}$, in which a is the first term and r is the ratio. For the watch problem a equals 1/3 of 60, or 20, and r equals 1/12 for the time in which the minute hand will gain 1/3 of a revolution, or 120 deg., over the hour hand, and this formula works out that the hour hand moves 1 9/11 minute spaces while the minute hand moves 21 9/11 minute spaces, and the second hand, if it moves in its proper ratio with the other hands, makes 60 revolutions while the minute hand makes one, and hence will in 21 9/11 revolutions, or, to state it another way, will make 21 revolutions and 49 1/11 minute spaces. By carrying out this computation it will be found that if the proper ratio of movement of the three hands is adhered to it will be impossible for them to ever arrive at a position in which they are equal distances apart. Of course it would be possible to set the second hand so that at twelve o'clock it did not agree with the other hands, and in this case once in twelve hours the hands would assume the position shown in the illustration, or by using a stop watch the second hand could be manipulated as before mentioned, or if the gearing of the hands was improperly proportioned such a position of the hands would be possible, but this last would mean an inaccurate watch. Assuming that the puzzle is based upon inaccurate ratio in the motion of the hands and that the second hand only was affected, this hand gains 1 9/11 seconds in 2 hours 54 6/11 minutes; that is, its ratio of movement to that of the minute hand, instead of being 60 will be $60\frac{1\,9/11}{174\,6/11}$.

A. D. Williams.

Highwood Park, Weehawken, N. J.

Can the Baalbec Stone Be Moved?

To the Editor of the Scientific American:

Referring to the inquiry made by Mr. Edwin Sidney Williams, of Saratoga, Cal., in your issue of June 24, asking the question, "Can the Baalbec Stone be Moved?" personally, I believe that modern mechanics could bring the huge stone, now about half way out of its quarry, to America. But Americans don't do things without a purpose, and it seems to me that it would be difficult to find a purpose which would justify the undertaking. The estimated weight of the stone is about 1,500 tons; it is about 80 feet long, and about 16 feet square at the ends. The road from Baalbec to Beirut is down grade all the way, but there are some exceedingly sharp turns in zig-zag. In many places the traveler has to go four miles by road to attain one mile.

Baalbec is 3,840 feet above the sea level, and from a scientific viewpoint is one of the most interesting places in the world. Its massiveness almost overwhelms one's imagination. If all the ruins of ancient and modern Rome were gathered together in one group, they would not exceed the ruins of Baalbec. The material used in the construction is mostly limestone, very richly decorated, although there is a part of a circular temple supported on six granite columns. It has been proved without a doubt that this granite was brought from the vicinity of Karnac in upper Egypt, down the Nile, across the Mediterranean to Beirut, thence to Baalbec by the zig-zag road. This is the only entrance to the city from the sea. It would be no larger an undertaking for us to bring the Baalbec Stone to our shores than it was for the ancients to bring these Cyclopean columns from Karnac to Baalbec.

From carvings found upon monuments and walls, it is inferred that the ancient Greeks and Romans handled these huge stones by animal power only. If electricity or steam had formed any part of their mechanical knowledge it is reasonable to infer that some record of it would now be found in the numerous pictures graven upon their stones. But such is not the case. The legacy they have left us shows that they utilized the inclined plane and pulleys. One of the largest stones used in construction during the Baalbec building boom measures 64 feet in length, diameter and height being about 14 by 15. This stone lies at a height of about 25 feet above the present ground level, and it is quite generally conceded that these hewn rocks, about the same size as a Pullman palace car (to use Mr. Williams's simile) were put in position by building earthworks in the form of long inclined planes reaching to the elevation desired, the rock being pulled up the inclined plane on rollers by means of cables operated on pulleys, and drawn by animal power. Subsequently the earth-works were removed. It is noticeable that these pictures always show a vast number of men operating at one time.

The city has passed under the rule of Persians, Greeks, and Romans. It has been plundered by Arabs, sacked by Tartars, dismantled by Saracens, Persians, and modern tourists. It is quite probable that earthquakes and Christians have wrought more ruin here than all the other vandals. Baal (or Apollo, as we know him) was worshiped in the Temple of the Sun. The six Corinthian columns, like grim sentinels guarding the unequaled beauties of the Bekaa Valley, form one of the most imposing relics of the world.

Syracuse, N. Y. Edward H. Dann.

An English Golf-Ball Decision.

The decision was recently delivered in the Chancery Division of the British Law Courts in the action brought by the Haskell Golf Ball Company, of the United States, against an English firm for an injunction to restrain the latter from infringing the Haskell patents in the manufacture of golf balls. The feature of the Haskell ball is its composite nature, comprising a kernel, a core, and a cover. The core is of a highly elastic material, such as rubber thread wound under high tension, which gives the ball a remarkably high degree of elasticity coupled with high rigidity and resistance, while the cover itself is non-elastic, tough, hard, and light. The effect of this combination is that the ball has special driving qualities. The defendant firm had placed three types of balls upon the market similarly built. Hence the action. The defendant firm, however, pleaded want of novelty in the Haskell ball and anticipation of the patent. The case was decided on the point of novelty. The defendants produced evidence to show that winding rubber-thread balls were made and sold twenty-five to thirty-five years ago, whereas the Haskell ball was not patented until 1898. Two other inventors had produced wound-rubber thread balls, but had not taken the trouble to patent their inventions, and although it was not shown which of these two inventions was produced first, the judge held that one of the two was the actual inventor, and therefore the Haskell ball was not novel. Judgment was therefore found against them, and their patent rendered invalid.

In the irrigated sections of this country, the landowners living along one stream are more or less dependent on each other for their respective supplies of water. One person disposed to appropriate more than his share can readily do so by diverting and holding the water, to the detriment of the farms situated farther down the stream. This is the cause of unending disputes, and all of the States in the West have laws designed to overcome it. A new and novel gate arrangement has been recently patented to meet this emergency by L. H. Rhead, a resident of Utah, stationed at the Rio Grande reclamation project, where he represents the United States government. This gate regulates the flow of water at the heads of distributing canals and laterals, and is especially designed where the scarcity and unsatisfactory distribution of water cause trouble among those concerned. The device consists of an iron gate stem, threaded, and two wheels also threaded to fit the stem. One of the wheels is for the purpose of raising and lowering the gate, and to the other wheel is attached a chain and padlock, by means of which the second and smaller wheel is locked in any position on the stem, and this constitutes the locking device. This is fixed at a point which will give a landowner all the water he is entitled to, and will permit him to cut the flow off entirely or partially if desirable, but he is unable to increase it to the point of depriving his neighbors of their share.

Engineering Notes.

A new smoke-prevention device for boiler furnaces has been invented by Mr. J. S. Pearson, of Glasgow. The system consists of discharging a combination of steam, air, and producer gas into the furnace. The three elements are combined and discharged onto the fuel in the front of the furnace through nozzles fitted to short pipe connections. The resulting chemical action releases the hydrogen in the steam, and combines the oxygen with the carbon in the fuel. The decomposition of the supplied gases is thus completed, and, by combining with the fuel gases and the resulting new gases thus produced, creates great heating power, emitting heavy smoke. The latter, however, decreases in volume toward the tubes, in which there are only flames, and is completely consumed before it reaches the chimney. The steam pressure does not vary with the stoking or cleaning of the furnace, and no ashes or clinkers are formed. The system can be applied to any type of boiler.

Utilization of Combustible for Freight Trains in Germany.—The Organ für die Fortschritte des Eisenbahnwesens reviews the modifications desirable in the methods of traction for freight trains in Germany. The reduction in the loads since 1895 has increased the expense about 28 per cent. The average number of axles per train has, during the same period, been reduced from 70 to 67. The expense of personnel has increased. It is true but irrational that while the loads have been diminished, the power of the locomotives has been increased. The construction of heavy freight engines capable of considerable effort is regarded as an error. It is more advantageous to draw ordinary trains by engines of average power, utilizing the steam under the best conditions, and if necessary overdriving temporarily, when the amount of freight becomes abnormal, than to employ locomotives which in the majority of cases are too powerful. The economic remedy in the diminution of loads consists in the increase of speed, particularly on inclined grades, where the weight should be turned to profit. But for security the number of brakes should be multiplied, where there is not a continuous brake for the train, as in England.

Preparation of Railway Cross-ties.—The Revue Générale des Chemins de Fer describes the preparation of cross-ties by the Compagnie de l'Ouest by means of the injection of creosote. Works for the purpose are established at Surdon in the department of Orme, about the geographical center of the railway system. The yard occupies more than eight hectares. The ties, on arrival at the yard, are classified according to their comparative resistance to the penetration of creosote, and are piled up so as to dry by means of a free circulation of air. This requires from six months to a year, after which they are placed in hot-air driers for twenty-four hours and afterward in large hermetically sealed injection cylinders, heated by steam worms, under a pressure of two kilogrammes, which allows of maintaining a uniform temperature of 80 deg. C. for the creosote. A vacuum is produced in the cylinders, which are put in communication with the creosote vats. When filled with the liquid, an inside pressure of seven kilogrammes is caused by means of pumps for thirty-five or forty-five minutes. The annual production at Surdon is 297,000 cross-ties, and 200,000 posts, stakes, and other pieces.

The earliest recorded attempt at superheating was that reported in 1828 by Richard Trevithick, at the Birnie Downs Mine in Cornwall, on a condensing pumping engine making eight strokes per minute, with a boiler pressure of 45 pounds, in which the cylinders and steam pipes were surrounded with brickwork and heated from a fire burning on a grate underneath. The results were remarkable, for, while performing the same amount of work, 9,000 pounds of coal were used per twenty-four hours without the fire under the cylinder, against 6,000 pounds when it was in use, the coal for superheating included. This experience led Trevithick to the invention of his tubular boiler and superheater, which was patented in 1832, and was a remarkably modern-looking arrangement, the boiler proper consisting of vertical water tubes surrounding a circular grate and forming a vertical flue in which other tubes were placed, through which the steam, generated in the boiler, passed on its way to the engine. Owing, no doubt, to the difficulty in regulating the temperature of the steam obtained from such an apparatus, little seems to have been done in the matter during the next ten or fifteen years, although in 1832 I. Howard, of Bermondsey, produced a superheater which obtained an economy of 30 per cent, and about 1835 Dr. Haycroft, of Greenwich, advocated superheated steam and found experimentally, about the same saving.