A New Flux.—A French metallugist, M. Brunow, claims to have discovered a reducing substance which so promotes liquefaction that by its aid he has melted pig iron in fourteen minutes.

Construction of Portable Rivetting Machines.—The object of this invention of R. A. Binns, Halifax, Eng. is to construct and arrange a portable rivetting machine, one that will be inexpensive, simple in construction, and operated without the aid of either steam, air, or water. The apparatus the inventor proposes to employ consists of two levers, hinged about the centre, and connected together by a cross bearer. At one end of these levers are dies for rounding or heading the rivets, whilst at the other end of the levers are knuckle joints, consisting of two short links or arms connected together by a suitable pin or bolt. At the part where these links are hinged together a stud or boss is formed for receiving one end of a screw, the outer end thereof entering a nut projecting from the cross bearer. By means of a handle the screw can be operated in such a manner as to cause the knuckle joints or links to assume an inclined position whereby the jaws of the two levers are opened, and when the screw is operated in an opposite direction, the links are straightened, and the jaws close up on the rivet.

Electric Tramcars.—An electric tramcar trial was recently successfully accomplished in Paris by the French Electrical Power Storage Company. At three o'clock p.m. the vehicle, an ordinary three-horse tramcar, left the Place de la Nation in the far east, and, after traversing the capital through several important thoroughfares, reached the starting point soon after six o'clock. A distance of thirty English miles was thus made in about three hours. There was not the slightest accident. The ease with which the car was turned off one set of tram lines and got on to another across several yards of unmetaled ground is stated to have been admirable. The locomotion is affected by means of Faure accumulators, weighing some fifty hundred-weight, which are fixed under the tramcar seats and connected with a Siemens' machine placed under the floor. The machine, which makes twelve hundred revolutions a minute, sets in movement, by means of a pulley, an axle to which are connected the chains which give impulse to the wheels. These wheels revolve sixty times to twelve thousand revolutions of the machine. The speed of the electric tramcar is nine and a third miles an hour on level ground, and five and half miles on an ascent. The present tram lines are not well adapted for the new locomotion. On the newer lines the movement was sufficiently smooth, but on those that have been laid for some time there was a marked difference, and the actual working force was considerably lower than the indicated horse-power. The estimated cost is one-half that of horse trams.

The Missouri River changing its Channel.—A letter appears in the *Kansas City Times*, calling attention to the danger of Kansas City being cut off, if some improvements are not made in the channel. The current of the river across the bottom below the mouth of Lime Creek has been more rapid than in the natural channel. It has cut an artificial channel several feet in width and depth, notwithstanding that the unfinished labors of our scientific engineer (Mr. S. Yonge) has revetted the banks for 1,000 feet. That gentleman informs us that if left in its present condition, another overflow similar to that of 1881 will most certainly cut through above Harlem in spite of the work now done. The effect of this cut off is the loss of the Kansas City bridge, the removal of the levee a half a mile north, forming an immense sandbar in front of the flouring mills. This huge sandbar will be overflowing for years, shifting and changing the city frontage, and the whole surface of the accrued lands will be unfit for buildings and improvements of any character. The Kaw River must have a place for outlet, either along the present channel or follow its onward course northeast until it intersects or empties into the river in its newly formed bed. The sewerage for the cities would prove a source of trouble and disasters that no engineer, however scientific, can now estimate. Millions of dollars will not cover the expense of repairs, damage and extension. To-day, notwithstanding that the city, by its naturally inclined surface, is the best adapted to perfect waterways of almost any other, yet it is almost, if not altogether, impossible for the engineers to adopt a system of drainage adequate to its necessities without occasionally sustaining heavy losses.

At the British Association meeting a paper by Prof. J. A. Ewing was read, on the magnetic susceptibility and retentiveness of iron and steel. This paper was a preliminary notice of some results of an extended investigation which the author had been conducting for three years in Japan. Experiments with annealed rods and rings of soft iron wire showed that that material possesses the property of retentiveness in a very high degree. As much as 90 and even 93 per cent. of the induced magnetism survived the removal of the magnetising force. The extraordinary spectacle was presented of pieces of soft iron entirely free from magnetic influence nevertheless holding an amount of magnetism (per unit of volume) greatly exceeding what is ever held by permanent magnets of the best tempered steel. The magnetic character of the iron in this condition was, however, highly unstable. The application of a reverse magnetising force quickly caused demagnetisation, and the slightest mechanical disturbance had a similar effect. Gentle tapping removed the residual magnetism completely. Variations of temperature reduced it greatly, and so did any application of stress. On the other hand, the magnetism disappeared only very slowly, if at all, with the mere lapse of time. The residual magnetism in hardened iron and steel was much less than in soft annealed iron. The maximum ratio of intensity of magnetism to magnetising force during the magnetisation of soft iron was generally 200 or 300, and could be raised to the enormous figure of 1590 by taping the iron while the magnetising force was being gradually applied. A number of absolute measurements were made of the energy expended in carrying iron and steel through cyclic changes of magnetisation; and the effects of stress on magnetic susceptibility and on existing meguetism were examined at great length. The whole subject was much complicated by the presence of the action which, in previous papers, the writer had named *Hysteresis*, the study of which, in reference both to magnetism and to thermoelectric quality, had formed a large part of his work.

THE CONSUMPTION OF FUEL IN LOCOMOTIVES.

(*Revue Générale des Chemins de fer*, 1883, *p.* 403.)

In 1881, Mr. Marié published results of experiments he had made on the consumption of fuel in locomotives on the line from Paris to Montereau, where he had found that in the course of regular service, the consumption frequently fell to 3·31 lbs. per H P. delivered at the rail. Like experiments were made in July 1882, by Mr. Hirsch and Mr. Marié on the Saint-Jean line between Maurienne and Modane, a length of 17 miles, on a continuous incline of from 1 in 100 to 1 in 33 3, averaging 1 in 54. The trains rise to a height of 568 yards.

The work done was calculated by means of a formula constructed in terms of the weight of the train, the length of the line, the frictional resistance, and the total rise of the line.

On the 18th July, 1882, an express train was run from Saint-Jean-de-Maurienne to Modane in 1 hour 4 minutes, stopping once at Saint-Michel, for 4 minutes, and making the run in 1 hour. The speed was 17 miles per hour, and the resistance was taken at 9.63 lbs. per ton gross weight, reckoned at the rails, after deducting the resistance of the machinery. Of the fuel briquettes, 1,113 lbs. were consumed for the trip, being at the rate of 65½ lbs. per mile; and 3·26 lbs. per H P. at the rails. The fuel, on analysis, was proved to contain 6.90 per cent. of ash, and 1 per cent of moisture. Water was evaporated at the rate of 8·83 lbs. per pound of fuel; or allowing 9 per cent for priming, 8·03 lbs. per pound of fuel; and at the rate of 26·19 lbs. of dry steam per H P. at the rails. The steam was cut off at 19 per cent. of the stroke of the pistons.

On the 17th and 19th July, 1882, the experiment was repeated, with the same train, on the same course, with the same driver, and at the same hour of the day. The fuel was briquettes made with dry coal. The quantity of dry steam consumed was 29 4 lbs. per H P. at the rails.

The Author concludes that, for locomotives in which the speed of piston is not too low, the consumption of fuel of good quality is 3.35 lbs per H P. developed at the rails per hour; and that, including the machinery-friction of the engine, the consumption is at the rate of from 2·24 lbs. to 3 lbs. per indicator H P. The great economy, he says, is due to the high state of maintenance, and the great speed of pistons. Stationary engines usually cause a consumption of from 4½lbs, to 6¾ lbs. per H P. per hour; and in general, it is better to employ small engines running fast than large ones going slowly. For further economy of fuel, the Author looks to the heating of the feed-water by the exhaust steam; and the elevation of the working pressure to from 10 to 20 atmospheres, with compounding of the cylinders.