that a continuous brake, capable of being applied simultaneously to every wheel of a train under the conditions which have been enumerated in this memorandum, is a much more practical and scientific method of bringing a train to rest than the old plan of concentrating the brake-power in two or three heavy brake vans placed in different parts of the train, and leaving the rest of the wheels without brakes.

The advantage which thus evidently ensues from utilising the adhesion of every wheel of a train for the purpose of stopping a train suggests the further consideration as to whether it would not be a more scientific arrangement, as well as more economical in regard to the permanent way of railways, to utilise the adhesion of every wheel of a train for causing the train to move forward, instead of depending for the moving force upon the adhesion of one heavy vehicle alone, viz., the locomotive. Experiments connected with the action of brakes on railway trains require very delicate apparatus; the credit of the design of the apparatus used in these experiments belongs to Mr. Westinghouse. The efficiency of the arrangements for making the experiments is due to the London, Brighton, and South Coast Railway Company, as represented by Mr. Knight, their general manager, who afforded every facility for the use of the line, and by Mr. Stroudley, the locomotive engineer of the Company.

DOUGLAS GALTON

OUR ASTRONOMICAL COLUMN

THE COMET OF 1532.—This comet, the second of the five observed by Apian, as described in his rare work, the "Astronomicum Cæsarium," has been the subject of much computation and discussion in connection with its long-assumed identity with the comet of 1661 observed by Hevelius, to which attention was directed by Halley when he published his "Synopsis of Cometary Astronomy." We read: "Halley was apt to believe that the comet of 1532 was the same with that observed by Hevelius in the beginning of 1661, but Apian's observations, which are the only ones we have, are too inaccurate to determine anything certain from them in so nice an affair." Pingré fully believed in the identity of the comets of 1532 and 1661, and in his "Cometographie" has endeavoured to point out several previous appearances of the same body, as in the year 1402, when he expresses his conviction that the great comet recorded in so many of the European chronicles about Easter was no other than the one in question. Between the perihelion passages of 1532 and 1661 is a period of $128\frac{1}{4}$ years, and so the return of the comet was long expected about 1789. Shortly before this year, however, the rediscussion of the observations of 1532 and 1661 was made the subject of a prize by the Paris Academy of Sciences, which was gained by Mechain.

His calculations threw much doubt upon the presumed identity of the comets, indeed were pretty generally considered as decisive against it. Olbers also recomputed the orbit from the observations of 1532, and although he found one much closer to that of the comet of 1661 than Mechain had done, seems to have arrived at the conclusion that the comets were not identical. Nevertheless, as the year 1789 approached, sweeping-ephemerides were prepared to facilitate a search, the then Astronomer-Royal, Dr. Maskelyne, taking a part in this work. The search was ineffectual, no one of the comets which appeared about that year presenting any indications of being the expected body.

It is probable that the elements of the comet of 1532 are open to even greater uncertainty than has been usually supposed. Apian's observations are clearly affected with large errors, yet we are under the necessity of relying upon them as the best data available, neither the vague and contradictory observations (if they deserve the name) by Fracastor at Verona, nor those of Vogelin at Vienna, being of service in the determination of a more certain orbit than can be inferred from the observations in the "Astronomicum Cæsarium." Apian appears to have observed at Dresden, and the times of observation are given by altitudes of Regulus and Arcturus; the amplitudes of the comet (S. to E.) and its altitudes are recorded. The positions of the stars for 1532·0 were:—

	Right Ascension.	Declination.
	° ′	° ′
Regulus	145 49·7	+14 12·1
Arcturus	208 35·2	+21 40·1

Assuming Apian's station to have been in longitude 0h. 54m. 56s. E. and latitude 51° 3′·7, his data furnish the following places, which, except for the first day, do not differ more than might have been expected from Pingré's reductions:—

	G.M.T.	Right Ascension.	Declination.
		° ′	° ′
1532, October	1·6635	155 43·8	−4 26·9
	2·6491	160 10·7	−3 20·3
	30·6699	206 3·6	+3 48·6
	31·6939	208 48·3	+4 20·6
November	7·6747	218 51·1	+5 55·8

We subjoin an orbit depending on the observations of October 2, 30, and November 7, and also Olbers' elements from Hindenburg's *Magazin für Mathematik*, 1787:—

	New Orbit.	Olbers.
Perihelion passage ...	Nov. 3·1355 G.M.T.	Oct. 18·3324
	° ′	° ′
Long. of perihelion	174 51	111 48
,, ascending node ...	132 32	87 23
Inclination	57 41	32 36
Perihelion distance	0·6736	0·5192
Motion	Direct.	Direct.

The comparison with the above-observed positions is slightly in favour of Olbers' orbit, though this differs from the place for November 7 by − 1° 40′ in longitude and − 4° 36′ in latitude. Still it will appear that Apian's observations may be represented within their evident limits of error, by orbits which differ widely.

The Chinese observed this comet from September 2 to December 25, according to the extracts from their annals which have been given by E. Biot and Williams: on the former date, according to Olbers' elements, the comet was in longitude 98°, latitude 47° south, distant from the earth 0·78, and on the latter date in longitude 249°, latitude 16° north, distant 2·13. The mention of the comet having traversed Cygnus probably applies to that of 1533; at any rate the comet of 1532 could not have passed through that constellation.

THE SUN'S PARALLAX.—Mr. David Gill, writing from Madeira, on his voyage to the Cape of Good Hope, to take the direction of the Royal Observatory, as successor to Mr. Stone, states in a communication to the Royal Astronomical Society, that the reduction of the observations of Mars, made during his expedition to Ascension, in 1877, have been so far completed that he is able to give the resulting solar parallax. He presents values, differing little *inter se*, deduced from various combinations of the observations and, as the definite figure, 8″·78, which being interpreted with the aid of Col. Clarke's last determination of the earth's equatorial semi-diameter, implies that the mean distance of the earth from the sun is 93,101,000 miles. This is a smaller parallax than perhaps was generally looked for, though not differing materially from several values which have been worked out recently.