intermediate pair 6.7 and 6.1. And these are not isolated facts. Comparisons of the same kind, and leading to identical conclusions, were made by Professor Eastman at Washington in 1889 (Phil. Society Bulletin, vol. xi., p. 143; Proceedings Amer. Association, 1889, p. 71).

What meaning can we attribute to them? Uncritically considered, they seem to assert two things, one reasonable, the other palpably absurd. The first — that the average angular velocity of the stars varies inversely with their distance from ourselves — few will be disposed to doubt; the second — that their average apparent lustre has nothing to do with greater or less remoteness — few will be disposed to admit. But, in order to interpret truly, well-ascertained if unexpected relationships, we must remember that the sensibly moving stars used to determine the solar translation are chosen from a multitude sensibly fixed; and that the proportion of stationary to travelling stars rises rapidly with descent down the scale of magnitude. Hence a mean struck in disregard of the zeros is totally misleading; while the account is no sooner made exhaustive than its anomalous character becomes largely modified. Yet it does not wholly disappear. There is some warrant for it in nature. And its warrant may perhaps consist in a preponderance, among suns endowed with high physical speed, of small, or slightly luminous, over powerfully radiative bodies. Why this should be so, it would be futile, even by conjecture, to attempt to explain.

AN INGENIOUS FORGING PRESS.

MR W. D. ALLEN, in a paper read at the autumn meeting of the Iron and Steel Institute, London, in October (Nature, Oct. 15), described a forging press, which, although it has been at work for some years at the Bessemer Works in Sheffield, is so ingenious, and so new to most people, that it is worthy of description. The press has the appearance of a steam hammer, and, indeed, there is a steam cylinder at the top, just as in a hammer. The use of the steam, however, is only to raise the "tup" when the hydraulic pressure is released. The press consists of an anvil block below and a ram above, the work being in a vertical direction. The ram works in a hydraulic cylinder, and is carried through the top end of the latter in the shape of a stout shaft or shank, which may be described as a tail-rod to the ram. Attached to this is the piston rod of the steam piston, the latter, of course, working in its own cylinder. The steam cylinder and hydraulic cylinder are therefore placed tandemwise, the latter being underneath. The hydraulic cylinder is supplied with water at pressure by a suitable pump, the barrel of the pump being in direct communication with the hydraulic cylinder, there being no valve of any kind between the two.

If we have made our explanation clear, it will be seen that the ram will descend and ascend stroke for stroke with the pump plunger (the same water flowing backwards and forwards continuously), it being remembered that the steam cylinder has always a tendency to lift the ram. Thus, upon the pump making a forward stroke, the water in its barrel is forced into the hydraulic cylinder; the ram is thus forced down, and gives the necessary squeeze to the work on the anvil. The pump plunger then starts on its return stroke, and so, by enlarging the space in the pump barrel, enables the hydraulic ram to rise and press the water out of the cylinder and back into the pump. The rising of the ram is caused by the lifting action of the steam under the piston; the atter, it will be remembered, being attached to the ram. Of course the water pressure is sufficient to overcome the steam pressure on the downward stroke.

The chief use of this press is to produce work of any given thicknesses within the range of the machine. This end is attained by regulating the volume of water used. The action may be explained as follows. We will suppose, merely for simplicity sake, the contents of the pump barrel to be one cubic foot, and that of the hydraulic cylinder, when the ram is at the full extent of its stroke, to be two cubic feet. We will neglect the connecting pipe between the two, as that is not a variable and does not affect the principle. If there be admitted to the pump but one cubic foot of water as the plunger moves forward, it will drive all this water (omitting clearance) into the hydraulic cylinder, and the ram would therefore only descend one-half its stroke. If the stroke were two feet the travel would be twelve inches, whilst there would be twelve inches of space between the anvil and the lower side of the squeezing tool on the end of the ram. Objects of twelve inches, or above twelve inches in thickness, could therefore be forged. If, however, an article six inches thick had to be worked, another half cubic foot of water would have to be admitted. As the pump barrel would only accommodate one cubic foot of water, the extra half cubic foot would remain permanently in the hydraulic cylinder, and the ram would therefore not go, by six inches, to the top of its stroke; in other words, the traverse of the ram would be carried six inches nearer the anvil.

It will be remembered that the upward movement of the ram is effected by the steam cylinder, which is powerful enough to lift the dead weight of the ram, but is overcome by the hydraulic pressure. It will be seen that by regulating the volume of water in the machine, the ram — although always making the same length of stroke — can be kept working at any given distance from the anvil: the ram and pump-plunger making stroke for stroke as the water flows backwards and forwards between the barrel of the pump and hydraulic cylinder. The device is no less important than ingenious. In ordinary forging, reliance has to be placed for accuracy of work on the skill of the workman. It is surprising how near perfection a good forgeman will arrive by constant practice. Such men are necessarily scarce, and as a consequence very highly paid, but even the nearest approximation of eye and hastily applied callipers, with the chance of getting a little too much work on at the last minute, cannot equal the absolutely correct results of this automatic system.

ASTRONOMICAL NOTES.

The Rev. T. E. Espin has found two new variable stars in Cygnus, viz., D. M. + 36°, 3852, and D. M. + 49°, 3239. They are both of a strong red color.

The Harvard College Observatory has just issued a paper entitled "Preparation and Discussion of the Draper Catalogue." The introduction to the volume contains reference to the gift of Mrs. Draper of the funds by which the work has been carried on, and also a description of the instrument with which the photographs were taken. Then follows a catalogue of the spectra of the stars. The plates were exposed in the years 1886 and 1887.

In the Proceedings of the Irish Academy (vol. 4, No. 4, third series) Mr. J. E. Gore has a very interesting paper entitled "A Catalogue of Binary Stars for which Orbits have been Computed." The catalogue contains 59 stars, giving the name of each star, its approximate position for the epoch 1890.0, the elements, by whom computed, magnitude of com-