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-

ponents, color of components, their spectra, the "hypothetical parallax,"— for the process of computing reference should be made to Mr. Gore's article,— and the most recent parallax of the star as determined by observation. Mention is also made of the publication in which the elements first appeared. The notes following the catalogue are very complete, and will be found very useful to those interested in this particular branch of astronomy.

In another paper read before the same society, Mr. Gore gives his observations of the variable star μ Cephei. He finds that the variation of light for this star does not exceed half a magnitude, and is very irregular, the star sometimes remains for several months with little or no change in its brightness. Mr. Gore, in a third paper, gives the orbit of the double star 35 ζ Comae Berenices. The magnitudes of the components are 5 and 7.8 respectively. He has found for this pair of stars a period of 228.4 years. He has computed the elements, and from this has derived the position angles and distance between the stars from Struve's first measurement in 1829 to Burnham's last measurement, made in 1891. The residuals betweeen the computed and observed position angles are quite small, and with one or two exceptions the computed and observed distances compare very favorably.

EXPERIMENTAL DIPHTHERIA.[1]

PROFESSOR WELCH and Dr. Flexner present a preliminary account of the results of their study of experimental diphtheria in guinea-pigs, rabbits, and kittens. They employed in their experiments pure cultures of the Klebs-Lœffler diphtheritic bacillus, which they inoculated into the trachea and under the skin of these animals. The study which they made was directed particularly to the changes in the tissues produced by these organisms. Previous observers had not confirmed fully the results obtained by Oertel in his study of the alterations in the tissues in human diphtheria, and hence an important factor in the causation of the disease was missing. Drs. Welch and Flexner found that the lesions described by Oertel in human diphtheria are also present in the tissues of animals dead of the experimental disease, and in addition they describe a number of lesions which have not been found up to this time in the disease in human beings. They produced at the seat of inoculation a false membrane, in which the bacilli multiplied. The bacilli remain in the local process; they never invade the blood and tissues of either animal or man, and the general effects are caused, not by the bacilli themselves, but by a poison which they produce.

As in human diphtheria the place of entrance of the poison and the contiguous parts show the greatest destruction, so also in animals the seat of inoculation and the neighboring lymphatic glands exhibit the gravest changes; and, further, as is the case in human diphtheria, distant organs are affected, so is it in the experimental form of the disease. These observers found lesions in the seat of inoculation and adjacent tissues of the most intense nature, in the heart, lungs, liver, kidneys, adrenals, thyroid gland, the epithelium and lymphatic apparatus of the intestinal tract, and in all of the lymphatic glands of the body. The lesions described consist of death of cells, shown by the extensive nuclear fragmentation that has taken place, the affected cells being converted often into a substance resembling fibrin; a hyaline death of cells which occurs in the liver and adrenals especially, and the production of intense fatty degeneration of the muscle of the heart, the epithelium of the kidneys and liver. Hence, a valuable link is added to the chain of evidence that the cause of human diphtheria is a specific organism — the Klebs-Lœffler diphtheritic bacillus.

[1] The Histological Changes in Experimental Diphtheria. Preliminary communication. By William H. Welch, M.D., professor of pathology and Simon Flexner, M.D., fellow in pathology. The Johns Hospital Bulletin, No. 15, August, 1891.

NOTES AND NEWS.

A KIND of artificial honey which has lately been produced seems likely to become a formidable rival of natural honey. It is called "sugar honey," and consists of water, sugar, a small proportion of mineral salts, and a free acid; and the taste and smell resemble those of the genuine article. Herr T. Weigle brought the subject before a recent meeting of the Bavarian Association of the Representatives of Applied Chemistry, and there is a paragraph about it in a recent number of the *Board of Trade Journal*.

— It is stated in *Nature* that a cat born with only two legs (the fore-legs being absent from the shoulder-blades) has been recently described by Professor Leon of Jassy (Naturw. Rundsch.). It is healthy, and goes about easily, the body in normal position. When startled, or watching anything, it raises itself to the attitude of a kangaroo, using the tail as a support. This animal has twice borne kittens, in both cases two, one of which had four feet, the other only two.

— Hysteria in men is apparently not rare in other countries, but in England, according to the *British Medical Journal*, it is, relatively speaking, very uncommon. Not many years ago a Russian physician observed that true hysterical fits were common among young Circassian men, and the disease might reasonably be suspected to prevail where men of an imaginative and impressionable stock predominate. Judging by the evidence of French medical publications, Frenchmen are far more subject to hysteria in adult life than Englishmen. Occasionally certain cases recorded in French medical newspapers must cause us to reflect; are such cases hysterical at all, or are certain nervous affections common in England really forms of hysteria? The doctrine that hypochondria is in males the homologue of hysteria, must be accepted by the French on the evidence of what prevails in England. For hypochondria, low spirits, or "spleen," is proverbially common there, and the French hold exaggerated opinions on the subject. In a more excitable race, more acute nervous symptoms might be expected.

— Rats at Aden appear to have a vigorous appetite, and to adopt remarkable ways of gratifying it. Captain R. Light, writing on the subject from Aden to the Journal of the Bombay Natural History Society (from which *Nature* quotes), says the rats in his house — which is overrun with them — demolish skins, braces, whips, etc.; and one night he awoke, feeling a rat gnawing at his toes. This happened in spite of a dog (a good ratter) being in the room. Captain Light was lately watching his pony being shod, and noticed the hoof apparently cut away all round the coronet, wherever it was soft. He accused the "nalband" of doing this in addition to the usual rasping of the hoof to suit the shoe. The "syce" said that the rats had done it, and that they came at night and ate away not only the pony's hoofs but those of the goat and kid, and that these animals were greatly tormented by the rats. Captain Light examined the hoofs, and found beyond doubt that such was the case, the marks of the teeth being plain; moreover, he found that the horns of the kid, which had been about half an inch high, were eaten flush with the head. Next morning, too, a large rat was discovered in the bedding under the horse. It had evidently been killed by a kick from him.

— The mareograph in the harbor of Pola, according to Lieut. Gratzl (Met. Zeitsch.), often shows, in addition to the ordinary tidal curve, certain more or less regular oscillations, generally with a period of about fifteen minutes (some with one of seven minutes). According to *Nature*, these appear to be of the nature of *seiches*, and to be caused by squalls, which drive water from the open sea into the partly inclosed basin of the harbor, where it rises as a wave, retires, rises again to a less height (as only part of