of the point bowed is changed, the bowing pressure must vary inversely as the square of the distance of the point from the bridge. If the speed of bowing is increased, the pressure must be increased, at first slowly, then more rapidly. If the pitch of the string is changed by stopping, the pressure varies with the frequency, and is a maximum at each of the resonance frequencies of the string.

IN the course of his presidential address to the North-East Coast Institution of Engineers and Shipbuilders, delivered on October 29, Mr. A. Ernest Doxford made reference to the educational functions of the institution. The promotion and maintenance of professional proficiency are among the chief duties accepted by the technical societies. Their policy is to increase the professional knowledge of their members by fostering the interchange of useful information by the members themselves, and there would seem to be no more useful method of attaining the end in view than that of the reading and discussion of thoroughly good papers. In the more scrupulous institutions no paper appears except from the pen of a practical expert, and the information provided has to be either quite new or sufficiently up-to-date to require further dissemination and discussion. If the engineering technical societies are truly representative of engineers in the particular territory to which they refer, they represent the only people who are able to provide new information on engineering questions, and it is the self-imposed responsibility of these societies to furnish such information. Strictly speaking, a society cannot *train*; it only finds the information with which its members must instruct themselves. Mr. Doxford puts the question as to whether the technical societies do, or can, fill a place in the educational system of this country, and considers that they are unique and indispensable factors in any complete national educational system. The institution is not endowed, and Mr. Doxford considers that the members, the local engineering and shipbuilding industries, and the shipowning businesses might find some opportunity of encouraging it by contributions to an endowment fund; he does not think that the institution should appeal to the State, particularly in these times when State generosity in some directions has become dangerous.

WE have received from Messrs. Dulau and Co., Ltd., of Margaret Street, Oxford Circus, W.1, two catalogues of books which they are offering for sale. One includes a number of old French and Italian books and a collection of some seventy volumes from the library of Adam Smith. There are also four volumes which belonged to Newton, two of which contain his autograph. The other catalogue contains a list of about one thousand books on mathematical and physical sciences, many of them very old copies. Among other important items we note that one set of the thirteen volumes in which the Paris Académie des Sciences published the works of Laplace is offered for sale. There are also some early works on sundials and a number of sets of the Proceedings of various British and American scientific societies and other scientific periodicals.

Our Astronomical Column.

THE DISTRIBUTION OF THE STARS IN SPACE.—The *Astrophysical Journal* for July contains an important paper by Prof. Kapteyn and P. J. Van Rhijn on star-density in different regions of the stellar system. The authors have lately accumulated from various sources much new material on star parallaxes and motions, and state that they could not resist the temptation to attempt a general solution of the problem of the universe, though they admit that it will need revision. They adopt the parsec as unit of distance, and the magnitude at unit distance as absolute magnitude. That of the sun is $-0{\cdot}2$, while the median magnitude of all stars is $+2{\cdot}7$. The expression for the logarithm of the number of stars of absolute magnitude M per 1000 cubic parsecs in the region near the sun is found to be $-2{\cdot}394+0{\cdot}1858\,M-0{\cdot}0345\,M^2$, indicating a parabolic curve when M is taken as abscissa. This gives 0·0451 stars per cubic parsec near the sun, or 23·6 within 5 parsecs of the sun. Observation gives some twenty-seven stars in this sphere—a satisfactory agreement.

The next step is to investigate the rapidity with which the stellar density falls off with increasing distance from the sun (provisionally assumed as the centre). Curves are drawn showing the lines of various densities on a plane drawn through the galactic polar axis. For example, the line of density 0·01 (the density near the sun being unity) is distant 1300 parsecs towards the galactic poles, and 8900 parsecs in the galactic plane. Density 0·063 is reached at about half these distances.

Prof. Kapteyn has re-investigated the formula connecting parallax and proper motion. The new formula is

$$\log \pi_{m,\mu} = -0{\cdot}690 - 0{\cdot}0713m + 0{\cdot}645 \log \mu,$$

m being the apparent magnitude and μ the annual proper motion in seconds.

THE MULTIPLE SYSTEM ξ URSÆ MAJORIS.—Dr. G. Abetti contributes a study of this system to *Mem. della Soc. degli Spett. Ital.* (vol. viii., Ott., Nov., Dic., 1919). He reminds us that it was this star which Sir W. Herschel, who discovered its duplicity in 17·0, used to demonstrate the extension of the law of gravitation beyond our system. On plotting the numerous observations of the last sixty years a minor oscillation clearly appears superposed on the orbital motion. This was explained by the discovery made by Wright and Campbell at the Lick Observatory in 1900 and 1908 that each star of the visible pair is a spectroscopic binary. The period of the pair A, a is 1·82 years, and their respective masses are given as 0·52 and 0·16 of the sun. The joint mass of B, b is given as 0·49 of the sun, but there is scarcely enough material to assign the respective masses of B, b. The parallax of the system is assumed to be 0·156″. If the mass of a is correct, this is about equal to the companion of Krueger 60, these being the smallest stellar masses known.

CHARLIER'S CRITICAL SURFACE IN ORBIT DETERMINATION.—Prof. Charlier showed that a certain surface divides those regions in space where there is a dual solution of the orbit problem from three observations from those where there is only one. Herr A. Wilkens gives in *Astr. Nach.*, 5067, tables for laying out this surface accurately. It suffices to give the intersection with the plane of the ecliptic, the surface being one of revolution about the earth-sun line. The curve resembles a looped *limaçon*, the double point being at the earth, the inner loop extending to the sun, and the outer one to a point 1·7844 beyond the sun on the earth-sun line produced. The table includes some other auxiliary quantities of use to orbit computers.