gealing probably is to bind the molecules into a rigid mass quite irrespective of any special polar attractions which they may have for each other. They are bound together by the general cohesive force, and their freedom of movement is much curtailed. This is evident not only because they cannot move sufficiently freely to take up the regularly oriented arrangement, but

FIG. 1.—Hard-drawn gold wire. Magnification $\times 700$.

also because their elasticity in this state is much less perfect than it is in the crystallised state; the molecules cannot vibrate freely in the amorphous state.

The effect of raising the temperature to the crystallising point is to raise the kinetic energy of the molecules, and therefore to neutralise a part of the cohesive force, thus weakening it and enabling the

FIG. 2.—Hard-drawn gold wire after crystallisation at 280° . Magnification $\times 700$.

molecules to spring into their uniformly oriented position; the crystalline state is thus restored and the internal energy of the mass is reduced. The present observations show that crystallisation occurs over a short and definite range of temperature—short, that is to say, compared with the ranges above and below the crystallisation range. Below the crystallisation

range the amorphous or non-crystalline form of the metal is known by direct observations to be perfectly stable down to -180° , while above that range the crystalline form is stable up to the temperature of liquefaction.

The changes in the electrical, mechanical, and other properties, which occur when the crystallisation range is reached, amply confirm the microscopic observations, and all point to the occurrence of an important change in the molecular structure.

By means of an acoustical method it has been found possible to detect the minute changes in elasticity which occur as the temperature is gradually raised to the crystallising range. In this way it has been made evident that there are two distinct stages in the relief of the molecular strains which are caused by hardening. In the first stage no important alteration in the other properties of the hardened metal occurs, while in the second and more important stage the complete restoration of elasticity exactly corresponds with the other changes which occur at the crystallisation temperature.

OCTOBER METEORS.

OCTOBER is a month when meteors are decidedly numerous. They are particularly abundant from October 15 to October 25, and this period includes the well-known shower of Orionids, but the conditions will be unfavourable this year owing to the full moon of October 21.

Early in the month there is occasionally a rich shower near the northern boundary of Boötes at $230^{\circ}+52^{\circ}$, and on October 8 there are many meteors from Aries about $42^{\circ}+20^{\circ}$, from Auriga, $77^{\circ}+32^{\circ}$, and from about this date to October 20 there is a well pronounced morning shower of long-pathed meteors from $154^{\circ}+39^{\circ}$.

Before sunrise the observer will also trace radiants at $101^{\circ}+1^{\circ}$, $100^{\circ}+13^{\circ}$, $108^{\circ}+13^{\circ}$, $121^{\circ}+0^{\circ}$, $133^{\circ}+68^{\circ}$, $133^{\circ}+48^{\circ}$.

Thirty years ago, viz. in 1877, during the first week in October there were very well pronounced showers at $133^{\circ}+79^{\circ}$ and $313^{\circ}+77^{\circ}$; the former gave swift streak-leaving meteors, the latter slow faint meteors.

October furnishes several radiants of Perseids, and one of the most notable of these agrees precisely in its apparent position with the centre of the great display of August Perseids on the date of maximum. Between October 8 and 14 I have recorded a number of slow meteors from a well defined radiant at $45^{\circ}+58^{\circ}$.

The principal shower in the last half of October is one of Arietids from near ϵ . On 1877 October 28–November 1, I saw thirty-one meteors from $43^{\circ}+22^{\circ}$, and on 1887 October 11–24, forty-five meteors were registered from $40^{\circ}+20^{\circ}$. The members of this system are white, rather slow, and occasionally brilliant, with trains of yellow sparks. As they were very active in 1877 and 1887, they may periodically recur at intervals of a decade, and be numerously manifested again in 1907.

W. F. DENNING.

MR. HALDANE ON SCIENCE IN COMMERCE.

A VERBATIM report of the speech on scientific commercial education in relation to the successful pursuit of trade, delivered by Mr. Haldane at Liverpool on September 19, and briefly mentioned in last week's NATURE, appeared in the *Liverpool Daily Post* of September 20. The two main points developed by Mr. Haldane in the course of his remarks were the domination of mind over matter and the value of