of Italy to get smooth paper and printing which they thought could not be had in England. The papers in the books of Baskerville, as well as in those of Dibdin and the Roxburghe Club, are below the standard of roughness now in fashion. When rough papers were common, the smooth paper was preferred. Now the tide has turned. Smooth papers being common enough, rough paper is "artistic." Price has something to do with artistic preferences. A spotty and cloudy smooth Japan paper is of more value than the rough hand-made linen; the wriggling vellum, too often greasily smooth, is highest of all in price. Is it the perception of really meritorious qualities in paper, or the intent to have what few can get, that makes the buyer at one time prefer, and at another reject, a smooth surface?

The opinion that dry paper does not hold ink as firmly as damp paper must have been obtained from some special or unfair experiment. Under the unwise and entirely unnecessary process of dampening the leaves (which will make them stick together), and of scrubbing or scraping these leaves together by violent beating under the book-binder's hammer, the ink will set off. Under this treatment any strongly printed work will lose its color, smear, or set off. But this is not a fault of printing, but of book-binding. Before leaving the bindery each copy of THE CENTURY magazine is tested by a direct (not a scraping) pressure of not less than a thousand pounds to every square inch of surface. Under this pressure any moisture or oiliness in the ink would at once be apparent. Twenty years ago the few black wood-cuts in books and magazines were faced with tissue paper to prevent smear. This tissue paper is no longer needed, although black wood-cuts are more frequently used, and are always printed with more ink and more clearness.

The best results are had from dry printing. Prejudice has nothing to do with this conclusion. The printers whose experience teaches them that dry and smooth paper has the best surface for wood-cut printing prefer dampening when the cuts are to be printed on rough paper. If an American printer were required to produce a facsimile of an early book on rough paper, he would surely dampen it. But the water that softens a rough paper is injurious to smooth paper.

The dampening of any paper is a practical admission that it is, in its dry state, unfit for press-work. Then come the questions: Why should it be unfit? Is it not possible to make paper printable by giving it from the beginning a faultlessly smooth surface? These questions have been fairly answered by the paper-makers of THE CENTURY. The paper they furnish is printed without dampening, yet with a sharpness of line on cuts and type, with a fullness of black, and a uniformity and firmness of color, impossible on damp paper.

Wood-cuts of unusual fineness and shallowness, with a delicacy of silvery tint heretofore rated as "unprintable," have been shown in this magazine (see pages 701–720 of the last volume of THE CENTURY), with the blackest of backgrounds, and without any loss of engraved work. If there be any printer who thinks he can get as good a result from damp paper, I am sure that I can not.

The publisher selects smooth paper, not because he thinks it luxurious, but because it yields better prints. He gets from it the result he seeks. It enables him to show a breadth, a beauty, and variety of engraving that cannot be shown by any other paper. He accepts the gloss on it in the same spirit that the book-collector accepts the specks and dinginess of India paper, the smoky cloudiness of Japan paper, the uneven thickness and variable color of vellum. He cannot get all the good qualities in any one fabric. He does not seek gloss. If he could get smoothness without gloss, he would have it.

Theodore L. De Vinne.

Recent Inventions.

IN the application of electricity to industry the tendency of recent work appears to be towards the construction of new forms of self-acting or self-controlling appliances. The opening or closing of a circuit at one point may cause the movement of an armature at a distant point in the same circuit. This is the underlying idea of the telegraph, fire and burglar alarms, and many other industrial applications of electricity, and a great number of inventions have been brought out seeking either to make the closing or breaking of the circuit at the transmitting end of the line, or the movement of the armature at the receiving end, automatic — self-acting, self-controlling, or self-recording. For instance, the rise of the mercury in a thermometer may close a circuit by touching a wire suspended in the upper part of the tube of the thermometer, and thus sound an alarm-bell. This idea is used in several forms of thermal alarms, and for another purpose in thermostats. The thermometer may be in a dry room or cold-storage warehouse, and the bell in a distant office, and serve a good purpose in reporting a dangerous rise in the temperature. The objection to such an alarm system is that it is too narrow in its range. It only reports the rise of the temperature to a known point, and tells nothing of the movements of the mercury above or below that point. One of the most recent inventions in this field seeks to make a self-reporting thermal indicator that shall give on a dial every movement of a thermometer at a distance.

For this purpose a metallic thermometer is used. It consists of a bar composed of two metals, having different rates of expansion and contraction, brazed together and twisted into the form of a spiral spring. By means of simple mechanism the bending of the bar, under the influence of heat and cold, is made to turn an index on a dial marked with the ordinary thermometer scale. In converting such a thermometer into an electrical apparatus for transmitting indications of the thermometer to a distance, a shaft moved by the variations in the instrument carries at one end a short arm. A sleeve, slipped over the shaft, carries the index of the thermometer, and also two arms placed one on each side of the arm on the shaft, and each connected with the line wire leading to the distant receiving station. There is also on the sleeve a toothed wheel, the arms and the wheel being insulated from the shaft. The receiving instrument consists of a shaft carrying a toothed wheel of the same size as the first, and also an index moving over a dial having a thermometer scale. On each side of the toothed wheel in each instrument are electro-magnets having armatures, that by means of levers and pawls control the movements of the wheels. While at rest the arm on the shaft of the thermometer or transmitter stands between the two arms of the sleeve and insulated from each, the circuit being open. If now there is any movement in the thermometer, caused by a change in the temperature, the arm on the shaft will move in one direction or the other, strike one of the arms beside, it and close the circuit. Three magnets are then brought into play, one after the other. The first magnet attracts its armature, and its movement first closes a shunt round the two arms, that have just met to close the circuit, and secondly operates the pawl and moves the wheel one step. Instantly after, the magnet at the receiving station is affected, and its armature, by means of the pawl, advances the wheel one step in the same direction. A third magnet is then brought into play to open the circuit and restore everything to its normal condition. As the two wheels thus move together one step, the index on each points on the dials to the same figure of the scale, and both report the same movement of the thermometer, however wide apart they may be placed. The advance of the wheel in the transmitter also serves to draw the arms apart and restore the instrument to its normal position, ready for the next movement in either direction. It will be seen that the system, while apparently complex, is based upon a simple mechanical movement. The turning of the shaft in either direction moves the wheel of the distant receiving instrument, and its index shows continually on the dial every movement of the shaft, and consequently every change in the thermometer. The shaft may in like manner be made to turn under any mechanical movement, be it the rise or fall of a barometer, the movement of a weather-vane, the rise or fall of the tide, the changing pressure of steam, gas, or air, or any physical force that it may be desirable to measure or record. In the instruments examined, the apparatus was employed in connection with a thermometer, a barometer, a steam-gauge, and a float in a water-tank, the transmitting instrument being in each instance at a greater or less distance from the receiver. In all except the barometer, the index of the receiver appeared to respond with precision to every movement of the transmitter. The instruments were also all fitted with a device for signaling on a bell whenever the maximum or minimum points of pressure, height of water, etc., were reached. The mechanism for this part of the system is made adjustable, so that the bell can be made to ring at any point desired. This system of indicating at a distance physical changes, however large or small, promises to be of great scientific and commercial value, because it makes it possible to observe and record variations in temperature, pressure, and even work at a distance. It can be used to record in a ship's cabin every variation in the wind, the temperature of the sea, the pressure of the steam, the speed of the vessel and her direction; to give variations of pressure in compressors, caissons, steam-boilers, vacuum-tanks, etc.; to indicate the quantities of water or other liquids in tanks and vats; and to show any changes in speed or out-put of machines, however great, or however minute. By the addition of any form of recording apparatus, the system can also be used to record automatically every movement at the distant transmitting station.

Among new school appliances is a clock designed to show the time at any given moment in all parts of the world. The clock does not differ in mechanism from any other clock, the novel feature being the arrangement of the figures on the dials. Two dials are used, one over the other, the smaller being in the form of a ring, and moving over the other dial in unison with the hour-hand. The larger dial covers the whole clock-face, and is marked with four systems of figures. The first system, in Arabic numerals, stands next to the edge of the dial, and begins at the beginning of the universal day, or midnight. The first number is at the left of the lowest point of the dial, and the others are arranged at regular intervals around the dial to 24 o'clock, or midnight. Midday, or 12 o'clock, is at the top of the dial, all the numbers to the left being marked A. M., and all to the right, or from 13 to 24 o'clock, being marked P. M. Within the circle of figures is a circle of Roman numerals, beginning also at the same point, or midnight, and marking XII figures to midday, and then XII more till midnight. Within this circle is another circle of 60 figures and points to mark the minutes for the hour-hand. Within this circle is also another system of figures giving 15 degrees of longitude, or one hour, and divided into 60 parts. The second dial moves over the larger dial with the hour-hand, and is marked with the degrees of longitude east or west in groups of 15 degrees. The hour-hand is in two parts, a single hand pointing to the minutes, and a series of fifteen minor hands that move with it. Supposing the clock is to be used at some point, say on the 75th degree west of Greenwich, the smaller dial is adjusted so that the figure 75 is opposite the hour-hand. The dial now moves with the hour-hand, and to find the hour at any degree of longitude it is only necessary to find the hour opposite that degree. The minute-hand will also give the time before or after that hour. If the place at which it is desired to know the time is not on one of the numbered degrees of longitude, and is either east or west of these, the time, faster or slower, can be estimated from the supplementary minute-hands and the inner circle of figures on the dial. This dial system explains a number of interesting geographical and time questions, and will, no doubt, prove of value in schools.

Charles Barnard.

A Plea for National Aid to Education.

THE movement to give national aid to elementary education, which originated with the National Aid Association a few years ago, nearly reached a successful culmination in the Blair Bill, passed by the Senate, and now awaiting the assembling of the next Congress. As a living issue of national importance and a measure of public safety, it ought to receive the general attention of the press. The larger journals and magazines have set a good example, but the network of local publications, through which the masses are best reached, have barely touched upon the subject. It has engaged the support of some of the greatest minds in this country, and literature on the subject is not wanting, but the means of distributing the data already available is sadly lacking.

Of course, the South will receive the most direct