sprats, mackerel, and other common species. A syndicate has lately been established in France to watch exports in the future, and prevent the sale of such fish as are not genuine and of marketable quality. The ordinary yearly production of sardines in France now reaches 500,000 cases.

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(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.
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For the Week ending March 4, 1876.

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INDUSTRIAL ART.---SOME THOUGHTS FOR THE CENTENNIAL.

A correspondent, referring to our recent editorial on what working men might contribute to the Centennial, in which we deprecated nickel or silver plating on handmade metal articles, and suggested file, polishing as a more workmanlike finish, asks whether we are not opposed to ornamentation of machinery or tools, and whether we do not think that artistic design is superfluous in implements or materials meant for "solid work." To this, we reply emphatically in the negative; and we have a few remarks to offer relating to the subject, which may be timely in their bearing upon the approaching exposition of our industries. It may be laid down as an unfailing rule that, when any person is given the choice of two articles, identical in every respect save that of grace of form or beauty of decoration, the handsomer will certainly be selected. This appears to be a simple enough proposition; but when it comes to be applied to great classes of manufactured products, those who make the latter seem to forget it, or at most to accord to it but very little attention. The majority of mankind even go further in their predilection for the tasteful, and in nine cases out of ten will prefer an inferior article of beautiful design, to a really superior object of homelier appearance, the gain in beauty compensating for the lack of usefulness. Several times a year dry goods dealers heap their counters with fabrics of elegant patterns; out of a variety of styles perhaps half a dozen may be "the rage," simply because of their beauty. As a result the resources of the manufacturer are taxed to the utmost to produce the particular kinds of goods demanded, and both manufacturer and dealer gain large profits on the favored fabrics. And yet these very goods may be identical, in every thing but dye or mere pattern, with whole bales of material which the dealer can scarcely get rid of at any price. The same is true of carpets, of wall paper, of crockery and glassware, of any of the varied products into which artistic design may enter. People will pay for beauty, pay for it on a scale which cannot be measured by any standard. They may examine their purchases for other qualities never so closely, may gage durability or strength or efficiency or internal composition to hairbreadth accuracy; but artistic finish and tasteful form defy us to judge how much money is commensurable with a given amount of elegance.

Not long ago a very wealthy merchant of this city paid $60,000 for a single painting about four feet in length by less than 3 feet in hight. From a purely utilitarian point of view, the picture was a mere bit of painted canvas, useless even as a fire screen; from an æsthetic standpoint it represented a fortune. The same merchant lately paid $9,000 for a block of marble. As a hitching post, that block would have been worth its cartage to the place where it was needed; as a sculptor's masterpiece, possessing exquisite beauty, its value exceeded even the large sum paid for it. We can proceed a step further, and glance at the amounts which, as a nation, we pay out for mere beauty. During the three months ending September 30, 1875, we imported $1,749,655 worth of fancy goods, such as Vienna trinkets, Swiss carvings, etc., $310,429 worth of paintings, statuary, and photographic pictures; and to this perhaps should be added $181,665 worth of jewelry and precious metal work. In the year 1875, we imported fancy goods worth $6,005,940, figures indicating nearly threefold the value of the similar imports of 1865. So much for the beauty we buy of other nations. Let us now compare these figures with those representing the artistic articles that we sell. For the three months above mentioned our domestic exports of fancy goods amounted to $90,250, of jewelry $19,307, and of paintings, including engravings, $46,079. Fancy articles we do not find quoted at all on the yearly tables; nor have we any such industry as their exclusive manufacture. For the quarter of 1875, however, we imported $2,241,759 worth of articles valuable principally for their beauty, and exported the same to the value of only $155,636.

To carry out our examination of this subject still further, we give here a list of the numbers of all persons engaged in artistic pursuits or callings which have for their end the decoration of raw products. There are 775 painters, 250 sculptors, and 2,948 general artists, 108 teachers of drawing and painting, 2,017 architects, 1,169 artificial flower makers, 208 bone and ivory workers, 79 bronze workers, 7,558 photographers, 4,226 engravers, 569 galloon and tassel makers, 1,534 gilders, 18,508 gold and silver workers, 970 mirror and picture frame makers, 85,123 painters and varnishers, and 223 plaster molders. Total 126,265. This aggregate is a little larger than that of all the teamsters and dairymen in the country; it is very much less than that of the blacksmiths, and it about equals that of the teachers. In fact, adding together the number of teachers who educate us, and the aggregate of those whose labor involves our artistic culture and refinement, we have a sum which just about equals the total number of tailors and milliners, and is 40,000 less than the total number of clerks.

Abundant evidence, similar to the above, can easily be adduced, first, to show that we import a very much larger quantity of artistic productions than we export, and that but a very small portion of our population is devoted to pursuits of an artistic or semi-artistic nature. What is true of individuals is equally true of nations. France, pre-eminent as the designer of beautiful wares, buys of us $50,000,000 worth of iron, and machinery, and provisions, and sends us $63,000,000 worth of articles, most of which find their way to the stores of the jewelers, the china dealers, and the picture sellers. Italy sends us $2,000,000 worth of art work in excess of the $7,000,000 in staples which we send to her shores. With the exception of these two countries, which for ages have led the world in tasteful and artistic productions, our exports to every other European nation are far in excess of our imports.

In face of all this, it is difficult for any one to see how the country can be otherwise than benefited by the fostering of art culture to its full extent among our workmen. The old world is tributary to us for rough and raw products, and for new means of manufacturing them. We are tributary to the old world for the means of gratifying artistic tastes which cultivate and refine. Let us develope the artistic ability which lies in us, and we are tributary no longer. Let us make our manufactured productions as elegant in shape, as graceful in design, as those of France, and then, and not until then, will we enter in fair competition with that country or any other artistic nation in foreign markets. Nor should we imitate. Copying is but servile work; originality in design the world seeks, praises, and pays for.

The above views we commend to the careful consideration of exhibitors at the Centennial. Many people, we have heard, propose showing machines taken straight from stock without further embellishment or ornamentation; others intend to send samples of their goods irrespective of pattern or design, trusting in the intrinsic excellence of the articles to secure notice and future custom. We think this is a mistake. It costs little to ornament a machine tastefully, and discrimination in selecting the handsomest patterns is easily exercised. The advantage gained will, in a collection of such entries, be twofold: first, we will show the world that we are able to produce tasteful and artistic designs, and, second, we shall have prepared a collection of models of industrial art which will be of the greatest value as an educator and in exciting the emulation of our own people.

A RAILROAD ACROSS THE EASTERN CONTINENT.

The great feat accomplished by the United States in connecting the Atlantic and Pacific Oceans, by a railroad across the United States, is stimulating enterprise in Europe; and it is now proposed—indeed the plan is matured—to connect the Atlantic and Pacific Oceans by a railroad through Central Asia. At a conference of the geographers recently held, Colonel Bogdanowitz explained some of the details of the road, which, it is expected, will overcome one of the great obstacles to the extension of civilization, namely, the separation of a large part of Asia from Europe by vast deserts, in which no means of transit but a railroad could be of any use. A railroad alone can develop the resources of the many lands through which it would pass; and as the mineral wealth of Siberia and the Ural Mountains is well known, the exploration and mining of these regions would be encouraged, and their resources developed.

It is proposed that the road shall start from Nijni-Novgorod, in Russia, where is now the extreme eastern station in the network of European railroads; it will run along the Volga to Kazan, then up the tributary of the Volga, the Kama, to Ekaterinbourg, on the Asiatic side of the Ural Mountains, then enter Asia, proceed in the direction of Troumen and Omsk at the Irtish, cross that river, and proceed by way of Kainsk to Tomsk on the Tom, a branch of the Obi, and cross that river. Tomsk is the principal center of commerce of Western Siberia; and thence the road will run directly to Irkutsh at Lake Baikal. Thence the road is to pass to the frontier of China, and then it is no longer an exclusively Russian, but an international undertaking. And here, also, the only serious engineering difficulties commence, at the mountain range of Kinghan, which, in its northern part, is crossed by the Amoor river. This range is the greatest obstacle: and it will be necessary to pass by the Mautchooria, and to lay the road from Baikal to Verhnéoudinsk through the valley of the Selenga. Then the best route by which to reach Pekin, the capital of China, near the Yellow Sea (a bay of the Northern Pacific Ocean) has been found to be that of Tchita and Dolounor. At the southern end, the famous great wall will be crossed; it already lies in ruins in many places. The whole distance from Nijni-Novgorod to Pekin will be 4,500 miles, of which 3,800 run through Russian territory.

When this plan is closely examined, according to known topographical data, the apparent difficulties dwindle down to nothing when compared to those encountered in the western section of our Pacific Railroad. The first section, from Nijni-Novgorod to Tomsk, runs on perfectly level land (the so-called steppes), similar to our prairies. In the second section, from Tomsk to Lake Baikal, the country is rolling, and interspersed with rivers and streams: but the greatest hight is only 3,500 feet, and the largest rivers are but of very moderate width and depth. The only serious difficulties, as we have said, lie at the Chinese frontier, and they are inferior to those overcome in the Rocky Mountains and the Sierra Nevada by the American engineers.

Russia has raised in 15 years more than $1,000,000,000 with which to construct 15,000 miles of railroad, and can easily find $300,000,000 or $400,000,000 to construct a line of such value to all the civilized world.

THE EDUCATION OF CROWS.

In the battle of wits between the gamekeepers and the crows of Germany, the latter are said to have acquired the ability to count as high as six—rather more than some tribes of human savages, if travelers' tales are to be trusted.

To protect the young broods of pheasants, the gamekeepers wage unsparing war against the crows, which have consequently become exceedingly wary and good judges of the range of ordinary guns. Various stratagems are resorted to by the keepers, one of them being to erect shelters near the gathering places of the crows, from which to shoot them when they unwittingly approach. The crows suspiciously keep aloof except when they are sure of safety; but the

moment the keeper departs, they flock to their posts of observation with provoking assurance. It is found that the keepers must go to the cover in parties of six or more, then depart one by one until six have left, leaving one or more behind to take vengeance on the crows. Should a less number than six visit the shelter, and all but one leave it, the crows perform the subtraction correctly, and know that there is yet no safety for them. Beyond six, their mathematical faculty fails—or did some years ago: perhaps they have learned to count more by this time.

It seems that the crows of Maine are only half as highly educated. A farmer in that State, exasperated by the depredation of crows among his sprouting corn, lay in wait for them often and long, but without success. Then he tried the German stratagem. He took his son with him to a shanty in the field, and shortly after sent him away; the hungry birds patiently waited until the farmer also departed, then they helped themselves. The next day he took two persons with him with the same result; first one person left the field, then another, the crows cawing their approval, but remaining in their safe position; and not until the third person had been seen to depart from the field would the cunning creatures trust themselves within gunshot of the little building. The next day, half a dozen entered it. Presently one of them went back across the field. The crows mentioned the fact among themselves, but kept their distance, among the trees. Another person went away, with the same result. Directly a third emerged from the building and disappeared, the unhappy crows, having reached the end of their mathematical rope, came down in platoons to their deferred breakfast, unaware of the three armed enemies still remaining in the building, who at once opened fire upon the poor birds, whose great misfortune was that they were unable to count more than three.

A gentleman writing to the Portland *Advertiser* says that this experiment was tried repeatedly, but the crows invariably lost their reckoning when the number exceeded three.

Evidently the education of the crows of Maine has been neglected. It would be an interesting experiment to repeat the process of deception to see how long it would take them to count four, or more.

THE CENTENNIAL BILL PASSED.

The bill appropriating $1,500,000 for the purposes of the Centennial Exposition has become a law. It passed the Senate by a vote of 40 to 15, and was soon after signed by the President with the plume of an American eagle, which some patriotic individual provided for the occasion. The accession to the Centennial funds prevents, it is said, the accumulation of any debts for the completion of the buildings and grounds. The act which grants the money is coupled with a stipulation that the sum shall be repaid into the United States Treasury, without interest, out of any profits which may remain after the subscribers to the capital stock shall have been reimbursed. This is of course a contingency which may or may not happen; but in any event the stipulation is a favorable one, and will tend greatly to appease the large number of people who have been opposed to Congress extending any pecuniary aid to the enterprise.

The financial prosperity of the Exposition now being secured, it remains for exhibitors to lend their best endeavors to assist the Centennial commission in having the entire American part of the show in readiness by the opening day. Our correspondents at Philadelphia state that goods are arriving very slowly, and that present indications point to a grand rush during the month of April. This only entails extra labor upon the Exposition officials, and tends to produce troublesome confusion and dissatisfaction among the exhibitors. It is very much to be hoped that exhibitors will not follow their usual practice, at the annual fairs throughout the country, of thus waiting until the last minute before sending their entries. They will find early arrival on the field to be very much to their own and to the general advantage.

THE COLLAPSE OF THE SHEFFIELD AMERICAN STEEL RAIL TRADE.

In referring to the progress of the steel rail manufacture in this country, nearly a year ago, we took occasion to point out the rapid falling off in the importation of steel rails from England, and expressed the opinion that a still further decrease would follow. We have, moreover, long adhered to the belief that, with our vast stores of mineral wealth supplying the material, all that our people have needed is experience and knowledge in utilizing it; and as that experience and knowledge augmented, so would our reliance upon the labor of other countries decline. As matters stand now, to quote from the English *Ironmonger*, "in the management of the Bessemer plant, the Americans must be yielded the palm; and this palm was yielded even by the English steel masters themselves at their great Barrow meeting. The real truth is that the Americans have learned how to make steel rails as well, if not better, than Englishmen, and there is no good to be obtained by hiding the fact."

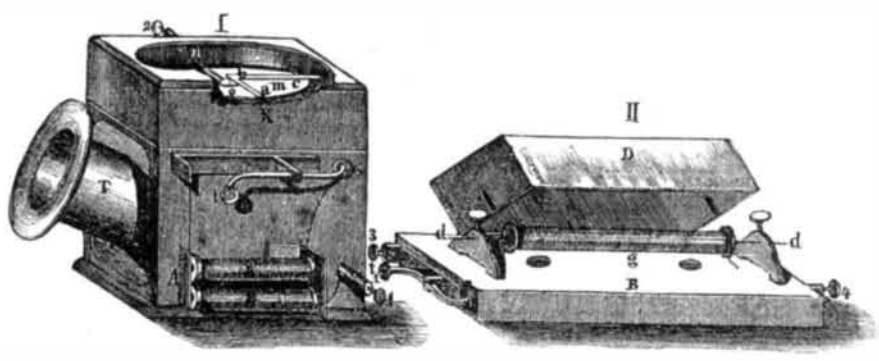
The reason of this candid admission by a leading English metal trade organ is found in the recent report of Dr. Webster, the American Consul at Sheffield. Steel makers in that great manufacturing town had felt severely the effects of a falling off in their American sales; but none, it appears, were prepared for the alarming announcement that the American market for their rails had practically closed against them. In 1873, Sheffield exported steel goods of all kinds to the United States of an aggregated value of $8,298,865; in 1874, this had fallen to $6,315,240; and the declared value of goods exported in 1875 still further falls to $3,456,160: a reduction of $5.000,000 in two years. Out of this aggregate of $3,456,160 for 1875, the value of the rails imported is but $11,505, and those rails were brought over here during the quarter ending March 31, 1875. Since that date, not a single tun of Sheffield rails has entered the country. For the last nine months of 1873 and 1874 respectively, the value of the rails imported hither was $1,311,890 and $1,136,610.

There are just four reasons for this loss of trade, which has stopped the machinery in several large Sheffield establishments. Two, namely, our high tariff and financial stress, might be urged with equal force as regards any other dutiable class of exports, and these, therefore, affect not a single branch of the latter, but our entire commerce with any foreign nation. The other two must be admitted as the more immediate causes; and these are, first, our progress, as already noted; and second, the blind conservatism, to use a mild term, of the Sheffield working men. So long as these men, through their combinations, persist in doing almost exactly as their grandfathers and fathers did to accomplish specific manufacturing results, so will they be distanced by more progressive people, irrespective of the nation to which the latter belong. Manufacturers, who employ a class of men who, again to quote an English contemporary, "display inveterate opposition to the use of modern mechanical appliances," must expect to find their productions unsought and their capital wasted; nor can they hope to compete with their American brethren, in whose more prosperous establishments the introduction of new machinery one year, and its abandonment for still further improved appliances before the twelve month has passed, are common occurrences.

THE INVENTION OF THE TELEPHONE.

BY P. H. VANDER WEYDE, M. D.

In connection with Mr. Gray's application of the telephone to the simultaneous transmission of several different telegraphic messages over one wire at the same time, and his paper read before the American Electrical Society (published on page 92, SCIENTIFIC AMERICAN SUPPLEMENT for February 5), it may be interesting for the readers of this paper to obtain some information in regard to the invention of the telephone, by Reuss. As mentioned in the article above referred to, Page and Henry observed that, by rapid magnetization and demagnetization, iron could be put into vibrations isochronic with the interruptions of the current; and later, Marian experimented extensively in this direction, while Wertheim made a thorough investigation of the subject, which induced Reuss, of Friedrichsdorf, near Homburg, Germany, to apply this principle to the transmission of musical tones and melodies by telegraph; and he contrived an apparatus which we represent in the engravings.



PROFESSOR REUSS' TELEPHONE.

The telephone of Reuss consists of two parts, the transmitting and the receiving instrument. Fig. I represents the former, and is placed at the locality where the music is produced; Fig. II, the latter, is placed at the station where the music is to be heard, which may be at a distance of 100, 200, or more miles, in fact, as far as the battery used can carry the current: while the two instruments are connected with the battery and the telegraph wire in the usual manner. One pole of the battery is connected with the ground plate, the other with the screw, marked 2 in our Fig. I, and thence over a thin copper strip, *n*, with the platinum disk, *o*, attached to the center of the membrane stretched in the large top opening of the hollow and empty box, K, intended to receive and strengthen the vibrations of the air, produced by singing before the funnel-shaped short tube attached to the opening in T. Over the platinum disk, *c*, attached to the elastic membrane, is a platinum point attached to the arms, *b c* and *b* K, while a set screw brings this point in slight contact with the platinum disk mentioned. A part of the box is represented as broken and removed, in order to show the internal construction. The strip, *a b c*, is connected with the end, *s*, of the switch, *t s*, and the screw connection, 1, at the lower right hand corner, and also, through the telegraph wire, to the instrument, Fig. II, at the receiving station, which may be situated at the distance of many miles. Here the current enters by the screw connection, 3, and passes through the spiral, *g*, surrounding the soft iron wire, *d d*, of the thickness of a knitting needle, and leaves the apparatus at the screw connection, 4, whence it obtains access to the ground plate, and so passes, through the earth, back to the battery. The spiral and iron wire, *d d*, is supported on a hollow box, B, of thin board; while a cover, D, of the same material is placed on top, all intended to strengthen the sound produced by the vibrations which the interruption of the current caused in the iron wire, *d d*, so as to make these vibrations more audible by giving a large vibratory surface, in the same way that the sounding board of a pianoforte strengthens the vibrations of the air caused by the strings, and makes a very weak sound quite powerful.

If a flute be played before the opening, T, or if a voice be singing there, the vibration of the air inside the box, K, causes the membrane, *m*, to vibrate synchronically, and this causes the platinum disk, *o*, to move up and down with corresponding frequency. At every downward motion the contact of this disk with the platinum point, under *b*, is broken; and therefore the current is interrupted as rapidly as the vibrations occur. Let, for instance, the note C be sounded; this note makes 64 full vibrations in a second, and we have, therefore, 64 interruptions of the electric current, which interruption will at once be transmitted through the telegraph line to the receiving instrument, and put the bar, *d d*, into exactly similar vibrations, making the very same tone, C, audible; and so on for all other rates of vibration. It is clear that, in this way, not only the rhythm of music can be transmitted (and this can be done by the ordinary telegraph), but the very tones, as well as the relative durations and the rests between them, can thus be sent, making a full and complete melody. The switch, *t s*, Fig. I, is intended, in connection with a similar one in Fig. II, to communicate between the stations, with the help of the electro-magnet, E E, to ascertain if station, Fig. II, is ready to receive the melodies; then it gives the signal, by manipulating the switch, which is received by the attraction of the armature, A, the latter arrangement being a simple Morse apparatus, attached to the telephone.

Professor Heisler, in his "*Lehrbuch der technischen Physik*" (3d edition, Vienna, 1866), says, in regard to this instrument: "The telephone is still in its infancy; however, by the use of batteries of proper strength, it already transmits not only single musical tones, but even the most intricate melodies, sung at one end of the line, to the other, situated at a great distance, and makes them perceptible there with all the desirable distinctness." After reading this account in 1868, I had two such telephones constructed, and exhibited them at the meeting of the Polytechnic Club of the American Institute. The original sounds were produced at the further extremity of the large building (the Cooper Institute), totally out of hearing of the Association, and the receiving instrument, standing on the table in the lecture room, produced (with a peculiar and rather nasal twang) the different tunes sung into the box, K, at the other end of the line; not powerfully it is true, but very distinctly and correctly. In the succeeding summer I improved the form of the box, K, so as to produce a more powerful vibration of the membrane, by means of reflections effected by curving the sides; I also improved the receiving instrument by introducing several iron wires in the coil, so as to produce a stronger vibration. I submitted these, with some other improvements, to the meeting of the American Association for the Advancement of Science, and on that occasion (now seven years ago) expressed the opinion that the instrument contained the germ of a new method of working the electric telegraph, and would undoubtedly lead to further improvements in this branch of Science, needing only that a competent person give it his undivided attention, so as to develope out of it, all that it is evidently capable of producing.

Before leaving this subject, I wish to draw special attention to the fact that the merits of this invention consist chiefly in the absence of musical instruments, tuning forks, or their equivalents, for producing the tones: any instrument will do, flute, violin, human voice, etc. If the aerial vibrations are only conducted into the box, Fig. I, the apparatus will send the pitch as well as the duration of the different tones, with the rests between, therefore not only transmitting perfect rhythm, but a complete melody, with its long and short notes. The two parts of the apparatus may even be connected each to a separate pianoforte; and if this were done in a proper manner, a melody played on the pianoforte connected with the transmitting instrument, Fig. I, would be heard in the pianoforte, at a great distance, connected with the receiving instrument, Fig. II.

Fighting Rams.

Says a correspondent of the Ohio Farmer: "At certain seasons of the year, rams are apt to develop their combative propensities, and those who keep several of them together often have trouble on account of their injuring each other. It is well known that they always 'back-up' to get a start to butt. Stop their backing-up and you disconcert them entirely. To do this, take a light stick (a piece of broom handle will do), about 2 or 2½ feet long. Sharpen one end and lash the other end securely to his tail: the sharpened end will then draw harmlessly on the ground behind as long as his majesty goes straight ahead about his business; but on the attempt to 'back-up' he is astonished to find an effectual brake in the rear. Don't laugh and call this 'all gammon:' but if you have a butting ram, try it, and the time to laugh will be when you see him jump out sideways, and whirl round and round, trying to inspect the machine, which will keep behind him."

DR. HAUGHTON has proved that the strength of the lion is only two thirds that of the tiger.