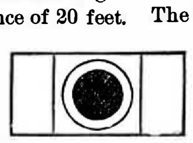
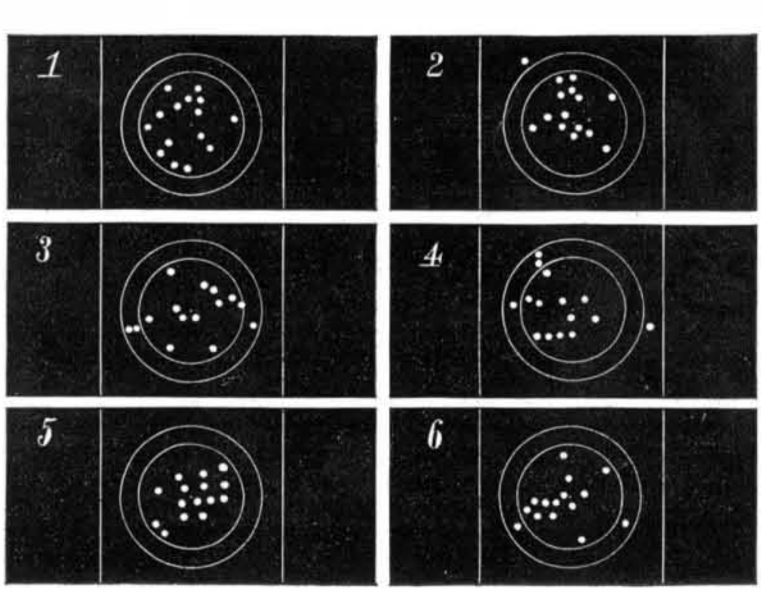
THE CENTENNIAL INTERNATIONAL RIFLE MATCH.

The international contest between the five best rifle teams in the world has resulted in a substantial victory for the American marksmen. The match was organized under the auspices of the Centennial Commission and held at Creedmoor near this city, and the American riflemen were brought in competition with picked teams representing the crack shots of Canada, Ireland, Scotland, and Australia. The contest lasted during two successive days, and on each day each marksman fired fifteen shots, respectively at targets located at distances of 800, 900, and 1,000 yards. The system of counting hitherto practised was employed, a bullseye marking 5, a center 4, an inner 3, and an outer 2, so that the highest amount possible to make by any fifteen shots was 75. At the end of the first day, the Scotch team led, the total scores footing up as follows: Scotch, 1,586; Irish, 1,582; Americans, 1,577; Australian, 1,545; and Canadian, 1,490. On the second day, however, the Americans worked steadily ahead, making a final score of 3,126 points, which left them 22 ahead of the Irish, who were second with a score of 3,104 points, and 64 over the Scotch, who netted 3,062 points in the two days shooting. The Australians finished with a score of 3,062, and the Canadians came last with a score of 2,923.

Some shooting was accomplished which, when the accidental difficulties to which the marksman is subject are considered, was simply marvelous. Two of the three distances shot over exceed half a mile. To obtain an idea how a target, having a bullseye 3 feet in diameter, looks to the rifleman when located so far away, pin this paper to the wall and regard the diagram herewith given from a distance of 20 feet. The black dot in the center then represents the exact size of the bullseye 1,000 yards away. To hit a mere speck like this is certainly difficult enough; but there are numerous accidental disturbances which combine to vitiate the straightest aim.



If the wind is blowing with the direction of the bullet, the latter is accelerated; and unless allowance is made, the shot flies over the target. If the wind blows in reverse direction, then the bullet is retarded, and is liable to fall short. In case of a side wind, the bullet is apt to deviate; while the grooving of the rifle gives the bullet a natural drift to the right. A "fishtail wind," which blows partly up or down the range and partly across, with varying strength as well, is extremely perplexing, and the sights on the rifles are readjusted for every shot. If the ground be damp and the sun hot, a shimmer of mist on the surface makes the target appear to dance; variations of light and shade apparently lift or depress the target center; heat and cold affect the metal of the gun. Then, besides, the bullets must be perfectly smooth and of uniform density, and the rifle perfectly clean. After all this, when the man has learned to hold his rifle true to the little bubble of the spirit gage which rests between the front and rear sights and across the barrel, and can hold it with a vice-like grasp, can repress for a moment all motion, and hold his head as steady as a rock and pull the 3 lbs. resistance of the trigger, and care not at all for the 200 lbs. kick which the rifle gives a shoulder probably already black and blue through previous blows, then, if he has not misjudged in any particular, he stands a chance of hitting the bullseye. Now imagine men overcoming all these difficulties and making such targets as these here reproduced. No. 1 shows 15 bullseyes in succession, the finest target ever made at 1,000 yards. It counts 75. This was done by Mr. J. K. Millner, of the Irish team. The second best target at the same range is given in No. 2. The count is 73, made by Dr. J. Mitchell, of the Scotch team.



The next two targets are the best at 900 yards. No. 3 was made by Mr. R. Rathbone, of the American team, and counts 72, and No. 4, by Mr. R. McVittie, of the Scotch team, scores 71.

The last two targets are the best at 800 yards. No. 5 is another very remarkable instance of 15 bullseyes in succession, made by Mr. E. Johnson, of the Irish team; and No. 6, by Mr. N. Thorburn, of the Scotch team, counts 73.

HEATING BY STEAM.

"The frequent occurrence, during the past few months, of fires in steam-heated buildings and dry kilns, and more particularly the burning last week of the dryer attached to the Mason Lumber Company's mill, at Muskegon, Mich., which I understand was of this type, must lead every one who has occasion to use steam heat, in any way, to inquire what causes them.

"It is certainly time that this subject should be more carefully and scientifically studied, and I think when the matter is better understood that all will be convinced that the trouble is not in the steam pipes or steam heating, but only in the imperfect construction of the heating apparatus. It matters not how the heat is produced, whether by steam, furnace, or hot water; all may be alike safe, or all dangerous, only dependent on how it is generated and applied. During the last decade I have examined hundreds of steam-heated dry rooms, and I am satisfied that, in a large majority of cases, either the supply pipe or a large part of the heating pipes have been supported by wood, and, in many cases, the former packed in sawdust and shut completely from the air. I have seen a pine timber six inches square and eighteen feet long (on which a 4-inch steam supply pipe has laid for months in daily use), when removed, so charred that I could and did split off pieces from one to two feet long with my hands, it breaking almost as readily as charcoal. Again, I have seen sawdust, that had been long packed around a steam pipe, so browned or scorched as to be almost black. I have also seen, in dwelling houses where tin conductors are used to carry the heat from a furnace, the pipe nailed to the wood, and upon examination have found the wood so charred around the nails that they could be removed with the fingers. The latter occurs most frequently directly below the register, and is the result of closing the valve, thus stopping the flow of air and confining the heat; while the fire in the furnace burns on as if the register was open. This explains why so many houses burn down where furnaces are used. But steam heat will accumulate as well as any other.

"Place a pipe on a wood support or closely pack it with any combustible material; and there being no circulation of air between the pipe and the wood, the heat is confined and accumulated, until at last, the conditions being just right, ignition is effected and all is gone. In other words the principle of accumulation applied to heat will make anything hot or burn any combustible substance up at last. In science I believe they call this law "the accession of forces"; it may be tested and illustrated by any one. Let any man who uses steam put his hand lightly on any heated pipe, and he may hold it there for several seconds without inconvenience. But let him grasp the same pipe with a firm grip, and, although the temperature of the pipe is not changed, he at once feels an increase of heat, and in a moment his hand will be blistered wherever it comes in contact with the iron. Now suppose we bind the hand there, and surround it with sawdust or any other non-conducting substance; how long would it take to literally roast that hand and cook all the flesh off the bones? Only a few hours at most. What then is the law? Simply that of holding the heat; and although received at only 212°, by keeping all we get and taking all that comes, it soon runs that up to 250°, 300°, or more. Now the hand might be held within one half inch of that pipe all day and no inconvenience felt, as the free circulation of air would prevent the temperature increasing. The law I understand to be the same, whether it is a hand, a piece of wood, or any other substance, that incloses the pipe. If we cut off the circulation of the air next to the pipe and surround it with a poor conductor like wood, the heat must accumulate, and doubtless often does, to the point of igniti of.

"When we lay our pipe on wood we convey the motion on the fire along the pipe by the steam, and it again passes into the wood under the pipe, where it accumulates and increases until the ignition point is reached and the wood takes fire."

The foregoing is from a letter from "H." to the *Northwestern Lumberman*; it is excellently written, and contains pertinent and interesting examples, but unfortunately it reaches a conclusion which is altogether baseless. The temperature of saturated steam depends on the pressure, and it cannot be augmented without augmenting the pressure likewise. In order, however, to check the too free radiation of heat and cousequent diminution of pressure, we felt or jacket boilers, steam pipes, cylinders, etc. These roughly stated facts are part of the A B C of engineering; but the above writer seems to have forgotten them, and he commits the more grievous scientific error of confounding the mechanical energy resident in steam with the physical properties of that vapor. Some brief reasoning will show this, and may prove interesting. Professor Trowbridge, in his recent work on "Heat and Heat Engines," admirably defines a steam boiler as "the apparatus by which, through the process of combustion, a rapid degree of heat motion is developed in the fuel and gaseous products of combustion and transferred to the particles of water." These last, in a steam-heating apparatus, communicate their heat motion to the molecules of their pipes or other enclosing vessels, thence the heat motion passes to the air molecules, and lastly to the molecules of our bodies, and the sensation called warmth is experienced. Now if we interpose any substance which prevents or retards these waves of heat at any point of their transmission, we merely confine them or render their escape slower. We do not accumulate them. The case is analogous to that of a suspended weight; the energy is there constant so long as gravity acts; it is in potential form; cut the string and the weight falls, and in so doing does work. It will not be pretended that the weight will exercise any more potent effect by hanging two hours or two centuries. No additional power is stored up. Now the steam pipe unjacketed communicates heat motion, jacketed it does not. The jacket in this case is the same as the cord which suspends the weight in the other, for heat and mechanical energy are mutually convertible. Obviously then no more additional heat is stored in the first than force or energy in the second instance. Further, if by jacketing through accumulation we can augment heat, therefore we augment mechanical energy, therefore we obtain an accession of power through a purely mechanical device, and therefore we land in the principle of a perpetual motion.

The error lies, as we said before, in confusing the molecules of steam with their mode of motion. Shut steam up in an invariable space and apply heat continuously, and temperature and pressure will steadily increase until the last element of liquid vaporizes and then the steam goes on to assume the properties of a permanent gas. But it will not do to confound the steam jacket with the safety valve, and such the above writer seems to have done.

As regards the ignition of wood, etc., by steam pipes, the true theory is pretty well settled as follows: The temperature of saturated steam, such as circulates in heating pipes, even at the unusual pressure of 120 lbs., reaches but 341° Fah. The temperature of 900° is about that of the red heat necessary to set dry woodwork on fire, so that it must be clear that saturated steam can never directly excite a conflagration.

The molecular conditions under which the oxidation, resulting in spontaneous combustion in many substances, occurs originate at a very much less temperature than 341°; and it would appear that under certain circumstances the heat of steam pipes is sufficient to determine these conditions in certain woods. There is good ground for crediting the idea that two circumstances here play a prominent part. These are, first, that the wood or other fibrous material must be, by protracted heat and dryness, reduced to a punk-like state in which it is easily friable, and, second, that it becomes pulverized and so offers a very large surface to the effects of oxidation, which last are assisted by the high temperature of the contiguous pipes. Some woods are more liable to become in punk state than others; and if the foregoing probabilities, through that much needed thorough investigation into the whole subject which we have long hoped to see, be rendered certainties, then it will be one of the first duties of architects to avoid such woods in house construction.

The above, in our opinion, is the true philosophy of the phenomenon; but if the writer of the foregoing extract or any reader still feels inclined to adhere to his "accumulation" theory, it is only necessary to fasten a thermometer against a steam pipe, cover it well with felting, and observe, after a few hours or so, whether the mercury rises beyond the known temperature of the steam corresponding to the pressure.

Those Collided Locomotives.

In our issue of July 1 last, we published a large engraving of a railway collision, wherein the two locomotives, on meeting, had reared up in a most remarkable manner and remained sitting, as it were, on the ends of their respective fire boxes. We stated that our illustration was prepared from a photograph of the actual scene, but where the event took place we were unable to affirm, and therefore asked of our readers any information leading to the discovery of both railroad and locality. We received in reply a host of letters. Some writers detailed accidents which happened long ago, which they were sure were the foundation of the picture, while others doubted the veritability of the occurrence and even took us to task for being so easily imposed upon. Others again, not content with mere assertion, exercised much ingenuity in explaining to us in detail how the appearance of the various parts of the engines and appendages utterly negatived the idea of any such collision.

The upshot was that we determined to ferret the matter out, and we have done so. In the SCIENTIFIC AMERICAN SUPPLEMENT, of even date with the present number, will be found the whole story. We publish several of our doubting correspondents' letters, and also that of the person who prepared the original photograph. The collection is extremely amusing and interesting, the latter especially, inasmuch as the circumstances of the strange collision are fully explained.

Arrival of German Workmen.

Two delegations of French workmen have been over to visit the Centennial, and have returned to their native country. The steamer Mosel, lately arrived in this city, brought a delegation of German workmen, members of the Berlin Central Bureau for the Benefit of Workmen. The following are their names and trades:

Albert Anderleit, locksmith; Otto Bærwolff, draftsman; J. Berckenhagen, engineer; Eduard Breslauer, engineer; Carl Burchardt, engineer; Carl Cario, technicist; George Daunert, technicist; Richard Fleck, machinist; Richard Fleischer, engineer; Oscar Hadank, goldsmith; Joseph Hoffmann, tinsmith; Wilhelm Kraemer, technicist; Johannes Leman, of Polytechnic Academy of Berlin; Joseph Luedtke, printer: Robert Maerz, engineer; Louis Meissner, engraver; Otto Neumann, mechanician; Franz Pest, coppersmith; Otto Pilz, engineer; George Rodenwoldt, architect; H. A. Schneider, boot maker, etc.; O. Schneider, draftsman; Julius Schreiner, sculptor; Oswald Strasser, engineer; Carl Strietzel, technicist; Max Unger, of Polytechnic Academy, Berlin; J. Wichelmann, goldsmith; Carl Wirth, sculptor.

Free Trade with the Sandwich Islands.

By the terms of the new treaty made with the Hawaiian Islands, the following products may be imported duty free: Arrowroot, castor oil, bananas, nuts, vegetables, dried and undried, preserved and preserved; hides and skins undressed; rice, pulu, seeds, plants, shrubs, and trees; muscovado, brown, and all other unrefined sugar, meaning hereby the grades of sugar heretofore commonly imported from the Hawaiian Islands and now known in the markets of San Francisco and Portland as Sandwich Island sugar; sirups of sugar cane, melado, and molasses; tallow.