

A COTTAGE AT CRANFORD, NEW JERSEY.

Our illustration is of a cottage recently completed for Mrs. D. H. Morrison, at Cranford, N. J. The design is a mixture of Queen Anne and Colonial architecture. It has many pleasing features. The underpinning is built of pressed brick laid in red mortar. The stonework and arch to front piazza are built of rock-faced red sandstone. The first story is clapboarded and painted olive green, with bottle green trimmings; second and third stories are shingled and stained oak color. Roof shingled and left to weather finish. Dimensions: Front, 35 ft.; side, 39 ft. 6 in., not including piazza and bay windows. Height of ceilings: Cellar, 8 ft.; first story, 9 ft. 6 in.; second, 9 ft.; third, 8 ft. 6 in. The several rooms, communicating as they do, make a most attractive vista of the entire floor. The hall is trimmed with ash, and the other apartments with whitewood. The broad, low, ornamental staircase and paneled divan are the features of the hall, while the old casement window with seat and antique mantel make the dining room in keeping, and the several spindle transoms and leaded windows carry out the antique effect so successfully sought. The parlor is treated in ivory white and gilt, and it contains an open fireplace built of brick, with tiled hearth and facings, and a Colonial mantel, with columns, etc. Dining room is stained and finished in cherry. The butler's pantry and store pantry are of sufficient size to contain the usual fixtures, drawers, shelves, cupboards, etc. Kitchen is wainscoted, and all the woodwork is finished natural. It contains all the improvements. There are four bedrooms, large closets and bathroom on second floor, and three bedrooms and storage on third. Bathroom is wainscoted and furnished replete. Cemented cellar contains furnace and other necessary apartments. Cost \$5,000, complete. F. W. Beall, architect, New York.

Our engraving was made direct from a photograph of the building, taken specially for the Architects and Builders Edition of the SCIENTIFIC AMERICAN.

Other exterior views, also plan of the interior of the house, are shown in the issue from which this view is taken.

Mecca as it is.

The Architect and Builder describes the present condition of this ancient city:

The streets of Mecca are regular, handsome, paved, and level. The houses are built of stone in the Persian and Indian style, with highly ornamented fronts, and are four or five stories high.

Every one is aware that the Holy of Holies at Mecca is the mosque or temple called the Kaaba. It was built of stone brought from the mountains which surround the town. It is twelve meters long, ten broad, and fifteen high. Of its origin nothing is known. According to Mussulman legends the first Kaaba was constructed in heaven two thousand years before the creation of the world. As to the Kaaba of Mecca, it dates from Adam, who built it immediately below the celestial Kaaba. In the course of ages it has been sometimes reconstructed and restored. It is thought that the last restoration dates from the sixteenth century. The doors of the Kaaba are covered with plates of silver and gold. In the interior are treasures which are gifts of the faithful. The floor is flagged with marble. The building is lighted by lusters and candelabra of great value. The whole temple is covered by a housing of enormous dimensions. This housing, which is called Kiswah, is of black brocade bordered with a gold band. Every year regularly a new Kiswah is sent from Egypt. In the interior of the mosque is the sacred spring called Zemzem, to which curative powers are attributed.

At the eastern angle of the Kaaba, five feet above the ground, is the Black Stone fastened in the wall and surrounded with a silver ring. Its visible face is about twenty-five centimeters in diameter. A round hollow in its center is probably the result of the numerous kisses of the faithful. It is not possible that fire has turned this stone black from being white, as it is pretended it was originally. This idea has its origin

in one of those legends with which the Mussulmans have adorned their religion, and according to which it is said that the stone was once whiter than milk. The Spaniard Badia, or Ali Bey, considered the stone a piece of volcanic basalt, Burckhardt a piece of lava, and Burton an aerolite, which the Arabs saw fall and considered a sacred thing. There are at Mecca several black stones of this kind, all regarded with veneration. In going through what is called the Street of Stones two of these black stones are seen fastened in walls. One of these has the form of a cylinder; the other is flat with a hollow of half-spherical form, which, it is pretended, is the print of the elbow of Mahomet. In the houses in which Fatima, Ali, and Mahomet were born the devout visitor embraces like stones, slightly hollowed in the middle. These are the most venerated fetishes of the ancient Arab paganism. Upon the Aboukoubes, the sacred mountain which rises on the east of Mecca, is found a rocky formation of the same kind, and the Arabs pretend that the celebrated Black Stone of the Kaaba came from this place. An Arab legend confirms this statement.

Ball Bearings for Wagons.

Ball bearings are successful only when the balls themselves are of the highest quality, and the shells and axles are of the best steel, hardened and ground to the highest perfection, writes Prof. Sweet in the Rural New Yorker. The limit of error in the best does not vary more than one-quarter of one-thousandth of an inch, or one-fourth the thickness of tissue paper.

of hauling on the farm roads 40 to 50 per cent, and the cost of the changing to ball bearings would equal the cost of the new wheels and front or back axles.

The Time of Mental Acts.

Let a dozen or twenty persons take hold of hands in a ring; each is to press the hand of his right hand neighbor as soon as he receives a pressure from the left. One person starts the pressure going, and at the same instant observes the position of the second hand of a watch. The pressure passes all around the circle; and when it arrives at the originator he notes how many seconds were required for the given number of persons in succession to receive an impression and make up their minds to act in response. The total time is then divided by the number of persons. This is a crude illustration of the reaction time which we measure with great accuracy on single persons.

As the mental portion of the reaction time becomes more complicated, the time becomes longer. For example, the processes of mental discrimination and choice require times of their own. The way we get at these "higher" mental processes can be illustrated in a simple way: A person placed in a quiet room is to tap a telegraph key every time he sees a red light, which can be produced at the will of the experimenter in the recording room. The interval of time between the actual appearance of the light and the moment the key is tapped is accurately measured. For a while nothing but the red light is used; this to obtain the simple reaction time. Then red and yellow lights are

turned on in irregular succession. The person has now to discriminate between two colors and to choose between action and non-action. The increase of time required over the simple reaction time gives the discrimination time for two colors. In another set of experiments three colors are used; then four colors. As the discrimination and choice become more complicated, more time is required.

The importance of rapid and accurate reaction and discrimination is evident. Astronomers have difficulty in recording the moment at which a star passes a line in the telescope. The sportsman must pull the trigger at just the proper moment. The football player, the fencer, and the boxer are trained in rapidity of discrimination

and reaction. It is very evident that a player or a pugilist who takes a long time for discrimination, choice, and volition will give a decided advantage to a quick opponent.—The Forum.

Military Brutality.

The German army has long been notorious for the brutal manner in which the private soldiers were treated by the non-commissioned and other officers. The system was inaugurated by the Great Frederick, and the military authorities since his day seemed unwilling to allow it to die out. Happily the present Emperor seems determined to have none of it. His imperial rescript on the subject forbidding any officer to strike his men made some sensation when it was issued, though it was commonly said in army circles that it would soon be a dead letter. A few recent cases prove the contrary. A well-known officer was recently dismissed the service with ignominy for the offense of striking a man in the ranks, the Emperor personally indorsing the order for his dismissal with a severe and cutting remark. Last week at Breslau a sergeant who was charged with ill-treating a soldier was tried for the offense by a council of war, was sentenced to two years' imprisonment in a fortress, and when his sentence has expired to rejoin his regiment as a soldier of the second class.

SIR JOHN LUBBOCK in his recent opening address to the Congress of the International Institute of Sociology, Paris, said that in Great Britain, one third of the taxation goes to pay for the wars of the past, one-third in preparing for wars of the future, and only one-third remains for the needs of the country itself.



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Such perfection is very costly, and the least dirt destroys the whole gain, for if the balls be stopped by any impediment, they are very soon ruined. Such accurate work is not likely to be properly protected or properly cared for in farm vehicles. Hence it is questionable whether the failures would not more than overbalance the advantages; besides, in the cost of drawing a load, a part is friction and a part is overcoming the ground resistance. The poorer the road, the greater is the ground resistance, and this has a great bearing on the percentage of advantage; for supposing that, in the case of a trotting sulky, the friction is half the resistance and the ground resistance the other half, now, if we reduce the friction one half, the power required to draw the sulky would be reduced one-quarter or 25 per cent; whereas if, in drawing a lumber wagon, the friction is 10 per cent and the ground resistance 90 per cent—which on a farm and farm roads is about what it amounts to—then, by reducing the friction one-half, we have reduced the actual power required only 5 per cent. The time has not come when it will pay. It will be an infinitely better investment to use the same money to put wide tires on the wheels and cut off the forward axles so as to bring the forward wheels the width of the tires nearer together than the hind ones. I have just been over a dirt road where one hundred tons of limestone are drawn every day, and the ruts were horrible when only common wagons were used. The road is now splendid, all owing to the use of half the number of wagons built as above described, while the ball bearings could at the best reduce the power required to draw farm wagons only from 5 to 10 per cent. The wide tires and short axle wagons would reduce the cost

A Year of Record Breaking.

This year will be memorable in the annals of athletics, sports, and physical achievements generally for the raising of the old standards of performance. When the trotting season began Nancy Hanks' record of 2:04 had stood unbeaten for a long time. Alix has brought it down to 2:03½. On the pacing track Robert J. has lowered the record to 2:01½, beating Mascot's previously fastest mile by 2½ seconds. Directum has made a new record for two year olds by pacing a mile in 2:07¾. Fantasy has made a new trotting record for four year olds by covering a mile in 2:07¾. The wonderful performance of Flying Jib at Chillicothe, Ohio, September 29, when, hitched to a running mate, he paced a mile in 1:59½, is the crowning track feat of the season. This feat is made still more astonishing by the fact that the last half mile was paced in 58½ seconds. The best previous pacing record made by a horse hitched to a running mate was that of Westmont, who, in 1884, at Chicago, covered a mile in 2:01¾. Robert J. still holds the pacing record, but Flying Jib's work has made it probable that in the near future a mile in two minutes or less will be paced by a horse running without a mate. Nearly all the old mile turf records have been broken this season, and we must not forget in this brief review that Ducat, at Sheepshead Bay, on August 28 last, ran a mile in 1:39, carrying 113 pounds—the best one mile time ever made on a circular track.

Passing from fast horses to swift men on wheels, we find nearly all the previous bicycle records have been surpassed in 1894, and probably the next month will break them still more. J. S. Johnson has made a half mile spin against time in 54 seconds. One mile has been flown over by J. P. Bliss in a fraction over 1:52. With standing starts N. Butler has cycled two miles in 4:04 4-5; while J. S. Johnson has spun three miles in 6:26 3-5, four miles in 8:38 4-5, and five miles in 10:48 4-5. E. C. Bald has made a mile in competition in 2:05 4-5. F. J. Titus has covered 26 miles and 1,489 yards in one hour, spinning against time. And the best previous twelve hour competitive race time has been beaten by Walters, in London, who made the astonishing run of 258 miles in that time, or 21¼ miles an hour.

Many other new athletic world's records have been made within the past month. The best world's running time for 300 yards has been lowered to 31 3-5 seconds. The farthest throw of a 56 pound weight has been increased to 35 feet 10 inches. The best time of a 120 yard hurdle race has been lowered from 15¾ seconds to 15 3-5 seconds.

The fastest time for swimming 100 yards was 1 minute

and 12 seconds until September 15 last, when it was reduced to a fraction below 1 minute and 9 seconds. A new swimming record for 880 yards has also been made for the world; the old one was 6 3-5 seconds slower.

The greyhounds of the sea, as the Atlantic steamers are not unfitly called, have also been contributing to the record breaking of this phenomenally fast season. The Cunarder *Lucania* made her last passage from Queens-town to New York, or, to speak more exactly, from Daunt's Rock to Sandy Hook—2,782 miles—in 5 days 7 hours and 48 minutes, or at an hourly average speed of 21.77 knots. This beats the best previous record, which was also made by the *Lucania*—5 days 8 hours and 49 minutes. This ocean racer now holds the best records for the eastward as well as the westward run, her eastward time being 5 days 8 hours 38 minutes. The American liner *New York* has broken the best previous record of time between Southampton and New York, which she has steamed, over a course of 3,030 miles, in 6 days 7 hours and 14 minutes. The best run to Southampton from New York is still that made by the Hamburg-American liner *Fuerst-Bismarck*, which made it in 6 days 11 hours 44 minutes.

Truly we live in a rapid age, and if we have not yet reached "the pace that kills," it seems likely that the extreme limit alike of human energy and endurance and of the power of machinery and steam is in sight. As we see from these records, the carefully bred and trained horse can pace a mile in less than two minutes, and yet the trained man on his steel horse can beat him by nearly eight seconds. Neither animal nor human flesh and blood can be expected to go much farther in the way of overcoming the obstacles of space and distance and enlarging the possibilities of time. It is no longer a debatable question whether in physical powers the best men of this age excel the best men of ancient times. There is no well-authenticated record of a Grecian athletic feat that has not been beaten by the athletes of this nineteenth century. Leander's swim across the Hellespont was far outdone when the late Captain Webb swam across the Straits of Dover from England to France. Lord Byron had already equaled Leander's feat. The Spartan runner Ladas dropped dead on completing a race of 2¼ miles, and it was thought to be not surprising that he should, as the distance was regarded as very long. We have no record of the speed at which Ladas ran, but as to the distance covered it was trifling as compared with the distances that many of our running athletes cover.

That the modern man is of a bigger breed scientific inquiry has made certain. The size of the heroes of classic days, like most other things about them, was

mythical. It was only in statuary that Ajax and the other large-limbed men of antiquity ever had existence. Many years ago an old-fashioned tournament was projected in England, and the corselets and greaves of the mailed men of the Plantagenet period were pulled out of the closets of the old castles to be used by the modern descendants of the "brave knights of old." It was at once discovered that the nineteenth century Englishman was much too tall in stature and large in girth to get into them. And thereby perished the long-cherished fiction that the human race was physically degenerating, and that the men of to-day were "not the men their forefathers were." We may, as we look over all that has been done on land and sea in lowering the racing records, alike of men, horses, and ships, feel that we are indeed "the heirs of all the ages in the foremost files of time." We have faster runners, stouter swimmers, surer marksmen, better rowers and yachtsmen, finer horsemen than ever were known to the Europe of feudal times or the Athens of Homeric days.—Baltimore Sun.

The German Beet Sugar Industry.

Speaking of this industry, Consul-General Dundas says German sugar is made entirely from beetroots cultivated by farmers who have an interest in sugar factories. The average yield of sugar in the beet is from 14 to 15 per cent, and in order to secure a good yield the roots destined for culture are selected solely with regard to the percentage of their yield of sugar. Therefore the excellence of the root in regard to yield and the production of the seed is a matter of the first importance. The plant most in demand is the little *Wanzleben*. The factories consume 200 tons to 1,000 tons of beetroot daily, according to size or working capabilities. The process is as follows: The roots cut into strips are edulcorated with warm water, and juice thus obtained is clarified by means of lime. The residue left is then subjected to a process by which all moisture is extracted by means of presses and utilized as provender, which has been found very serviceable. A second and third purification with carbonic and sulphurous acids follow; and the sirup and crystallization operations by evaporation and boiling give the final production of the manufactured article, which is separated by centrifugal machinery from the sirup. The deposit left from this process is the molasses which is so much used in the manufacture of spirit. The number of factories in Germany in 1891 was 406, equipped with 4,717 steam engines of 68,691 horse power, using up 10,623,319 tons of beets, and yielding 24,273,784 cwt. of sugar and 4,815,922 cwt. of molasses.

RECENTLY PATENTED INVENTIONS.**Engineering.**

BOILER.—Harry H. Kelley, Elyria, Ohio. This boiler is designed to generate steam quickly, and be very economical of fuel. It is vertical, having a central sectional column or shell, and on its outside are spiral water circulating pipes having their ends connected with the shell. The shell is preferably made in four sections, connected with each other by joints, each having a ring forming a seat for metallic gaskets, and the heads of the upper and lowermost sections are connected with each other by stay bolts. The shell is supported at its lower end by water legs supported by the brickwork.

Railway Appliances.

SWITCH.—Ephraim H. B. Knowlton, West Superior, Wis. According to this improvement the switch is set by hand to side track a train, but the train in passing automatically resets the switch to close the main line again, so that the latter never can be left open by the neglect of the switchman. The operating bar is moved by a weighted lever, the bar and lever being locked by a detent, and a depressible bar and tilting frame are arranged to be operated by the wheels of the train to trip or dislodge the detent.

Electrical.

BATTERY.—Milton E. Smith and Maurice F. Geer, Rochester, N. Y. This battery comprises a jar in which is set a porous cup containing the positive electrode, preferably zinc, the exciting fluid being chromic acid and sulphate of zinc, while outside the porous cup a negative or carbon electrode extends into a solution of sulphuric acid and water, or other suitable fluid. The exciting agent may be used in liquid or solid form, and in general work the proportions preferred are nine parts of chromic acid to one part of sulphate of zinc. It is designed that a high electromotive force shall be obtained with a comparatively moderate destructive action on the elements.

ELECTRIC HEATER.—Jesse R. Davis, Parkersburg, West Va. This improvement is applicable to all classes of furnaces or stoves, and converts the current into sensible heat without the use of wire coils. The heating medium forming the walls of the stove or furnace, and made hot by the passage of the current, is composed of finely comminuted carbon mixed in varying proportions with an inert refractory non-combustible material, also a non-conductor, as slaked lime, magnesia, silica, asbestos, etc., so that when the current is passed through the mixture the mass is rendered partly conductive by its carbon particles, but is of high resistance from the preponderance of non-conducting substances. By regulating the proportion of carbon to the inert material, the proportion of heat developed may be adapted to various uses.

CONDUIT ELECTRIC RAILWAY.—James E. Toole, Northumberland, Pa. This inventor has de-

signed a strong and comparatively inexpensive conduit, in which the trolley is so hung that it will pass easily around curves, the trolley wheel being guided on the line wire, and means being provided for conveniently raising the trolley to break the circuit. The construction of the trolley is such, also, that the insulation will be perfect, and there will be no danger of grounding the circuit.

PRODUCING OZONE.—John T. Donovan and Henry L. Gardner, Springfield, Mass. For the production of ozone in large quantities these inventors have devised a process to work in connection with currents from electric light wires, employing electrolytic apparatus with communicating chambers in which are inserted positive and negative electrodes connected with the electric generator. There are connections for removing the hydrogen liberated from the negative electrode, while the ozone generated at the positive electrode escapes into the surrounding air or may be conveyed away in a tube.

Mechanical.

CABLE SUPPORT.—Erik G. P. Wern, Brooklyn, N. Y. This invention relates to supports for cables propelling cars to carry buckets of coal, etc., and arranged to swing out of normal position when struck by a device coupled to the moving cable, returning to former position automatically after the device has passed. The arm supporting the cable swings on a fixed pivot, springs connected with the arm being compressed when the arm is swung out of position in either direction, and the springs returning the arm to its normal position.

CHAIN HOD ELEVATOR.—Gustaf P. Wern, Brooklyn, N. Y. This inventor provides improvements whereby the driving shafts are securely held in proper position to prevent undue friction and binding in the bearings. Fixed blocks are attached to the standards of a strongly constructed frame and bearing boxes with curved exterior surfaces are seated in the fixed blocks, while a shaft is journaled in the bearing boxes and adjustable blocks engage with their concave under surfaces the bearing boxes opposite the fixed blocks. The adjustable blocks screw on pivoted screw rods carried by blocks fixed in the standards.

ELEVATOR PLATFORM.—This is another patented invention of the same inventor, for a simple and durable construction more especially designed for use in elevators carrying wheelbarrows, hods and other vehicles and articles, or which, being very safe and strong, may also be used to carry passengers. Spaced metallic plates are located at the sides of the platform, posts between the plates, and bolts pass through the plates, posts and platform, while shafts with reduced ends are journaled in the plates, safety clutches being secured on the outer ends of the shafts, and means provided for actuating the clutches.

VARIABLE GEAR FOR SAW MILLS.—Jacob T. Oberdorfer, Delmont, Ohio. Beneath a vertically movable shaft carrying a friction disk is a count-

ershaft on which is a sliding pulley engaging the disk, while an oscillating horizontal shaft carries a notched quadrant with which a lever fulcrumed on the shaft may be held in engagement. There is an operative connection between the lever and pulley, to slide the latter, and a lever to lift the vertical shaft, the lever riding on a crank on the oscillating shaft. The mechanism is cheap, strong and simple, and by a single lever the saw mill carriage may be driven in either direction, its speed perfectly controlled, or the apparatus be thrown out of gear.

WOOD BENDING MACHINE.—John Dawson, Brooklyn, N. Y. This is a machine more especially designed for quickly bending chair backs, and in it a large number of the backs may be simultaneously undergoing treatment, with very little labor and a high degree of economy. It has a steam box adapted to be rotated, and with a series of seats and clamps for each seat, a carriage traveling above the box having lever devices to be moved against the clamps. The machine, besides taking in a large number of articles at one time, effects the bending in an hour's time, as against twenty-four hours formerly required for the same work.

Miscellaneous.

REEFING SAILS.—Samuel G. Martin, Branchport, N. J. This inventor has devised a fore-and-aft sail which may be readily converted into a storm trysail and quickly restored to its original shape. The sail may be conveniently reefed, then folding regularly on the boom until the reef points are fastened, and when the reef tackle is manipulated the mast hoops are hauled down simultaneously and evenly with the furling of the sail cloth, dispensing with the services of an attendant at the hoops. An auxiliary leech rope is located above the reef points, that when the sail is reefed to its utmost it will draw from the auxiliary leech, a second auxiliary leech forming the upper leech of the trysail.

OIL CAN CARRIER.—Jurgen H. Lins, Brooklyn, N. Y. This carrier is designed for use on grocers' wagons and other vehicles, to facilitate the delivery of oil to customers without danger of spilling the oil over groceries or other goods. The invention consists of a box to be fastened to the under side of the wagon body, and having a downwardly swinging door, there being in the box a number of compartments, each adapted to receive and hold a can, and a drip aperture through which any oil that leaks will pass to the ground.

VEHICLE BRAKE SHOE.—Henry F. Shephard, New York City. This shoe is designed to follow the curvature of the wheel, affording a full bearing from one end of the shoe to the other, whether the wagon be loaded or unloaded. A barrel is connected with the shoe, and a carrying shaft provided with a spindle is loosely passed through the barrel, a spring encircling the spindle and being compressed within the barrel, whereby the latter is maintained in any position in which it may be placed.

CARRIAGE TOP WORKER.—August C. Bendler, Milwaukee, Wis., and William E. Bendler, Chicago, Ill. A two-part crank shaft on the carriage top has a handle forming the coupling which connects the two sections of the shaft, and there is an operative connection between the cranks of the shaft and the braces of the carriage top, forming an extremely simple and strong device, readily applied to any carriage top, enabling it to be conveniently worked from within the carriage.

KNOCKDOWN BARREL.—Hartley Ellis, East Liverpool, Ohio. This inventor provides a package specially designed for shipping crockery and glassware, the empty package being readily taken apart and packed for return shipment. It has an interior middle and exterior end hoops, bolts connecting the end hoops with the middle hoop, by which the barrel-like bulging of the staves is effected, the middle hoop holding the staves out and bracing them firmly.

WORKMAN'S TIME RECORDER.—Edward G. Watkins, Gardner, Mass. This is a very simple and cheap machine, to be operated by the individual employes when they begin and leave off work, keeping an accurate record of each one's time on a sheet which may be detached and filed away for future reference. No ink is employed, and there are no parts which require constant care and frequent renewal, nor is it necessary to transfer the record before the pay roll can be made out, the figures for a whole department being made up in total on the same sheet.

DRAWING INSTRUMENT.—George Thomas, Jersey City, N. J. This is an improvement in compasses or other instruments having a jointed laterally extended arm carrying a tracing device or socket for holding a tracing point. The tracing arm of the instrument has a lateral screw-threaded post at its outer end, and a detachable point or arm to carry a tracing device with a head having a lateral slot to receive the post, on which screws a nut, a sleeve being interposed between the arm and nut. The range of the instrument may be increased or decreased as desired in a quick and simple manner.

LINER AND MEASURE.—Sannosuke Katani, Belmont, Cal. A cord-carrying spool is held in a suitable casing, having a pawl and ratchet for locking the spool, and in the casing is an inking well, while a sliding rod, with one end resting on the pawl, is provided with a guide for forcing the cord into the ink well. It is a simple device, readily carried about, by which a straight line may be easily marked, the length of cord withdrawn being accurately shown by an indicator upon a circular dial.

TOBACCO OR CIGAR MOISTENER.—Jay A. Robinson, Denver, Col. This device comprises a water tray upon the bottom of which rest a number of hollow porous blocks having open bottoms, the tray being placed in show cases to moisten the air more effectually than is accomplished by the sponges usually employed.

CASTRATING INSTRUMENT.—John E. Anderson, Carbon, Wyoming. For the quick and safe cas-