portant properties, partly because of the ad- dealing with newly-discovered documents. The vantage, when presenting the analytic method latter have remained neglected for three cento the student, of applying it in the first in stance in the systematic study of a few in teresting curves. In deference to usage, a chapter on the circle is introduced immediately fter that on the straight line; but, if experi course to proced from the straight line directly o the parabola, so that, as early as possible, the student may get the impression which comcs from seeing a method employed in the nvestigation of new material. The part of the book devoted to solid geometry is more xtended than is customary in elementary text books; but it is desirable that the material here given should be easily accessible to stuents. Although intended as a college text modern tendency toward the practical and forms as good a treatise upon the subject as possible for the non-collegiate student.
A Manual of Practical Assaying. By
the late $H$. van $F$. Furmañ. Re
497 pp.; 8vo. New York: John is standard work on. Price, $\$ 3$. ew (sisth) edition, been thoroughly revised and brought up-to-date. The chapters on zinc water, and coal analyses have been rewritten, and minor changes have been made in certain parts due to the description of new methods. Because of their increasing importance com mercially, chapters have been added on the and vanadium. On the latter important sub and vanadium. On the latter important sub leading text-books on the subject has been completely maintained and the usefulness of the whole enhanced.
Structural Details. Elements of De
Jacoby. ${ }_{368}$ pp.; 8 vo.; 6 fy H. S
plates and 34 full-page ill. New
York: John Wiley \& Sons, 1909 Price, $\$ 2.25$.
course of instruction conducted by the autho In the College of Civil Engineering in Cornell University during the past nineteen years. In this course the students receive their first in struction in the application of the principles of mechanics to the design of the details of
structures. Experience has shown that in structures. Experience has shown that in
many respects problems involving timber construction are better adapted for this purpose than if confined to structural steel. It may appear at first as if too much attention to details is given in the examples on the design of joints, beams, and trusses. The author be lieves, however, that the importance of carefu study of every detail can only thus be properly emphasized. In practice it seems to be the attention to details of timber structures as to neering practice it is essential that all connec ions and details have the same degree of se curity as the framed members. In severa articles the order of design is given in full with a view of economizing the time of the student, and of promoting systematic habits in making the computations required, these objects being regarded as important elements in eff Whereas the book is intended for college use much of it is so written as to be intelli gible without the mathematics involved and aluable to the practical carpenter or builder desirous that his work shall be on sound prin ciples or interested in the theory upon which re founded the rules of his practice
The Internal Combustion Engine. By H. E. Wimperis. $320 \mathrm{pp} . ; 8 \mathrm{vo}$; fully
ill. New York: D. Van
Company, 1909. Price, $\$ 3$.
This is the first treatise on gas, oil, and gasoline engines we have seen which goes as thoroughly into the subject both theoretically the steam engine. The author traces the energy that drives our engines all the way uses to which the modern internal combustion engine is applied, covering sufficiently the laws解 ines and explosion, the best design in gas en gines. The final chapter on gasoline engine en this much debated question, and is in so far practical and helpful to the amateur and the sportsman as to discuss the modification of climbing and other automobile competitions
Henry Hudson. A Brief Statement o His Aims and Achievements. By Thomas A. Janvier. To which is added a newly discovered partial record, now first published, of the and others were abandoned to their death. New York and London death. New York and London
Harper $\&$ Bros. 148 pp.; 12 ill. Harper \& Bros. 148
16 mo . Price, 75 cents.
The Hudson-Fulton Celebration has aroused romantic characters among the explorers and navigators of the sisteenth and sevententh centuries. The book before us is divided into
two parts. the first consisting of a brief sketch two parts. the first consisting of a brief sketch
of the life of Henry Hudson, and the second
uries, and are here published for the first time P G. Mcovery of these documents is due to Dr. R. G. Marston, M.A., as a result of a search in trial is of reat interest but of little satisfaction, inasmuch as we are ignorant of what punishment, if any, was inflicted upon the mutineers of the "Discovery." The importance of these documents is that they establish the fact (until now not estabished) that the mutineers worn testament hitherto that they embody a membestament, hitherto unproduced, of slx ting. The illustrations include no portrait of Hudson, since the author is satisfied that no authentic portrait of the man is in existence. Outside of the new documentary evidence above a condensation of the facts that have been recorded by Hudson's authoritative blogra phers, notably Purchas, Gerritz, Van Meteren sher, Muphy, Brodhead, and Read.
Machine Shop Drawings. Reading Drawings, Making Shop Sketches, and Laying Out Work. By Fred H. McGraw, Hill Book Company, 1909. 16mo.; 139 pp . Price, $\$ 1$.
This little book is intended to be a help those who do not thoroughly understand the reading of drawings, rather than an ow seen and unseen portions are represented, he use of full and dotted lines, the way in which different views are drawn, and how to of the shape of the piece represented. Mans the shape of the piven from the drawingroom practice of the leading shops in this country, and the meaning of each carefully xplained. The book is an eminently practical ne and is illustrated by well-executed engravings, the wax process, which is the only suitable one for the purpose, being used.

A Book of Fourth-Dimerision Essays.
The subject of the fourth dimension seems to have aroused so much interest among the readers of the Scientific American that we have decided to publish in book form the prize
essay, the three essays that received honorable mention, and about sixteen of the best essays which were submitted in the recent Fourth Dimension Contest. The entre collection will be edited by Prof. H. P. Manning, who will prepare an introduction of considerable length, in which the subject of the fourth dimension will be simply and lucidly discussed. The book rill be ready about the latter part of December

## Legal Notices

## PATENTS

INVENTORS are iuvited to communicate with Mnnn \& Co., 361 Broadway, Aew York. ur to securing valid patent protection for their inventions,
registered.
Pasade-Marks and Copyrights registered. Desig
Patents secured. inventor furnishing us with a model or sketch and a brief description or the device in question. Al Hand-Book on Patents will be sent free on request.
It wars is the Oldest arency for securing patenta;
MUNN \& CO., 361 Broadway, New York Branch Office, 626 F St., Washington, D. C.

INDEX OF INVENTIONS
For which Letters Patent of the United States were Issued or the Week Ending October 26, 1909,

AND EACH BEARING THAT DATE See note at end of list about copies of these patents.]


| Amueement device, N. P. Lithander |
| :---: |
| mal trap, |
|  |
|  |  |
|  |




르룰路| 9378,889 |
| :--- |
| 98973 |








Milals, uniting, W. Griffith...
Mil cooler, W. T. Muray
Milling aparatus. E. E. Good
Miling process, M. C. Peters.
 Miter bos,
Miving manhine, F. F Aeschbach.....
Molding machine, w. N. Sterling.
Moting machine, H. H. Harris.
Motor control system, electric,







 Pennolder,
Phonograph,
P.
P.
T. Weber







Mastic materials, nested drom, P. J. Fish,
Plate horder, L. . . Jiegel.
Plunger mechanism for jig t
more





Pumping engine, steam, M. W. H. Hibbard.:
Punch cutting, and like machine bla
holder for, F. H. Pierpont
Punch eatting Fand like machines, cutt
head mechanaism for, F. H. Pierpont.

Punching machine, 1 . Me. Bernard.

Rail joint, H. Protheroe, et al.............
Rail joint and fastener, H. H. Markland.
Rail joint and tie bar and nut lock, C. C. Railway composite cross tie, o. Gerlach....
Railway danger signal mechanism, R.



How to Construct An Independent Intertupter

 Each Supplement costs 10 cents; 20 cents for the
two.



Hardening, Tempering, Annealing and Forging of Steel

By JOSEPH V. WOODWORTH 61/4 x $91 /$ inches: 288 pages. 201 illustra-
tions. Price $\$ 2.50$ postpaid $\xrightarrow[\begin{array}{c}\text { HIS is a practical work, treating clearly and } \\ \text { concisely modern processes for the heating, } \\ \text { annealing, forging, welding, hardening and }\end{array}]]{ }$ annealing, or ,
tempering, welding, hardening and value to toolmakers and metal-working mechanics
in general. Special diricetions are given for the
successful hardening and tempering of steel tools of all descriptions, including milling, cutters, taps,
thread dies, reamers, hollow mills, punches and
dies and various metal-working tools, shear blades, dies and various metal-working tools, shear blades,
saws, fine cutlery and other implements of steel别 brands of steell. may be adapted are discussed and their treatment for working under different
conditions explained; also speril methods for the
hardening and tempering of special brands. A hardening and lempering of special bra
chapter on case-hardening is also included.
The American Steel Worker
By E. R. MARKHAM
Sixe $53 / 4 \times 8$ inches. 367 pages. 163 illustra-
tions. Price $\$ 2.50$ postpaid
 has had twenty-twe years' practical experi-
hat in steel-working, during which time he has
ne collected much of the material for this book. Care-
ful instructions are giveen for every detail of every
tool. Among the subjects treated are, the selection of steel to meet various requirements: how to tell
of
steel when you see it; reasons for different steels;
how to treat steel in the making of small tools. taps, how to treat steel in the making of smant tools. taps,
reamers. drills, millinq cutters; hardening and tem
pering dies ; pack-hardening; case-hardening. anpering dies; pack-hardening; 'case-hardening; an-
nealing: heting apparatus; mixtures and baths,
the best kind , and why ; and in fact everything that
OUR SPECIAL OFFER: The price of these
this books is $\$ 250$ ach, but when the two volumes are ordered from
us at one time, we send them prepaid to any address
in the world on receipt of $\$ 4.00$.
MUNN \& COMPANY, Inc. Pu
361 Broadway. New York

THB 10,000-TON SUCTION DREDGER FOB USE ON THE MERSEY.
(Continued from page 332.) Each valve is of tapered cylindrical form extending the full depth of the hopper with open-bottomed valve at the lower edge, and has a lift of four feet. These valves are worked by hydraulic cylinders controlled from fore-and-aft gang ways and supported by a continuous fore-and-aft girder running the full length of, and above, the hoppers. Guide rings efficiently stayed to the hopper sides are fitted at the upper and lower parts
same.

A surface valve with lever for opening or closing it from the gangways is fitted on top of each hopper valve, to drain off the surface water. During dredging operations, the mixture of sand and water is delivered into the landers, and thence falls into the hoppers through the valves already described. The sand settles in the hoppers, while the surface water escapes aft along the waterway formed by the hopper coamings to the weir plates, which can be adjusted to suit the trim of the ship, and then flows overboard through large rectangular shoots, two of which are disposed on each side. When discharging spoil, the hopper valves are raised, and the sand rapidly falls through the openings in the bottom of the vessel.
There is an indicator fitted in the chart room which shows the draft of the ship, together with a complete system of repeating telegraphs and speaking tubes for transmitting orders to the pumping and propelling engine rooms, and to the different winchmen in their respective
winch houses. Moreover, there are powwinch houses. Moreover, there are powerful electric alarm bells fitted to the pipemen's positions. Pushes are pro
vided for each pipeman, and one on the vided for each pipeman, and one on the
navigating bridge, so as to give alarm in navigating bridge,
case of necessity.
The hydraulic installation carried out by the builders of the ship comprises a set of three-cylinder inverted high-pressure direct-acting engines having three cranks and three single-acting ram pumps, driven direct from the piston-rod crossheads. The hydraulic pressure is 800 pounds per square inch, and is used for working the four main sluice valves
on the suction pipes at the sides of the vessel, as well as those on the.delivery pipes at the ends of the landers, and for opening and closing the twelve hopperdischarge valves.
The propelling machinery is right aft, and consists of two sets of inverted, ver-
tical, triple-expansion engines of the same type as the pumping engines, each having cylinders of $221 / 2$ incnes, 37 inches, and 61 inches diameter, respectively, by a stroke of 45 inches. Steam is raised in four large single-ended marine
boilers measuring $15,1 / 2$ feet by $121 / 2$ feet, placed between the propelling and pumping engine rooms and constructed for a working pressure of 180 pounds per square inch. Watertight doors controlled from the upper deck are fitted in the machinery space bulkheads to provide access from one room to another.
The side compartments adjacent to the hoppers, as well as the two forward nocessary are buoyancy spaces rendered weight of hull, plant, and load on the specified draft of water.

The engineers and officers are housed in the poop and the crew in the forecastle, the master's cabin being placed in a large teak house on the navigating bridge, with the chart and wheel house

The vessel is fitted throughout with a complete installation of electric light on the incandescent system. The engines and dynamo are placed in the propellingengine room. The engine is of the inclosed type, compound direct double-acting, and coupled direct to the dynamo, which is of the direct-current compoundwound pattern. The powerful windlasses, each driven by separate vertical engines (Conctuded on page 340.)

## Home-Made <br> Experimental Apparatus

In addition to the following articles, the
Scientific Scientific American Supplement has published
innumerable papers of immense practical value.
of which over 17,000 are listed in a carafully prepared catalogue, which will be sent free of
charge to any address. Copies of the Scientific
American Supser charge to any address. Copies of the Scie
American Supplement cost 10 cents each. If there is any scientific, mechanical, or en-
gineering subject on which special information
is desired is desired, some papers will be found in this
catalogue, in which it is fully discussed by
competent authority. competent authority.
A few of the many valuable articles on the
mating of experimental apparatus at home are given in the following list:
ELECTRIC LIGHTING FOR AMATEURS: The article tells how a small and simple ex
perimental installation can be set up at home.
Scientific American Suplement 1551 . AN ELECTRIC CHIME AND HOW IT MAY
BE CONSTRUCTED AT HOME, is described in
Scientific American Supplement 1566. THE CONSTRUCTION OF AN ELECTRIC HOW TO MAKE A 100.MILE WIRELESS
TELEGRAPH OVTFIT is told by A. Frederick
Collins in Scientific American Supplement 1605.

 THE CONSTRUCTION OF A SIMPLE PHO.
TOGRAPHHC AND MIGRO.PHOTOGRAPHIC
APPARATUS is simply explained in Scientific
A SIMPLE CAMERA-SHUTTER MADE OUT
OF ASTEBOARD BOX, PINS, AND A
RUBBER BAND is the subject of an article in RUBBER BAND is the subject of on, article in
Scientific American Supplement 1578 . HOW TO MAKE AN AEROPLANE OR GLID.
ING MACHINE is explained in Scientifio Ameri-
can Supplement 1582 , with working drawinge EXPERIMENTS WITH A LAMP CHIMNEY.
In this article it is shown how a lamp chimney may serve to indicate the pressure in the in
terior of a piluid, to explain the meaning o
capilary elevation and depression; to serve as capirary elevation and eepression; to serve as a
hydraulic tournique, an aspirator, and intermit-
tent siphon; to demonstrate the ascent of liquids
in eshant;
in of the bursting bladeor and ore the phenomena
force of gavive
1583.
Scientific American Supplement
HOW A TANGENT GALVANOMETER CAN
BE USED FOR MAKING ELECTRICAL MEAS-
VREMENTS is described in Scientific American
Supplement THE CONSTRUCTION OF AN INDEPEN. actual dimensions are published. Soientific
American Supplement 1615 . AN EASILY MADE HIGH FREQUENCY AP-
PARATUS WHICH CAN BE OSED TO OBREAN EITHER
RENTS is ${ }^{\text {desc. }}$
Suplement
atwoinch spark
pint Leyden jars

## the apparatus made at home

SIMPLE WIRELESS TELEGRAPH SYSTEMS
are described in Scientific American



 HOW TO MAKE A MAGIC LANTERN, Scie
tific American Supplement 1546 . THE CONSTRUCTION OF AN EDDY KITE.
Scientific American Supplement 1555. THE DEMAGNETIZATION OF A WATOH is
thoroughly deecribed in Scientific American SupHOW
CAN
BE
MADE
CALORIC
OR CAN BE MADE AT HOME is well explained,
with the help of inlustrations, in Scientific
American Supplement 1573 . THE MAKING OF A RHEOSTAT is outlined Gcod articles cn SMALL WATER MOTORS
are contanine in Scientific American Supplement
1494, 1049, and 1406 . HOW AN ELECTRIC OTEN CAN BE MADE
is THE BUILDING OF A STORAGE BATTERY
dis described in Scientific American Supplement
 A WHEATSTONE BRIDGE, Scientific Ameri-
can Supplement 1595 . Good articles on INDUCTION COILS are con-
tained in Scientific American Supplements 1514, 1522, and 1527 . Full details are given so that
the coils can readily be made by anyone. HOW TO MARE A TELEPHONE is
in Scientific American Supplement 968, A MODEL STEAM ENGINE is thoroughly de-
scribed in Scientific Americun Supplement, 1527. HOW TO MAKE
plained in Scientific American Supplements 1561 ,
1563, ANEROID BAROMETERS,
Supplements 1500 and 1554 .
A WATER BATH, Scientific American Supple A CHEAP LATHE UPON WHICH MUCH VALUABLE WORK CAN BE DONE forms the
subjeet of an article contained in Scientific
American Supplement 1562.
Each number of the Scientific 4 merioan Sup-
plement costs 10 cents by mall.
lement costs 10 cents by mall.
MUNN \& CO., Inc., 361 Broadway, New York
and connected by compound positive clutches at both crank and main shafts, are fitted on the forecastle head for working the anchors.
The steam steering is of the Caldwell combined steam and hand type, with control shafting to the steering standard on the navigating bridge, and is placed in the engine-room casing. Hastie's handscrew steering is fitted aft immediately over the rudder head, for use in case the steam gear breaks down. On the starboard side a motor launch is carried under Welin bow davits, ready for immediate use for taking soundings or making observations.

## SOME CURIOSITIES OF INVENTION.

(Concluded from page 332.)
by cork bulwarks $b$. We wonder if the inventor really believes in the efficacy' of the hand-operated screw propeller which he has provided.
The Society for the Prevention of Cruelty to Animals would undoubtedly interest itself in restraining the inventor who devised the arrangement here shown to enable a dog or cat to run a sewing machine. We once heard of a man who patented a contrivance for driving a coffee mill by means of a bicycle, so that by the simple contrivance of riding a bicycle it was possible to obtain not only a certain amount of exhilarating exercise, but also to provide enough ground coffee for breakfast. This patentee surely outdoes him. The dog is made to rotate a central shaft carrying a large gear wheel which meshes with a small bevel gear carried on the sewing machine driving wheel. It seems to us that after the dog had sewed one shirt he would be too dizzy to do much more; or perhaps when that occurs, the central shaft is to be driven in the opposite direction.
A grain of common sense is to be found in the trunk that becomes its own luggage trolley, for it must be confessed that the ordinary trunk when full is not the easiest thing in the world to handle. The inventor has provided a single wheel and a folding. lever handle which serves the purpose of pushing the wheeled trunk along. He evidently was not concerned much with the problem of the amount of space consumed by the wheels and the handle when folded within the trunk.
The handle shown for carrying parcels used in carriages has been employed in European railways. The device consists simply of two straps and a rest board, with the whole easily detachable. Straps serve the purpose of binding the rest board and walking sticks. and umbrellas together.
A boat driven by windmills is cer tainly a mechanical curiosity. Just why this complicated arrangement of bevel gears connecting the propeller shaft with the vertical windmill shaft should be better than canvas transcends our imagination.
There is a touch of the Yankee in the fishing device, the last of the inventions illustrated. Evidently the inventor was accustomed to fishing in streams where bites were few and far between, and where patience was ill rewarded. He has contrived a fishing pole with a swinging arm carrying a clapper which is made to ring a bell as soon as a fish bites and swings the arm down.

> BIRDS OF PASSAGE.
> (Continued from page 335. ) of the return of the same individuals Some wonderful European records of the return of a species to a given nesting site are given by the late Prof. Alfred Newton. A common falcon, Falco pere grinus, a cosmopolitan bird commonly known as the duck hawk, in this country, had its eyrie at one point in Finland for 110 years; that is to say, there was at this same point an occupied nest of this species from 1736 to 1855 . At Oxbridge, in one or the other of two earthen bottles placed for their use, a pair of blue titmice had their nest every year, with two (Concluded on page 342.)

## STILL GROWING Over 210,000 Circulation

LESLIE'S WEEKLY is growing in circulation, influence and advertising value-growing fast.

Over 200,000 people subscribe to or buy LESLIE'S WEEKLY each week because they want an illustrated newspaper and cannot get anything like it elsewhere.

Advertisers use LESLIE'S WEEKLY because they recognize it as the only paper in its class without a competitor in a highly profitable field.

Because in consequence they run less risk of duplicate circulation than in the multitude of other publications which aside from name are all about alike.

Because a big publication like LESLIE'S WEEKLY filled with the finest photographs depicting every important or nationally interesting event makes the best possible history of the world's progress and insures each weekly issue a longer life than most monthly magazines enjoy.

Advertisers who buy space now at the rate of 75 cents a line will get the benefit of this large and rapidly increasing circulation which is absolutely guaranteed.

## Advertising Department

## LESLIE-JUDGE COMPANY

Western Office 1136-37 Marquette Building CHICAGO, ILL.

Fifth Avenue and 27th Street Brunswick Building<br>NEW YORK



Just Published-A BOOK OF INTEREST TO RIFLEMEN

## The Bullet's Flight from Powder to Target

The Internal and External Ballistics of Small Arms. A Study of Rifle Shooting with the Personal Element Excluded, Disclosing the Cause of the Error at the Target.
Illustrated with one hundred and eighty-eight plates, showing the results of over tluree hundred rifle experiments performed and chronologically arranged

> By F. W. MANN, B.S., M.D.

## Size $71 / 2 \times 933 / 4$ inches. 384 Pages. Price $\$ 4.00$ postpaid

## $T$

 HIS is a thoroughly practical tratise and deals with a subject the literature of which is not commensurate with itsimportance impor ance or interest, and it possesses unusual value, not ont because itfumishes a large amount of information, of $a$
veny practical kind, but because this infommation is the ereulto of a practical experience on the part of the witer extending over a period of thintyeeight years. The results of the author's expecriments, os osere giver, have been per.


 experiments such os that of venting the barrel neart he muzzle. Anidea of the contents mas be gathered from a few of the

 $T$ wists: Kinetico of Soin, etc. In many nespects this work is unioue in the literature that has been pubbished on this subtrot.


MUNN \& COMPANY, Inc., Pablishers, 361 Broadway, New York City




\section*{| R |
| :--- |
| R |
| R |
| R |
| R |
| R |
| R |
| R |
| R |
| R | <br> 가ํㅋํํํํ}



```
cus\({ }_{c}^{3 \times 240}\)
```


 ..... 



|  |  |
| :---: | :---: |
|  |  |
|  |  |
|  |  |
|  |  |

## 正



 Sewing machine guide for hat sweats, J. C
Ringe

$$
\begin{aligned}
& \text { Inson } \\
& \text { Shade and screen or windows, combination, } \\
& \text { Hughes \& Robinson. }
\end{aligned}
$$







marms strikers or foring bolts. auto
matic safety device for, Tor Tambur


Stamp, time, J. J. Busenbenz...............
Steam, apparatus for utilizing exhaust, H.
H. Wait . . . . . . . .






## $\underset{\substack{\text { Te } \\ \text { Te }}}{\text { en }}$

\section*{| Test |
| :--- |
| Thr |
| Thr |
| Tr |}





Tool
Tool
Tool
Top
 Toy, R. R. Re, Essig. .........




938,326
938,256937,784

$$
\begin{aligned}
& \text { Hughe \& Robinson. } \\
& \text { Shade bracket. L. E. } \mathrm{E} \text {. } \mathrm{C} \text {. } \\
& \text { Shade roller, W. D. Janes. }
\end{aligned}
$$





2m






## testing bitumens.

(Concluded from page 336.) penetrated into the specimen. As it is desired to ascertain this with considerable accuracy, it is necessary to magnify the displacement of the rack. This is the office of the pinion and indicator. The dimensions of these are so arranged that a fall of 0.1 millimeter $(=0.0039$ inch $)$ will correspond to one division on the dial.
Penetration at most temperatures is permitted for just five seconds. At the beginning the reading of the dial is noted, and also at the close. The difference will show the amount of penetration in terms of tenths of a millimeter. But if the test is made at the freezing point of water, or at a lower temperature, the penetration is allowed to continue for a full minute. The weight carried by the needle is not always the same. For temperatures that do not rise above 32 deg. F., the weight is 200 grammes. At 77 deg. F. it is 100 grammes. For a temperature of 100 deg . F . or higher, the weight is reduced to 50 grammes. As the apparatus depending upon the needles weighs just 50 grammes, apart from the weight $W$, the requisite variations in load are readily made.
The question arises here, however, as to whether there is any point of view from which the amounts of penetration at the various temperatures may be regarded as comparable. Thus. Mr. Dow gives the penetrations of three different asphaltic cements, $A, B$, and $C$, as fol lows:

| penetration | numbers. |  |
| :---: | ---: | ---: |
| Temperature. | A. | B. |
| 32 deg. $\mathrm{F} \ldots \ldots \ldots \ldots$ | 10 | 13 |
| 77 deg. $\mathrm{F} \ldots \ldots \ldots \ldots$ | 55 | 47 |
| 100 deg. $\mathrm{F} \ldots \ldots \ldots \ldots$ | 150 | 110 |
| 115 deg. $\mathrm{F} \ldots \ldots \ldots \ldots$ | 350 | 220 |

The amount of penetration of A at 32 deg. F. is 10 ; at 77 deg. F. it is 55 . But are the cases comparable? Can we say with an justice that the viscosity in the one case is $51 / 2$ ' times that in the other? The penetration of 55 was accomplished with half the load and in one-twelfth the time. Offhand, it would seem that the number 55 should be 24 times as great.
There are, however, two other influeuce at work-one tending to make the number 10 too large, the other tending to reduce it. Falling bodies-and such a body the penetrating needle is-do not have a uniform velocity, but become ac celerated. On the other hand, as pointed out by Mr. S. Whinery, the depth of penetration is not a measure of the work done, the needle being in fact of a coni cal form. The farther the penetration the greater the amount of material displaced, and the greater the frictional re sistance (due to adhesion) per unit of penetration. However, it is conceivable that the form and material of these counteracting factors might be so adjusted as to nullify each other

With the disturbances arising from ac celeration and from variation in resistance eliminated, there still remains the apparently faulty method of varying the weights and the time. It would seem better to maintain these factors precisely the same, or else correct the numbers so as to have them comparable, whatever the temperature. However, the Dow machine has, apparently, proved itself of great value in actual practice. An improved machine has recently been put on the market, in which the framework arrangement supplying weight for the needle is entirely discarded, being replaced by a tube containing the weight and holding the needle. This tube slides in a guide-arm supported by a substantial upright. The extra weight, as may be seen in the engraving, is placed low on the tube, and so will tend to deflect it but little, if at all. The table carrying the specimen is supported by a screw arrangement. This enables the specimen to be brought into contact with the needle at zero position. The mirror, seen at the bottom of the apparatus, enables the
operator to determine when contact be-

INVENTORS


CONSULTING ENGINEER.


SOUTHERN STAMPING \& MFG, CO.

## 


RUBBER

MODELS
Models, Novelties and Patented Articles Manufactured by contrict. Punching Dies and Drawing Work
NEW YoRK FLA'IRON Co. Belle Mead, N. J.



Remoh Diamond


 Remoh Jewerry Co., 453 N. Broadway, St. Loois


HOLTZER-CABOT MACNETOS



## The

Middle West Number SCIENTIFIC AMERICAN

## On December 11th, 1909, the Scien-

 tific American will issue a numberdevoted entirely to the wonderful Middevoted entirely to the wonderful Mid-
dle West region of the United States, a number which will set forth broadly and lucidly not only the agricultural interests
of that region, but also those larger enof that region, but also those larger en-
sineering undertakings which are dessined to transform the Middle West, in part at least, into a manufacturing ter-
ritory.
With that object in view the Middle West Number will publish articles on the following subjects :

## 

 ynerringthe greatest rallroad center in the wortd.
111. The Wonderful Grain Trade of Chicago.
Ofhicago is an enormous wheat bin, into which much
of the grain raised in the middle West is pourec
IV. Shipping on the Great Lakes.-Most of the
ironorethat is now smelted in Pennsylvania is mined

 teen constructed Wbich convey ore at smal cost
through the Great Lake and which are without a
counterpart anwhere in the world.



Vr. Freighting on the Mississippi.-Freigbting
on che Mississipp is a more important industry than
most of us may realize. VIII. The Steel ludnstry. -One of $t$ the greatest
steel plants in the world is that which has bees buit at VriI. The Freight Suburay System of Chi-
cagor Chicago can boast of rational system of kand-
ling freight bs means ois subwass. IX. The Waters supilyof Cl
with water by means of a tunnel Tbe chity is shicapho's
which extends two
miles out into the lake.
X: Reclaiming Arid Lands.-The United States Government has under way mañ irrigation projects
for tite purpose of reelaming lands wnicia are arid, but
which will olossom if properly waterect

 The Middle West Number will be more than twice the size of the resular SCIE NIFIC AMERICAN. It will be lavishly illustrated. It will be contained in a. colored cover which strikingly depicts Chicago's grain elevators at work. Order from your newsdealer or from
MUNN \& COMPANY, Inc., 361 Broadway, New York City
tween needle and specimen has been secured. The counterbalancing arrangement used in the Dow apparatus is replaced by the pressure of a spring. The remaining features are essentially the same. The rejection of the framework device weignting the needle and the string counterbalance would seem to be steps in advance, especially if the replacements will yield as good results.
A practical word may be added as to the results shown in the table of penetrations. The cement $A$ is regarded as showing as great a variation as is safe for pavement use. A greater variability in viscosity at the different temperatures would be difficult, if not impossible, in practical application. If soft enough for practical application.
32 deg . it would be too soft at high tem32 deg. it would be too soft at high tem-
peratures. C shows a steadiness which would be valuable if it were not for an accompanying bad quality. Its ductility (at 77 deg. $F$.) is but 20 , while $A$ is 300 . B shows less variability in viscosity than $A$ and more than $C$. Its ductility (at 77 deg. F.) is 75.
The susceptibility to change in hardness resulting from application of heat or to ageing may be ascertained by utilizing the penetrometer.
It will be seen from a consideration of the facts which have been recounted, that the tests for ductility and viscosity are of great practical utility.


A printed copy of the specification and drawing

 Ganadian patents may now be obtained by the in
ventors for any of the inventions named in the foreventors for any or the inventions named in the fore-
vorng list For terms and further particuars
gidress Munn $\&$ Co., Inc., $\mathbf{3 6 1}$ Broadway, New
Yots.

