 Already answered in eariler numbers．Abont one horse power for each twelve feet of total hesting surface is
a common proportion in the boflers of good bullders． F．F．M．asks：1．What diameter of cylinder izontal bofler $12 x$ so，of 3 Inch iron，with no flues？The engine tit to run 100 to 150 per minute．2．What presiure an engine be？Answer：1．About a 1x or $11 \%$ inch cylin－
and
der hy or 4 inch stroke．2．It would be safe，if the heade were well secured and work well done，at 175 lbs

H．C．J．asks：1．Will a boiler，under which
there may be the uasal amount of fre，mate oo loge there may be the usual amount of ire，maze or loge
steam if the blow off or safetyvalve is uuddenly opened
wide，or the engine atarted tn the aame way．2．Have Wide，or the engine atarted in the same way．2．Have
you ever publlabed a report of a trial in regard to
loss of weight and heat in coal from belng atored in loss of welght and heat in coal from betng stored in
the open afr？If so，please tell me where I can find
it．Answer：1．The rapidity of generation of ateam it．Answer：1．The rapidity of generation of ateam
would be temporarily increased by opening the gafety
valve or tncreasing the speed of engine．The preseure valve or increasing the speed of engine．The pressure
would not bc increased，although the maso of ateam in
motion to strike a dangerous blow upon any surface againa which it may be thrown．2．We cannot call to mind any
such trial． such trial
J．T．says：I cannot understand the answer
the crankquegtion 1 ．What do you mean by a line perpendicular to both the lines of the shaft and of the crank
ders in the two followfug casee，accordjng to Van
Buren＇s formula，$t=03 \sqrt{D P}$ ．$A 10$ tich cylinder with 90 1bs．pressure，I found to be 0.9 inches，and a 72 inch cyl Inder with 25 ibj．pressure， $1 \cdot 27$ ．3．Please give me a
plain，simnle rule for obtaning the right size of
wrought tron connecting rod for any presiure of ateam， and（4）also the right diameter and length of a parallel wrought bar to restit any presiure without deflexion． 5
Please let me know where you get the 866,000 when cal Please let me know whe fles．6．How does Van Buren arrive at his formula ？In your answer draw all your rea－ soning right from the foundation or the atrength of the
materin，oo that I may know where andhow everynum－ materig1，so that I may know where andhow．everynum
ber fo found．Answers： f ．Put on anothercrankat right angles to the frst，and it will be at right angles both to that crank and to the line of shaft．2．We make $03 \sqrt{\overline{D F}}$
-0.9 and $=1.33$ for the two examples．3．We know of no $-0 \cdot 9$ and $=1.33$ for the two examples．S．We know of no
glmpler rule than that given by Profesbor Thurston，in an approximate formula： $\mathrm{d}=\boldsymbol{v}^{2} \sqrt{\frac{\mathrm{D}^{2} \mathrm{pb}^{2}}{20000}}+\frac{1}{60} \mathrm{D}$ ．Rule：Mul tiply together the square of the diameter of cylinder in
inches，the maximum steam presaure，and the square of the length of the rod in feet，between centers；divide
the product by 20,000 and extract the fourth root of the quotient．Add $\frac{1}{6} \overline{0}$ ，and the result is the diameter o the rod in inches at its middle．4．No rod can be made
to bear any pressure with absolutely no deflection． 5 $806,00 \mathrm{p}$ a a coefflctent derived by Mr．Fairbairnfrom ex periment．6．Van Buren＇s formulas are based upon the results of experiments made by trustworthy authorities
and by comparison with the expertence of practical ap

J．G．H．says：I am using 3 3 plain cylinder
bollers for grinding purposes，with a plain elide valve engine which works very will．The objection ts that
we uee too much wood．Two of the boflers are elde by alde t the thifr 1 s separated by a brick wall，and so con－
structed that we can shut offthe feed water and otean connections，and use 2 bollers only；but we cannot keep
up steam unless we have the beat wood．What I wlih to know is：Would it be safe to leave，and should I gain power by leaving，the ateam plpe open from the botler，
with the feed plpe shut off and no nre under it？Would it answer for a steam dome，it befng level with the
bofler，or would it be dangerous and disadvantageoua？ What is the cause of the smoke stack getting red hot？
It is 3 inches in diameter，of $x / 4$ inch iron， 25 feet long horizontally，then 4 feet high．Answer：The trouble 18， rangement，although eminently satiofactory on the score of expense for repairs．If it has lap enough $t$
cut offat a bout two thirda cut off at a bout two thirds stroke，and both platon an ably．If the steam pipe and cylinder are lagged，to pre－ all right．The boflerg have too intte heating aurface in proportion to the amount of wood burned，and there quently escapes through the omoke stack，heating it as
described．More heating surface is wanted．The ar－ rangement proposed to increase ateam anace woulc
probaily，almply result in flling that bofler with wat robaily，Blappy reand an aling that bofler with wate to kect both steam and feed plpes．open，but even the

H．T．L．asks：How can I estimate centrif
gal force？For inatance，what will be the centrifuga force of a one pound wetght，revolvingat 100 revolution per minute in a 4 foot circle around a perpendicular
ahaft，and what 18 the rule by which I can get at the force of any weight at any apeed in any circle？Please give me
an arithmetical answer，as I do not underatand algebra． Answer：Multiply the equare of the number of revolution per minute by the radius of the circle in which the bod
gwings，and by fits welght in pounde，and divide the pro dact by 100,000 ．Thirty－three times the resulting igure will be the centrifugal force in pounds．This rule，ex－
pressed algebralcally is：$F=\cdot 00038$ WRN $^{2}$ ．In this case，$F=$ $-00033 \times 1 \times 2 \times 100 \times 100=6.6 \mathrm{lbs}$ ．If our correspondent were to take the time and do some hard work in learning th his time．A intle patience and earneat effort would ac－

W．W．says：
1．My employers and I appeal
dectde a
question about the horse power of a first class horizontal ateam engine，cutting off steam at
a point that will give it the mont power．The itze of
cyinder engline runs at 80 revolutions per minute，or 240 feet apeed of piston ；there is a 2 inch steam pipe 8 feet long． Whence this dispute has arisen．I mastatin it will give a nearly 20 horse power，if properlyconstructed．Thes say I am greatly in error in overestimating it．I also
maintain that，if we apeed it up to 100 revolutions，it wil give us 24 horse power．2．I would also like to know
your optnion as to themost economicalcoalto use under your opinion as to themost economical coal to ube under
a 25 horse power boller（tubular）with a good dratt．We are using large Lehigh．It is thought that a cheaper
coalwould be better．Answers： 1 ．We think our corres－ pondent right on the question of power．2．It ta generally economy to use the best cosi．The difference in price
arely suffletent to compensate for the difference in heat－ Ing power，
poor coal．

C．S．C．sargs：I have a small
locomotive，and I cannot make it go．It
English tighteen ncheain length，and runs on elght wheels；two of them are the drivers．The cylinders are about two finches，
and osccllate from the end．The trouble to as follows： When
steam，but the englne will not go；if If Ift it ip ap o that
it will not touch the track，the wheels go around with ightning apeed；but as eoon as I let it down on the track， they atop．I always keep onsuffliclent quantity ofsteam．
Can you suggeat a remedy？Answer：Probably the Can you suggest a remedy？Answ
valvenay．be set with too much lead．
D．K．asks for an explanation of the phe
nomena of polar attraction and magnettic variation．In this latitude， $40^{\circ}$ N．，variation west has increased $1^{\circ}$ in
fourteen years．Why 1 in that the annual precesalon is not the same everywhere？As you are brecposed to
nonow everything，ithink that you can give a more ast－ iafactory explanation than can be found in ordinary treatises on surveying．Answer：The directions of the magnetic and the geographical or true merldian do not
cotuctde because the geographical and magnetic polea cofuctde becaus the geographical and magnetic poles
aremany miles apart．The variation is weaterly in the eastern atates，and easterlyin the weatern atates．The nor of no variation is nearly straight，pasiligin in north of South America，through Cape Hatteras，Cleveland
o．，and Erie，Pa．The changea of varition gecular，annual，diurnal，and Irregular．The latter may be comparatively great，are lable to occur at any time，
and are subject to no known law．The dfurnal change， and are subject to no known law．The diurnal change，
though amall in amount－a quarter of a degree at moat
mot －-1 quite enough to produce annoying differences in surveys of thesame line taken at different times of the day．This change of a quarter degree amounts to about
25 feet in a mill．Annual changes of this diurnal varts tlon are noticeable，this change belng twicé as great tin over a pertod of centurles，and the amount of thit
ochange ie，in Paris，where ft has been longeat observed， change is，in Paris，where it has been longest observed，
over 34 degrees．These changea correapond to and ac－ company the solar movements．The irregular are fre
cole phenomena．The dlurnal accompany the rotation o the earth，which thus presenta its sides succe Baively to the sun＇s rays；the annual follow the motion of the arth in her orott，and the secular probably have a close
correapondence in period with secular changea in the re ation of the sun and the earth．These variations have ifferent magnitudes at different points on the earth＇ he geographical and magnetic poles and mertidana do not colnctde；and hence，while the needie at Cape Hat erasmay point uorth，at the north pole it would poin outh．The north magnetic pole is in $70^{\circ} \mathrm{N}$ ．lat．In the
Earl of Ross Stratit．If our correspondent will trace probleme which occur to him．
 oom with ateam？If so，how should it be applied，with
tationaryplpe entering at bottom or top of room，or Wth hose？We only use forty pounds steam when gln water atanding at one eeam or bofler；is that a algn of rust or burning？It is clean and amooth inglde．No
water rung after the fire 18 started．Answers： will extlinguish fire in a lint room，or in any other apart ent where it can De sufficlently well con Ined to ber
oghlypervade the enclosed space．It would be beat pplied by leading plpes into the room and making them xtures．In an cmergency a hose pipe could be thrue team carrled by hose，of gum or well greased leather The nozzle should，of course，be covered with canvas o
other covertng to enable it to be handled．Fortypound ther covering to enable it to be handled．Fortypound pre日sur
2．No．
N

H．S．M．wishes to know where an indica hould be applied，and what the resultwill be．Answer：
A treatise upon the conatruction，method of application， and the interpretation of the dragrams obtained by the or our columna．We have prepared a brief aketch for he general reader，but for such full accounts as every engineer should make himeelf famillar with，our cor respondent must consult some such work as that of
Chas．T．Porter on the Richards indicator．to be ob tained through any bockseller．The instrument can be purchased of Elliott，of 1，ondon，or of the dealers in en instrument cost about y hundred dollars．
C．B．N．sends the following solution of the welghing 5 lbs．deacends vertically and draw a bod of 6 lbs ．up a plane whose inclination is $45^{\circ}$ ，＂and wighe to know＂how far the first body will descend in ten sec
onds．＂Let A BC，in the flgure，represent the incline


## 5 lbs． IE

plane，and H and K the weights，jcined by a cord which
works over a pulley at C ．Let lllength of the plane ＝hight of the plane．From H，draw a Mie i E De
 component $\mathbf{F}$ E will be counteracted by the reaction of the plane and only the component $H$ F will produce
 we have the acceleration of the de日cending weight at $K$ by theacceleration is equal to the moving force：or epresenting the acceleration by $\mathrm{a}, \mathrm{Ma}=\mathrm{f}$ ，or $\mathrm{a}=\frac{\mathrm{P}}{\mathrm{M}}$（ In this case，f，the moving force，to the difference be whole masa moved ts equal to the sum of the welghts E and $\mathbf{H} F$ divided by $g$ ，the acceleration due to gravity or $\mathbf{M}=(5+3 \sqrt{2})+g$ ；or，Blace $g=82 \frac{1}{6}$ feet at New York， $\mathbf{M}=(5+3 \sqrt{2}) \div 82$ ． ．（8．）Substituting the values of f and $M($ equations 2 and 8$)$ in equation 1 ，we have $=\frac{f}{M}=(5-3 \quad \sqrt{2})$
laws of falling bodies that the spacethrough which the body
falls is equal to the acceleration multiplied by the square of the time and divided by two，or $n=\frac{1}{2} a t 2$ ．Substituting in this the value given for $t(=10$ seconds and the value of a
from equation 4 ，we have：The ditance $=h=2 \cdot 68 \times 100+2=$ from equation 4 ，we have：The ditance $=h=2 \cdot 68 \times 100+2=$
1315 feet．The princtles stantially the eame as those upon which the action of the Mn Atwod＇s machl
Minerals．－Specimens have been received from the following correspondents，and ex－ amined with the results stated
f．W．－Bothare crystaline hornble

## COMMUNICATIONS RECEIVED

The Editor of the Scientipic american cknowledges，with much pleasure，the re ceipt．of original papers and contributions pon the following subjects
On Fast Side Wheel Steamers．By M．N ．L On the Million Dollar Telescope．By O．M． On by C．V
On a Vacuum Balloon．By F．
On Deep Sea Soundings．By H．N．C．
On Increasing the Crops．By A．W．
On Diving Bells．By Q．
On the Wheel Question．By H．S．
On the Aurora Borealis．By．A．C．C． On Air and Gas Engines．By F．G．W On Sugar Boiling A pparatus．By A．W．J．M On Plows．By L．L．B
On the Sea Urchin．By P．S
On Tannate of Soda．By N．S．T
On a Boiler Explosion．By W．J．S
On Deep Sea Soundings．By A．R．
On Science and Revelation．By J．W
also enquiries from the following
E．J．M．－S．W．J．－E．W．－G．W．T．－G．N．J．－A．R －D．J．R．－L．P．A．
－C．K．C．- B．H．G．
Correspondents who writetoask the address of certain canufacturers，or where specifled articles are to be had alio those having goode for asle，or who want to ind
partners，should send with thefr communications an amountauffcient to cover the cost of publication under
the head of＂Buatiness and Personal，＂Which is spectally the head of＂Bustness and
devoted to such enquiriea．

## ［OFFICIAL．］ <br> Index of Inventions

for whicr
Lettera Patent of the United Staten WERE GRANTED FOR THE WREE ENDING April 22，1873，
and each bearing that date． （Those marked（r）are retseued patents

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Gas IIght Indtcator，etc．，w．w．Goodwin．．．．．
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| Grater，G．Booth． <br> Grater，nutmeg，A．L．Platt． |
| :---: |
|  |  |



| Harvester，S．L．McCollock Harveater，corn，S．Patton |  |
| :---: | :---: |
|  |  |


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Hub，vehtcle，A．Warner，（r）．．
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Injector，engine，S．Rue，Jr．．．．．．
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Marble，molding ediges of，J．Finn．．．．
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Mill hopper，grinding，
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sawlagmachine，band，O．Bonney，Jr．． Sclsвors，A．Wia．．c．emore．．．．．．．
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Shaft hanger，W．Bellif．．．．．．．．．．．．．．．． Shating bearing，cesting，
Shoe fastening，I．Banititer． Shoema ker＇s flithhng tool，Wileon \＆Foster．
 Siate frames，\＃lighng，J．H．
Slate washer，W．Weatlake Slate wabher，
Snow shovel，H．C．Cole．．．
Soda water cock，etc．，W．Gee．．．．．．．．．．．．．．．．．．．
Soda waterfountaln attachment，w．R．Cady． Soda
Soldering apparatua，J．Gulden（r）．．
Spikea，pointing，Waldron \＆Moore．

