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A. P. asks: Is there an invention for ex racting watery mat
preserving the meat
S. A. Bays:
drying ge have serious difficulty in
making petroleum barrels during hot
hot southerly wind fin gummer. Can you tell us of any pre-
paration that will faclitate the drying of glue and not paration that
njurethe oll?
A. E. S. says: I tried to make ink by follow but as soon as I put in the blchromate of potash, the water and colorlng separated, and no amount
would make them untte agaln. Why did I I fall?
U. E. asks: What are the cause of and
 hard enough. The same trouble occurs with cutters,
which crack and spllt off from the outside elrcte usually accompanted with a report, espectally in the
C. E. asks: Can you give me a reliable ap-
proximation of the horee power required to drive the different IIIds of cotton machInery, namely, openting
 poollng, warplng, slashlng, weaving, etc.?
D. T. asks: What is the best process for
mitating Rusela leather? R. C. K. K. desires to to know the difference off
strength, for tarm purposes, in ashes made from white mood and trom oak, maple, and brch
J. H. P. asks for a for mula for determining
with accuracy the contents of a barrel or cask when only partiyfull.
S. A. T. asks for a recipe for a dead black
or making a black board $"$ on white pine. S. A. T. says: I should like a recipe for
making hard soap for tollet use, say about 25 lbe, quantity, colored and perfumed
W. H. R. asks: Can magnesium be ob-
tatned in andy
comminuted state?
If oo, where and at what
fected?
W. F. H. asks for the best method of cleaning wanted for ue in the next fall.
J. H. W. asks: 1 . If 100 gallons of proof
spirit are mixed with 100 gallons of water, what will be the degree below proor and what the gravtry? 2. How
 one of lower proof?
B. L. B. asks: Is the temper of steel knives
mpaired by cuttun apples or other frutt? It so, why? B. L. B. says: I have noticed that my vartin cups, becomes of a dark muddy color. Does the til tn cups,
affect tit
J. W. K. asks: Would there be any advan



## 

J. B. asks how to prevent food, put in
cupboard newly palnted ingide and grained outside
 are thoroughly dry
E. J. M. says: Near here was a high pres as represented below. During a cold sanap, the iltule globe marked $\mathbf{B}$ was found Alled with ice, and a plece
was broken out. It puzzee us to know mas broken out. It puzzies us to know how the giobe
could have been flled with water, when there wai could have been filed with water, when there was
notuling to prevent tta fowing back to the boller as fnat
 dlameter, illed up and froze frrt. There's the rub, as
how did any more pase, zo as to alil the globe? $A$ triend how did any more pass, po as to inl the globe? A frlend
gays that he took the indictotor down, and that there
 be able to circulate within and 0 anow of the entrance of team or alr to dipplace 1 t. The ppe should be mad
at least $X$, and Atralght from B down to the lower end.

 bow 18 In the clouds beeause God put it there, that all the nations of the earth might know that it would not be destroyed by water agatn. I contend that it it the
sun
ontunting on the rant, refecting on the clouds, because sun. The bow shows more platinly on the oky than on the clouds. Ihavenever seen a bow tn the south or north. I once $\frac{8}{}$ a a very tall tree rallinto rlver . The
 ever I saw. 2.I have heard dt sald that the machinery of a water mill ran 25 per cent f faster in the night than tin the day time. The water appeared to be the same. What
was the cause of ti? s . 1 want to know the cause of the nocking In an engine. One englneer aays it ts in the cross head, another ayys it was an up and down or slde
knock in the writt. Answers: 1 . The cause of the ralt on 18 that supposed by our correspondent. The ray of IIght from the gun, refected and refracted by the
trangparent ratin dropa, are brought to the e efe tin such a
 ize the ralnoow. The center of the curve, the sun, and
the eye,arealwaysin one Itne. Hence a ralnbow cannot be seen at midday. The moon eometimes causes a
not ratnbow to appear. The phyalcal conditions necessar to produce the ralnbow may have frrat occurred as
stated tin the scriptures.
scriptural trutha and the trutho of nature nerer conalict, although our interpr:-
tation of the former often createe an apparent contratation of the former orten creates an apparent contra-
diction. 2. We do not know that is the cause or the
the phenomenon noted. 3. We cannot guess, but a good
G. C. H. says: W W' represent two weights ropes, C , the other by one continuous rope $\mathrm{C}^{\prime}$, pasasing that theese method smooth fat faces. Some assun


 swer: There would be no difference in the amount
 tenston on $C$ 'muth be equal throushout, at $A$ as well as
J. B. P. gays: A circular sawivg machin ance wheels, 20 inches in diameter. Would there b gatn, orloss, by plact ng a large balance wheel beneat the foor, connected by b belt with the machine? If auch
change tis adviable, what बize and welght of whee
 We ehould not anticlpate a galn, and the friction of the

 many lbs. of ateam we should carry to give one half of the power as described above, and alloo how we should run the engine to produce its full power. Angwer: An- An-
swered In part on page 255 of our current volume. Prob ably 401 ib.ateam would glve about hall power. It cap
only be determined with certanty by the indicator only be determined with certalinty by the fndicator
E. gays: One of our workmen from England
gave us the following rectpe for removing scale from
 jectionable otherwise? slbs. gum catechu, sibse blac


F. O. C. says: 1 . I claim that in order to get
pertect combustion, you must not admit any more alir under or through the tire than It will conaume, for if you
do, It will tend to deaden the fre, and to lose the heat that you would get if only the right quantity were ad mitted. A frlend clasms that tit does not matter how much arr you admit to the fre, and that all the difference
in that the derthe other; but still, he amya, the Are tis burning fust ab well as at first. 2. My friend aays the clussices are the foundation of everything tin the matter of learning. I say they are not; and that, , if a great part of the time
gpent on them were dexoted tonathemat drafting, drawing, natural phliosophy and some other practical studtes, there would be many less drones In the battle of ilfe, and that we ehould have many more young men ready and willing to work. Many a father and
mother will work to atuff thelr chlldren with French and German; and when the parents drop by the maa, dead, the chlldren fnd thetr stay tis gone. 3. My
rirend asy the sevent he Currstian sabbath was not changea from centurles arter Christ, and that by the Pope. I clatm that Christ changed it when He arose from the dead, and been so regarded by historians ever slince that tlme; and
that nownere in the New that nowhere to the New Testament, atcer the death of
Christ, can you find $1 t$ mentloned as any other than the Arrt day or the week. . . On page 251 of your current volume the drectlons sor making gealng wax do not
say what the proortion of shellac should be. 5 . A book
 isright? Answer: : 1. Were it posible to reduce the temperature of escapting gases to that ac which they entered the furnace, your frlend would be correct. Actu.
ailly, however, he to
wrong. It tis, however, found usu. required to combline with the fuel, tin order that com. plete combustion may take place. The excess causes
gome loss, but $t$ tis not so serious as would be the loss from Incomplete combustion, were a less quantity sup-
plied. About 12 pounds ofair per pound of fuel would be sufflctent, could time be given it to find and unite with every atom of fuel. It 1s, however, necessary to supply
usually 24 pounds, although in some cases of torce draft the quantity has been brought as low as 18
pounds. 2. To man of fortune, or to the proposes to devote his life to study, we should say tbat his education would be incomplete did it not include a knowledge of the classics. To the man of business, to
the working man, or to any one who must depend upon his own Intelligence, energy and educatlon for support and for success in life, we should commend a thorough-
is practical, technical course of study. Were we desirous of titling a son for a high position as a workman,
and to take a valuable position as superintendent of manufactory, we should send him to pome such school as the Industrial School at W orcester, Mass. If he as-
 Technology, at Hoboken, that of the Massachusetts In-
stitute of Technology, In Boston, or that of the Sheffeld School, at New Haven. To make him a good civil englneer, we should go to a apectal school of engineering
ilke that at Troy, N. $\mathbf{Y}$. The necessity of such schools has long been seen by us, and In answer to the rising de-
mand they are springlng up all over our country. Their success is one of the most encouraging signs of the
times. 3. Your friend is about right. The change, how. times. 3. Your friend Is about right. The change, how.
ever, was a gradual one, beginning with the time of Constantine the Great,In thefourthcentury. 4. Six ounces 5.
E. W. G. says: 1. I bave two engines run
ang circular baw mill. They have cylladers 8x22, set about 5 feet apart and connected by a crankon each end
 cyllinders; then it branches to each stean chest with 1 s nch plpe. The question 1s: Is this 2 tnch plpe large enoughfor the main pipe, and the 1 x inch for the branch-
es malu pipe ; would it be better nearer the engines or the boller? 3. My steam gage shows 10 lbs . When at rest,
and we usually run the enginesat 60 lbs. by it. Do we really have 60 lbs., or only 5501 ls .? Ts there any way of
adjusting the gage? Anwer: 1 . We should make the main plpe about $2 \chi$ Inches diameter, and perhaps 3 Inch-
es,if the engine were running at high speed, and the branches 2 nnches. 2. The regulator should always be as
near thecylinder as possible. 3. Probably 50 lbs. Have near thecylinder as posible. 3. Prob
the gage teated if you would be safe.
L. P. C. says: I would like to know how large a round chimney would be required for a boliter
with 88 three inch tubes. In other words, ought the chimney to contain the same number of inches in its
area as the sum of theareas of the tubes? Answer: The area as the sum of theareas of the tubes? Answer: The
chimney ts usually made of somewhat less cross area than the collective cross section of the tubes. A common proportlon, when natural draft ts employed, gives
the area over bridge wall one elghth the area of grate,
H. B. B. says: I have a saw mill with 54 There is a drum of wood 12 feet in dlameter, connecting
with counter shaft, on which is a small drum, 22 fnches in diameter, and a large drum about 8 feet in dlameter. ane 44 feet long and hare considerable irouble in lameter up steam, with wood sometimes partly wet. The smoke atack is of Iron, 26 inches diameter and 30 fect long. What kind of grate surface should I hive to burn saw it? Which is best of the two, and at what point and it what way should it be applied? How many revol lous perminute should the saw make cutting soft cy revolution? Answer: Run the saw about 609 revolution per minute. There are many devices for burning wor
saw dust and spent tan bark, few of them satigactory, however. A blast must be used to burn them on ordi-
ary grates, but it fis better to makc spectal furnaces fo hem, with large area of grate, and with provision fo drylng them before burning, and allowing considerable
$\underset{\text { S. }}{\text { S. B. E.asks: }}$ What injury, if any, would hot oll, say at bolling point? Which lens would be best
fora miniature bull's eye lantern with very small flame, plano-convex or double convex? Answers: 1 . Ther erature, unless where the parts are case hardened. But hot oll has less body than cold, and would be les unningjournalbrassesquite alack, to prevent binding nd overheating in consequence of expansion with the
heat. 2. Plano-convex, with plane side tuward th eource of light
$\xlongequal[\text { A．}]{\text { A．V．．．asks：}}$ Already answered in earller numbers．Abont one horse power for each twelve feet of total heating surface is
a common proportlonin the bollers of good bullders． F．F．M．asks：1．What diameter of cylinder izoatal boller $12 \times s 0$ ，of $\%$ Inch Iron，with no fues？The engine fs to run 100 to 150 per minute．2．What pressure an engine be？Answer：1．About a $11 \%$ or 1yis inch cylln－
der by 3 or 4 inch stroke．2．It would be safe，if the heads were well secured
H．C．J．asks： 1 ．Will a boiler，under which
ere may be the usual amount of fre，make or lose ateam if the blow off or aafety valve is suddenly opened
wide，or the engine atarted in the same way．2．Have you ever published a report of a trial in regard to
loss of welght and heat in coall from belng atored in loss of wetght and heat in coal from befng atored in
the open alr？If so，please tell me where I can find the open air？If so，please tell me where I can tind
it．Answer：．The rapdity of generation of theam
would be temporarily Increased by opening the safety valve or increasing the speed of engine．The pressure would not be increased，although the mass of ateam in
motlon may carry a quantly of water with it sumflent to strike a dangerous blow upon any surface againg which it may be thrown．2．We cannot call to mind any such trial．
J．T．says：I cannot undcratand the answer
the crank question： 1 ．What do you mean by a linc perpendicular to both：the lines of the shaft and of the perpenda．2．Have I found the proper thlckness of cylln－
crank in
ders in the two following casee，accordjng to Van Buren＇s formula，$t=03 \sqrt{\overline{D P} ?}$ A 10 Inch cylinder with 90 1bs．pressure，I found to be 0.9 inches，and a 22 inch cyl Inder with 25 lbj．pressure， $1 \cdot 27$ ．3．Please give me a
plain， plara，int fron connecting rod for any pressure of ateam，
and（4）also the right diameter and length of a parallel Wrought bar to resist any prespure without deflexion． 5 ．
Pleage let me know where you get the 866,000 when cal culating the collapse of flues．6．How does Van Buren arrive at his formula？In your answer draw all your rea－ soning right from the foundation or the strength of the materig1，，o thati may know where andhow．everynum
ber is found．Answers：f．Put on anothercrankatrigh angles to the frat，and it will be at right angles both to
 mo．9 and $=1.133$ for the two exampic．S．We know of no
glmpler rule thanthat given by Prof essor Thurston，In an approximateformula： $\mathrm{d}=\boldsymbol{V}^{2} \frac{\overline{\mathrm{D}^{2} \mathrm{pb}^{2}}}{20000}+\frac{1}{80} \mathrm{D}$ ．Rule：Mul tiply together the square of the dlameter of cyllinder in
inches，the maximum steam pressure，and the square o 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 tis middle．4．No rod can be made
to bear any presaure with absolutely no deflection． 5 $806,00 \mathrm{P}$ ta a coefflctent derived by Mr．Fairbairnfrom ex periment．6．Van Buren＇s formulas are based upon the results of experiments made by trustworthy authortites
and by comparison with the experience of practical ap

J．G．H．says：I am using 3 plain cylinder
bollers for grinding purposes，with a plain ellde valve
 olde；the third ts separated by a brick wall，and so con－ connections，and use 2 bollers only；but we cannot keep
up steam unless we have the beat wood．What I wlah to snow is ：Would it be safe to leave，and should I gal power by leaving，the ateam plpe open from the botler
with the feed plpe shut off and no fre under it？Would it answer for a steam dome，it befng level with the
boller，or would it be dangerous and disadvantageous？ What is the caise of the smoke stack getting red hot？
It 18 inches in diameter，of 48 Inch Iron， 25 feet long horizontally，then 4 feet high．Answer：The trouble is， rangement，although eminently satifactory on the core of expense for repairs．If it has lap enough t ut off at a bout two thirdsatroke，and both platon an ably．If the steam plpe and col！nder are lagged，to pre－ 11 right ．The bollers have too ilttle heating surface in proportion to the amount of wood burned，and there uently escapes through the smoke stack，heating it a described．More heating surface is wanted．The ar－ rangement proposed to increase ateam anace would from condensed steam and priming．It would be better from condensed steam and priming．It would be bette
to kecp both steam and feed pipes open，but even the

H．T．L．asks：How can I estimate centrif
gal force？
For ingtance，what will be the centrifuga orce of a one pound welght，revolvingat 100 revolution per minute in a 4 foot clrcle around a perpendicular
ghaft，and what is the rule by which I can get at the force of any welght at any apeed In any circle？Please give me
anarithmetical answer，as I do not underatand algebra Answer：Multiply the square of the number of revolution per minute by the radius of the circle in which the bod
minge，and by its welght in pounde，and divide the pro dact by 100,000 ．Thirty－three times the resulting figure will be the centrifugal force in pounde．This rule，ex－
pressed algebratcally 18：$F=\cdot 00038 \mathbf{W R N}^{2}$ ．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 the princtples ofalgebra，he would never regret such usc of his time．A Iftle patilence and earnest effort would

W．W．says：
．My employers and I appeal first class horizontal ateam engine，cutting off steam at
a point that will give it the mont power．The itze of englne runs at 80 revolutions per minute，or 240 feet apeed of platon；there is a 2 inch steam plpe 8 feet long． whence thits dispute has arisen．Imaintain It will gr， as nearly 20 horse power，if properlyconstructed．They say Iam greatly in error in overeatimating it．I also
maintain that，if we ppeed it up to 100 revolutiona，it will give us 24 horse power．2．I would also like to know
your optnionas to themosteconomicalcoalto ure under your opinionas to themosteconomicalcoaltouse 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 o power．2．It is generally economy to use the best cosi．The difference in price
arely sufflectent to compenaate for the differenceln heat poor coal．

C．S．C．says：I bave a small $\underset{\text { locomotive，andi }}{\text { English toy }}$ nches in length，and runs on elght wheels；two of them
are the drivers．The cylinders are about two fnches and oscllate from the end．The trouble 1s as follows：
When I get up steam sufflently to run it ，I turn on When I get up steam suficlently to run It ，I turn on
steam，but the engine will not go；if If Ift it up so that
it wilinot touch the track，the wheels go around with ightning apeed；but as coon as I let it down on the track， they stop．I always keep onsufflicent quantity yof team．
Can you suggeat a remedy？Answer：Probably the Can you suggest a remedy？Answe
valve nay．be set with too much lead．
D．K．asks for an explanation of the phe
nomen of polar attraction and magnetic variation．In this latitude， $40^{\circ}$ N．，variation west has increased $1^{\circ}$ in
fourteen year．Why is that the annual precesion is fourteen years．Why is it that the annual precession la
not the вame everywhere？As you are supposed to
俍 tafactory explanation than can be found in ordinary treatises on surveyling．Answer：The directions of the magnettc and the geographical or true merldtan do not coluclde because the geographical and magnetic polee
aremany milee apart．The variation Is westerly in the eastern states，and easterly in the weatern atates．The Inue of no variation is nearly stralght，pasing in a north northwest direction from the extreme eastern point O．，and Erie，Pa．The changea of varlation are gecular，annual，diurnal，and irregular．The latter may be comparatively great，are liable to occur at any time， and are eubject to no known law．The diurnal change， though small in amount－a quarter of a degree at mos in
－is quite enough to produce annoying differences in surveys oft hesame line taken at different times of the day．Thls change of a quarter degree amounta to about feet in a mille．Aunual changes of this diurnal varis summer as in winter．The secular variation extende over a pertod of centurles，and the amount of tht
ochange is，in Parts，where ft has been longeat observed， ver 34 degrees．These changes correspond to and ac ompany the solar movements．The irregular are fre phenomena．The dfurnal accompany the rotation of the earth，which thus presents Its sides auccesilvely to the aun＇s rays；the annual follow the motion of the
earthinher orott，and the secular probably have a close correspondence in period with secular changes in the re Iation of the sun and the earth．These variations hav
aiferent magnitudes at different points on the earth＇ aifferent magnitudes at different points on the earth
surface，In consequence of the fact，already atated，that the geographical and magnetic poles and meridtans do not conncide；and hence，while the needle at Cape Hat
terasmaypoint iorth，at the north pole it would poin south．The northmagnetic pole is in $70^{\circ} \mathrm{N}$ ．Iat．In the
Earl of Ross Strait．If our correspondent will trace merl of Ross stralt．If our correspondent will trace e which occur to hlm．
J．R．L．Says：We have a gin connected
with our mill．Is it posible to extlingutgh fre in a lin rom with ateam？If so，how should it be applifed，with
tationaryplpe enteringat bottom or top of room，or with hose？We only uge forty pounds oteam when gin
and water atanding at one rust or burning？It Is clean and amooth inside．N
water runc after the fire Is started．Answers： 1 ．Stean will extliguleh fire ina lint room，or In any other apar ontwhere it can De sufficlentiy well con ined to beat pplied by leading plpes into the room and making them xtures．In an cmergency a hose pipe could be thru
hrough a amall hole cut in the door or a partitlon team carrled by hose，of gum or well greased leather The nozzle ehould，of course，be covered with canvas o
other covering to enable $t$ to be handled．Fortypound ther covering to enable 1 t to be handled．Fortypound ．No．
H．S．M．Wishes to know where an indica hould be applied，and what theresultwill be．Answer：
A treatise upon the conatruction，method of application， and the interpretation of the diagrams obtained by th or our columns．We have prepared a brlef alketch for the general reader，but for such full accounts as ever ngineer should make himbelf famillar with，our cor respondent must consult some such work as that or
Chas．T．Porter on the Rechards Indicator．to be ob atined through any bookseller．The instrument can b purchased of Elliott，of tiondon，or of the dealers in en neers＇bupplies in New York or Boston．
C．B．N．sends the following solution of the welghing 51 bs ．descends vertically and drawe a of 6 lbs up a plane whose inclination is $45^{\circ}$＂，and wishee
to know＂how far the firt body will deceend in ten fec onds．＂Let A BC，in the IBure，repre


## 5 lbs． IE

plane，and $H$ and K the welghts，jcined by a cord which
works over a pulley at $\mathbf{C}$ ．Let l－length of the plane －hight of the plane． pendicular to $A B$ and let it represent the pressure of
the weightat $H$ ．Then reosiv $B E$ into component H $F$ and $F$ E，parallel and per the plane and only the component $H$ F will produce HE：HF：：1：h；or $6: \Pi Y:: V 2: 1 ; \operatorname{Or}, \mathrm{HF}-6+V 2=8 \mathrm{~V} 2$ ． we have the general principle that the mas melght at $K$ by theacceleration ts 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，, ，the moving force，so the difference be
tweenthewelght at and whole mass moved Is equal to the sum of the welghte $K$ and $H$ F divided by $g$ ，the acceleration due to gravity or $\mathbf{M}=(5+3 \mathrm{~V} 2) \div \mathrm{g}$ ；or，blnce $\mathrm{g}=32 \frac{1}{4}$ feet at New York， $\mathbf{M}=(5+3 \sqrt{2}) \div 82$ ．（8．）Substituting the values of $f$ and

laws of falling bodtes that the spacethrough which the body
falls is equal to the acceleration multiplied by the square of the time and divided by two，or $h=\frac{2}{2} a t$ ．Substituting in this the value given for $t$（ $=10$ seconds）and the value of a from equation 4 ，we have：The distance $=h=2 \cdot 63 \times 100 \div 2=$ stantially the eame as those upon which the action of the thom Atwood＇s machine is explained．
Minerals．－Specimens have been received from the following correspondents，and ex－ amined with the results stated

H．W．－Bothare crystaine hornble

## COMMUNICATIONS RECEIVED

The Editor of the Scientific American knowledges，with much pleasure，the re eipt．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． nd by F．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 Apparatus．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．－H．N．J．－A．R
－D．J．R．－L．P．A．－C．F．S．－G．F．M．－C．M．B．－M．E －D．. R．- L．P．A．
C．K．C．- B．
．G．
Correspondents who writetoask the address of certain anuracturers，or where specified articles are to be had riners，should send with their communications a mountrufflent to cover the cost of publication under the head of＂Buslness and
devoted to such enquirtea．

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

Letters Patent of the United State WERE GRANTED FOR THE WREE ENDING April 22，1873，
and mach bearing that date． （Those marked（r）are retroued patents


Drill，grain，J．King．
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## Fork，horse hay，H．C．Stouffer Frutt baeket，S．B．Conover（ $\mathbf{r}$ ）

Frurnace，cupola，J．B．Bearse．
Furnace，hot alr，c．
Furnace，hot air，c．L．Plerce．
Furnace，hot arr，. ．Plere．
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