Wheel Carriages

1 Great and Small rollers
— of equal weight

2. Sole small — large

3. Great wheels do.

4. Small wheels —

5. Inconvni. of Great wheels
— up and Down hill —
— wheels 6 : 4 = 4 : 3.
ft. wt. wt.

6. Friction of in small wt.
+ move faster — Inconvni in
turning — Cock cans
have more friction —

7. Stone pulls best sand
— wheels should be 4. 5½

8. Small wheels on uneven
ground not less than 30 Inc

9. Dished wheels — use
— a little straight below
— but not before —
10. Method of setting in the
axle L Bushes —
11. Position of the axle —
12 Length of the body — long.
13. Shoeing — hoofs — nails
should have thin heads

1 Single and double carts
— Reason the latter — Prefer
the former — × Opp. of W.! Qu.! 1/2 —
×2 — Bad yoking — Horses do not
— act equally — One has a
— weight of — up and down
— hill —
×3. Traces fixed to the ends of the
shafts — a better method
4. Yoke them abreast —
5. Waggon wheels —
— small fore wheels — reason —
6. Broad and narrow wheels
7. Six horse waggons cwt.
50. Cwt. — Single cart 16
96 = 16 = whole 1/4 in favor
of single carts —

8.

Cost 5 years old	£15
Maint. one year	7
for 12 year	84
total	99
	20
Sold in full for the ox	£79

Cost 5 years old	£10
Maint. 12 years	£120
	130
Ox at 5 year	5
Maint 4 year	20
	25
Sold for	8
	17
	3
	51
Sold for the ox	79

Line of draught

+ In a wheel the power that draws the greatest effect acts in a line parallel to the axis

Elements of a wheel

Consequences

1. On level ground the best used wheels are the best as near the line of draft parl. to the horizon.
2. When there is much up and down hill small wheels are best

Irish Car —

1. Preferable
2. Low price
3. Easily repaired
4. Easily loaded and unloaded
5. ~~Small~~ Easily put on the axle

Two kinds of Cars —

Single or Double

reason — Experience

bad yoking — Driving

Shaft horse does most work

weight on the back —

yoke them abreast —

Empty cars drawn —

Waggons —

Front and hinder wheels

bridge — pressure of the elm

waggons do not carry what

might from ruts would but

better if spade —

Oz. 4 year . . 16 —

Maint. for 3 yr. 12

Deduce what sold for 7

total at 3 year 5

4

20

In Scotland oats for draught

horse in one year amount

to 270,000 £

Strength of timber —

3 Strains —

— Absolute —

20 Inches long ½ Inch sq.

Best oak — 65 Lib

— fir — 46 —

Elm — 32 —

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oak to fir as 3 : 2 —

— Sution × Dist. centre of gravity / 2

— Com: Joints — Base × H —

× Cones — Quills —

— weight in the middle

= ½ over the whole —

— Ends fixed = twice the str.

— Mortise — middle

+ To raise a bended beam — wedge

+ Triangular beam — base an

to △

— Slender Cylinder 3/5 length

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* Oblique pressure

Moment : obliq :: Co-sine

Incl. Inst : to Radius

— Practical rule —

Roofs — Gates —

Centers —

— Strongest Beam —

— Ropes — 180 into 120 ft.

— Bar to Machines —

— Small machines and Ann:

stronger than large in proport.

++ Schemedes — —

Note

The circumstances necessary
in the construction of a plough

1. Perform the work perfectly
2. Least expense —

Effect of a plough the share
1. Cut the earth perpendicularly
to a certain depth
2. Horizontally at the depth
3. Turn it over —

M—

Head of the Plough
— Length —
— Shoe's length — curve
—

Sock and coulter

— Spiked sock necessary in stiff or stony ground in the sock plough necessary — but the feather sock equally preferable in worse —

— In the sock plough the position of the sock and coulter absurd — obliges the plough to be held obliquely — and increases the resistance — coulter should cut and the sock turns over —

Shank to incline forwards to land

Beam — Length of the moment
extended must be made
stronger — stand oblique
when —
+ when applied to the
beam — to prevent the
plough sinking in bags &c

Reducing the weight of the
plough is not always an ad-
vantage — In heavy soil
a light plough will not
perform well — Resistance
more easily overcome by a
heavy than a light body
— greatest resistance — most
— advancement to the lower —
+ Fly added to a machine
+ Pendulum of a clock —

Earth properly moistened promotes the growth of vegetables but if there is too much moisture or converted into mud it is injurious to plants — thorn hedges —

Oxen preferable to horses
Difference - 6 £ p. Annum -
- Ancient farmers used only
oxen - hauled out the corn - plough
- tack volentia plaustra -
XX Oxen eat no oats
- In Scotl. Draft horse eat
300,000 £ worth of oats -
- requires little attention -
- sold to the butcher
- will draw as much as a
horse
- more steady - moves sufficiently fast -
- Should draw from the shoulder
- not from either the tip or
root of the horn -

Experiment.

to ascertain the resistance offered to a plough share Mulgrave

Notes for Abstract of Key on Strengths

Swing Strengths

The swing strength is found by two levers, one of the first the other of the second kind — The handle the fulcrum is at the heel ~~the weight~~ between the foot and the handle and the weight on the shoe —

2. Beam, here the heel of the strength is the fulcrum the weight on the shoe and power at the wipe

× Centre of resistance
near the point of the share
— Expt. —

The length of the handle or
is the long arm of the lever
should be to the length
of the bottom of the plough
which is the short arm
as the weight on the share
or tendency of the point
into the ground are to the
power applied at the
handle — This is evident —
But the other part of the plough
which constitutes the lever
of the second kind is not
well understood

Shortness with the
of growing the best sort of
wheats ——

That you with
the ends of motion a little
above the of suspension

Strength of timber

3 Strains

absolute strength

relative strength

$\frac{h^2 \times b}{l}$ = strength

Plough

2 Regulator — 1 Clevis. 2 Cart wells

3 Pieces of a plough —

1 Coulter — oblique

2 Share — feathered — spiked

3. Mould board — straight

Share — curved

both inclined —

4. Sheath — oblique — curved

Short. Sheath bent

5. Head — sole straight

in a line with the coulter.

6. Beam — Long — Short

curved — straight

7. Center of resistance

Rule for fitting the Beam

8. Rule for the form of the mould board — earth side

9. Chain plough —

10. Handles long — low

11. Weight of a plough

no obstacle — some

times an advantage —

12. Spring machine —

— Wishing
— crest
— axle fitted in
— length of the nave or stock
— felloes
— heart rim
— stronger.
— lighter
— as easily repaired
— when broken repaired
with a single felloe &
— jaws
+ Nails should be
smoke with the tyre
— keeps the pavement
+ contractions of the wood
— ascertained by Exp.
— Spoke broke in the heart
rim is repaired by cutting
out a piece in the stock

Irish car

— Waggon —

× Castello in Virey — make their wheels from — 5 feet to 5. 6 and 7. 6 feet wheels from 3. 6 to 3. 10

+ machine for shoeing an excellent contrivance —

— Contraction of the horseshoe 2 inches in a wheel of five feet —

New Carriage —

Great advantage of a wheel is that the resistance is much less than the weight —

— I can Draw the carriage with my own weight ~~at~~ in it — lever on the axle —

— wheel on the axle —

— — 2 wheel wheel —

— Levers

— Method of turning —

— only one wheel turns

— advantage of this

Remarks on the plough

Remarkable on the long
beam is to keep the plough
steady — a long beam
has the same advantage
— In stubble land if the
beam is not bended the
stubble will choke it
— Rotherham made of fining
the sheath and handles
the strongest and best
Remark respecting the
mould board turning in the
mould board — Double
wrest plough —

— Mr Knowlis method of fitting the beam of a plough —

— Centre of resistance near the point of the share when the horses stop and the traces are kept taut and the carts removed they pass thro' the point of the share —

Remarks on Wheel C

Suppose a waggon with equal wheels whether will it be drawn easier with more ease with the weight laid on the fore or hind axle? Mr. F. thinks on the fore — little difference —

That the wheels may move in the same rut the fore wheels should have a different dishing from the hind or fore axle through determined in this way

AC spoke, BAC angle of dishing — AD small wheel spoke DE dishing then to make the wheels move in the same rut the fore axle should cross the

by the half of B C — W. F.

— Objection to the hoop shown that unless the proper degree of heat can be ascertained the hoop weight may either give the hoop too much or too little and consequently contract the rim either too much or too little —

Dr. F. —

— What is the error arising by a shaft on the nave of a wheel? On the circumference it is a cycloid

— What is the best quality of the wood of a wheel? and the best practical rule for fitting in the axle?

— Only inconvenience of hooking the traces to the bottom of the shaft is in turning — This no great inconvenience

To remedy the inconvenience arising from the pull down hill the fore horses have breeching — How are they yoked? —

It is in favour of small wheels that allowing the line of draught does not produce so great an effect as a large wheel

One advantage of a long frame is that the wheel has less play when a stone shakes the circumference obliquely the gallop of the carriage is less —

— The space between the fellies before putting on

the hoop leaves sufficient room to contract — To
— The length of Anchor line
of Draught is said to facilitate
the Draught — this a vulgar error
— If the cam wheels are made
to move separately will there
be any advantage? —
— They may be placed like
two wheelbarrows without
an axle — Mr. Henry —
— In a cart when one shaft
is slipped will the other run
back and the shaft shake
the horse on the side that
is slipped? — Mr. M —
— In a wagon if one horse
is lame he will soon be
done out — this is an objection

— The letter of a horse when
applied to the shoulder makes
an angle with the horizontal
plane. should not the line of
draught be perpendicular to
the collar? —
— When any thing goes
wrong a wagon must stop
but with single carts a
cart when one breaks down
they can divide the cargo
and load among the rest
— The dishing drawers with
wear this inconvenient, it is cured
by the spokes sinking more
into the hind part of the
mortice which is narrower
than the fore part.

— When the hoop is heated and fitted tight, it holds the spokes in contracting — this circumstance will be of service provided the spokes retain their elasticity —

— Method of hooking the chain back on the shaft of the first car is very proper —

— The wedge form of the tenon is an excellent contrivance when the layer is first laid on it forces the spokes against the rider as well as the end and renders it firmer —

— Mend wheels of a carriage for 5 to 5,6 and fore 3.6 to 3,10

— What is the difference of pushing a car or obstacle on a horizontal and inclined plane? —

Wheel Carriages

Great and Small Wheels
compared.

— Roller hard and smooth —
— Great and Small drawn with
the same ease on a level
but upHill the great will
more difficulty —
— Great with more ease over
an obstacle. —
— A wheel a roller with
an axle.
— Two extremes, axle as
large as the wheel — infinitely
small. —
— In every intermediate case
the resistance arising from
friction will be in the proportion
to the Diam. of the Axle —

— Great wheels drawn with more difficulty up hill — push greater down hill — better may be remedied the former cause

— Great wheels more can overcome an obstacle — remains in a higher proportion than the diam.

+ Exp.t Waggon drawn with great and small wheels on the
+ horizontal plane — inclined
— Small wheels carry in the difference of the weight
— Point of contact.

— But for the length of the spoke there would be a double disadvantage — weight the only circumstance which opposes the experiment —

— Power exerted by the horse on an inclined plane must be as much less than the weight of the Load as the ht.: : length —

— To ascertain the quantity of friction on an inclined plane Exp.t Raise the plane until the carriage runs down the friction is to the wt. of the carriage as the sine of incl.n: Rad.

— Friction is greatest on a horizontal plane

— Small wheels injurious
from incl. more — fall more
readily into ruts — drawn in
more deep out —

— Alteration of the line of
draught produces a lift from
in ~~high~~ ~~wheels~~ low than in
high wheels. —

Wheel —

Spokes — Stock spokes
and the rim —

— Stock or Nave —

Form well known —

Arms sufficiently large

Length of the Nave
on wear and tear of little con-
sequence —

On an inclined plane
oblique — Short nave gives
an unsteady motion to the
wheel — Smaller more
the nave — Thin enhances
in proportion to the length
of the spoke — Some a
Disadvantage in Gravel &c

— Hence also high wheels should have longer shafts than low wheels —
— from horses bites on the ends —
+ Spokes — placed obliquely — diminishing — see — ingenious contrivance
— Mortise wedge form — see — should have no bolt
+ Rim — composed of several or of one piece
— Coach makers formerly left two openings in the rim — see a proof for bad workm.

— Bent rim —
— The simplest any body is — fewer pieces it is composed of so much the better
— for the least wheel even the grain is preserved —
— Suffers nothing from boiling
easily repaired
— Rim piece put in
— Spoke — piece cut out of the kind part of the nave
— Lightness a great advantage particularly up hill —

Shoeing

— Separate pieces
— Circular hoop heat.
— Put on red hot contracts and draws together the circumference —
+ Quantity of contraction per ~~an~~ $\frac{1}{50}$ to $\frac{1}{100}$ part of the whole in iron —
— When put red in day light contracts about 2 Inches in fifteen feet on a wheel of four feet in Diam.
— Nail heads should be flat when otherwise hurts the wheel and the paved.

Axle

— Conical form fits better
— Same rule will not cond for fitting the axle in a horizontal or ob: mov. plan
+ Rule for a level —

Crest —
— The fore wheels of different diameters, or their axle long in — How this is determ.

— The crest should be somewhat less than the rule gives it
+ Broad wheels less injurious to roads — easier drawn in sandy ground —

Jinks Car —

— Simple and cheap —
— Loading easy —
Inconvenient in turning
— Smallness of its wheels —

Waggons —

— work done by single ~~horse~~
— more than double horses
— reason — yoking — for
horse frequently does not
— draw yoked to the ends
of the shaft inconvenient
— weight on the back horse
— when a pr. of horses are yoke
if one is lazy he is dragged
— if any thing goes wrong
about a waggon the whole
must stop — but the load
of a car is distributed among
the rest, and little delay
occasion —
+ Waggons preferable for
the safety of the goods —

Conclusion

— On level ground least wheels about height of the
— Up and down hill less
— none should be less than 3 nor greater than seven ft.

× Much depends on the materials and workmn.
— Strength of wood — well seasoned — well put together

+ All the defts. hitherto made on wheel carriages insufficient —

— Model —

— Use of a model little understood —
— Model shews the manner not the quantity of action of a machine —
— To carry weights model stronger than the master
— Friction — Momentum —
— It is taken for granted that the superior P. of the model is similar to the engine or carriage at large but this has never been proved

— Spring Machine

Experiments must be made on the machine — construction of the inst. — thought of it in the year 1790 —

+ Uses — obvious.

1. Ascertain the quantity of draft in all cases.
2. Two small machines hooked to the draught chains of a carriage —
3. High and low wheel accurately compared
4. Quantity of friction.
5. One and two pair of wheels

1. No. of Systems in one pr
2. Belts Lists &c
3 Flies – how regulated
3. Burn – shifted – temper
4. Rollers – Flutes – Velocities
4. Upper Rollers how coow
5. Weight hung upon cast
6. Regulation for different sized thread –
7. Proportion of Carding, Roving and spinning.
8. Preparing of the cotton
9. Quantity spun in twelve hours of each sort of thread –
10. How many spindles has the largest mill in England going?

10. Is the velocity of the flies to the rollers alt. in different degrees of fine ness of the thread?

11. What is the best velo. of the flyers to the rollers

12. Size of rovings for different kinds of thread

13. Is the drawing frame necessary - its form

14. Twisting frame

15.

Queries respecting
Cannon foundry —

1 How is the cannon supported during boring?

2. Whether is it bored or turned first? —

3. The shape and temper of the Drill — Edge

4. What are the lower colors of the Cylinders made of?

5 What kind of leather is made use of for the piston is there any stuffing? —

6. What sort of Clay is made use of for moulds? —

7. The bottom and sides of the Furnace —

8. How is a large boiler
cast – Cylinder – Grate &c

9. To get a sight of the
Drawing of the Albion Mills

10. Whether a Cylinder for
a Sarah steam Engine

General Queries

1. Acid of vitriol —
2. Form of the furnace
3. Sal: Ammon:
4. Chrystal Glass work
5. How is the white opaque
form in the shank of Glass
6. What is difference between
the ingredients in the Compos
of the different kinds of Glass
7.

Prof Gates to
leave the Stage
Dumfries
Valley field

If [illegible] not
from Coll Preston
letter to Gen
Lime Works
Oak Rockbank
Salt-pans Mag-
[illegible]

Com. cover of
22 hanks of
Pr — 60 Hanks —
net — — 10 + 16
Contract — — 56
Cond of front Roll. 10 for
Shed Sheet — — 2s 2½
on the last a few of 10-11
Second roller . . 3 2 2s
Cond Row — — 10
Shed. 10
Last Roller — 16

2.2
2.5 for 60 hanks
140
56
6.

{ 11
2s

10:2s
10:32
56

5.96

2.2
3.2
56
54
2.96 —

No liquid preparation of the Cotton made use of for Mills — only for very diff. cotton Jennies — All the prepa^n for Mills consists in tearing it Mr Arkwright makes use of a large Cylinder of wood Stuck round with Spikes like Hackle teeth turned round in a room filled with cotton this is called a Card. —

Sometimes the Cotton is beat with a Stick with points — The end of all these is to remove the knots —

In the new frame ~~where~~ woof as well as warp can be spun — They are twisted contrary wise which is the reason the same Mill cannot spin both of it is of the old construction —

— The ~~t~~ lengthening the greatest Dimension in Mills done with ~~lengths~~ pieces of cloth — very imperfect — Upper rollers sometimes made of cotton not covered — Flutings should not be very fine — Iron rollers better than ~~Wood~~ brass — weights on the hind rollers light — Steel good — nicely adjusted — Goodness of the cotton known by one spinning its fibres near the eye. —

— The back roller is made often of wood —

The heart or lifter of the bobins has its motion from the hind roller — above — below — The contrate wheels are made with bevel teeth — when the four spindles wh- compose a system were placed in a curve the outside ones travelled much harder than the other two — a middle wheel answers better —

The warp and the woof being twisted different ways makes the cloth closer and softer, than if both the same way —

— This circumstance is said by Mr Smith to be of no consequence.

Rooted on the end of
the front roller
a pinion of 12
the same as the other two
drawing frames

Drivin pinion	16
Contrate wheel	—
end of the roller rooted	12
Shed wheel	20
Pinion on Ditto	12
First frame	
Second Roller	16
Pulley on Roller	
Second frame	
Third Roller	20
Third frame	24

Every front roller has a pinion
~~pulley~~ ~~roller~~ with inside the contrate

The only difference in the
three three ~~frames~~ of ~~rollers~~
drawing frames is in the
no. of the second roller
Rollers of different diameters
are the rollers of diff. diameter
in the spinning frame —

Weight of a Burhell of

Oats from 30. to 42 Lib
Barley ... to 58
Wheat — to 63

Oats at 42 Lib will produce
about 25 Lib of meal —
guess how much will oats of 30 lib
produce — The above Expts. were
tried at Aberdeen —
In a Brewery in Glasgow
English to scotch Barley cost
22/ to 15/ this year 1786 —

Water wheel — 28 feet 0.
Float boards — 24
Moves round in a min: — 10 times
Cog wheel — 10 Ds.
Spur wheel — 8 Ds.
Number of Cogs
Number of teeth of S.W.
Mill stones Diamet. — 4. 2 feet
Revolve in a min: — 100 times
Each pair of stones will grind in an hour — 10 Bush.

f Miles
4000 = 77.445
4
16000 15,4890
760

3200 4000. 77.445
1000 30 p

22.44

M.

1. 89. 3 4/5200
1320

22.5
89.0
170

Outer wheel —
Diameter — Number of ~~cogs~~ float boards
Undershot — overshot —
Undershot & descend to ascertain the best number of float boards for an undershot Mill —
Back water — float boards with hinges — Best velocity of the wheel is to the vel.y of the water, and about 10 times in a minute —
Cog-wheel should be ½ W.W.
Number of cogs should be odd
Beech ~~the best~~ good wood for cogs —
Spindle runs on brass —
Ragged wheel supports the Mill stone — brass bearing one end rub fast — the other on the Bearer — Stone raised or depressed by a lever, or

which is held by a screw
In this manner the mill is
composed — A spindle passes
down a piece of wood in the
eye of the upper mill stone
which by wedges is kept
tight to the spindle and must
be always well squared — It
would otherwise soon take
fire — Lower stone about
2 inches broader than the upper
both stones cut into oblique
grooves — Stones run fast but
near the centre farther from centre
other than near the eye? —
Use of this —
Horse-shoe — Funnel —
Eye — Hoops —
× Apparatus for the Sack