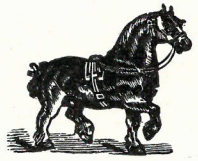
Publishers, Fullers Bookshop, Cat & Fiddle Arcade,
Hobart, Tasmania

K. M. DALLAS

HORSE POWER



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TO THE MEMORY OF
ROBERT DALLAS - 1823-1890
ROBERT DALLAS - 1861-1921
and
MARGARET JANE DALLAS *nee* Robinson - 1868-1946

Printed by C. L. Richmond & Sons Pty. Ltd., 10-12 Wenvoe Street, Devonport, Tasmania
1 9 6 8

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ILLUSTRATIONS

Front Cover : Bindering at Yolla, 1967

Back Cover : Sunset — The Last Round

ACKNOWLEDGMENTS

For photographs used, thanks are due to the proprietors of "The Advocate", Burnie, and Winter's Studios, Burnie; also to Margery Godfrey of Somerset, Bert and Bob Smith, Bob Steer and Murray Haines of Yolla, Bill Magill (for photos of the ploughing match), Ben Shepherd (two photos of draught horses) and Mrs. H. Devine, Devonport (photo on back cover).

Much help with drafts and proofs was given by Charles Lamp, Jr., Michael Roe, Tom Errey, Jim Moore, Barrie Dallas and others.

Though only a few are named in the narrative, the inspiration from the farmers of the North West Coast, of past and present generations, should be apparent.

THE ANCESTRY OF HORSES

AFTER the last Ice Age, when primitive men began to leave traces of their existence, the ancestors of our various breeds of horses were numerous. They roamed over the vast plains of Europe and Asia wherever suitable grass lands existed. They were small animals, perhaps a little larger than Shetland ponies. The Stone Age hunters killed them for food and somewhere in the human story the taming of these herds began; they were used for milk, meat and hides, as the Lapps used the reindeer. From that diminutive ancestor all the known breeds of horse have come. There are still breeds of wild horses in Mongolia which are probably little altered since the earliest times; on the cold, barren northern moors several pony variants have been established; those of the arid semi-desert have been developed into the Turkish and Arabian strains, source of our thoroughbreds, our blood horses. Yet in those small animals there existed the potentiality to breed the giant Shire or the Brabancon of Belgium, weighing well over a ton and standing over 18 hands high. Men have done this — the horses we know (or that our fathers knew) have been invented, bred from the types available, to give the qualities of speed or power, of endurance, docility or sagacity. Most of this bringing out has been done in the last two centuries — almost all of it in the last five.

When men learned to ride they gained new powers in hunting as well as in warfare. The nomads who moved, over centuries, out of Central Asia into China or Europe, used horses for riding but not for traction. Such ploughs and carts as they used were ox-powered. The neck of the ox is made for the bow, that of the horse is not. The later migrations of Huns and Tartars were of horsemen, with no social distinctions attached to owning or using

horses whereas the sedentary peoples of the river valleys, Assyrians and Egyptians, knew horses only as pampered creatures that pulled the chariots of the nobility. These were harnessed by a girth and throat strap, a device unfit for heavy work. Likewise, in the Roman world, horses were for patricians, for the chariots of the circus, that is, the racecourse.

There were ploughs in western Europe before the Romans ruled in Gaul or Britain but these were ox-ploughs. Horse chariots were for chieftains. For another thousand years the horse was a noble animal and the common people did not know its ways, nurture or uses. The Bayeux tapestry shows horses being shipped to England for the Norman knights — horses which, judging by the boats and men, were of some size and power. Some evidence suggests they were not more than 12 hands high. This "Age of Chivalry" tells us the status of the horse—a delicate and expensive animal used only by people of noble birth. They rode with stirrups—a device invented by the Chinese or Tartars, which increased the efficiency of hunters, soldiers or travellers ; it helped the horse, too, as much as it helped the rider.

The crucial invention in adapting horses to human needs was the collar—this, too, seems to have come from the Chinese or Mongols. Chinese drawings of about 870 A.D. show horses with collars. This was introduced to England about the twelfth century. The Luttrell Psalter of 1270 A.D. shows horses pulling carts, ploughs and harrows with rope traces fastened to collars. The horses are sturdy but of pony size ; they have nailed shoes and the cart wheels have tires of short plates of iron. The plough has a two-wheeled front carriage ; the harrows are a wooden grid with wooden tines ; the cart has a load of hay but the vital aspect is the padded collar which added a new efficiency to farming. The breast plate harness or the girth and throat harness might serve for light chariots and short runs but not for heavy, sustained pulling.

The collar is more expensive to make and more exacting in its fit to the shoulder but it doubles the tractive effort or horse-power and makes faster, cleaner work possible. Its use shows a demand for better tillage, increased crop return. Harrowing, for example, is an operation which pays only with fast work and frequent repetition.

The extent of its use at that time cannot be measured. Arguing from first principles we might hold that ox power continued for all heavy ploughing in stiff soils so long as the clumsy wooden plough persisted — and in some parts that means well into the 19th century. For light soils, and for fallowing, and harrowing, horse power was more profitable but only if other changes, like crop rotation, were occurring. We must also allow for the change

brought by the use of wheeled carts in towns and towing barges on rivers — both increasingly important as the wealth of Western Europe increased.

We need to remember that from Roman times at least the richest and most technically advanced region of Europe was that around the lower Rhine — Flanders and the Netherlands. Here the use of clovers, turnips and grasses came into farming and the quality of animals improved both by this and for this. Let us note that Henry VIII imported mares of Flanders as well as a fat German wife, at a time when his greedy courtiers were seizing the lands of the monasteries in order to improve them to the greater glory of God and their own profit.

More profitable farming demanded more powerful horses ; also better horses meant better cavalry and wagon transport for cannon and gunpowder. Let us also note that the breeding of larger horses came after the armoured knights were extinct but that Cromwell's Ironsides and the Swedish cavalry before them based their devastating tactics on the shock effect of disciplined horsemen. Mobile guns and baggage trains increased — the army that King Billy brought over to put him on the throne included Swedish artillery whose sixteen brass guns had twelve horses to each gun. His equipment also included a portable floating bridge, in sections, a device used earlier by the Turks in their attack on Vienna. Marlborough's famous march from Flanders into Austria proves that horses and wheeled carts were obtainable in sufficient numbers for the new tactics of mobility.

The new scale, complexity and mobility of warfare show a new scale of agriculture and transport based on horse power. All inland towns were river towns and a wealth of picture maps of these, many of them showing incidents of wars, depict river barges with four horses stemming the current of the Rhine, Moselle, Danube and others. By 1700 at least the Dutch were using ice-breaker barges on their canals to keep them serviceable in winter. These were powered by as many as forty horses, hitched in pairs to long, heavy hemp ropes. Yet the horses shown are little heavier than the coach and carriage horses of a century later. We have to allow that always the heaviest horses were called for not on the land or the roads but on the short hauls of the city ports, carting barrels of wine or salt fish, or sacks of grain, from dock to warehouse.

So it seems that our large farm breeds appear only within the last two centuries. The Flanders chestnut or Brabancon, the Suffolk Punch, the Shire, the Clydesdale and the Percheron have until then a legendary and dubious origin ; we also must allow that the first definite types of these were not at first what they became after another century of careful selection and breeding,

not to mention better and more ample food and systematic use, which surely brought out the qualities which appealed to breeders and buyers. We have got to allow that all this change was gradual and tentative : to increase the numbers of a known type is one thing ; to select and breed for special qualities is quite another. It is also certain that such change was most marked in prosperous times and regions — done by those who had money to risk in such work as well as knowledge of what was wanted and how to bring it out.

The arts of breeding were being applied to other stock, and also to plants. The increased demand for power is shown by the outburst of canal projects, the building of turnpike roads, the improved arts of wheelwrighting, the invention of threshing machines (a Scots device powered by horses or water wheels) and the use of wrought iron in carts and ploughs as well as in chains. Our history books have much about chain shackles for negro slaves but show no realisation that without the demand for farm horse gear the chain-making trades would not have grown to large scale. More powerful horses for road wagons and coal barges imply more powerful gear — the army demand was large but intermittent ; that from farms and coal mines was continuous and growing.

It is the same with the turnpike roads — built to carry grain or wool. They were also used by the fast coaches and post chaises, for which the Cleveland Bay was bred from the carriage types of Yorkshire.

The crux of the matter is that the industrial revolution, which was then upsetting all social relations and political systems the world over, was marked in all its aspects by the specialisation of machines, of men and of animals. Specialised horses, like heavy draught breeds, were economic only if there was enough specialised work to warrant their increased cost. Their fuel consumption was enormous and they were expensive to house, harness, shoe and groom. The gradual spread of specialisation was marked by mechanised farming — the Norfolk plough, the steel mould-board, the seed drill, the horse hoe which led on to scarifiers, mechanical mowers and reapers. The middle weights persisted for general light work and haulage on railways and canals or as " pit ponies " in mines. They were the types for omnibuses and forestry ; lighter types were wanted for cabs and coaches.

The finest flowering of horse power came even later, say from about 1870, and endured about sixty years. In this period the most striking change was to the reaper-binder and multi-furrow ploughs ; larger farm wagons and better roads were linked to this. Also the scale of town haulage of coal, ice, timber, stone and grain called for the most powerful but slower types of heavies.

It was the petrol engine on the land, the roads and in cities which made these obsolescent though there are towns in Europe where narrow streets and congestion still give the horse-truck a cost advantage over motor trucks.

All this invention or evolution was from a single species, a pony type, which roamed the grasslands tens of thousands of years ago. If the specialised heavies were turned out to shift for themselves, as camels have been in Central Australia, they would die off quickly ; the lighter breeds would revert to the brumby strains as they did in Australia and in North America. While the finest inventions of Europe went along with other capital investment into the farms and forests of America and Siberia or the wheat lands of Australia and the Argentine, their small cousins, five hundred and thirty-seven times removed, were still grazing the moors of Scotland, or the bleak cold deserts of Mongolia, as their ancestors had done when men merely hunted them for meat and hides.

HORSES IN TASMANIA

THERE is very little evidence of the use of horses in Tasmanian or any other colonial agriculture before 1850. This may seem quite wrong when we know that breeds of horses suitable for, if not bred for, farm use were known in Europe a hundred years earlier and that horses had been used for farm work for many centuries.

There are certain sobering facts to consider. First, ploughs of any sort were rare here before 1820 and for decades after were made from local materials and imported iron by country blacksmiths. Nor were conditions much different in Europe. In Britain the cheap all-iron plough was first made after 1800 — in Scotland. This gave an advantage for faster, stronger teams but we must allow that they called for new skills in ploughman and blacksmiths — these don't grow rapidly unless there are other uses for the horses when ploughing is finished.

Also, in colonial farming the bullock team was general for a long time especially in rough work — and the same was true in Europe. We must also remember that hoe and spade gangs did much of the cultivation while convict gangs were cheap — and the same was true of Britain and Europe where paupers worked under even worse conditions than convicts. We might note that ploughs, with horses or mules, and indentured Scots ploughmen, were innovations in the West Indies when the emancipation of negro slaves became law. There is some reason to assume that the efficiency of animal power led to the emancipation of slaves and convicts — not the other way round as is commonly supposed. That is to say that the rising cost of feeding slaves and convicts led farmers to refine their methods, buy ploughs and animals and import ploughmen.

When we take actual cases we find that the import of horses for saddle and carriage was more common than that of power horses. The epic of the Hentys, as told so well by Marnie Bassett, shows a transplanting of farm life then in full flower in Sussex. Five thoroughbreds and two cart mares were shipped, along with cows, sheep and the rest of their livestock. The cost of keeping stock alive on such a passage was high ; it paid only with high grade stock. The blood horses were for breeding to meet colonial demand and for export to India. The cart mares were of the Suffolk breed but at their farms there is no evidence that these were used for ploughing. Similarly, the Cressy Company, V.D.L. Company and others imported blood stock as the most profitable venture, and the dual purpose Cleveland carriage horse. In 1831 there were in Tasmania at least five draught horses at service — the scarcity of well-bred animals is shown by the advertisement that one of these would stand for some months at Avoca.

After 1840 grain growing for the Port Phillip market increased but most of this would have been by bullock ploughs or hand methods. The import of Scots ploughmen, recruited by agents, in 1856, shows how changes were occurring — earlier still Scots millers and shepherds had been similarly imported.

On the other hand, in England, in spite of all the improvements of a century — the seed drill, horse hoe, fertilisers, rotation and enclosure — there was still a vast amount of crude hand work, of seed sown broadcast, hand threshing with flails. Within two miles of Brighton in 1847 six bullocks worked with an all-wooden plough. In 1850 very rough estimates gave about a million draught cattle and the same of horses as the animals used in husbandry. When we consider that in Scotland and Northern England there was much more mechanisation — the threshing machine and the first reapers were made there — the southern counties were, in general, more backward still. The first reapers were heavy and clumsy machines and, as will be told later, it took many years to make them efficient even in America. Even after this, which lowered reaping costs in England to 1/6d per acre, the costs of tying and stooking grain were 4/6d an acre. So that while the reaper itself gave scope for profit using horses instead of men, it was not until the reaper-binder was made that horses of power and speed were worth the cost for these and all other forms of machine farming.

Until this happened all other changes, steam threshing machines, steam ploughing (very limited in its use) did little to offset the high harvesting costs. The reaper-binder, or self-tying binder as the Americans called it, was applied more widely and more rapidly than any other invention. The making of reapers and mowers was already widespread and on mass production

lines ; the tying mechanism was a small extension to existing manufacture. Also by this time, 1877, rail transport and cheap steel and fast sea transport influenced its use. The other factor was that breeding of horses like the Clydesdale and Suffolk Punch and others was already at a stage where rapid expansion was cheaply possible. Whatever the explanation, the Stud Book of the three main heavy breeds and the string-tying binder appear almost in the same year.

Farm Team of Light Draughts, Brighton, Tasmania

The standardising of these breeds was the result of a century of careful selection and nurture, by hundreds of anonymous breeders. The rapid expansion in numbers was in response to an increasing home and export demand for quality stock for systematic breeding of power units. These horses and mares were a standard product of the principles of the industrial revolution just as much as were the locomotives, steel rails and triple expansion engines which were being applied to lowering transport costs in all developing regions — in mining and timber as well as

on farms. Of the heavy breeds the Clydesdale was most in demand. In 1911, the peak year of export, 1600 pedigree animals of this breed were exported.

We need to be reminded that the development of mobile power played a vital part in the military operations of the World War. Some may recall the story of the taxis of the Marne or the use of London buses and motor trucks in France but few will recall the paintings of Septimus Power, Munnings and Lambert of the heavy howitzers moved into action by teams of six draught horses. The search for heavy horse power led to import of Percheron types from America ; these aroused interest in the French breed so that in 1918 import of stud horses from France began. By 1941 the Percheron Stud Book in England listed 3000 animals ; the type came into extensive use on British farms and for all purposes of heavy draught.

The *Book of the Horse* by Brian Vesey Fitzgerald gives details of the draught horse stud breeding though the power horses get only 60 out of 800 pages. This power capacity of all countries seems to have reached its peak, if we take crude numbers as a guide, about the end of the first World War. The Australian maximum was over 2.5 millions ; the United States 21.5 millions. The Tasmanian total then was 41,000, fewer than the total used by London bus companies in 1910 when petrol buses first appeared. At that time London cabs used about 40,000 horses. The demands of wartime farm production and civil transport, as well as army purposes, were met by this enormous energy source. On the eastern front of that war the horsepower influence was greater still. Military historians estimate that in 1917 the Russian armies used eleven-twelfths of their transport equipment to supply horse fodder.

Further details will be given later on of the horse power revolution of the last hundred years. We can now go back to the Tasmanian story on the safe assumption that all the significant changes in mechanised farming came roughly within the same time. The crude statistics are not of much help. The official total of horses in farm districts for 1860 is 21,034 but we have no break up of these into purposes like road transport, forestry or farming. They include all horses over a year old whereas few horses under three years were at regular work. It is more realistic to make inferences of importance from the numbers of horse-powered machines, even though reports mention machines lying unused for lack of skilled men. Figures of output also might give dubious inferences because much tillage was by hoe and spade and much reaping and threshing were also by hand.

The figures also are for police districts whose names and boundaries change. Conditions varied widely between the older,

longer settled ones where wealth and the concentration of machines was highest ; these had lower transport costs. In remote districts like Russell (Horton) in the far north west, where farms were small clearings in heavy forest, mechanisation was long deferred. In 1882 a metalled road was being built in this district ; the contractor had a steam stone crusher on hire from the government. Before this all trade had been by sea, making it, then as now, more a satellite of Melbourne than of Launceston. The same conditions led to the persistence there into this century of hand reaping and even hoe culture.

In 1860 most remote districts had water mills for their own flour supply — when it cost 40/- a ton to cart flour from Deloraine to Launceston there was little profit in milling for export. Many mills also had bone crushers to make crude fertiliser. Imported guano increased in cost with distance from ports. The making of phosphatic manures by treating bones and guano with sulphuric acid was projected but the cost was too high for remote districts. Hand reaping was still almost universal : in 1867 60,000 acres were hand reaped and only 2,400 acres by machines though in South Australia horse powered reapers harvested 356,000 acres while only 52,000 acres were hand reaped.

Year by year the number of reapers increased ; in 1869 horse powered chaff cutters are first mentioned — man-powered chaff cutters might have been numerous ; no figure for these is ever given. Horse threshing machines were common in Richmond and some steam threshers are mentioned. Chaff cutting and threshing are intermittent, wet weather jobs and when horses are used for reaping it is economical to use them for indoor work in wet weather. The steam thresher was often merely a portable plant, pulled from farm to farm by horses. In 1870 it was reported that such threshers were little used in Port Sorell because of the bad state of roads. In that year in Horton (where farms were forest clearings with many large stumps) there was only one reaper and only nine acres of crop on which it could be used. The report says : " Emphatically the land of the cockatoo or peasant farmer and if he cannot succeed here no one else can." So the term "cocky farmer" was official and equated with peasants of Europe.

The figures for 1873 include 66 reapers and 17 mowers but give a new category " Reaper and Mower ", numbering 35. The distinction is clear and important though to many these are poetic terms for the same thing. From neolithic times grain had been reaped by sickles but the mowing of hay, by scythes, began only when men began to conserve summer grasses for winter hay for domesticated animals. In reaping the straw is cut high up as only the grain is important ; in mowing it is cut as close to the ground as possible to get all of the grass. Hay-making meant

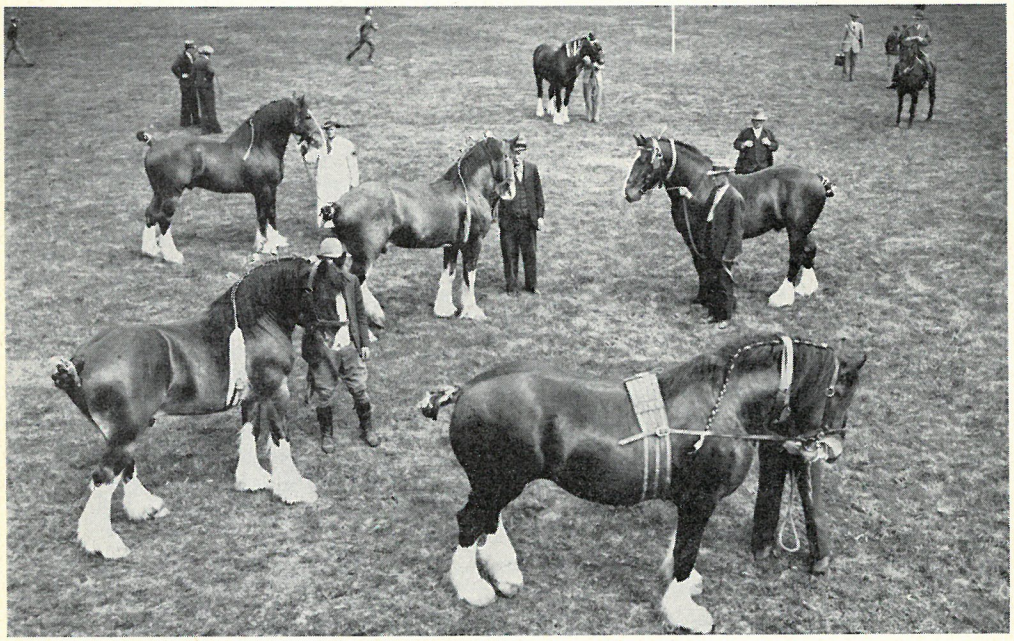
drying the grass before storing by turning it as it lay in the field — in 1942 this was still being done by hand in England in spite of wartime labour shortages and two centuries of horsedrawn hay rakes. The Reaper and Mower was adjustable for either operation ; for mowing the cutter worked at lower speed to lessen risk of damage and also because the straw cuts easily when it is firmly held by the earth ; for reaping it moved faster because the yielding stalks would not otherwise cut cleanly.

Year after year the numbers of machines were highest in the Westbury-Longford-Evandale region, the leading grain-growing one ; moreover, machines were intensively used because labour was scarce whereas, in Green Ponds, though there were 5 reapers, none was used through dearth of skill and because " when labour is plentiful, it is more economical to reap by hand ". Clearly, where men were cheap the demand for horses was weak ; for the Westbury district there was report of strong demand from Melbourne and New Zealand for heavy horses — prices had doubled. This suggests that prosperous grain districts were also breeding horses for market, an inevitable by-product. Out of the total of 73 horse powered chaff cutters 40 were in the Westbury district and 23 in Deloraine, suggesting that the new railway made it profitable to sell chaff in Launceston. This should remind us that one factor in marketing grain or chaff was the cost of jute sacks and bags — one of the new industries whose growth was essential for the age of horse power.

In the years 1874-7 the number of reapers and mowers rose steadily but by 1878 chaff cutters totalled 336 by horses and 15 by steam. In Westbury the double-furrow plough was becoming common, a sign of increased horse power.

In the ten years, 1868-78 the trend with threshing mills was quite different. Horse mills declined from 217 to 168 while steam threshers increased from 35 to 61. We are not told how many of these were itinerant, working on contract, and so more intensively used. The work done by steam threshers was much greater than mere numbers can tell. Still there was a great amount of stationary machinery worked by horses. Chaff cutting was probably done at frequent intervals for short periods but threshing was usually more sustained — a whole stack was threshed at one time, if not the whole crop. This might mean that horses were set to this monotonous round for some days on end and this can be as detrimental to the horse as if a skilled tradesman were put to work in a treadmill. The sagacity of trained horses was wasted when they were set to the unremitting round of the mill — it was donkey work. This was known in Scotland when the horse thresher first came into use. For all that, and in spite of the increase in steam power, twenty years later there were 935 horse

chaff cutters in Tasmania. So long as chaff cutting was for farm use it was an intermittent, standby job; the cost of a steam engine was not warranted if horses were idle, "eating their heads off". Moreover, boilers were subject to government inspection and operators had to hold a steam ticket. So the horse remained a versatile, mobile power unit, for farm and road work — and as well for chaff cutter, thresher, pump or sawbench. Some of the first milk separators were horse powered. Steam machinery was more economical in closely settled districts where more specialised workers and larger output served the town or the export market.



Last appearance of Draught Stallions at the Hobart Show.

In 1877 also, there was a marked increase in the use of double furrow (and a few three furrow) ploughs. This further economy of horse power and man power was attainable only on larger, well cleared farms. By 1882 there were 450 of these, of which Longford had 90 and Evandale 62, Brighton 40, Richmond 36, Westbury 35, Green Ponds 28 and Clarence 23. It meant more ploughing rather than fewer horses. Subsoil ploughs were also

listed; in 1882 there were 236 of these; common ploughs were never enumerated. The report for 1881 for Clarence has the significant remark that the double furrow plough and the Reaper and Binder were extensively used and that "only for these labour saving implements a great deal of land would be laid down in grass".

The vital part of the Reaper was the Knotter — by far the most revolutionary invention ever made. It embodied no new mechanical principle; it was small, simple and cheap. It augmented thousandfold the productivity of the established principles of reapers and abolished the backbreaking toil (and cost) of hand-tying of sheaves. The power take-off to the cutter, the elevators, packers, butters, were all in use in many forms in machines of many kinds. The technology of quality steel casting and machining was general in machine shops. Cheap, coarse twine (known as "McCormick" in many districts) was mass-produced. All that was wanted was a device to whip the string round the packed stalks, twist a simple knot and cut it free. Also, for the exacting demands of this moving packer of hay, there was an efficient prime mover, the Clydesdale horse, one of the ultimate products of centuries of breeding deriving from the wild ponies of the early stone age. This animal was the most efficient for the vast grain fields that were sown as soon as harvesting costs could be lowered to bring them within the margin of cultivation. So the simple knotter, which has remained unaltered for eighty years, was the vital gadget which completed the conjunction of many lines of mechanical improvement and especially of the breeding of a specialised prime mover which had in a higher degree than others, the power, speed and endurance which maximised the effect of the various mechanical devices.

The Binder is first mentioned in 1878 — two in Sorell, two in Westbury and one in Clarence. There is a family tradition that Thomas of Port Sorell was the first to bring a Binder to the state. One of the best known was Woods' Patent String Tying Binder, made at Hoosic Falls in New York State. The name suggests that it was one of the many engineering works there worked by water power.

At the Sydney Exhibition of 1870 a reaping and heading machine made in New York was shown — price £90. There were several Melbourne-made reapers with back or side delivery in the price range £35 to £60 (*'Industrial Progress of N.S.W. 1871", p. 259*). The exhibition of 1877 had no example of the Binder — yet in the next year five are reported in use in Tasmania. The point is that the speed of its adoption was world wide. In Tasmania, 1878, it cost £75 and was held to repay its cost in three years. Ten years later there were 470 in the state but Westbury

(120), Longford (118), Port Sorell (74) and Evandale (36) accounted for three-fourths of the total. This shows how rapid the revolution was in developed regions. By 1896 the total was 1248 and the district numbers were Westbury 335, Longford 154, Mersey 97, Evandale 76, Launceston 65, West Devon 65; these make 782 in all, or 62% of the total, in the northern region which grew so much of the production of oats, wheat and barley. There were then only 20 strippers in the state whereas in 1885 there had been 27. These were chiefly in Longford and Glamorgan districts.

The use of the Binder was the most distinctive application of the horse as a mobile power unit, the use in which the heavy draught horse was the only efficient power — in which it held the field unchallenged by steam or internal combustion tractors. Before we go into the technical and economic reasons for this we must recognise the importance of the joint products of grain farming of that period. The supply of corn — wheat, oats, barley, rye — was mainly for human consumption but also for stock feed in large measure. Where grain was the main crop and the straw had little market value there was scope for even larger scale operation of the stripper or header harvester and the grain combine. These were applied only in regions where the production of hay and chaff was beyond the margin of cultivation because of transport costs. The economy of these was striking — in their special regions — but has been overrated. In 1920 in the United States there were only four of these; in 1940 there were 190 and by 1956, 1000 (*"Historical Statistics of U.S.A."*). Not all bonanza farms used these — about 1890 on one of these the harvest was done by 600 men using 115 self-binders and 71 steam threshers (*Davidson: "Life in America", Vol. I, p. 418*). The giant combine did not prevail until the crawler tractor with diesel power was mass produced — and that was after World War II.

Wherever straw was of commercial value — and that means all regions of intensive farming near to the large urban centres where rail freight was lower — the graincrops were harvested by the binder and the steam thresher. The straw, compactly baled for economical transport, was used largely for cattle food near large centres of meat production and the meat-demanding cities.

The other important products of grain farming were hay and chaff, usually from the oat crop. This was the fuel for the vast armies of horses of the rapidly growing urban areas. In London, for example, the petrol bus began to take over about 1910; until then the private omnibus companies had over 45,000 horses; cabs had about the same; the heavy transport from rail terminals and wharves was all by horses and on short hauls, until after the

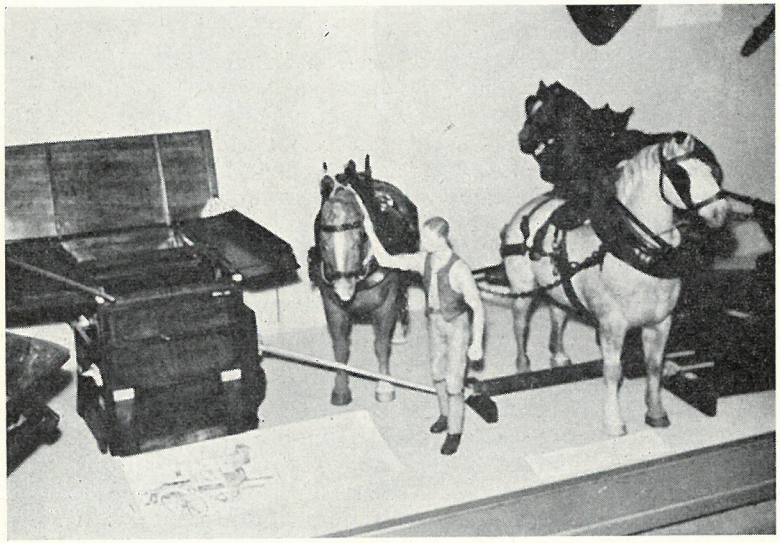
depression years of 1930 the economy of horses was conspicuous. It was in this field that the large Shire breed was much used. The wholesale and retail delivery of the supplies of the rapidly growing urban agglomerations — the food, ice, milk, coal, the garbage collections, street cleaning and all — were using a prodigious army of horses. It is beyond doubt that in that Pygmalion world the urban areas housed a larger horse population than the agricultural regions did; the horses had to haul their own food just as the rural horses had to produce theirs; we might also allow for the large numbers of dairy cows still stall fed within the city limits.

When light motor transport became economical this state of things passed quite rapidly away but it was not until the years of the great depression that the urban horse transport fell to small proportions and the Haymarkets of London, Sydney and Melbourne became merely a name for a part of the city. With this change came a farming revolution in hay production. More hay is made to-day than ever before but it is a very different product. To-day oaten hay and chaff are wanted only for play horses — the making of hay from grass and clover by completely mechanised methods is mainly for stock raising and fattening on the farms themselves and the city demand is insignificant. It was the loss of this market for hay and chaff in prodigious quantities that rapidly abolished the use of the binder and its horse teams on the intensive farming lands within short transport range of the cities. It changed the pattern of land use; diversified vegetable and milk production with hay conserved very cheaply from improved pastures might describe it briefly. This stimulated the mass production of light weight tractors applicable to a diversity of uses; even on the small farms of central Europe these may be seen everywhere, continually at the farm work of tillage and haymaking and on Sundays taking the whole family to church. Horses are few even there; the hay crop is mainly for dairy cattle.

So it was the rapid cessation of the demand for hay as fuel that ended the horse power phase of industrial development. We may take it as covering the half century from 1880 to 1930 in which the heavy draught breeds dominated rural industry but which are now almost extinct; the breeders of these and the ancillary industries of saddlery, chain harness and farriery have gone with them.

The rapid expansion was inherent in the gradual developments of the previous half century — the phase of the Hand Tying Reaper. The reaper and mower were machines with a power take-off. Their manufacture was organised on mass production lines for the production of wheels, gears, shafting and

hard steel cutter blades. For these two-horse machines the breeding of more efficient draught animals (which could move off in top gear and sustain an even power output through the long summer days) also took on something of large scale methods. In a similar manner the mule, standardised in America for cotton and corn culture with slave labour, was mass produced for the increase in farm machinery in the sub-tropical south of the United States in the decades after the Civil War.



Model in South Kensington Museum—Threshing drum with horse powered gear, type once common in Tasmania. Horses are of Suffolk Punch type—clean legs. Only Clydesdale and Shire breed have feather.

Therefore, when the great increase in world population with rising living standards and increased consumption of wheat and meat began, the engineering industries and the horse breeding industries merely expanded in scale on similar lines to those already laid down — and at decreasing unit cost. This was due to many reasons — the cheapening of mild steel (the Oliver Chilled Steel Plough in 1870 was also mass produced in the United States) as well as the large scale production for a continually expanding demand. The binder paid for itself in three years — but intensive use wore it out rapidly, too ; in the mixed farm Tasmanian economy those who owned machines reaped for others on a contract basis.

The reaping mechanism was already highly efficient and reliable. The binder embodied this but added the canvas belt conveyors which elevated the swathe of cut grain to the sheaf-packing and butting mechanisms above the central drive wheel. A tripping lever activated the tying mechanism when the sheaf was of a standard weight ; a crescent-shaped needle drew the string tight, two deft steel fingers shot forward to grip the ends of the band and tie a twist knot as a short knife cut the string and the ejector arms came over and kicked the sheaf clear of the machine. The operation of cutting and compacting was continuous ; tying, cutting free and ejecting were intermittent. On a down grade in a heavy crop sheaves fell every few seconds in an almost continuous line. There was a definite upward limit at which the packing and tying part gagged on the flow of the swathe or cast loose sheaves as the knotter stuck. There was also a lower limit where the cutter jammed or the canvas belts would not move the stuff.

So a machine designed for a standard density crop and type and length of straw had to be moved at an optimum speed to get continuous efficiency in reaping, packing, tying and ejecting. The team used had to have power and speed, as well as sagacity and trained response to the driver : power to move the weight of iron, with its added weight and drag of hay moving through it, even on uphill going, but also to keep to the optimum speed for the mechanism to work efficiently. This combination of qualities was highest in the Clydesdale breed.

It is not due to the twin myths of Chance and Circumstances that this type was evolved in the Scottish lowlands at the same time as the horse-powered thresher of Meikle, the Carron iron plough and the clumsy reapers of Bell, Smith of Deanston and others. It had not only power and speed but the stamina to sustain these through the long summer days. It was not only best for the reaper and the seed drill, the plough, harrow and cultivator. Its fast stepping, clean action also stood to it on road haulage. The clumsier but more powerful Shire breed tired on long journeys ; it was preferred for the short, intermittent haulage of the brewer's dray or the logging truck.

Therefore anyone seeking a quantitative measure of the importance of horse power on farms — an index number — would do better to work from the number of binders in use than from any juggling with recorded totals of horses in general. The gross figures for farm districts may include everything from the pony of the doctor's dog-cart to the sleek black pair that pulled Mr. Myron's plumed hearse. The recorded numbers of binders may include many that were little used ; perhaps obsolescent types that were taken out only in emergencies. What matters is that

the harvest season was a short, intense one. It began with the oat crop cut when near ripe for hay and went on through the grain crops of oats, wheat or barley as they matured. The intensity varied with the weather — the loss in harvesting overripe stuff was high. The ripening was therefore closely watched — there was a common belief that crops ripened off more quickly at times of full moon. Who can guess through what tale of centuries that belief had come ?

Wet weather stopped all bindering so in fair weather there was intense activity, often with relays of horses if they were available, but there were no relays of men. Big farms had several binders ; small mixed farms relied on contractors who owned machines and sometimes supplied horses. However this was organised, the effective capacity of the machine in use depended on the presence of at least three times their number of competent horses. The reaping was the crucial process ; the same horses carted the stooked crop but for this the pressure of time was less intense.

Most binders were of six-foot cut ; a five-foot was enough for three horses in hilly crops. In level districts a few eight-foot cut machines were known but were not standard. They needed four horses. Of course, at all times the driver could vary the volume of stuff cut by taking less than the six foot swathe. An oversize machine with larger teams posed problems of scale like the clearance between obstacles, the width of gates and lanes. A more important limit was the standard size of sheaf that men could handle and the optimum speed of the tying mechanism.

In hilly country or where grain was sown broadcast between the stumps or dead trunks of fallen trees, the binder and even the reaper were useless. In such rough cultivation, a transition stage in clearing farms, grain was broadcast on the rough ploughing and chipped in with hoes. Thus in 1882 when Longford-Westbury-Evandale had 81 of the 130 reported, in the bush farms of Russell there was still no binder or reaper. The sickle and the scythe sufficed ; there were only three horse threshing mills and two by steam. On most farms the flail was still the only tool. So while in the central north farming was as mechanical as anywhere in Britain, the remote districts used the techniques of the ancient Egyptians.

In 1885 Russell had two reapers ; in 1893 the first binder was used there. The figures for 1894 show a different pattern of mechanisation. There were seven binders (State total, 881), two reapers (171), six double furrow ploughs (1190), five mowers (370), 85 horse hoes (3494), six steam and six horse chaff cutters, four steam and three horse threshing machines (89 and 131) but there were six potato diggers and two horse-powered cream

separators. This district was soon to become a famous grower of spuds and butter for mainland markets but the scope for horse power was less somewhat in these than it was in grain farming. So up to 1900, at least, there were still gangs of hand reapers, working on contract and tying huge sheaves with hay bands.

Some may infer that horse-powered potato digging began then. It didn't. The writer saw, about 1912, the trial of one which had not been used in the memory of those present and the reason was soon apparent. It had a six-armed beater of iron bars designed to break up the earth lifted by the huge share and release the potatoes ; it did that but many were propelled like bullets into the nearby creek. An efficient digger came forty years later.

There were steam and horse driven separators but a small efficient hand separator soon appeared and enabled the cocky farmers to prosper on a cow and potato basis with horses for cultivation and transport but more gradually for grain farming. The climate was unsuited to wheat, the hills made bindering too heavy. Even the later use of tractors was more gradual than that of horse power and for the same reasons. In 1967 the writer found a small group of farms where all work was done by horses because tractors were too dangerous. Hay was cut with a vintage binder kept in commission by patient tinkering. Besides, one man can operate a horse-drawn binder ; a tractor needs an extra man and in harvest time manpower is scarce.

The collector's report for the Westbury district stated that the first binder reaped twelve acres in a day but required three men and two horses. Later experience suggests this should read " two men and three horses ". Also, to reap twelve acres a day, and sustain this rate, could not apply in heavy crops or hilly land. With hand reaping it was reckoned that a skilled man could reap an acre a day but that must have meant with a helper to tie the sheaves. Even so, the early binder effected a great saving in labour cost ; another important advantage was that the crop was reaped while fine weather lasted.

Any index number of horse power capacity got by weighting the totals of various items of machinery would not allow for diversion of resources into construction industries, mining and timber getting. There are passing references in Tasmanian statistics to labour (and presumably horses and carts) being diverted from the Brighton district in 1874-5 to build the Main Line railway and also from Emu Bay district in 1878 for the Waratah tram line. Horses and men were mobile, versatile power units, which could be diverted from consumer goods to capital equipment according to alternations of boom and slump.

Thus we might consider that the rural districts held the reserve power resources of the community. In the nineties'

depression the urban and mainland unemployed returned to Tasmania to subsist on the family farms just as they did in the Nineteen Thirties. Depression reverses the flow of migration. Also, in times of boom, mining companies and sawmill and railway contractors bought young horses at sales in country districts and drew hired labourers from them too. The large farms always bred horses for replacement and sold the redundant young ones if any. The production of a work horse takes, including the gestation period, about four years, so there was room for fluctuations in market prices according to the boom or slump condition of the economy, but the fact remains that the settled farming districts produced the reserve stocks of mobile power units for all other industries as well as producing the fuel for the power units of all short range transport.

For all businesses the maintenance of the capital equipment and the provision for replacement entail some form of provision for depreciation and obsolescence. For the horse age some farmers bought young ones and trained them ; others bred up regularly and sold any surplus ; some replaced merely by seeing that old Bell had a foal every three years or so. Whatever the cost advantages, they were under the farmer's control and the maturing two year old cost nothing to rear while he also became accustomed to the ways of the land on which his whole life was to be spent.

Returning to the point that the maximum number of horses was reached in horse power lands (the wheat-oats economies) about the end of the First World War, it is clear that the period of most rapid growth would have occurred well before that time. Biologically speaking, when the maximum total is reached, any population of men or rabbits is at a higher average age. In the great inflationary boom that followed the Boer War the investment in stocks of horses also reached its highest level. In 1899 Sir William Crookes startled business men, statesmen and scientists when he posed the question of the future of the world's supplies of food grains. The rate of population increase was still rising — the greatest total of births ever in Britain occurred in 1906 ; it was also the period when immigration into U.S.A. averaged about a million for ten years. He stated that from 1871 to 1899 the number of horses on British farms increased from 1,254,000 to 1,526,000 — an increase of 27%. In 1899 50,000 horses were imported. (*Crookes : "The Wheat Problem", p. 122.*)

The import may be fictitious — the Americans found a big export at the same time but it proved to be the result of buyers for the armies in South Africa operating in America. We might note that the rate of increase is close to that shown for Tasmania at the same time.

Crookes presents papers by two American authorities showing how the increased wheat production of that period has been achieved. In Dakota the wheat production had risen from 3,000,000 bushels in 1879 to 100,000,000 bushels ; by 1898 in the Missouri valley (including Dakota) half of the American wheat crop was being produced but the region had only 33% of the total of farm horses. This shows higher than average mechanical efficiency. A region with twelve million people was producing more wheat and almost as much oats as European Russia which had nearly ten times its population (*Ibid. p. 190*) .

So in America, as in the Australian wheat belt, the increased production of food grains was from previously unused land resources with increased use of mechanical equipment and of horses on a commensurate scale. The land developers had to build railways, buy the machinery and organise the immigration of peasant labourers, but the horse population, partly from imported stock, was bred up in the country where it was to work. There was no petrol tractor in this period — indeed the Fordson made only a small contribution to the farm production of the First World War. The steam tractor and steam winch plough had been tried and rejected. Steam engines were very important in threshing but only in that. (The Year Book for 1896 reported that they were too costly to be used even as stationary plants for lifting irrigation water, p. 186.)

The steam engine was simplicity itself to operate compared with the petrol engine. It was one thing to make an efficient power unit ; it was quite another to train operators and mechanics to achieve on the farm the efficiency shown in the test room. (The writer recalls how during World War II British marine engineers trained in steam were completely ignorant of the principles of diesel engines when these were installed as auxiliaries.)

In Britain, by 1925, there were only 21,000 tractors ; by 1939, 55,000, and by 1954, 400,000. The fundamental aspect of the change to mechanical power was that the hay and oats fuel for horses had been replaced by fossil fuels ; the oat crop became stock food for pigs and cows or alternatively the oat land became wheat land. No one would have expected Sir William Crookes or even Henry Ford to have foreseen, in 1900, this solution to the world's food grain problem.

Thus in all this period, 1870-1930, Tasmanian growth and change was merely part of a world pattern. Horses for underground haulage in coal mines were dominant until the passing of the depression. In the thick seams of N.S.W. coal fields the pit ponies were full grown Clydesdales. These were supplied with fuel from farms. At the end of World War II the Joint Coal

Board reported that only a few pits had mechanical haulage underground — which means that thousands of horses were still used. In 1952 the writer found one of the largest and most efficient mines in which horses were still used for maintenance work underground. So, though wheat growing in Tasmania declined there was a countervailing increase in oats, peas, barley and root crops. Up to 1930, at least, the export of chaff was important for the horse feed of Melbourne and Sydney and, in drought years, even for inland regions.

The Tasmanian Director of Agriculture in 1928 reported that there were 40,000 horses on farms — " as most of the agricultural land is too hilly and unsuited for tractor work ". (*ANZAAS Handbook 1928*). There were other reasons, for even on the northern plains tractors were rare. The tractor was too specialised ; it could not be used for road haulage because its steel-barred wheels damaged roads, its first cost was high and mechanics were rare. Though it did not eat when not working we must realise that the horse, when idle, got his own food from grass which had no other commercial value. One important aspect was that its power and speed were of no use in bindering. The binder had an optimum speed — that of the horse — and could not be speeded up. Besides, it needed a separate driver. If it was tireless its drivers were not, so its advantages remained, for some purposes, theoretical. It did not reproduce, and depreciation and the provision for it, were novel concepts for most farmers.

Also in 1928, when the Development and Migration Commission was at its highest activity, the Victorian Government issued a *Handbook for New Settlers*. The only mention of tractors is a photograph (p. 93). Neither the machinery advertisements nor the official advice make any mention of tractors — there are advertisements for oil engines and power kerosene. The brief survey of the agricultural provinces (p. 35) show a horse population of 486,075 and mentions eight horse teams as common in the Mallee province but does not mention mechanical power at all. This is not hilly country.

The grain lands of Eastern Europe and Siberia show a similar development to that of the United States though with substantial differences. Cultivation extended into Siberia with migrants from European Russia just as it extended into the North-west states of U.S.A. In the East European lands and Siberia the reaper was the main instrument — it was cheaper ; two light horses could work it on level land and labour (for sheaf tying) was cheap. In the Poltava Guberna from 1890 to 1895 sales of machinery included 12,000 iron ploughs, 500 winnowers, 300 reaping machines and 200 horse threshers (*Lenin : " Captalism in Russia ", p. 234*). The low proportion of reapers to threshers suggests that much

hand reaping was still done. From 1879 to 1895 the production of reaping machines in Russia increased from 780 to 27,000. The works belonging to J. Greaves, in Berdyansk, " the largest works in Europe in this line of production ", made, in 1895, 4,464 reapers (*Ibid. p. 230*). Just another British or American manufacturer who found that it paid to emigrate and manufacture near his market and spell his name in cyrillic characters. Clearly the labour-saving but more complex, expensive, power-demanding binder was not then profitable in a peasant economy. The agricultural revolution of 1927-32 made the sweeping change from this primitive harvesting to the tractor-powered combine — and released millions of workers for heavy industry.

Sweden was also influenced by the American-type revolution in mechanical farming but with unique differences. In 1872 its agricultural population was 72% of the whole. It is a notorious fact of American history that the wheat lands from Minnesota westward were colonised by Scandinavian emigrants — for iron mines and lumbering at first, then farming. The organised emigration by the Great Lakes began just after the Civil War and reached its peak (65,000 from Sweden) in 1882 though it continued high until 1923. The mechanisation of Swedish farms, at first with American machines, on the level lands of Southern Sweden was the obverse of this migration. The contemporary Swedish inventions of cream separators (with small steam turbine drive) and milking machines are part of the same changes. By 1884 a firm at Arvika was making farm machinery, by 1893 was making mowers and then binders, in competition with imported machines. Munktells of Eskilstuna began in 1859 to make threshing machines (*Modern Sweden : General Export Assn. 1937*). This firm also built the first Swedish locomotive (1853) and today makes tractors, combines, diesel engines and road graders.

Horses are still used a good deal on Swedish farms and are a distinctive type, smaller than Clydesdales, the descendants of the heavy cavalry types which made the armies of Gustavus Adolphus the most formidable in Europe. For level land a three-horse team handles a binder with efficiency. The Swedes had one unaccountable difference in design — the cutting knife and tray are on the right hand side of the driver. As in so many other aspects of its life the Swedish farming ways closely resemble those of North America but they seem to have mechanised to offset labour shortage to a higher degree than Americans ever did.

The development of mechanical and power farming in the U.S.A. set the pace of change and fixed the methods for the new wheat lands of the world. The McCormick reaper was devised for conditions on the farms of the eastern states. Though patented in 1834, nothing much happened until 1845 when 140 were

made. In 1851 it was a sensational exhibit at the Crystal Palace. In 1852 a trial of reapers and mowers had nine competitors but none of these could start into the standing grain without backing to get up speed. In 1855 the total made was 10,000 and in 1857 a trial of 19 types showed that all except three could work efficiently without a flying start (*Yearbook of U.S. Agric. 1900, p. 307*). So it took twenty years to make a reaper that was efficient. This account also states that in 1870 a self-binder was mechanically successful but the export to Australia does not seem to have followed for some years.

The 1904 Year Book reported the use of traction engines and automobiles instead of horses on country roads and of gasoline, steam, wind and electric power to operate "mowers, threshers, ploughs, corn huskers and dairy machinery" but the list makes no mention of self-binders or reaper threshers as being steam powered and emphasises the losses to farmers and manufacturers from ignorance of mechanical devices. With harvesting machines the speed of the works was governed by the speed of the prime mover. The steam engine accelerates; horses start in top gear.

In 1896 there were 14,000,000 horses and over two million mules on U.S. farms and ranches. For a few years there was a slight decline but by 1900 numbers again began to increase and by 1918 reached the highest level of 21.5 millions. The highest numbers were in the states of the north-west wheat belt. In 1897 the Year Book shows teams of light horses, in New Jersey, pulling road graders, rollers and stone carts but refers to stone crushers and rollers powered by steam. Another angle on primitive methods on road works is shown by the accepted practice of employing convicts of southern states, including prisoners awaiting trial, on road forming. The average so employed was 4,377 and the imputed value of labour $985,000 a year (*Year Book 1901*). These workers used mules — slave labour and powered machinery do not mix; even horses are too valuable to be entrusted to helots.

After 1900 the Year Books divide horse numbers into draft and carriage types but it is quite clear that "draft" there did not mean what "draught" came to mean in Australia. In the Year Book of 1898 an article on roads with wheel tracks of steel plate shows a load of eleven tons pulled by twenty horses but all of them were coach horse types by Australian standards. Although there is much mention of the import of heavy horses from Europe all pictures of farm machinery from the reaper to the combine show light or middle weight types in numbers twice as large as were ever used in Australia. The explanation may be that the heavy draughts were used on the hilly farms of the eastern states and for breeding half-weights for the western

farms. One advantage of the lighter types would be that in snow or in wet conditions of the spring thaw they would be less prone to bogging down; twice the number of horses with twice the number of feet has the same advantage that a truck with eight wheels has over one with four.

The spectacular pictures of huge combines pulled by steam engines are often seen but the cost of supplying these with fuel and water was in proportion to their size. Also we have to ask what these giant engines were used for during the rest of the year. When we read that "by 1900 the gasoline engine was about ready to lend its aid" (*Wells: "Industrial History of U.S.A., 1922", p. 469*) we should first recognise the folly of ascribing of personality to an inanimate thing and then look at what happened afterwards. In the next twenty years the number of horses rose by 50% and declined slowly over the following ten years. By 1918, after labour shortages and production incentives of wartime, there were only 80,000 tractors in the United States. By 1939 this number had increased to 1,600,000 but there were still then 11,000,000 horses on farms.

In Great Britain, though the tractor was replacing the horse on the land, harvesting was still a special case. By 1939 there were 55.000 tractors on British farms. It was in the U.S.S.R. that the most spectacular change was made. In 1920 there were there 700 tractors which by 1940 had increased to 523,000. In 1938 in both U.S.A. and U.S.S.R. fifty per cent of the grain harvested was by tractors (*Lilley: "Men, Machines and History, 1948", p. 149*). So at that time horses still supplied half the energy for harvesting in the two most mechanised countries — a hundred years after the proving of McCormick's patent.

In South Australia in 1876, a wheat farm of 4,000 acres used 30 double furrow ploughs and 27 strippers. Both plough and stripper had four-horse teams. (*W. S. Kelly, "Rural Development in South Australia", p. 23*).