Combine engine

The modern combine harvester , or simply combine , is a versatile machine designed to efficiently harvest a variety of grain crops. The name derives from its combining four separate harvesting operationsâ€" reaping , threshing , gathering, and winnowing â€"into a single process. Among the crops harvested with a combine are wheat , rice , oats , rye , barley , corn maize , sorghum , soybeans , flax linseed , sunflowers and canola. The separated straw , left lying on the field, comprises the stems and any remaining leaves of the crop with limited nutrients left in it: the straw is then either chopped, spread on the field and ploughed back in or baled for bedding and limited-feed for livestock. Combine harvesters are one of the most economically important labour saving inventions, significantly reducing the fraction of the population engaged in agriculture. In in Scotland, the inventor Reverend Patrick Bell designed but did not patent a reaper machine , which used the scissors principle of plant cutting â€" a principle that is still used today. The Bell machine was pushed by horses. A few Bell machines were available in the United States. In , in the United States, Hiram Moore built and patented the first combine harvester, which was capable of reaping, threshing and winnowing cereal grain. Early versions were pulled by horse, mule or ox teams. By , combine harvesters with a cutting, or swathe , width of several metres were used on American farms. A parallel development in Australia saw the development of the stripper based on the Gallic stripper, by John Ridley and others in South Australia by The stripper only gathered the heads, leaving the stems in the field. Combines, some of them quite large, were drawn by mule or horse teams and used a bullwheel to provide power. Later, steam power was used, and George Stockton Berry integrated the combine with a steam engine using straw to heat the boiler. In , the Holt Manufacturing Company of California produced a self-propelled harvester. In , Alfredo Rotania of Argentina patented a self-propelled harvester. At the time, horse powered binders and stand alone threshing machines were more common. In the s, Case Corporation and John Deere made combines and these were starting to be tractor pulled with a second engine aboard the combine to power its workings. The world economic collapse in the s stopped farm equipment purchases, and for this reason, people largely retained the older method of harvesting. A few farms did invest and used Caterpillar tractors to move the outfits. Tractor -drawn combines also called pull-type combines became common after World War II as many farms began to use tractors. An example was the All-Crop Harvester series. These combines used a shaker to separate the grain from the chaff and straw-walkers grates with small teeth on an eccentric shaft to eject the straw while retaining the grain. Early tractor-drawn combines were usually powered by a separate gasoline engine, while later models were PTO -powered, via a shaft transferring tractor engine power to operate the combine. These machines either put the harvested crop into bags that were then loaded onto a wagon or truck, or had a small bin that stored the grain until it was transferred via a chute. In the U. In , the Australian-born Thomas Carroll, working for Massey-Harris in Canada, perfected a self-propelled model and in , a lighter-weight model began to be marketed widely by the company. Until the self-cleaning rotary screen was invented in the mids combine engines suffered from overheating as the chaff spewed out when harvesting small grains would clog radiators, blocking the airflow needed for cooling. A significant advance in the design of combines was the rotary design. The grain is initially stripped from the stalk by passing along a helical rotor, instead of passing between rasp bars on the outside of a cylinder and a concave. Rotary combines were first introduced by Sperry-New Holland in In about the s on-board electronics were introduced to measure threshing efficiency. This new instrumentation allowed operators to get better grain yields by optimizing ground speed and other operating parameters. Combines are equipped with removable header that are designed for particular crops. The standard header, sometimes called a grain platform, is equipped with a reciprocating knife cutter bar , and features a revolving reel with metal teeth to cause the cut crop to fall into the auger once it is cut. A variation of the platform, a "flex" platform, is similar but has a cutter bar that can flex over contours and ridges to cut soybeans that have pods close to the ground. A flex head can cut soybeans as well as cereal crops, while a rigid platform is generally used only in cereal grains. Some wheat headers, called "draper" headers, use a fabric or rubber apron instead of a cross auger. Draper headers allow faster feeding than cross augers, leading to higher throughputs due to lower power requirements. On many farms, platform headers are used to cut wheat, instead of separate wheat headers, so as to reduce overall costs. Dummy heads or pick-up headers feature spring-tined pickups, usually attached to a heavy rubber belt. They are used for crops that have already been cut and placed in windrows or swaths. This is particularly useful in northern climates such as western Canada, where swathing kills weeds resulting in a faster dry down. While a grain platform can be used for corn, a specialized corn head is ordinarily used instead. The corn head is equipped with snap rolls that strip the stalk and leaf away from the ear, so that only the ear and husk enter the throat. This improves efficiency dramatically,

since so much less material must go through the cylinder. The corn head can be recognized by the presence of points between each row. Occasionally rowcrop heads are seen that function like a grain platform, but have points between rows like a corn head. These are used to reduce the amount of weed seed picked up when harvesting small grains. Self-propelled Gleaner combines could be fitted with special tracks instead of tires to assist in harvesting rice. These tracks can be made to fit other combines by adding adapter plates. Some combines, particularly the pull type, have tires with a deep diamond tread which prevents sinking in mud. The cut crop is carried up the feeder throat commonly called the "feederhouse" , by a chain and flight elevator , then fed into the threshing mechanism of the combine, consisting of a rotating threshing drum commonly called the "cylinder" , to which grooved steel bars rasp bars are bolted. The rasp bars thresh or separate the grains and chaff from the straw through the action of the cylinder against the concave , a shaped "half drum", also fitted with steel bars and a meshed grill, through which grain, chaff and smaller debris may fall, whereas the straw, being too long, is carried through onto the straw walkers. The drum speed is variably adjustable on most machines, whilst the distance between the drum and concave is finely adjustable fore, aft and together, to achieve optimum separation and output. Manually engaged disawning plates are usually fitted to the concave. These provide extra friction to remove the awns from barley crops. After the primary separation at the cylinder, the clean grain falls through the concave and to the shoe, which contains the chaffer and sieves. The shoe is common to both conventional combines and rotary combines. In the Palouse region of the Pacific Northwest of the United States the combine is retrofitted with a hydraulic hillside leveling system. This allows the combine to harvest the steep but fertile soil in the region. Gleaner , IH and Case IH , John Deere , and others all have made combines with this hillside leveling system, and local machine shops have fabricated them as an aftermarket add-on. The first leveling technology was developed by Holt Co. Hanson Company, Inc. Hillside leveling has several advantages. Primary among them is an increased threshing efficiency on hillsides. Without leveling, grain and chaff slide to one side of separator and come through the machine in a large ball rather than being separated, dumping large amounts of grain on the ground. By keeping the machinery level, the straw-walker is able to operate more efficiently, making for more efficient threshing. IH produced the combine which leveled both side-to-side and front-to-back, enabling efficient threshing whether on a hillside or climbing a hill head on. Secondarily, leveling changes a combine's center of gravity relative to the hill and allows the combine to harvest along the contour of a hill without tipping, a danger on the steeper slopes of the region; it is not uncommon for combines to roll over on extremely steep hills. Newer leveling systems do not have as much tilt as the older ones. These modern combines use the rotary grain separator which makes leveling less critical. Most combines on the Palouse have dual drive wheels on each side to stabilize them. A leveling system was developed in Europe by the Italian combine manufacturer Laverda , which still produces it today. Sidehill combines are very similar to hillside combines in that they level the combine to the ground so that the threshing can be efficiently conducted; however, they have some very distinct differences. They are sparsely used in the Palouse region. Rather, they are used on the gentle rolling slopes of the midwest. Sidehill combines are much more mass-produced than their hillside counterparts. The height of a sidehill machine is the same height as a level-land combine. Hillside combines have added steel that sets them up approximately 2â€"5 feet higher than a level-land combine and provide a smooth ride. Another technology that is sometimes used on combines is a continuously variable transmission. This allows the ground speed of the machine to be varied while maintaining a constant engine and threshing speed. It is desirable to keep the threshing speed constant since the machine will typically have been adjusted to operate best at a certain speed. Self-propelled combines started with standard manual transmissions that provided one speed based on input rpm. Deficiencies were noted and in the early s combines were equipped with what John Deere called the "Variable Speed Drive". This was simply a variable width sheave controlled by spring and hydraulic pressures. This sheave was attached to the input shaft of the transmission. A standard 4 speed manual transmission was still used in this drive system. The operator would select a gear, typically 3rd. An extra control was provided to the operator to allow him to speed up and slow down the machine within the limits provided by the variable speed drive system. By decreasing the width of the sheave on the input shaft of the transmission, the belt would ride higher in the groove. This slowed the rotating speed on the input shaft of the transmission, thus slowing the ground speed for that gear. A clutch was still provided to allow the operator to stop the machine and change transmission gears. Later, as hydraulic technology improved, hydrostatic transmissions were introduced by Versatile Mfg for use on swathers but later this technology was applied to combines as well. This drive retained the 4 speed manual transmission as before, but this time used a system of hydraulic pumps and

motors to drive the input shaft of the transmission. This system is called a Hydrostatic drive system. This pressure is then directed to the hydraulic motor that is connected to the input shaft of the transmission. The operator is provided with a lever in the cab that allows for the control of the hydraulic motor's ability to use the energy provided by the pump. By adjusting the swash plate in the motor, the stroke of its pistons are changed. If the swash plate is set to neutral, the pistons do not move in their bores and no rotation is allowed, thus the machine does not move. By moving the lever, the swash plate moves its attached pistons forward, thus allowing them to move within the bore and causing the motor to turn. This provides an infinitely variable speed control from 0 ground speed to what ever the maximum speed is allowed by the gear selection of the transmission. The standard clutch was removed from this drive system as it was no longer needed. Most if not all modern combines are equipped with hydrostatic drives. These are larger versions of the same system used in consumer and commercial lawn mowers that most are familiar with today. In fact, it was the downsizing of the combine drive system that placed these drive systems into mowers and other machines. Despite great advances in mechanics and computer control, the basic operation of the combine harvester has remained unchanged almost since it was invented. First, the header, described above, cuts the crop and feeds it into the threshing cylinder. This consists of a series of horizontal rasp bars fixed across the path of the crop and in the shape of a quarter cylinder. Moving rasp bars or rub bars pull the crop through concaved grates that separate the grain and chaff from the straw. The grain heads fall through the fixed concaves. What happens next is dependent on the type of combine in question. In most modern combines, the grain is transported to the shoe by a set of 2, 3, or 4 possibly more on the largest machines augers, set parallel or semi-parallel to the rotor on axial mounted rotors and perpendicular on "Axial Flow" combines. In older Gleaner machines, these augers were not present. Those combines are unique in that the cylinder and concave is set inside feederhouse instead of in the machine directly behind the feederhouse. Consequently, the material was moved by a "raddle chain" from underneath the concave to the walkers. The clean grain fell between the raddle and the walkers onto the shoe, while the straw, being longer and lighter, floated across onto the walkers to be expelled. On most other older machines, the cylinder was placed higher and farther back in the machine, and the grain moved to the shoe by falling down a "clean grain pan", and the straw "floated" across the concaves to the back of the walkers. Since the Sperry-New Holland TR70 Twin-Rotor Combine came out in , most manufacturers have combines with rotors in place of conventional cylinders. However, makers have now returned to the market with conventional models alongside their rotary line-up. A rotor is a long, longitudinally mounted rotating cylinder with plates similar to rub bars except for in the above-mentioned Gleaner rotaries. There are usually two sieves, one above the other. The sieves are basically metal frames that have many rows of "fingers" set reasonably close together. The angle of the fingers is adjustable, to change the clearance and thereby control the size of material passing through. The top is set with more clearance than the bottom to allow a gradual cleaning action. Setting the concave clearance, fan speed, and sieve size is critical to ensure that the crop is threshed properly, the grain is clean of debris, and all of the grain entering the machine reaches the grain tank or 'hopper'. Observe, for example, that when travelling uphill the fan speed must be reduced to account for the shallower gradient of the sieves. Heavy material, e. The straw walkers are located above the sieves, and also have holes in them. Any grain remaining attached to the straw is shaken off and falls onto the top sieve. When the straw reaches the end of the walkers it falls out the rear of the combine. It can then be baled for cattle bedding or spread by two rotating straw spreaders with rubber arms. Most modern combines are equipped with a straw spreader. Rather than immediately falling out the rear of the combine at the end of the walkers, there are models of combine harvesters from Eastern Europe and Russia e. Agromash Yenisei 1 HM, etc. For some time, combine harvesters used the conventional design, which used a rotating cylinder at the front-end which knocked the seeds out of the heads, and then used the rest of the machine to separate the straw from the chaff, and the chaff from the grain. Other manufacturers soon followed, International Harvester with their ' Axial Flow ' in and Gleaner with their N6 in In the decades before the widespread adoption of the rotary combine in the late seventies, several inventors had pioneered designs which relied more on centrifugal force for grain separation and less on gravity alone. By the early eighties, most major manufacturers had settled on a "walkerless" design with much larger threshing cylinders to do most of the work. Advantages were faster grain harvesting and gentler treatment of fragile seeds, which were often cracked by the faster rotational speeds of conventional combine threshing cylinders. It was the disadvantages of the rotary combine increased power requirements and over-pulverization of the straw by-product which prompted a resurgence of conventional combines in the late nineties. Perhaps overlooked but nonetheless true, when the large engines that powered the rotary machines were employed in conventional

machines, the two types of machines delivered similar production capacities. Also, research was beginning to show that incorporating above-ground crop residue straw into the soil is less useful for rebuilding soil fertility than previously believed. This meant that working pulverized straw into the soil became more of a hindrance than a benefit. An increase in feedlot beef production also created a higher demand for straw as fodder. Conventional combines, which use straw walkers, preserve the quality of straw and allow it to be baled and removed from the field. While the principles of basic threshing have changed little over the years, modern advancements in electronics and monitoring technology has continued to develop. Whereas older machines required the operator to rely on machine knowledge, frequent inspection and monitoring, and a keen ear to listen for subtle sound changes, newer machines have replaced many of those duties with instrumentation. Early on, simple magnetic pickups were used to monitor shaft rotation, and issue a warning when they deviated beyond preset limits. Temperature sensors can also give warning when bearings overheat due to lack of lubrication, sometimes leading to combine fires. The job of monitoring how much grain is wasted by the thresher by being discharged with the chaff and straw used to require going behind the machine to check. Yield monitors work like a microphone, registering an electrical impulse caused by grains impacting a plate. A meter in the operator's cab displays the relative amount of grain loss proportional to speed. Measuring the amount of yield bushels per acre or tonnes per hectare has become increasingly important, particularly when real-time measurement can help determine which areas of a field are more or less productive. These variations can often be remediated with variable crop inputs. Yield is determined by measuring the amount of grain harvested in relation to the area covered. Cameras placed at strategic points on the machine can eliminate some of the guesswork for the operator. The advent of GPS and GIS technologies has made it possible to create field maps, which can assist in navigation, and in the preparation of yield maps, which show which parts of the field are more productive. Grain combine fires are responsible for millions of dollars of loss each year. Fires usually start near the engine where dust and dry crop debris accumulate. From to , major grain combine fires were reported to U. The application of the appropriate synthetic greases will reduce the friction experienced at crucial points, i. Engines with synthetic lubricants will also remain significantly cooler during operation. From Wikipedia, the free encyclopedia. Machine that harvests grain crops. For the novelty song , see The Combine Harvester. Play media. Agriculture and Agronomy portal. Mascus UK. September Quick, Rosenberg Publishing, , page Wichita Eagle. Retrieved September 12, Archived from the original on Retrieved Categories : Agricultural machinery Combine harvesters Harvesters Vehicles introduced in Grain production. Hidden categories: Webarchive template wayback links Articles with short description Short description matches Wikidata All articles with unsourced statements Articles with unsourced statements from April Commons link is on Wikidata. Namespaces Article Talk. Views Read Edit View history. Help Learn to edit Community portal Recent changes Upload file. Download as PDF Printable version. Wikimedia Commons. Wikimedia Commons has media related to Combine harvester. Whatever the conditions or the operator, the S Series Combines automatically give you consistent grain quality. Shortcut buttons let you customize and quickly toggle between run pages. Plus, the optional Extended Monitor works with your Display to give you more real estate for viewing. This optional package includes 7 automation technologies to maintain the performance settings you choose - no matter the moisture or crop conditions. The ActiveVision cameras use cameras on the clean grain elevator and tailings elevator to help you see what's going on. Manual calibrations can take up to 90 minutes, but with ActiveYield, it's done with no time or effort. Automatic calibrations occur as you're running, sensing the weight of the grain in the tank as it fills and continually calibrating the yield system, giving you more accurate field mapping. Getting the best yield data is only useful if you can easily access and share it. With the John Deere Operations Center, you can turn your data into information that will make next year's harvest even better. Plus, with more than 75 connected software tools, including the major farm management systems used by agronomists, you can make the most out of your data. Connect and no cost, which opens an automatic, wireless information pipeline between you and your equipment. Agronomic data and as-applied data can be accessed from anywhere and shared if needed. And sending your data from the field immediately and automatically can prevent you from losing data. S Combines come with built-in technology to sense potential issues and alert you - or your dealer - when there's a concern. You can monitor machine fuel levels, location history, receive alerts and view the in-cab display remotely. On an S Series Combine, the technology isn't just on-board, it's fully integrated. More acres, higher yields and hybrids with tougher stalks are real challenges at harvest. That's why our corn heads are robust enough to cut the toughest, thickest crop with ease to help ensure every kernel makes it inside the combine. Now with a complete draper line that includes sizes from 25 feet to 50 feet, John

Deere offers the biggest selection of draper heads for the widest range of crops and conditions. Our auger platforms were engineered to match the high capacity of the S Combines and are equipped with a range of performance boosting features. No matter how rough the field or how thick the windrows, the BP15 Belt Pickup gives you smooth, complete gathering of windrowed grain, thanks to a variety of exclusive features and innovations. Power, grain quality, and efficiency are not mutually exclusive. The S combines deliver on all, and then some. Thanks to the Active Tailings System, a feature dedicated to the two largest models, capacity and efficiency are at their optimum. This system increases separator capacity by providing the opportunity for additional threshing of the return grain, if necessary. The tailings are evenly distributed to the cleaning shoe while you keep harvesting. The more your grain tank can hold, the less time you spend unloading. That's why the S and S models feature a robust bushel grain tank designed to hold more, so you can knock out the acres, fast. Roomy, comfy, and with all the amenities you need. Deluxe S cab turns ordinary operator station to luxury mobile home. Best-in-class views and lighting. Convenient controls. Well-appointed technology. And optional package featuring leather steering wheel and lumbar supported leather seat. We gave the S cleaning system a large cleaning shoe and unique, multi-leveled design that reduces sensitivity to slopes while still delivering quality results. Choose the model of your combine and the type of crop and receive suggested initial settings for the task at hand. Also features the ability to save notes and photos for reference in changing conditions. Find diagrams to help identify the part you need or view parts pricing and availability. Skip to main content. Electronic Solutions. Rental Sales. View All Equipment. View Used Equipment. John Deere Financial. Make a Payment. Sign In To My Account. Owner Information. S-Series Combines Whatever the conditions or the operator, the S Series Combines automatically give you consistent grain quality. S-Series Combines. S-Series Combine Videos. John Deere Operations Center Getting the best yield data is only useful if you can easily access and share it. John Deere Connected Support S Combines come with built-in technology to sense potential issues and alert you - or your dealer - when there's a concern. Compare our S-Series Combines. Experience Combines. Put Precision Ag to work for you all year long. Integrated technology for your combine On an S Series Combine, the technology isn't just on-board, it's fully integrated. Learn more about technology about Integrated technology for your combine. Corn Heads More acres, higher yields and hybrids with tougher stalks are real challenges at harvest. View Corn Heads about Corn Heads. View Drapers about Drapers. Auger Platforms Our auger platforms were engineered to match the high capacity of the S Combines and are equipped with a range of performance boosting features. View Auger Platforms about Auger Platforms. Belt Pickup No matter how rough the field or how thick the windrows, the BP15 Belt Pickup gives you smooth, complete gathering of windrowed grain, thanks to a variety of exclusive features and innovations. View Belt Pickup about Belt Pickup. Be efficient and productive. Active Tailing System Thanks to the Active Tailings System, a feature dedicated to the two largest models, capacity and efficiency are at their optimum. Spacious Premium Cab Roomy, comfy, and with all the amenities you need. High-performance Cleaning System We gave the S cleaning system a large cleaning shoe and unique, multi-leveled design that reduces sensitivity to slopes while still delivering quality results. GoHarvest App Choose the model of your combine and the type of crop and receive suggested initial settings for the task at hand. John Deere 6 cyl. Wet corn. Tough straw. Staring down less-than-ideal harvest conditions as go time approaches. You have a tight harvest window and an even tighter profit margin. You need more productivity and low losses. You need a combine that can get as much done in a day as you need it to â€" day in and day out, season after season. You need an X9 Combine. The X9 can harvest up to 30 acres an hour in wheat. And it can harvest up to 7, bushels an hour in high-yielding corn, which is more than enough to fill 7 semi-trailer trucks per hour. Unload a full tank in about a minute and a half â€" up to 5. Choose from three power-folding auger lengths. With In-field Data Sharing, you can share coverage map and guidance lines for increased efficiency. Machine Sync allows the combine to control the speed, direction and position of the grain cart tractor to automate unloading on-the-go. A new John Deere Our simplified belt-drive system uses larger pulleys and longer belts to improve the handoff of power and belt wear-life. It's not just the engine that delivers lower fuel costs, it's every aspect of the design. The belts, transmission, residue system, rotors, and lower RPM all play a role in saving you money on fuel. New system spreads up to feet wide; the double-decker design provides better air flow for even distribution with less power consumption. Tracks deliver improved floatation and allow for transport speeds up to 25 miles per hour. With the CommandCenter TM Display, you get in-cab control of the power folding unloading auger and adjustable spout for easier unloading and residue adjustments. A high-pressure common rail system more efficiently injects fuel into the engine for additional fuel savings. The all-new harvesting cab offers more comfort and improved visibility. Available

in three packages with two lighting options. Keep running. You can reduce downtime with connected tools that remotely monitor and proactively service your combine. Keep your combine in tip-top condition with comprehensive inspections. The best-trained technicians in the industry will replace worn parts and tune up other key areas. Skip to main content. Electronic Solutions. Rental Sales. View All Equipment. View Used Equipment. John Deere Financial. Make a Payment. Sign In To My Account. Owner Information. X Series Combines. X9 4. X9 5. Fast unloading Unload a full tank in about a minute and a half â€" up to 5. Save time and improve logistics With In-field Data Sharing, you can share coverage map and guidance lines for increased efficiency. A more efficient engine A new John Deere Belt-drive system Our simplified belt-drive system uses larger pulleys and longer belts to improve the handoff of power and belt wear-life. Improved residue management New system spreads up to feet wide; the double-decker design provides better air flow for even distribution with less power consumption. Choose from wheels or tracks Tracks deliver improved floatation and allow for transport speeds up to 25 miles per hour. Easy-change concaves Lighter concaves make switching crops even easier. Drapers View Drapers about Drapers. Comfort and visibility The all-new harvesting cab offers more comfort and improved visibility. Explore cab and visibility packages about Comfort and visibility. Inspections Keep your combine in tip-top condition with comprehensive inspections. Find a dealer about Inspections. Flexible Financing Count on John Deere for loans and leasing. Visit John Deere Financial. Demo an X9 Combine Sign up to demo the combine. Request a Demo. Find Parts. Pre-production model shown. Specifications and design subject to change. Agco Parts Book. Case iH Parts Store. John Deere Parts. New Holland Parts Store. After many years of working at a local tractor salvage yard he decided to start buying some older combines and selling used par

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 ts off of them. With the purchase of a 45 John Deere combine the business was under way. Several years later and after a lot of advertising, we now get calls from people all over the country. After 30 years of supplying the farmer with the parts they need for their combines, we now have 6 full time and 3 part time employees. Our salvage combines are purchased from many sources such as dealers, insurance companies, auction companies and farmers. New Parts We carry many new aftermarket parts for various combines such as belts, bearings, chain, sprockets, shafts, augers, auger flighting and much, much more. Used Parts Used parts are the heart of our business. Some of the most common asked for parts are final drives, transmissions, tires, rims, unload augers, straw walkers, seives, grain head and corn head parts along with complete grain heads and corn heads that are in good condition. If there are any parts you might be interested in, please give us a call and we will try to help you out.