

# The Model T Ignition Coil

## Part 2: The Ford Motor and K-W Ignition Companies

By Trent E. Boggess and Ronald Patterson

“Be it known that I, Joseph A. Williams, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Ignition Apparatus...”

- U.S. Patent # 1,092,417

In 1907 the K-W Ignition Company of Cleveland, Ohio had attempted to persuade the Ford Motor Company to adopt their magneto for the Ford Models N, R and S. Although K-W's attempt was unsuccessful, it appears that Joseph A. Williams, president of K-W, continued to look for opportunities to hitch K-W Ignition Company's wagon to Ford Motor's rising star.

The association between K-W Ignition and the Ford Motor Company was resumed in late 1912. After its failure to get Ford to adopt the K-W magneto for its Models N, R and S cars, K-W continued to refine the design of its ignition coils as well as developing a line of accessories for the Model T. Ford Motor Company sales records in the Research Center at the Henry Ford Museum show that K-W purchased from Ford Motor Company a number of items that could have been used in K-W's product development program. These items included flywheel magnetos, a complete Model T motor, and a jig for testing coil units. The K-W product line also included “road smoothers” for Model T Fords and a magneto powered electric headlights and sidelights.

Sometime in the fall of 1912 Joseph Williams, President of K-W Ignition was in Detroit negotiating for advertising space in the Ford Motor Company's publication the Ford Times. During this meeting Williams told Ford representatives of his newest design of coil. He claimed that the new coil gave much better results in synchronizing the cylinders and eliminated the need for a master vibrator. Williams left Detroit with the advertisement placed and an appointment to meet with the Ford engineers to discuss and test Williams' coil. The tests appear to have satisfied the Ford engineers that Williams' claims were true, and soon thereafter Ford began using K-W coils on part of its regular production. (See Photo 1)

1913

Here is the Making of  
**A Merry Christmas**  
For Any Ford Owner

**Master Vibrator**  
\$15.00

For all cars using vibrating spark coils and ESPECIALLY FOR Ford Cars

You will never know how much speed, power and flexibility there is in your car until you try a K-W Master Vibrator. It takes the place of the separate vibrators on your coil, giving you one fast vibrator and powerful condenser for all of them, thus giving absolute synchronism, with a smoother running engine and More Power.

Try it 30 days: if for any reason you don't want it, return it and get your money back.

**PRICE, \$15.00**  
Express paid anywhere if cash accompanies order.

**Electric Headlight Outfit, \$15.00**

Not makeshifts, but are complete in every detail, designed and engineered to work in connection with the ignition, both deriving their supply of current from the Ford Magneto. The outfit complete, which is all you need, consists of: 1 pair complete 8" Head Lamps with Parabolic Reflectors with 1 1/2" focus. 2 Tungsten Bulbs, size 2 1/2" diameter. 12 feet Wire, all soldered to lamps. 1 Diamond Switch. Instruction Sheet for Wiring. The best results in electric lighting cannot be obtained by the use of reflectors put in gas lamps. The highly burnished silvered surface must be protected in a dust-proof lamp. The Reflectors have a 1 1/2" focus which throws a strong beam ahead as well as lighting both sides of the road brightly. The Lamps are made entirely of one piece of brass, drawn from steel dies, have no soldered joints, easy to polish, and are 8" over all, making a handsome lamp for the Ford cars. They fit the forks furnished on the Ford cars. The Light which this outfit gives is vastly superior to either a generator or gas lamp. The Bulbs have a Tungsten filament of the proper voltage and amperage which will not interfere with the ignition and have the Edi-Swan or Bayonet base, impossible to fall out and injure the silver reflector like the screw base. The price for complete outfit is \$15.00. We pay the express charges East of the Mississippi, and to the Mississippi on points beyond when cash accompanies the order.

Special outfit DeLuxe with nine-inch Bullet-Shaped Lamps . . . . . \$20

We also make High-Tension Magnets, Low-Tension Magnets, and Vibrating Spark Coils—a complete line of ignition apparatus. Tell us you want when writing for catalogue.

FACTORY AND MAIN OFFICE:  
**THE K-W IGNITION CO.**  
40 Power Ave. CLEVELAND, OHIO, U.S.A.

Photo 1: A K-W Ignition Company advertisement published in the Ford Times in 1913.

The coils that K-W supplied Ford during early 1913 and perhaps late 1912 are easily distinguishable from later Model T coils. They are larger in size than later Model T coils and the locations of the three contacts on the coil units are also different. Finally, these coils have a flat brass top that with a black anodized finish (See Photos 2, 3 and 4) Four of these units were installed in a finished wooden box outfitted with the characteristic triangle-shaped K-W switch. (See Photo 5).

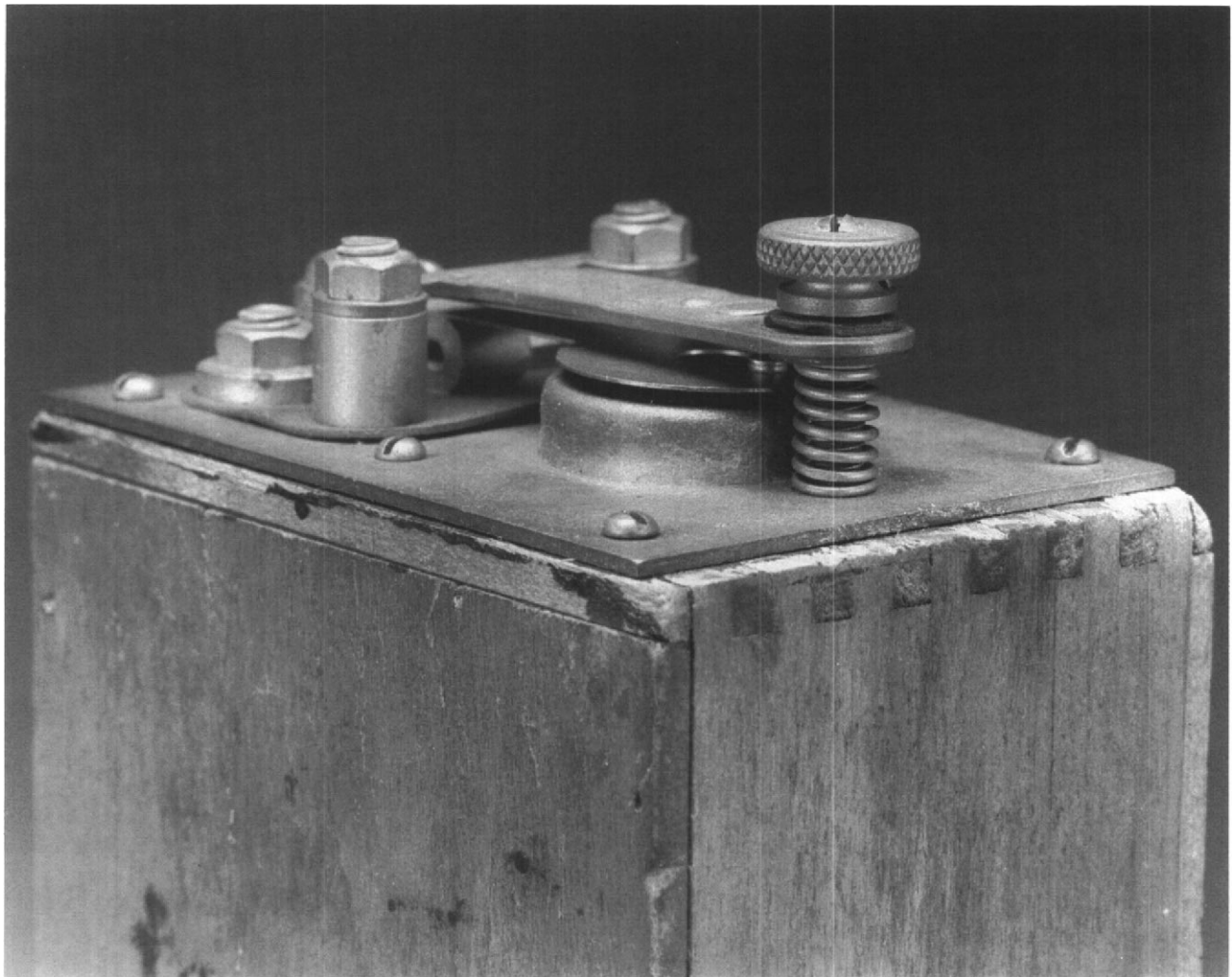
With the adoption of ignition coils manufactured by the K-W Ignition Company in late 1912 or early 1913 the Ford Motor Company began a business relationship with K-W that would last almost fifteen years. While both companies prospered during the tenure of the relationship, there were times when difficulties arose between them. The most serious difficulty arose over Joseph Williams' patent on the design of the K-W coil. Here is what is known of the story.

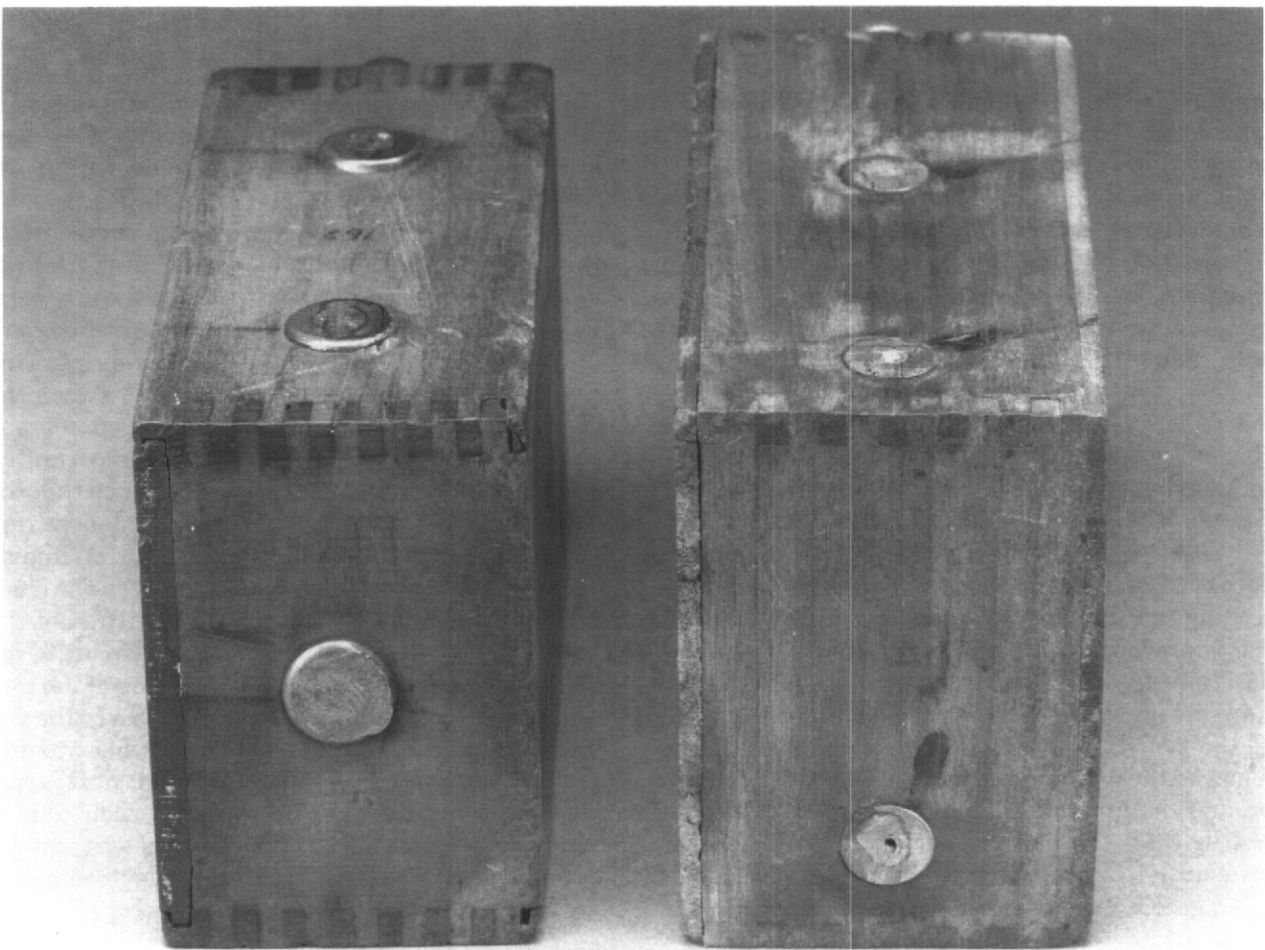
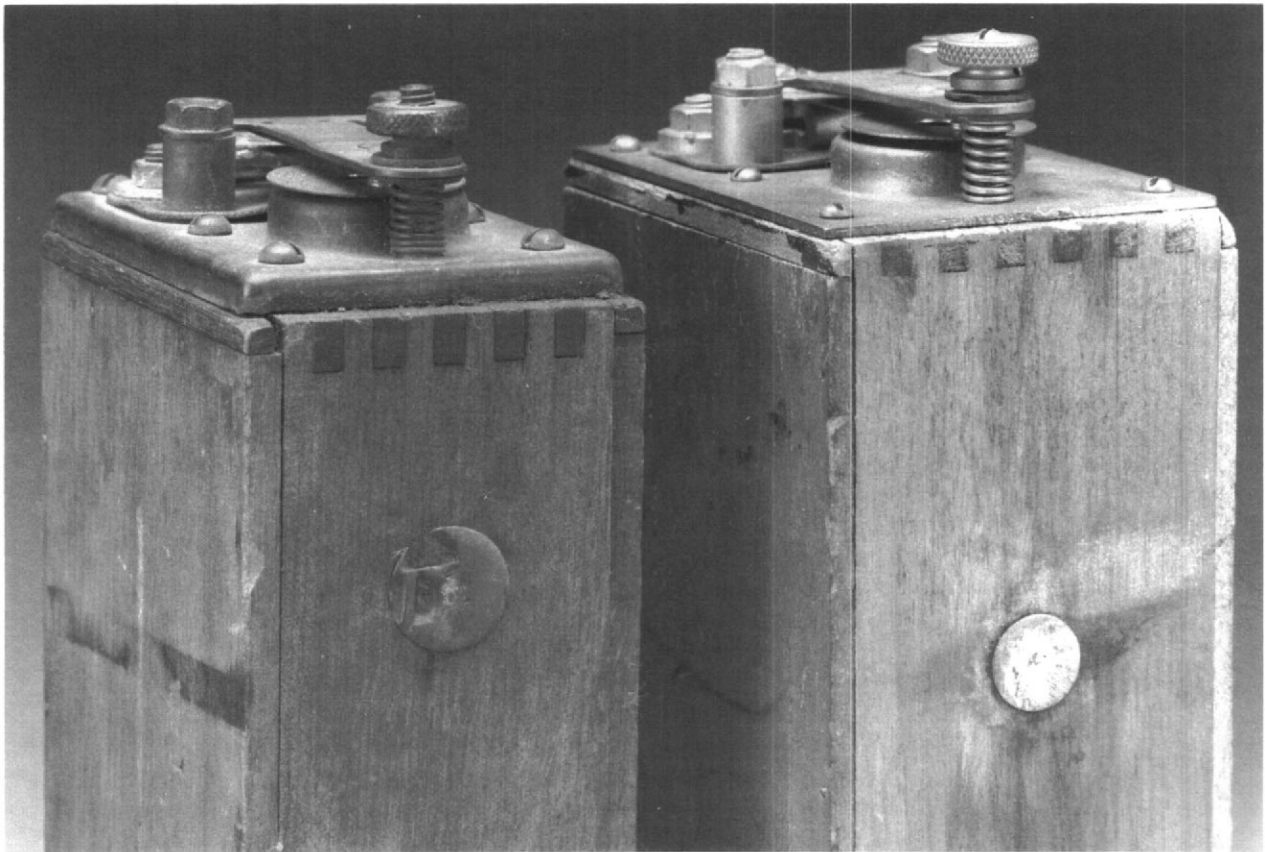
During the first half of 1913 Ford continued to use coils produced by Heinze, and perhaps by Kingston, as well as the K-W coils. By this time Ford had used six or seven different and non-interchangeable coils in the four years Model Ts had been in production. In order to avoid the confusion that resulted from using so many different coil units, to achieve production cost economies, and to reduce the different styles of coil boxes and coils that Ford dealers would have to carry in stock, Ford decided to standardize its coils. The standardization began with the Ford engineers specifying

Bottom (Photo 2): *A 1913 vintage K-W Ignition Company coil. It is easily distinguished by the flat, black anodized brass fop.*

Top Right (Photo 3): *A side by side comparison of the fops of the 1913 KW and the later brass fop style coils. The 1913 style coil's fop is a flat piece of brass while the later style brass fop is embossed to raise the height about 1/8 inch.*

Bottom Right (Photo 4): *A comparison of the location of the contacts on the 1913 K-W coil with a later K-W coil. The 1913 coil's side contacts are lower and the bottom contact is located near the rear edge of the box. The coil unit itself is thicker than the later standard coils.*





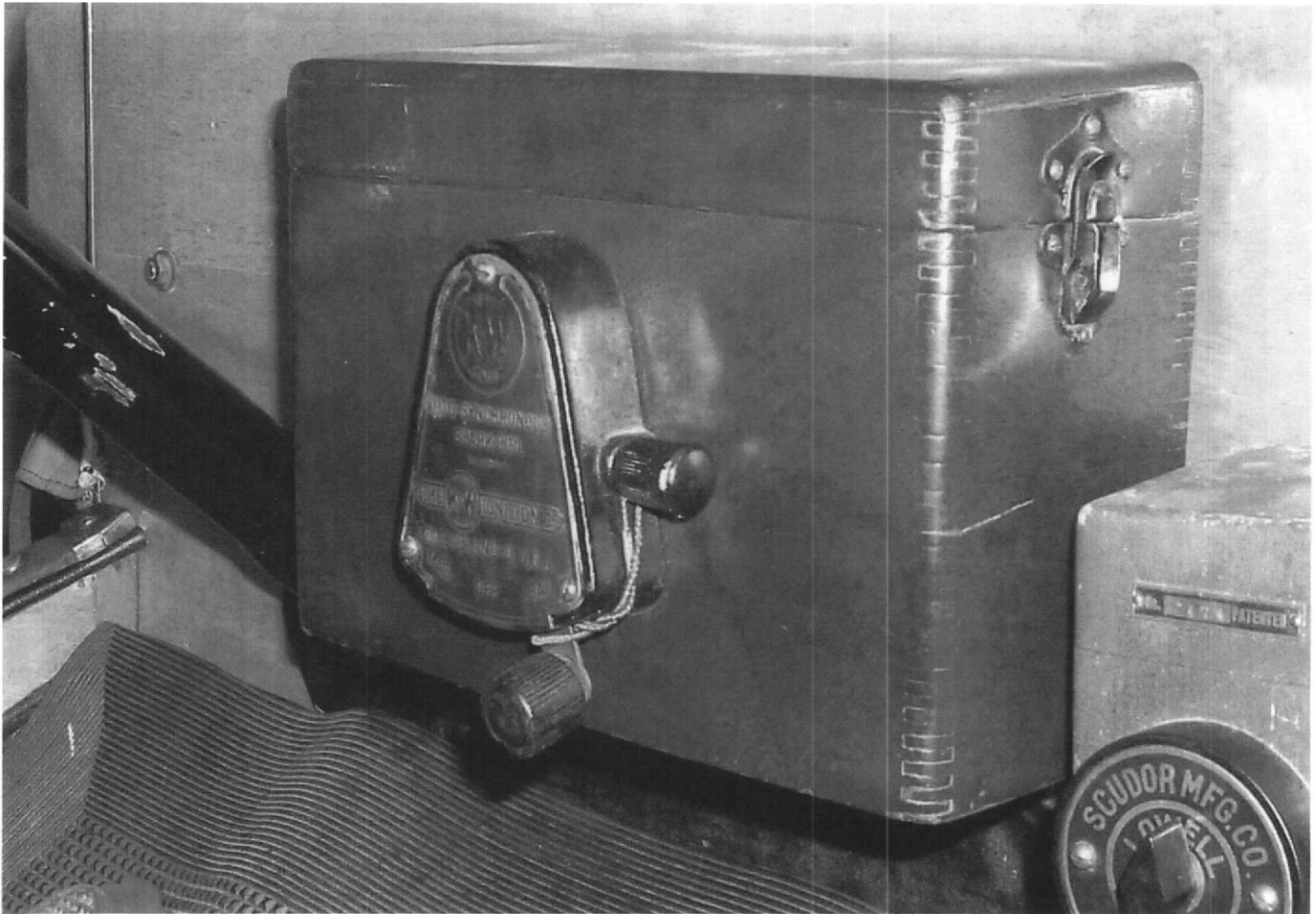


Photo 5: *The K-W coilassembly used in late 1912 and early 1913.*

ing the size that coil makers were to make their coils to and the location of the contacts on the outside of the coils. In February or March 1913, Williams met again with the Ford engineers. As a result of this meeting Williams redesigned the K-W coil so that its size would conform to the Ford specifications. He also made other improvements in the design that would enhance the coil's performance. After this redesign, K-W coils exhibit the stamped brass base that is characteristic of "brass top" coils. On March 5, 1913 Williams also took the step of applying for a US patent on the redesigned coil. US letters patent # 1,092,417 was awarded to Joseph A. Williams on April 7, 1914. (See Photo 6)

What made the K-W coil superior to Heinze, Jacobson and Brandow, and Kingston coils? According to Williams' patent, the principle basis for the improved performance of the K-W coil was the design of the primary circuit winding around the iron core and the design of the vibrating component of the points. Contemporary coil manufacturers followed the practice of winding the primary circuit around the iron core so that the core extended out well beyond the end of the windings. When the primary circuit was energized, the resulting lines of magnetic force began to curve sharply immedi-

ately after the end of the windings, thus making the intensity of the magnetic field at the end of the core much weaker than the magnetic field within the windings. (See Figures 2 & 3 in Photo 7).

Williams thought that the sharp curvature of these magnetic lines of force contributed towards two problems. First, the weak state of the magnetic field made it necessary for the manufacturers to use a very weak tension of the vibrator spring. This tended to make for a poor connection between the contact points just before the primary circuit was energized. Second, and perhaps more importantly, the curvature of the lines of force was such that the strength of the magnetic field increased more rapidly than the tension in the vibrator. Williams asserted that this caused the lag between the energizing of the primary circuit the induction of the high-tension spark in the secondary circuit to depend upon the distance between the top of the core and the bottom of the vibrator spring. Since the gap between the core and the vibrator spring was frequently different from one coil to the next, especially as owners attempted to adjust their coils to produce fatter and hotter sparks, this was a major reason why it was difficult to achieve complete synchronization of all four coils.



1,092,417.

Patented Apr. 7, 1914.  
2 SHEETS-SHEET 1.

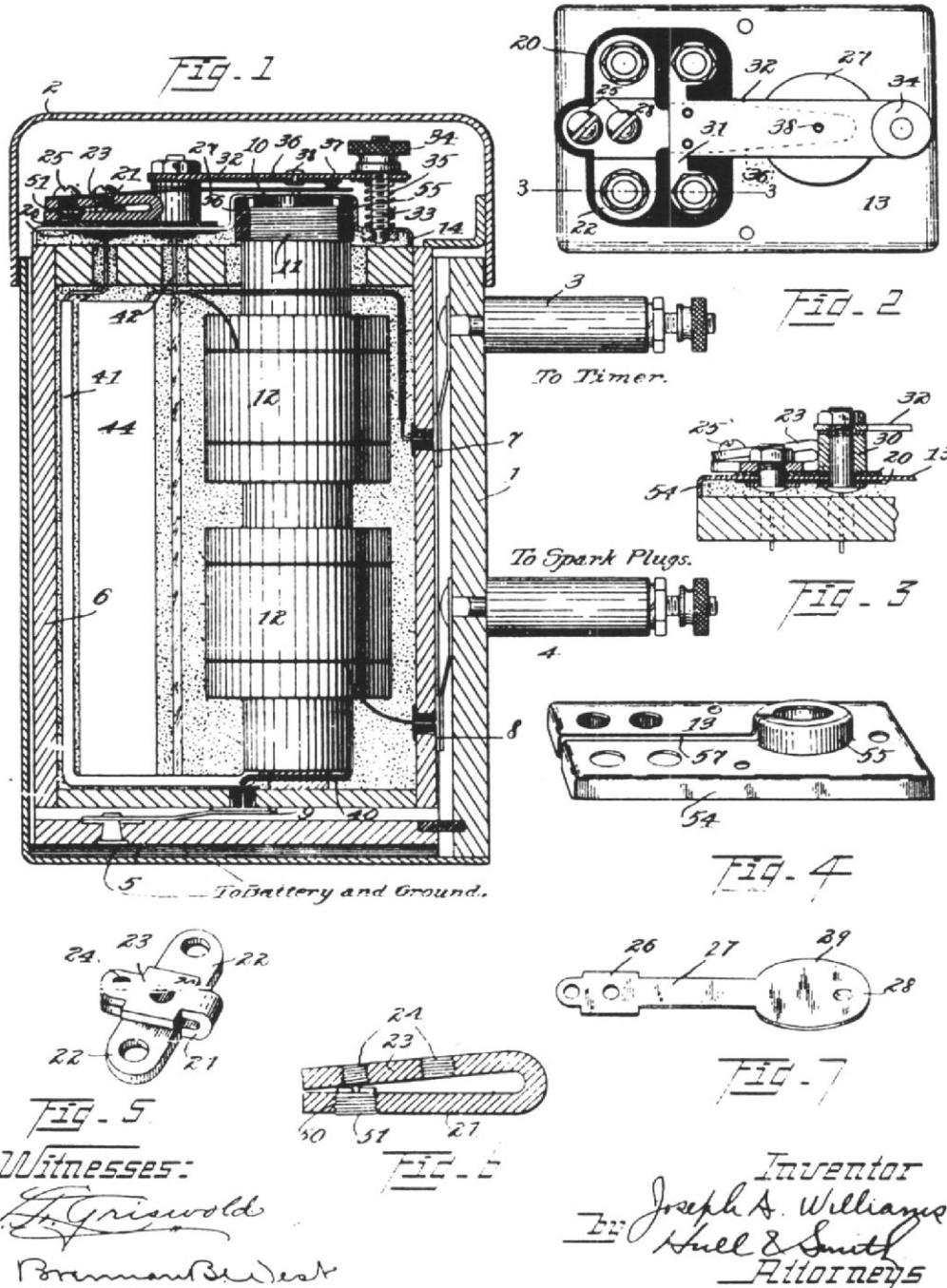


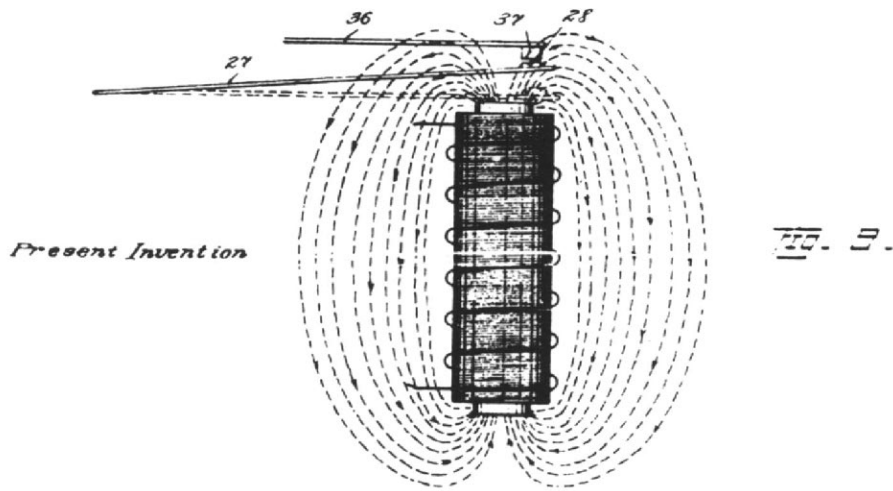
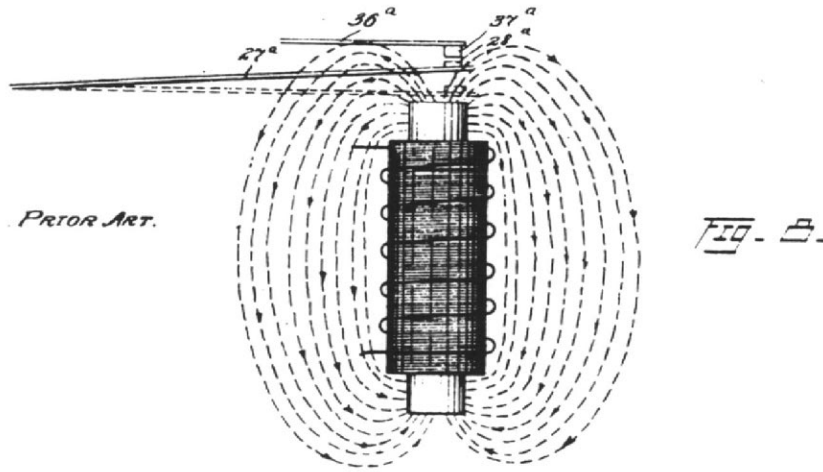
Photo 6: Illustration from Joseph A. Williams 1914 patent for the K-W coil showing the various parts of the coil. Although Williams attached little significance to the cushion spring on the upper contact bridge, some Ford engineers thought that it was this feature that made the K-W coil superior to the other coils then on the market.

1,092,417.

J. A. WILLIAMS.  
IGNITION APPARATUS.  
APPLICATION FILED MAR. 5, 1913.

Patented Apr. 7, 1914.

2 SHEETS-SHEET 2.



Witnesses.  
R. L. Bruck  
Brennan West

Inventor  
Joseph A. Williams  
By Hell & Smith  
Attorneys

Photo 7: Illustration from Joseph A. Williams 1914 patent for the K-W coil showing the effect of extending the primary circuit windings to the end of the iron core. The result, shown in figure 2, is a magnetic field that extends further out from the end of the core and whose lines of force are straighter than those produced in a coil where the primary windings do not extend to the end of the iron core.

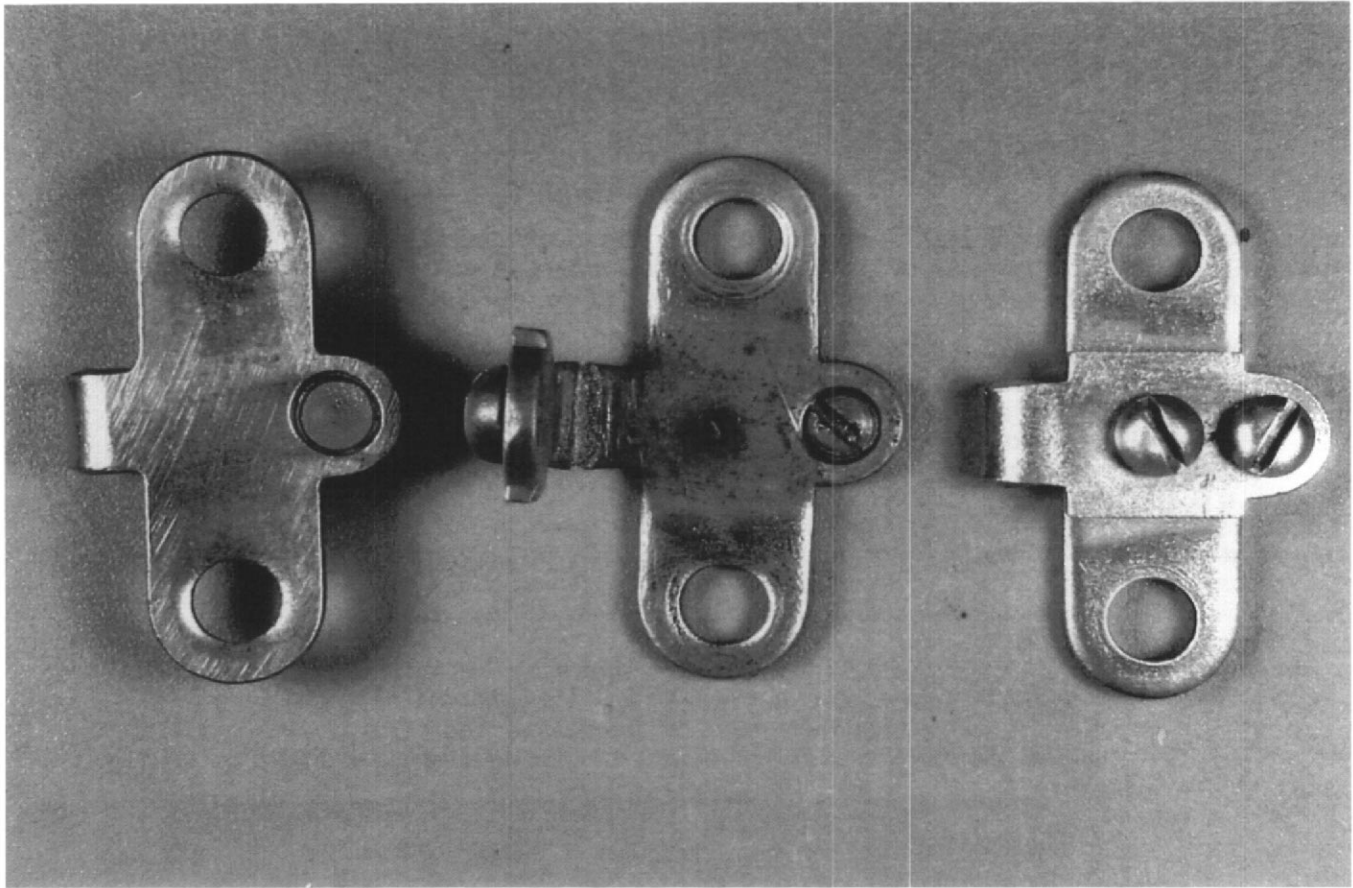


Photo 8: *The K-W coil assembly used in late 1912 and early 1913*

Williams claimed his coil design was different in that he extended the length of the windings of the primary circuit substantially to the end of the iron core. This tended to make the magnetic lines of force more parallel to the core and consequently the strength of the magnetic field increased more uniformly over the distance the vibrator traveled. Williams also changed the design of the vibrator itself so that the amount of tension to move the spring would be substantially the same over the entire range of movement of the vibrator. The tension of the vibrator to resist the magnetic pull of the core was adjustable through a “grub” screw that Williams had hidden in the vibrator spring’s base. This hidden location was chosen “so as to afford the least possible chance for ignorant, careless or unintentional displacement.” (See Photo 8)

Williams asserted that the significance of his design was this: as magnetic force from the core drew the vibrator downwards, the tension of the vibrator spring tended to increase at the same time the strength of the magnetic field increased. He claimed that this design was superior because the time lag of the spark and the strength of the spark’s intensity would not be affected by the wearing away of the surfaces of the contact points nor by the

vertical adjustment of the contact bridge. In Williams’ words “The consequence is that an engine operator can adjust the [contact bridge] screw...to his heart’s content without interfering with the regularity of sparking the various cylinders.

The Ford engineers rightly believed that there was an additional feature of the Williams coil design that was not mentioned in the patent but that nevertheless improved its performance. This feature was the cushion spring on which the upper point contact was mounted. Model T coils “buzz” because the coil is cycling and the points are vibrating at nearly 17,000 times per minute. This means that the time of contact between the points when current flows through the primary circuit and the magnetic field is building up is extremely short. The Kingston, Heinze and Jacobson and Brandow designed coils all had the upper contacts on their points fixed. The rapid movement of the vibrator frequently caused “rebounds of the vibrator,” or point bounce. Literally the two contact points would bounce off of one another before a good contact between the points could be made. These rebounds caused a damping effect on the build up of the magnetic field by the primary circuit and consequently had a tendency to reduce the voltage

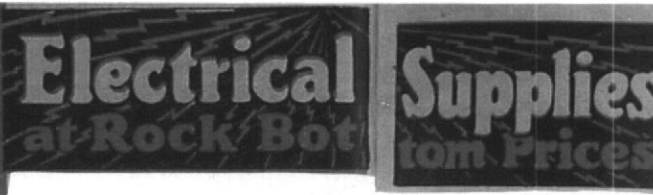


Photo 9 (Above): Advertisement for K-W points and coils from the catalog of a 1920's automotive parts retailer. K-W sold millions of points and replacement coils to Model T Ford and Fordson tractor owners through these channels.

Photo 10 (Below): These women employees at the Ford Motor Company were employed in the coil manufacturing department during the early to mid-1920's. They appear to be winding the primary circuits onto the iron cores of the coil.

From the Collections of the Henry Ford Museum & Greenfield Village. Neg. no. P.O.- 7330.



Photo 11: (Top Right Facing Page) Another view of the coil assembly line at Highland Park. In this operation the workers appear to be assembling the secondary windings of the coil to the primary windings and the iron core.

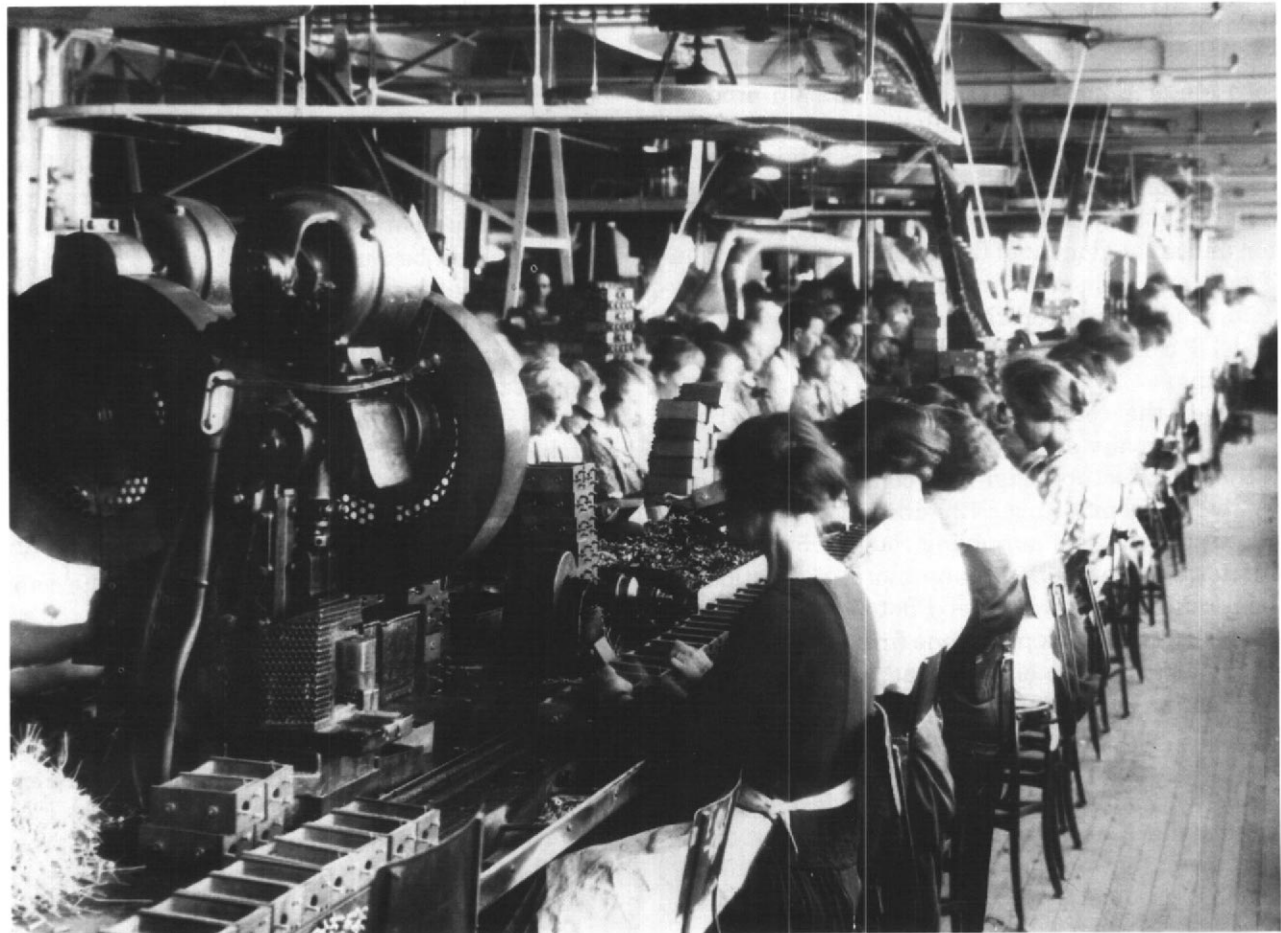
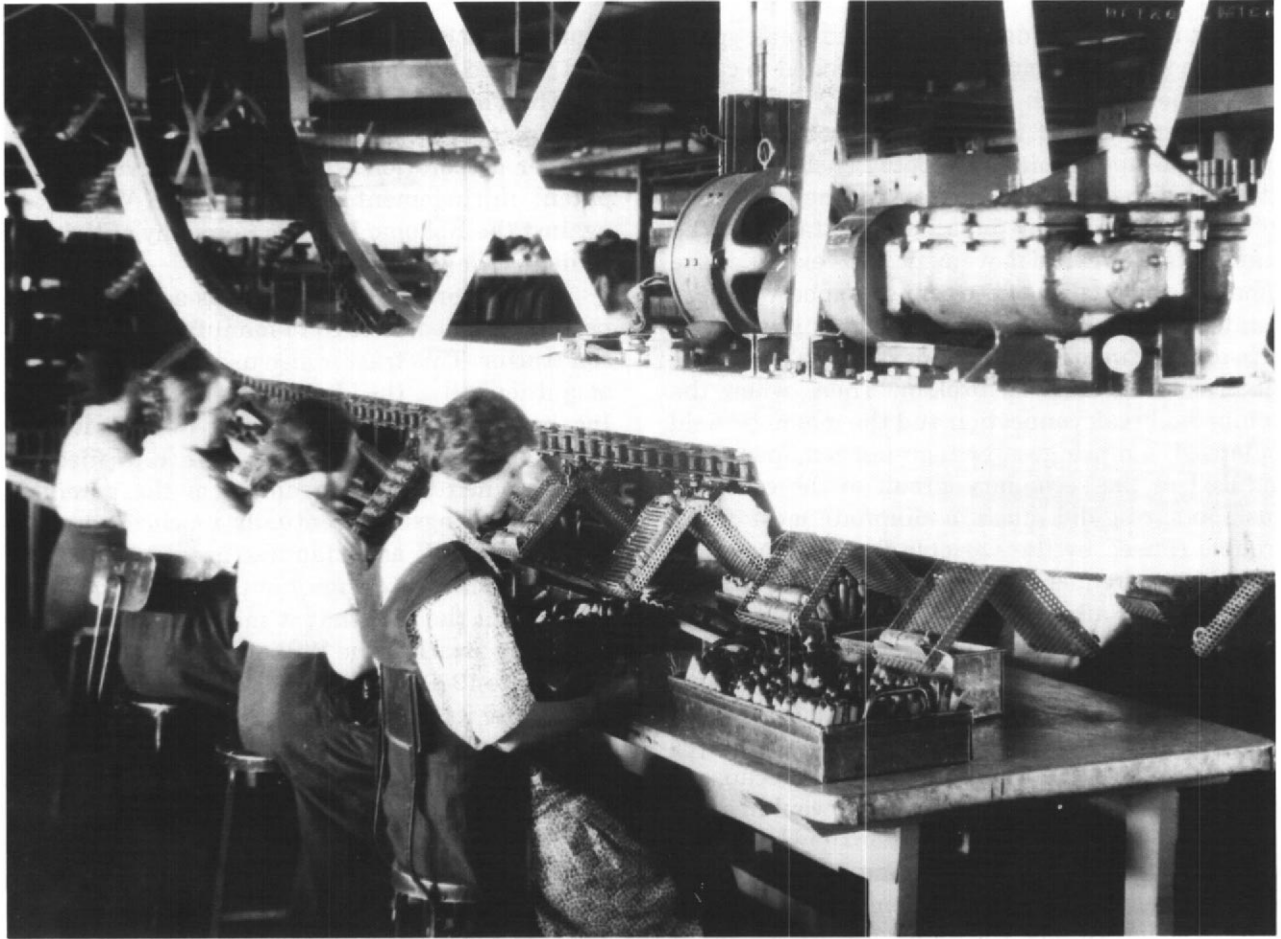
From the Collections of the Henry Ford Museum & Greenfield Village. Neg. no. P.O.- 9395.

Photo 12: (Bottom Right Facing Page) The photograph shows the final assembly of the coil units. Empty boxes can be seen on the left, and as they progress towards the right hand side of the picture, the various components of the coil are being added.

From the Collections of the Henry Ford Museum & Greenfield Village. Neg. no. P.O.- 6412.







induced in the secondary circuit. The weak spark from the secondary circuit in turn tended to cause the engine to misfire.

Williams solved the rebound problem by attaching the upper point contact to a cushion spring. This design allowed the contact on the top bridge to follow the vibrator for a short distance at the start of its downward movement. This extended the time and the quality of the connection between the points and allowed the magnetic field in the iron core to build up to its maximum strength before the electrical contact was broken. Then, when the points did break connection and the magnetic field collapsed, a much greater high-tension spark was induced in the secondary circuit of the coil. The cushion spring did much to eliminate most of the trouble caused by the variable factors of voltage, current and frequency in the Model T magneto.

Sometime after May 1913, the exact date is not known, Ford decided to standardize on the Williams coil produced by the K-W Ignition Company. Thereafter, all Model Ts were equipped with Williams design coils. At the time of adoption it was understood between Ford and K-W that because of Ford's extensive business that there would be two sources of supply for these coils. Ford had long since established the practice of having two sources of supply for all of the major components of the Model T. This policy avoided the damage and delays that could result from strikes, fires and other disruptions of business that might result if only one supplier was used. During the first half of 1914 the Ford Motor Company took steps to begin production of coils following the Williams design in its own Highland Park factory. The newly established coil manufacturing department was equipped by Ford Motor Company, but Williams assisted in the selection and arrangement of the machinery. Production of coils by Ford seems to have begun during May 1914, and thereafter the enormous demand for Model T coils was supplied by both Ford and K-W Ignition.

Over the course of the next six years Ford Motor Company and K-W worked closely together in the manufacture of ignition coils. Between them the two firms made over 12 million coil units. K-W was responsible for supplying roughly 5 million of this total and supplied many more in addition to the retail trade as well. (See Photo 9) On occasions when shortages took place, one firm would lend the other parts so as to ensure that the production of coils was sufficient to meet the demand. However, Williams and K-W never bothered to inform the Ford Motor Company that it had applied for and received a patent on the Williams' designed coil. Neither did K-W ever mark any of their products with the patent number, or suggest in any commu-

nications with Ford that the coil, or any of its parts, was covered by a patent.

The Ford Motor Company did not learn of the Williams patent until several years later when another corporation was indirectly involved in a patent infringement suit filed by K-W Ignition against the Kokomo Electric Company of Kokomo, Indiana (Kingston).

Henry Ford and Son, Inc, was a Michigan corporation formed in 1916 to manufacture the Fordson tractor. This tractor also used the same design of ignition coil as the Model T. Henry Ford and Son, Inc. had placed an order with the Kokomo Electric Company (Kingston) for some coils. K-W filed suit and enjoined the infringement of the patent by Kingston. Kingston eventually reached an agreement with K-W and manufactured many coils to the Williams/Ford design, but the importance of the suit lies in the fact that it made the Ford Motor Company aware of the Williams patent.

In late 1919 the K-W Ignition Company decided to exercise its right over the Williams patent with Ford. They filed suit in the US District Court in Indiana against Ford for infringement of the Williams patent, seeking to stop Ford's production of coils and seeking damages for past infringements. This court ruled in favor of K-W Ignition, and the Ford Motor Company appealed to the US Circuit Court of Appeals for the Seventh District in 1920.

Ford Motor mounted a vigorous appeal based on invalidity of the patent, laches (an inexcusable delay in enforcing K-W's patent claim), non-infringement of the patent within the State of Indiana where the suit was filed, and estoppel. The Court of Appeals based its decision in favor of Ford on this last argument. Estoppel is a legal principle that prevents a person from making an assertion of a patent claim because it is contrary to a previous assertion that he has made. In the case of Ford Motor Company vs. K-W Ignition Company the court found that Williams and K-W had made no attempt to notify Ford Motor of its patent, but had instead induced Ford to adopt the Williams design coil, had assisted in the establishment of Ford's coil manufacturing department, and had sold Ford Motor an extensive proportion of the parts and material necessary to manufacture coils. Given K-W's failure to assert its patent claims earlier, the court ruled it had no right to assert them later.<sup>5</sup>

During the 1920s Ford's production, and consequently the demand for ignition coils, continued to grow. In 1923 over eight million coils were needed just to meet the requirements of new Model T production. Many more were sold through dealers and agents to owners of earlier Model Ts. The Ford Motor Company continued to expand and improve its coil-manufacturing department. One of the in-

interesting features of this department was that it was one of only three or four departments at Highland Park where women were employed in regular production work. During 1925, 394 women were regularly employed in this department.<sup>6</sup> Period photographs of the coil department at Highland Park show women winding the primary and secondary circuits around the iron cores and assembling the components into the wooden boxes. (See Photos 10, 11 and 12) Ford appears to have been an early leader in equal pay for equal work. Women received the same minimum dollar per hour wage that males received.<sup>7</sup>

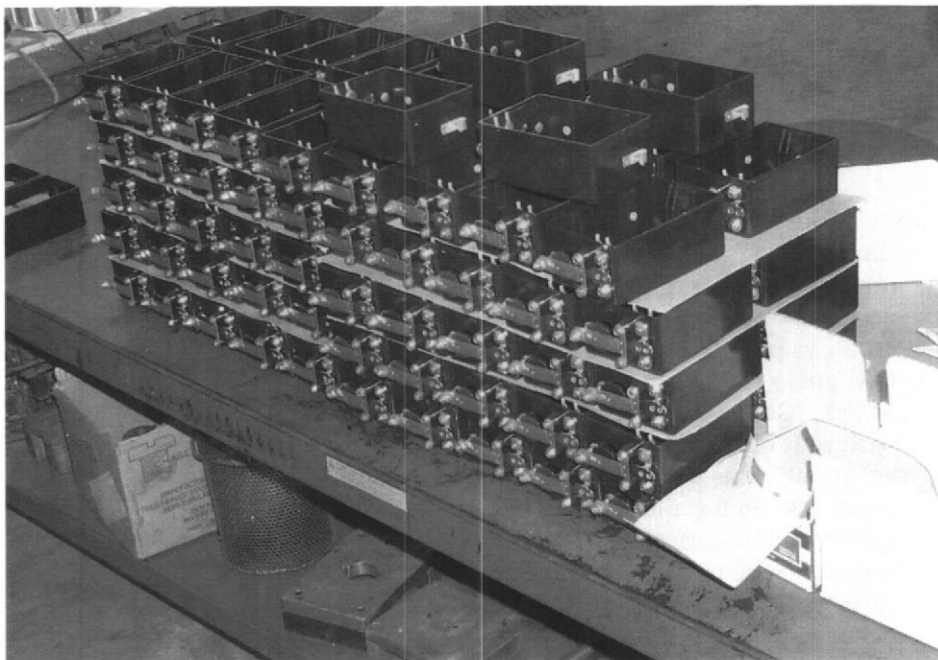


Photo 13 (Above): *The new K-W coil final assembly line at Bob's Model T Parts.*

The end of Model T production in 1927 marks the beginning of the end for the K-W Ignition Company. Apparently K-W did not engage in research and development of new products, and the end of the Model T left it with no new product to take the

place of the vibrator ignition coil. K-W continued to supply new coils and replacement points to the retail trade, but this market continued to dwindle as the number of Model Ts used daily diminished during the 1930's. K-W did develop an alternative use for the vibrator ignition coil as a device to electrically charge farm fences, but again this market was small and extremely limited compared to the former demand for Model T coils. In 1940 the K-W Ignition Company went out of business. K-W's plant and equipment were purchased by the firm of Jack and Heintz, Inc. soon thereafter.<sup>8</sup> Eventually Blackstone, a Chicago based company, took over the manufacture and sale of repair parts. Blackstone continued to supply K-W marked coils and points to the retail market until the end of 1998.

In January 1999 Blackstone sold the designs and tooling for K-W coils and the rights to the K-W trademark to Bob's Model T Parts of Rockford, IL. The machinery has been moved and installed at Bob's Rockford facility and the production of K-W coils and points has resumed. (See Photo 13) □

#### Footnotes

<sup>1</sup>Accounts Receivable for K-W Ignition, 1911-1916, Accounting Records: Ford Motor Company 1904-1914, Accession 623, Research Center, Henry Ford Museum and Greenfield Village. Hereafter cited as Research Center.

<sup>2</sup>Ford Motor Company vs. K-W Ignition, No. 2879, US Circuit Court of Appeals for the Seventh Circuit, April Session, 1921. A Ford factory letter dated November 6, 1912 also states that about 10% of the 1913 cars are to use K-W coils. Accession 509, Factory Letters, Research Center.

<sup>3</sup>US Letters Patent #1,092,417, pp. 3-4.

<sup>4</sup>Reminiscences of H.L. Maher, Accession 65, Box 43, Folder #1, Research Center, pp. 17-18.

<sup>5</sup>Ford Motor Company vs. K-W Ignition Company, 7~ US District Court of Appeals, No. 2879, October Term, 1920, April Session, 1921.

<sup>6</sup>Daily Factory Count for January 6, 1925: Department 5845 Coil Unit, Accession 732, Research Center.

<sup>7</sup>Letter from E.G. Liebold to C1~istabel Pankhurst dated October 29, 1921, Accession 285, box 37, folder "C", Research Center.

<sup>8</sup>1941 Cleveland Buyers Guide, The Cleveland Chamber of Commerce, Cleveland, Ohio, 1941.

The authors may be contacted by writing:

Trent E. Boggess  
Department of Business  
Plymouth State College  
Plymouth, NH 03264  
e-mail: Trentb@oz.plymouth.edu

Ronald Patterson  
8 Olde Surrey Lane  
Medway, MA 02053  
e-mail: Modeltcoils@sprynet.com