

RADIO

for

TRACTOR CONTROL



INTERNATIONAL HARVESTER'S

SCIENTIFIC DEMONSTRATION

at A CENTURY OF PROGRESS 1934



FOREWORD

Approaching the World's Fair Food and Agriculture building from the west you quickly discover that something unusual is taking place in that fenced-in enclosure around which a crowd of people stands, intently watching. Moving closer you are astonished to see a snappy little farm tractor cavorting around the field apparently out of control. It has no steering wheel, no seat, and no driver. Yet it starts, stops, turns right and left—and you find it isn't running wild at all!

Then a voice from the little cottage at the far side draws your attention to the overalled, slouch-hatted figure who rocks back and forth on the porch, holding a newspaper in his hand. Is he real? He certainly looks it. And how he can talk!

He tells you that he is running that tractor. Tells you he used to farm with horses but sold 'em and got this IHC tractor. Informs you he equipped the tractor with radio control so he wouldn't have to go to the field with it any more. Wishes he had a field a mile long so he could show you some real long-distance plowing.

Interesting, instructive, amazing, you say. But what does it all mean? Has this demonstration any practical value now, or for the future? In the following pages you may read the full story of International Harvester's radio-controlled tractor—from the beginning.

PUBLISHED BY
INTERNATIONAL HARVESTER COMPANY
(Incorporated)
CHICAGO 606 So. Michigan Ave. U. S. A.

THE keynote of the century of progress interpreted by Chicago's great 1933-34 Exposition is—Science! A hundred years ago there was little science and little progress. From the cradle to the grave most men's lives followed a deadening routine of hard physical toil. Mechanical aids were few and inefficient. Such crude labor-saving devices as were in use were the chance inventions of scattered individuals.

A World Transformed in 100 Years — Then dawned the century of scientific progress—more science and more progress than in the previous twenty centuries. The stationary steam engine evolved

into the locomotive. In America, railroads linked the advancing western frontier to the populous East. Travel and transportation took on new meanings. Cyrus Hall McCormick invented the world's first successful reaper. Others followed his lead. For every reaper sold five men were released from the land to man factories and develop sciences and arts in the growing cities. Industry expanded, commerce reached farther and farther afield. The agricultural West sold its grain abroad and bought the products of the industrial East. Steam replaced sails on river, lake, and ocean. Came in their time the telegraph, the telephone, modern medicine and surgery, electricity in all its thousand manifestations, the high-speed printing press, the gas engine, the automobile, the airplane, the radio. Came also plenty in place of scarcity, nationalism in place of provincialism, comfortable living in place of laborious existence, and coordinated scientific knowledge and organized research in place of haphazard adventuring, general ignorance and superstition. A world transformed in 100 years!

Science Marches On—Today science, organized on a thousand fronts, continues to add to human knowledge and well-being. Hardly a week passes but some new development, chemical, metallurgical, medical, or what not, is announced. The streamlined motor-driven train competes with the airplane. Synthetic rubber challenges the supremacy of latex. The atom, reservoir of power, is smashed experimentally. Radioactivity is artificially induced. The stars give up new secrets. Photographs are made in the dark. Scores of such developments suc-

cessively challenge established ideas and project the imagination far into the veiled future.

And now since May 26, 1934, International Harvester Company has been bringing to millions of World's Fair visitors still another new phenomenon—a stock-model farm tractor, minus seat, steering wheel, and driver, which is started, steered, and stopped by means of invisible radio waves!

Radio! What Is Its Future?—When Marconi began his “wireless telegraphy” experiments years ago, intriguing stories of this new scientific wonder began to trickle into newspapers, magazines, and man-in-the-street conversation. The word “wireless” was on everybody's lips. In a few years, however, wireless communication by land and sea became almost universal, an

President A. E. McKinstry (right) and President Rufus C. Dawes, of A Century of Progress, watch a demonstration of the tractor and interestedly discuss this and other possible applications of radio control to mechanical operations.



accepted fact no longer exciting. Then came the first crystal receiving sets, followed by the earlier forms of the "cabinet radio," and public interest flared up anew. But the ensuing rapid expansion of the radio manufacturing industry, the organization of national broadcasting systems, and the virtually universal ownership of home radio sets have in little more than a decade made this recent sound-communication marvel just another commonplace of everyday life. And does that complete the layman's story of radio?

No. There is more, much more—Television—long-distance movies instantaneously made, transmitted, and received via radio—has experimentally been shown to be possible. The public, mindful of other equally unbelievable accomplishments during this century of scientific progress, confidently and patiently awaits its production on a commercial scale.

And is that all? No. In recent years the public's imagination has concurrently been stirred by reported experiments in the field of wireless power transmission and long-distance control of mechanical operations. Driverless automobiles have been picking their way through traffic. Crewless ships plowing the sea and holding their course. Pilotless planes taking off and landing. Bombs, rockets and torpedoes shooting unerringly to their mark directed by unseen forces. These accounts have periodically renewed and intensified the public's interest in radio.

Will the future see the radio-control principle widely employed in transportation, for example? In manufacturing and industrial operations? In military operations? In farm-

ing operations, perchance? One wonders what startling developments still lie ahead?

Radio-Controlled Tractor a Novel Adaptation—Into this fertile field of scientific experimentation and popular speculation stepped the International Harvester Company on May 26 with the first radio-controlled farm tractor to be exhibited on the grand scale of a unique World's Fair exhibit viewed by millions. In so doing the Company, while unquestionably achieving deserved publicity for itself and its product, feels that it has made a definitely valuable contribution to the growing fund of scientific knowledge of radio and its control adaptations. If the long-distance control and operation of moving machines is some day to have varied practical applications, surely the cultivation of our broad acreages of farm lands offers engaging possibilities for radio and agricultural engineers.

The Harvester Company No Newcomer in This Field—It should be stated here that the Harvester Company's interest in radio control for tractors originated not in 1934 but in 1932. In the early summer of the latter year one Captain J. J. Lynch, a clever radio engineer, approached the Company with a proposal to take a regular Farmall tractor, equip it with radio apparatus, and operate it under remote control in the Company's farm machinery exhibit at the Illinois state fair at Springfield. The Company, interested then as now in anything pertaining to the technical advancement of farm machines and methods, heartily sponsored the project. It was an instantaneous success. Lynch's radio apparatus, while lacking the

modern features and finished professional appearance of the World's Fair tractor, functioned efficiently to the plaudits of the throngs that gathered to watch it. Later, at Noblesville, Indiana, a more elaborate demonstration was given. With the radio transmitter in a truck which followed along behind the tractor, Lynch actually plowed a field by radio control!

The Company gave considerable thought to the idea of having a radio-controlled tractor in operation at the 1933 Fair. The idea was

Clara, Lu 'n' Em are plainly captivated by International Harvester's tractor that "runs by itself." These nationally known stars of the airways, sponsored by Super Suds, are second-time visitors to the Company's display, having in 1933 inspected the mechanical cow and later entertained their millions of listeners with a characteristic account of "Lady" Alken Ina's unique abilities.



finally given up for a number of reasons, one being the lack of suitable space for the demonstration. In the meantime, however, rumors got about and radio-tractor stories appeared in print. Thousands of Fairgoers came to the Fair inquiring for the radio tractor.

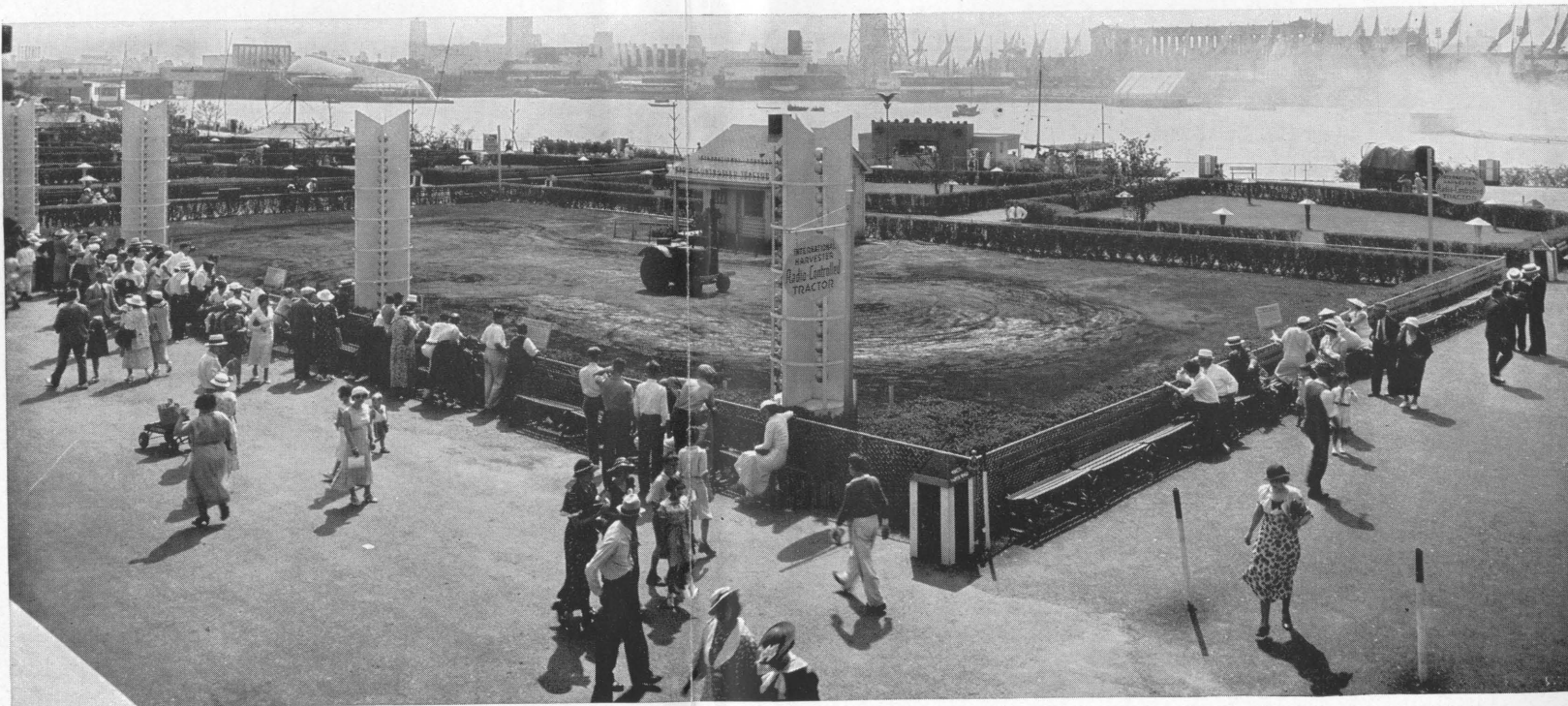
Public Interest in Radio Tractor Is Keen—The public's interest aroused Fair officials and those of International Harvester likewise. They decided that something should and would be done in 1934. The Fair agreed to supply the best space obtainable and the Harvester Company agreed to go ahead and produce a radio-controlled tractor for the 1934 Exposition. In a world's fair whose keynote was Scientific Progress there was an acknowledged obligation on the Fair management and on leading exhibitors to cooperate in presenting the latest results of research in their respective lines, provided the presentation could be adequately staged at a justifiable expense.

The Engineers Go Into Action—Of a number of prominent electrical and radio manufacturing organizations thoroughly competent to build and install the radio equipment in the tractor, the General Electric company at Schenectady, New York, was selected by the Harvester Company. General Electric was keenly interested, and its radio engineers and Harvester's tractor engineers forthwith put their heads together and proceeded to demolish one after the other the numerous obstacles that presented themselves.

The Company was assigned a "general experimental" license by the Federal Radio Commission. Call letters of its station in the

farmer's cottage are W 9 X B Q. It broadcasts on a wave length of approximately 7 meters, which means a frequency of 41,000 kilocycles or 41 megacycles. This is a lower wave length than that of the well-known "police calls." This wave length and frequency lie in the "general experimental" band which includes the television allocation on a still shorter wave and higher frequency. Other bands and frequencies, as readers know, are assigned by the commission to the Federal Government, to amateurs, to communications, and to established commercial broadcasting stations. The power output of Station W 9 X B Q is 8 watts.

The intriguing scene which greets the visitor to Harvester's radio tractor "farm" just west of the Food and Agriculture building. Up and down and all around, cork-screwing, circling, cutting figure 8's, starting and stopping, runs the little O-12—with never a hand to guide it. Spectators study it, listen to the remarks of the ostensible owner, chuckle, wonder what next will come from the laboratories of science.



The Job Moves Along—Working in conjunction with Harvester tractor engineers at the Company's Chicago tractor works, the G. E. engineers designed, built, and tested the transmitting and receiving sets in the G. E. laboratory at Schenectady, New York. The complete outfit was then brought to the tractor works at Chicago, the receiving set installed in the tractor, the power turned on, and the tractor given a series of thorough tests. After necessary adjustments had been made the tractor operated perfectly in these tests, and it was thereupon transferred to its summer home at the Fair.

Engineers Surmount Many Difficulties— Here, as a result of the anticipated electrical interference, trouble developed immediately. The tractor bucked and balked, refused to obey orders, and even ran into the fence. However, admirable patience and self-control on the part of the engineers, not to mention a profound acquaintanceship with the technical problems involved, finally prevailed. After several hours of adjusting, testing, checking and rechecking, their painstaking efforts were rewarded with a perfect performance. All interference was successfully “tuned out” and the saucy little O-12 tractor was pronounced ready for the scrutiny of a progress-minded public.

Farm Setting Adds to Human Interest— To heighten the remote-control effect the transmitting set or broadcasting station and the operator thereof were concealed in the Cape Cod cottage on the porch of which sits the ostensible owner and operator, an overalled farmer who discourses humorously and pithily on the subject of “brain” farming versus “back” farming. The real operator sees but cannot be seen. Through the screened bay window he has a clear view of almost the entire 180 ft. by 50 ft. “field” in which the tractor runs.

The Mechanical Farmer Deceptively Real— The mechanical farmer as an intermediary between exhibitor and spectator has proved to be ideal. He imparts the human touch which such a demonstration should have to be successful. That he is lifelike admits of no argument after one has overheard onlookers audibly wondering whether he is a “real man.” Philosophizing in his homespun way, conversing with visitors,

answering questions, ordering the tractor to git-up, gee, and haw, he has already won a reputation for himself as being “one of the best dummies that ever was.”

And this interesting individual with the pleasing voice and good-natured observations on up-to-date farming is capable of a variety of movements, too. He rocks contentedly back and forth in his cushioned chair. But when his tractor is at one end or the other of the field he can turn his head in that direction to watch it or can turn and face any individual in the crowd to whom he may be addressing his remarks. Then when for any reason his tractor is standing idle he raises his arm, lowers his head, and proceeds to read very diligently the newspaper in his hand. He is the handiwork of the Modern Art Studios, Chicago, a firm outstanding in this department of showmanship.

Harvester's Radio Tractor is News!— International Harvester's radio tractor has received wide publicity in newspapers and magazines, both popular and technical, in the news reels, and over the radio. Paramount News camera and sound men recently visited the radio tractor “farm” and made a sound movie of the tractor.

Clara, Lu 'n' Em, “chatter queens of radio,” have also visited the radio tractor. A year ago these noted stars of the airways entertained the public in their own inimitable way with a description of their visit to that other headline attraction in the Company's exhibit: the famous mechanical cow. Doubtless they will now give their millions of devoted listeners a similarly characteristic appraisal of this new-era system of “broadcast” farming.

You Draw Your Own Conclusion— No one should mistake International Harvester's radio tractor demonstration for anything more than it is: a practical contribution to radio research and a possible signpost pointing to improved agricultural methods in the future. This demonstration of remote control may be a forerunner of revolutionary new practices in farm operation or it may remain for all time just an interesting experiment. The Harvester Company makes no prophecies. It has merely demonstrated what can be done. It suggests, however, that if this application of radio appears visionary and useless at the moment, so did many another invention and discovery in its early stages, including radio itself. If on the other hand radio control of farm operations becomes an important development of the future, its beneficiaries, the farmers, may expect the Company on its record to be in the forefront of whatever progress is made.

Paramount News camera and sound men early visited the radio tractor "farm" and made a movie. For better screen effects and to give a running-fire interpretation of the demonstration, R. A. Hayne, Harvester employee and one of the licensed operators, sat in the rocking-chair and spoke into a "mike." This news reel feature, appearing in motion picture theaters since the middle of July, has brought additional thousands hot-foot to the demonstration.



The Mechanical "How" of the Radio Tractor

FOR the further information of readers who are radio enthusiasts and who wish a more detailed explanation of the radio control set-up, the following brief description is given:

The tractor is International Harvester's standard McCormick-Deering O-12 (orchard type) farm tractor equipped with low-pressure pneumatic tires.

The seat and steering wheel were removed and a specially designed short-wave receiving set, in a weatherproof duralumin box, installed. The antenna is a duralumin tube about 4 feet long. A similar antenna for the broadcasting set may be seen projecting above the roof of the cottage.

Power to operate the clutch, steering mechanism, and the receiving set is supplied by a 32-volt storage battery. A dynamotor steps up the battery current to the 150 volts also required by the receiving set tubes. The storage battery is kept charged by a generator driven by the fan belt.

The front wheels of the tractor are turned right or left by a 32-volt reversible motor. Its rotation one way or the other depends upon the direction of the current flow from the battery through the motor windings controlled by relays.

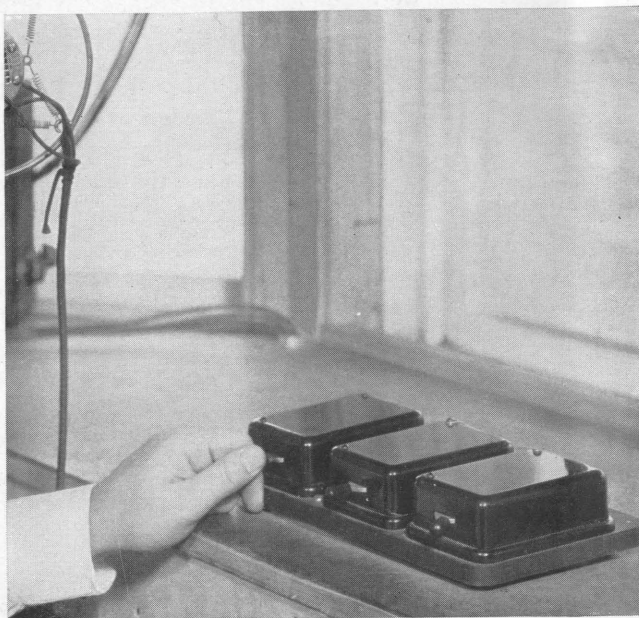
The regular tractor clutch was replaced with a special "snap" type clutch which remains "in" or "out" as desired. It is operated by a powerful

solenoid. Current passing through the coils of the solenoid causes the core of the solenoid to pull the clutch to the "in" position and hold it there. When the current is broken a spring automatically pulls the clutch into the "out" position and at the same time pulls the core of the solenoid down ready for the next movement.

The contacts allowing the 32-volt current to run the motor in either direction and operate the solenoid coils are made by heavy-duty relays actuated by small relays connected with the receiving set tubes.

The transmitting set is a short-wave transmitter using a wave length of approximately 7 meters and a frequency of 41 megacycles, with a power output of 8 watts. It is compactly installed in a duralumin cabinet about a foot square and 18 inches high. It sends out a continuous carrier wave upon which are impressed three modulating frequencies of 800,

The three switches with which the unseen operator controls the tractor's movements. The one at the right controls the "carrier" wave of 41,000 kilocycles. Closing or opening the middle one causes the clutch to engage or disengage. Moving the left-hand one right or left causes the tractor's front wheels to move right or left correspondingly. Note also (upper left corner) the microphone through which the operator speaks to the spectators by way of the rocking-chair farmer on the porch.



1300, and 1900 cycles. These audio frequencies after demodulation are separated by filter circuits to the proper tube and cause plate currents to flow in these tubes and in the receiving set relays which operate the clutch, right-steering, and left-steering heavy-duty relays using the 32-volt control circuits.

Certain safety features were built into the tractor. The front bumper is mounted on two slides. If the bumper strikes an obstruction sufficient to push one of the slides back half an inch, a switch is opened which breaks the 32-volt current in the solenoid controlling the clutch, instantly releasing the clutch and stopping the tractor.

The use of the "snap" type clutch, which is held "in" by the solenoid, provides a safety feature in the event of failure in the sending set—such as the burning out of a tube. If the carrier wave with its modulating frequency of 1300 cycles (clutch control) were to be cut off for any reason, the relays controlling the clutch would immediately open, allowing the clutch to be pulled "out" by the spring.

So far as the operation of the controls is concerned, the starting, stopping, and steering of the tractor are quite simple. The movement of one small switch turns on the main carrier wave and places the transmitting and receiving sets in operation. Closing another switch impresses the modulation of 1300 cycles on the carrier wave, causes the relays to act and the solenoid to pull the clutch to the "in" position and hold it there. With the engine running, the tractor in gear, and the clutch in, the tractor moves forward. To stop the tractor the switch is opened, cutting off transmission of the 1300-cycle modulation and allowing the relays controlling the solenoid to open and the clutch to return to the "out" position.

A similar switch, but with two contacts, controls the steering. Pushing this switch to one side imposes the 800-cycle modulation on the carrier wave, actu-

ates the respective relays controlling the flow of current through the reversible steering motor, and causes the tractor's front wheels to turn right. Pushing the same switch in the opposite direction brings the 1900-cycle modulation and its system of relays into play, causing the tractor to turn left.

A word regarding the mechanical farmer:

A motor-driven mechanism under the porch floor rocks the chair and the man back and forth. Two small motors in his body, controlled by switches beside the tractor operator in the house, move his head right or left. Another switch controls the up-and-down movements of his head and arm.

His voice is the voice of the tractor operator in the house speaking through a conveniently hanging microphone. The dummy's lips as he talks are automatically actuated by the vibrations of the speaker's voice.

And this is Station W 9XBQ, if you please. About a foot square and eighteen inches high. That's all there is—there isn't any more. It broadcasts, not sound, but eight watts of power to operate, via the receiving set in the tractor, the relays controlling the starting, stopping, and steering mechanism of the little O-12.

