of Chicago and of the United States. Its equal may scarcely be seen again. Exhibitions too, are of a three-fold nature in the benefits they confer on us; instruction, pleasure and the increase of good feeling among nations.

May the world's fair be the means of cementing still more closely the peace, shall I say the fraternal good feeling, already existing between the great English speaking race on both sides of the Atlantic.

WORLD'S FAIR EXHIBIT OF THE BILLINGS & SPENCER CO. AND THE E. HORTON & SON CO.

The illustration herewith shows the general appearance of the world's fair exhibit of the Billings & Spencer Co. and the E. Horton & Son Co. The main part of the exhibit of the Billings & Spencer Co. is composed of drop forgings, and in addition to these a large number of small tools are shown. It is claimed by this company that it is the pioneer in the drop forging business in the United States. Drop forgings were made before the year 1869 when the company was established, but it is stated that up to that time no one had entered into their manufacture as a commercial business. The company was started in a small way and now after twenty-eight years has 60 hammers and 140 men constantly employed. All kinds of drop forgings are made, embracing aluminum, copper, iron, steel and aluminum bronze, varying in weight from 1-16 of an ounce up to 50 lbs. An extensive collection of samples of work is exhibited; a large number are of aluminum bronze for use in Whitehead torpedoes, the forgings for 120 of which have been furnished by the company. The copper forgings are most of them made in connection with electrical work, where the direction of the grain of the metal is an important item. Large numbers of commutator bars have been forged from this material for the Thomson-Houston Electric Co. Among the wrought iron forgings shown are five different sizes of piston rods for Westinghouse engines and a large variety of forgings for fire arms, sewing machines, bicycles, etc. Lathe dogs are successfully made and a large number placed on exhibition. The company is also doing quite a business in the manufacture of gages, both rough and finished. Micrometer calipers are also made in large numbers for the Brown & Sharpe Co. Spinning rings are furnished to one company to the number of 100,000 per month.

One of the largest contracts ever filled by this company was for an outfit of dies for the Prussian government to be used in the manufacture of needle guns. The aggregate weight of this outfit was 42 tons. Each set of dies before delivery was tested by turning out 500 pieces to show the workmanship, after which they were sent to Prussia and the workmen in that country instructed in their use by a representative from the Billings & Spencer Co. Several pieces of these guns are difficult forgings, and being used without machining must be absolutely uniform in size. One of the most extensive displays of the exhibit is of wrenches. These are rough and finished and shown in sizes from ⅛ up to a 4 in. nut. The company manufactures belt stretchers of neat and convenient design for use in lacing belts. The show case exhibit contains a large number of small tools, which are new and interesting. Among these is a hand vise for telegraph line men. It has a parallel motion and is provided with all necessary attachments for this work. A new pattern of micrometer gage is shown and a collection of die stocks for cutting threads from 1-16 up to 2 in. These are made to cut threads of the Whitworth, United States standard and the old V forms. Wire cutters of several sizes are exhibited; also ratchet wrenches, hammers, wire cutters with a gage, an adjustable tool steel grip pipe wrench and also a forged adjustable alligator wrench. All of the different parts of these tools are drop forgings.

WORLD'S FAIR EXHIBIT OF THE BILLINGS & SPENCER CO. AND THE E. HORTON & SON CO.

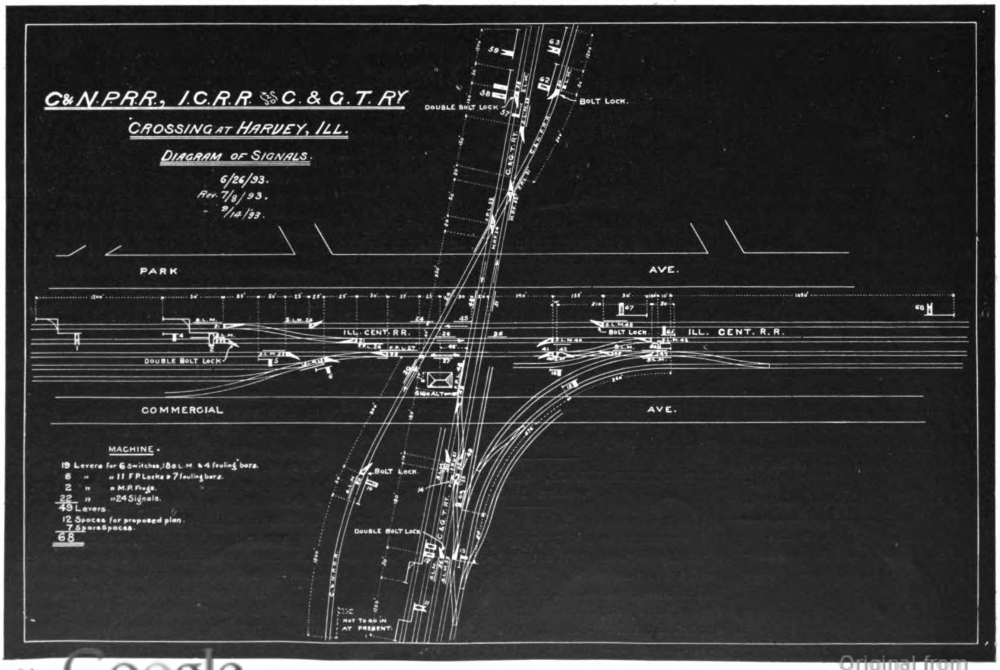
An illustration of the thorough manner in which the members of this company are studying the subject of drop forgings is the fact that they manufacture their own hammers. A great many experiments were made with different types of drop forgings machines, and finally the decision was reached that better results could be had by making their own machines. The hammers are made in three different sizes, the smallest size takes a drop weighing 300, 400 or 500 lbs. the second size a drop weighing 600, 700, 800, 900 or 1,000 lbs., and the third size a drop weighing 1,200, 1,400, 1,600, 1,800 and 2,000 lbs., the weights of the hammers being changed to suit the work in hand. The design of the hammer is very simple. The weight is guided by two housings, and lifted by friction rollers acting on a flat plate, the rollers being driven by belts. The height of the drop is controlled by either a hand lever or an automatic trip. Any further information concerning the products of this company or its methods, may be obtained by addressing the Billings & Spencer Company, Hartford, Conn., or calling at the exhibit which is located in machinery hall, section 29, column No. K, 51.

The exhibit of chucks made by the E. Horton & Son Co., joins that of the Billings & Spencer Co., and is plainly shown in the back ground of the illustration. It is claimed that this is the most extensive exhibit of chucks ever made. There are eight or ten different lines shown, varying in size from a small hand chuck up to a car wheel chuck 42 in. in diameter. They are three and four jaw, both universal and independent, and three and four jaw combination chucks. The universal chucks are shown in 22 different sizes, varying from 4 to 22 in. A 42 in. car wheel chuck is shown, which it is claimed is the largest universal chuck ever made. A line of three and four jaw combination reversible chucks is shown in sizes from 6 to 42 in. Special scroll chucks are also shown operated by hand wheels, and intended for use on cut-off machines.

The exhibit is neatly arranged and shows to advantage the products of the company. Further information regarding the different parts of the exhibit may be obtained by calling at the exhibit or addressing the E. Horton & Son Co., Windsor Locks, Conn.

INTERLOCKING PLANT AT HARVEY, ILL.

The illustration herewith is reproduced from the working drawings of an interlocking plant which has recently been placed in service at the crossing of the Illinois Central, Chicago & Northern Pacific and Chicago & Grand Trunk railways at Harvey, Ill. The arrangement of the tracks, signals and switches is clearly shown in the illustration. The Illinois Central has three tracks, the Chicago & Grand Trunk two and the Chicago & Northern Pacific one. The interlocking is complete in governing all switches and signals at the crossing, and on the Illinois Central Railroad in connection with the Hall system of automatic block signals recently installed. The in-



terlocking machine is one of the Johnson standard and the entire system is mechanical. In installing the plant particular attention has been paid to fitting up the connections so the levers will work easily, and it is claimed that almost any lever in the machine may be thrown with one hand. The machine is built for 68 levers, 49 of which are in daily use. Of these levers 19 are for six switches, 18 switch lock movements, and four fouling bars. Six levers are for 11 facing point locks, and seven fouling bars. Two levers are for movable point frogs, and 22 are for 24 signals. There are 19 spare spaces, 12 of which will shortly be used in an addition to the system.

The top arm in each case governs the high speed route, the lower arm all diverging routes. Low signals govern sidings, and main tracks in their reverse direction. All signals are located and point to the right of track they govern, except in case of bracket posts, where signals on right hand must govern the right hand track, the left hand mast the left hand track. Where a plain mast is displayed on a bracket post between the two masts on which arms are displayed, it signifies that there is a track intervening which is not signaled from that post.

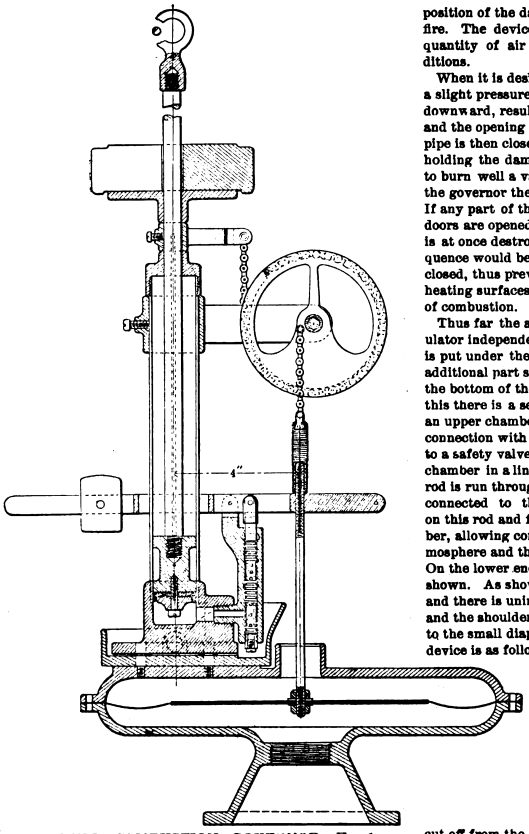
The plant was erected by the Johnson Railroad Signal Company, of Rahway, N. J., and was put in service on September 10, 1893.

THE THIELL COMBUSTION GOVERNOR.

The illustrations herewith show the details of construction of the new Thiell combustion governor. The operation of the device is fully set forth in the following description furnished by the makers:

The interesting thing about the device here illustrated and described is that, the sides being designed to regulate the draft on a fire, it uses the fire itself as an agent for controlling its workings. Its action is dependent upon the difference between the atmospheric pressure and the pressure in the furnace, which latter (as is well known) is always somewhat below the atmospheric pressure, due to the ascending gases of combustion. Between these two forces is a diaphragm of large diameter, one side in communication with the atmosphere and the other with the furnace. This diaphragm may be said to float between these two pressures, and as the atmospheric pressure is regulated and as the partial vacuum in the furnace is greater or less, the diaphragm obtains its movement by reason of its variation in pressure. This movement of the diaphragm is utilized to operate a small valve which controls the flow of water to and from the cylinder in which moves the piston, and as the upper end of the piston rod is connected to the damper, any movement of the diaphragm results in a movement of the damper, through the mechanism described. A balanced piston valve is used and the only work the diaphragm has to do is to move this valve a maximum distance of 3-16 in. As is well known, the partial vacuum in a furnace varies according to the condition of the fire, and the condition of the fire depends upon the proper supply of oxygen, which combines with the carbon of the fuel to produce combustion. It is thus seen that the fire not only signals its need of oxygen to produce more or less perfect combustion, but also has within it the power for controlling the means of supplying the oxygen.

As can be seen from the drawing this device consists of a casing containing the diaphragm (see Fig. 1). From the lower side of the casing there is run a 1¼ in. pipe into the furnace. A rod connects the upper side of the diaphragm to the mechanism which controls the valve. A ¼ in. pipe from the city water pressure connects with the valve chamber, and a smaller pipe acts as a discharge from the valve chamber. On the upper end of the rod, connected to the diaphragm, there is a highly sensitive coil spring brazed to a nut running upon the threaded end of the rod. The upper end of this spring turns freely around an acorn-



THIELL COMBUSTION GOVERNOR.—FIG. 1.

shaped shoulder. This, in turn, is connected to a chain pivoted about half an inch from the center of the wheel shown in the illustration. A similar chain has one end fastened to the circumference of the wheel and the other end fastened to a projecting arm which is held by a set screw to the piston rod. The parts of this last described mechanism may be explained as follows:

As a vacuum in the furnace causes the diaphragm to be moved downward, carrying the valve also downward, water under pressure is admitted to the underneath side of the piston, causing an upward movement of the piston and rod, and as the small projecting arm moves upward with the piston rod the wheel is made to revolve and wrap the chain connected to the spring around the hub of the wheel. This puts a tension on the spring. As soon as this tension makes up the deficiency in the pressure on the underneath side of the diaphragm the forces on the opposite sides of the diaphragm are balanced and the diaphragm moves upward, causing the valve to be blanked and retaining the water in the cylinder, which results in holding the damper in the position required by the condition of the fire at that particular time.

As soon as the partial vacuum in the furnace is either increased or decreased by any change in the condition of the fire the diaphragm takes either an upward or a downward movement, causing a similar upward or downward movement of the piston and a corresponding change in the position of the damper to every changed condition of the fire. The device thus controls the supply of the right quantity of air at the right time and under the right conditions.

When it is desired to build a fresh fire under a cold boiler a slight pressure of the finger will move the diaphragm downward, resulting in an upward movement of the piston and the opening of the damper. The valve in the discharge pipe is then closed, confining the water in the piston and holding the damper open. As soon as the fire has begun to burn well a valve in the discharge pipe is opened and the governor then takes charge of operating the damper. If any part of the grate becomes bare, or if the furnace doors are opened for any cause, the vacuum in the furnace is at once destroyed by the inrush of air, and the consequence would be that the damper would be nearly or quite closed, thus preventing the passage of cold air from the heating surfaces to the boilers and the cooling of the gases of combustion.

Thus far the apparatus described is a perfect draft regulator independent of the steam pressure. But the damper is put under the control of the steam pressure through the additional part shown in Fig. 2. A 1¼ in. pipe runs from the bottom of the diaphragm casing to the furnace and in this there is a section made of cast iron which consists of an upper chamber in which there is a diaphragm, and in connection with this diaphragm a weighted lever, similar to a safety valve lever. In this section there is also a valve chamber in a line of communication with the furnace. A rod is run through the upper part of the valve chamber and connected to the weighted lever. A shoulder is turned on this rod and forms a seat in the top of the valve chamber, allowing communication to be made between the atmosphere and the 1¼ in. pipe, when this seat is uncovered. On the lower end of this rod there is a large wing valve, as shown. As shown in the drawing, the large valve is open and there is uninterrupted communication to the furnace and the shoulder seat is closed. A ¼ in. steam pipe is run to the small diaphragm chamber. The operation of this device is as follows:

The lever is weighted to the required steam pressure and until this pressure is reached there is free communication throughout the length of the 1¼ in. pipe; but as soon as the required steam pressure is reached there is an upward movement of the small diaphragm which causes the weighted lever to lift and with with it the rod carrying the valve in the valve chamber. Communication is thus cut off from the furnace and opened to the diaphragm, as described. The air then flows into the 1¼ in. pipe and to the underneath side of the large diaphragm, causing it to move upward and resulting in a downward movement of the piston and rod and a closing of the damper, thus shutting off the draft from the furnace until the steam pressure flows, renewing the first position of the parts of the steam regulator; then the damper comes under the control of the combustion governor through the medium of the fire alone.

That this device will do its work properly and continuously, and without attention or expense for maintenance, is proven by the repeated tests of about forty of the machines under as many varied conditions of the draft, fire, coal etc., as there are machines in operation. The lowest gain shown in any test is 13·3 per cent., and the highest is 25·25 per cent. The report of one test is given below, showing two average results.

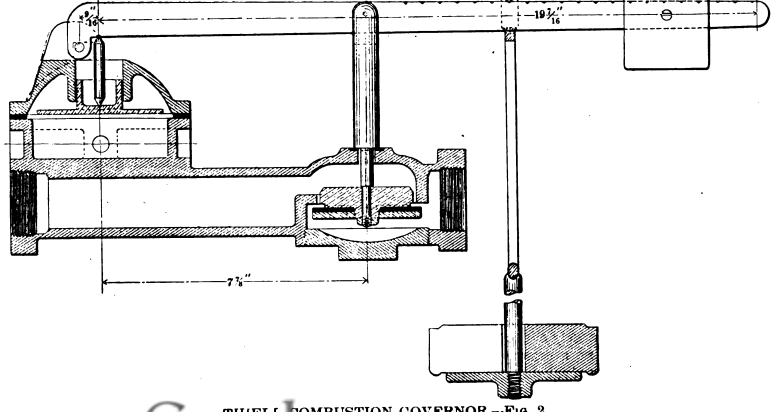
The boiler was tested on August 25 before it was fitted with the Thiell automatic governor. On August 28, 1893, the same boiler was tested with the governor attached and under as nearly similar conditions as possible.

SUMMARY OF RESULTS OF TESTS.

Test made.	Coal.	Water.	Evaporation per lb. Fuel.	Evaporation per lb. Combustion from & at 212°
August 25.....	3,558	20,550	5·78	6·95
August 28.....	3,158	21,606	6·84	8·27
Increase pr. ct.	11·1	5·13	18·3	18·9

The test was made by the well known and reliable firm of R. W. Hunt & Co. of Chicago. As shown by the report of the test without the Thiell governor fairly good conditions had already been obtained with the boilers tested.

The parent company, and the one owning the patents is the Thiell Combustion Governor Mfg. Co., of Baltimore, Md. A sub-company is forming in Chicago to manufacture and sell the device in the western territory. Chas. L. Sullivan is the western manager, located at present at No. 1011 Monadnock block, Chicago.



THIELL COMBUSTION GOVERNOR.—FIG. 2.

The Order of Train Dispatchers held its annual session at the Grand Pacific Hotel during the past week. The second Tuesday in September, 1894, and Colorado Springs were chosen as the time and place for the next meeting. The treasurer's report showed a prosperous condition of the order, which has been in existence less than a year, there being $150 in the treasury after all expenses for the year have been paid.

Commencing Sunday, October 1st, 1893, a through line of first class sleeping cars will be established between Chicago and Seattle, Wash., via the Chicago, Milwaukee & St. Paul Railway between Chicago and St. Paul, and the Great Northern Railway between St. Paul and Seattle. Westbound the sleeping cars via the line will leave Chicago daily at 10·30 p. m., arriving at Seattle 11:30 p. m. fourth day. Eastbound these cars will leave Seattle at 8 a. m., arriving at Chicago 6·45 a. m. fourth day.