device and the steel spur gearing for the transmission of motion from the vertical shaft to the revolving tool spindle. On the sliding head is mounted a rotary turret head. All the spindles in the turret are indexed to the same point when the spindle is in position for work. Any spindle wanted may be swung into position without stopping the machine by means of a lever shown on the front of turret, which when moved to the right will release the index pin. When the turret is revolved to the spindle wanted, the lever will automatically lock the turret head with the spindle running in position for work. The hand feed is operated by a handwheel in front of the turret. The power feed is operated by the belt and cone pulleys on the sliding head. The feed is started and stopped by the knock-off in front of the hand wheel, or it can be set to stop automatically for any depth up to 28 in. by means of the stop shown on the face of the column. The quick return of the head is obtained by means of the pilot wheel on the left-hand side of the head. The clutch for connecting the back gears may be thrown in or out while the tool is running. These Quint turret machines are made in four sizes with from four to 12 spindles.

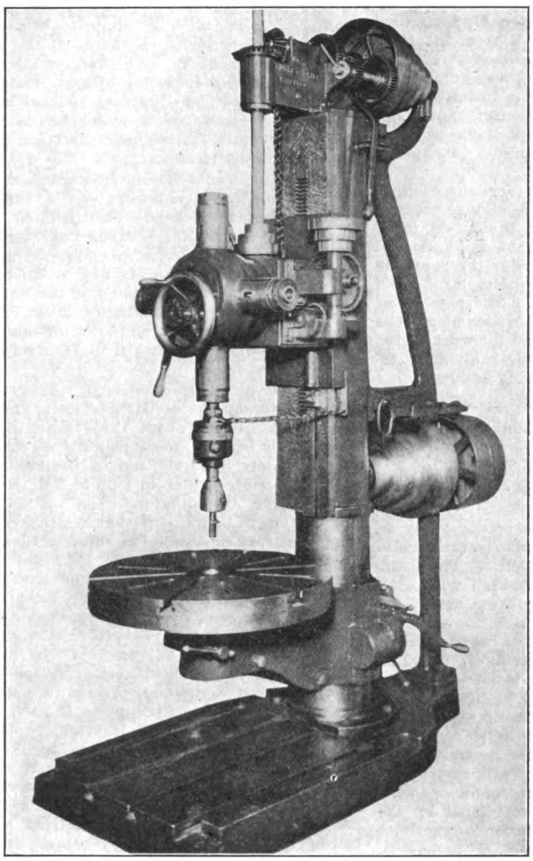

Fig. 2—The A. D. Quint Upright Turret Machine.

Fig. 3 shows a 40-in. swing, back-geared drill made by the New Haven Manufacturing Company, New Haven, Conn. The spindle of this machine is balanced and has a feed of 12 in. operated either by hand or power, has an automatic stop, a quick return motion and an index for measuring the depth of the hole drilled. The shipper is fitted with a brake for stopping the spindle quickly. The head is adjusted by means of a screw operated by miter gears. The adjustable arm which carries the table can be swung aside so that the base plate can be used for drilling. The back gearing is operated by a lever which is within easy reach of the operator. The spindle is 2½ in. in diameter and is of hammered crucible steel fitted with a solid forged collar, and is reamed to fit a No. 5 Morse taper and will hold drills from $2^{1}/_{16}$ in. to 3 in. inclusive. The wear between the quill and the spindles is taken care of by a loose, hardened tool steel collar which is cupped to hold oil. The quill has a threaded collar for taking up wear. All gears are cut from solid blanks. The countershaft is at the base of the machine, and the driving shaft and spindles run in cap boxes. The distance from the face of the post to the center of the table is 20 in., the maximum distance from the spindle to the base plate is 53 in., and the greatest distance from the spindle to the table is 34 in. The vertical traverse of the table is 15 in. and the vertical traverse of the adjustable head is 14 in. The planed surface of the base plate measures 35 in. x 32 in., and the diameter of the adjustable table is 36 in. The machine is 9 ft. high and weighs about 4,200 lbs. The driving pulleys are 16 in. in diameter and have a 3¼ in. face. The largest cone pulley is 14 in. in diameter and it takes a 3-in. belt. The countershaft should run at 225 r.p.m. These drills can be arranged for tapping by adding a pair of friction pulleys which are supported in a bracket attached to the rear of the base of the machine. A device for automatically reversing the machine and running back the tap by power is also supplied when desired. *(To be continued.)*

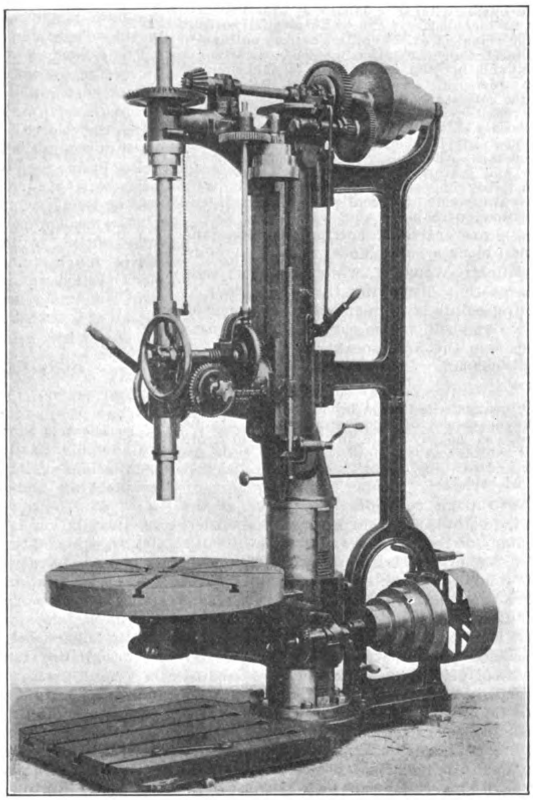

Fig. 3—Upright Drill, New Haven Manufacturing Company.

The Block System in Iowa.

At the meeting of the Iowa Railway Club which was held at Des Doines on September 12, there was an animated discussion on the question whether or not the block system can be used on the railroads of the west and, if it can be used, whether it is worth having. At a previous meeting a paper had been read by Mr. P. G. Campbell, Chief Train Despatcher of the Chicago & North Western, at Boone, speaking favorably of the block system, and at this September meeting Mr. A. T. Woodruff, Examiner on the Chicago Great Western, read a paper sustaining the opposite side of the question; and the subject was discussed by Messrs. Hammill, Shipley and others.

Mr. Woodruff says that the increase in operating expenses resulting from the use of the block system on the average western railroad will amount to about $1,000 a month for each 100 miles; which means, we suppose, that usually it is found necessary to put on about 20 additional operators or signalmen in a road of that length. From this he goes on to argue that unless the cost of collisions is reduced at least $12,000 a year the block system is too expensive. As he has not found any hundred miles in Iowa where the collision losses have amounted to this sum, he is satisfied that the block system is not worth having. He holds that the delays due to block signaling and their cost are a dead loss. He believes that every attempt to work the absolute block system on lines of heavy traffic in the west have failed; permissive blocking had to be substituted. Permissive blocking is dangerous; no railroad man can be made to believe that the rule, to run under control when a permissive signal is given, will be lived up to. The under-control rule

is not made any safer by having the initials of the despatcher on the caution card. Mr. Woodruff went on to detail some of the bad practices which he finds where the block system is ostensibly in use.

An operator is liable to signal a clear block when it is not clear. This may result from the mechanical oversight of a sleepy operator or from a misunderstanding. An incompetent operator misinterprets the telegraphic code. A "get there" operator clears the block when a train is "coming" to release a following train, which may otherwise be seriously delayed for an opposing train. The nervous operator loses his head. A stupid operator don't know why he did it.

A conductor will perhaps occupy the main track at a station doing work, figuring that the operator is protecting him. The operator does not understand it that way and the train is unprotected.

A favorite trick of a certain class of night operators is to find out "what is coming," then change the position of the signal to "proceed" and go to sleep, depending on the first passing train to awaken them.

The custom of using the train order signal for a block signal is a dangerous practice peculiar to the block system. The normal position of the signal is at "Stop." There is nothing to remind the operator that he has orders for a train and nothing to indicate to the engineer that orders are awaiting him. It all depends on the operator's memory, which if defective will result in his failing to deliver the orders.

Another thing which must not be overlooked, responsibility has been removed from train and engine-men, who as a class are men of experience and mature judgment, and increased responsibility imposed upon operators, who as a class are young, frequently inexperienced and sometimes, perhaps, incompetent.

As a preventive of butting collisions the manual block system affords additional security, but Mr. Woodruff, while admitting this, declares that displaying the stop signal at meeting points is simpler and less expensive.

Mr. Campbell, whose paper had been criticized, was the first speaker in response to Mr. Woodruff. He spoke of a recent case where

"A heavy freight train broke an air hose, and hurt the conductor and rear brakeman, and there was nobody there to protect the train until the men at the head end of the train got back and saw the condition of affairs, and they flagged back."

As to butting collisions, the order at the meeting point is all right if there be an order, but many of the collisions are between trains which should meet according to the time-table and rules, no orders being issued. In two years on his (block signaled) division he could recollect no collision of either kind.

Mr. Hammill (C. & N. W.) with ten years' experience as despatcher and trainmaster on a road using the block system combated the claim that the block system caused delays. On one division he had moved 28 stock trains, six passenger trains and three fast freights in one direction and a corresponding movement in the opposite direction, in one day, with an outlay of not over $200 for overtime of freight trainmen, mostly those on way freights. Mr. Hammill cited instances of the block system preventing collisions where operators or despatchers had neglected to give proper meeting orders. If he were general manager of a railroad on which there were but two trains a day, one each way, he would use the absolute block system.

Mr. Campbell, in telling of the practice on the North Western, said that enginemen sometimes objected to running on a caution card at night when patches of fog are liable to arise; and the despatcher never compels an engineman to run on a caution card. Regarding the assertion that enginemen ruaning under a permissive signal do not carefully regulate their speed, he said that the train sheets would show that the claim is not true, as regards his division; trains running under permissive signaling take much more time than those which get clear signals. In his experience, on two divisions, he has never known a train to get into trouble while running under a caution card. It must be acknowledged that the block system permits certain kinds of carelessness, "but all you need to do is to drill the men and discipline them a little stronger, and you will get the desired results." On the Iowa division 10 to 15 caution cards are issued daily; nearly all of them are for way freight trains.

Mr. Schevenell.—Mr. Woodruff has admitted that the manual block system is useful as a precaution against head end collisions; and I want to say that in the last ten years four or five disasters have been averted just in this way. Despatchers issue orders for a train to run extra and overlook an opposing extra; a despatcher seldom discovers an error of that kind until it is too late, while the block system does prevent the collision. This feature alone will pay for the extra expense of the block system. The claim that the block system increases expenses $1,000 a month is excessive. With the light traffic which has been referred to in this discussion it can be installed without one cent of extra expense; though, of course, it is necessary, at some stations where there is no night operator, to lengthen the block sections at night.

On the North Western for three years much double tracking has been done between Belle Plaine and Council Bluffs; 30 to 50 miles west of Boone, and the same amount east of Boone each year. For this work 40 to 65 work trains have been employed from early spring to late fall. There was, of course, much changing of grades also. The block system was in use and the work trains were run under permissive signals, but during all this time there was no accident.

Storage Batteries for Signal and Track Circuits.

The Electric Storage Battery Company, of Philadelphia, has issued a description of the installations of its chloride accumulators on the Reading and the Pennsylvania roads; nd we give it, condensed, below. The Reading installation is in connection with Hall disk signals and the Pennsylvania with Westinghouse electro-pneumatic.

In the case of interlocking, when there is a considerable current demand within a limited area, storage batteries have already largely superseded primary batteries, but in block signaling the conditions are different. On a four track road, the decision will undoubtedly be in favor of the secondary battery; but on single track the primary battery will frequently show better economy. An installation has just been completed by the Philadelphia & Reading between Wayne Junction and Huntingdon street, Philadelphia, where the concentration of the devices requiring current has made the comparison of the cost of furnishing power by primary cells and by storage batteries greatly in favor of the latter. It is estimated that the cost of the storage battery installation will be returned within the first year's operation. This section consists of four tracks, and is 12,500 ft. long. The primary cells were distributed at eight points, a total of 1,203 cells being used. At each of these points storage battery cells, type PT, have been put in, requiring a total of 134 cells to displace the 1,203 primary cells. This type of cell has a capacity of 24 ampere hours. At each location there are two sets of storage cells, one being used to operate the signals while the other set is being charged. In other words, there are 67 storage cells in service at one time. The number of cells in each set at each battery point varies from a minimum of seven to a maximum of 20, this being necessary on account of the different voltages required. From some of the battery points several circuits of different voltage are desired, and this is accomplished with one battery. Resistance in the form of counter electro-motive-force cells is used to reduce the voltage to the requirements of the minimum voltage circuit.

At a point approximately 3,000 ft. from Wayne Junction is the charging station. Here are installed two direct-connected generating sets, each having a capacity of 275 volts and 10 amperes. Two generators are provided in order that one shall serve in case of a breakdown of the other. From this charging station two charging circuits are run, a No. 12 wire to Wayne Junction, and a No. 10 to Huntingdon street. There is a rheostat which can be inserted in either circuit. Each day one of the batteries at each battery point is thrown upon the charging circuit while the other is left to operate the signals. The batteries on charge at the various battery points on each charging circuit are, therefore, all in series with each other and are cut out one by one as they are filled. The system has been working in the most satisfactory manner, and the labor has been somewhat reduced.

The Pennsylvania Railroad is using storage batteries for signal work on the Philadelphia Division, from Philadelphia to Downingtown; on the Pittsburg Division, from Gallitzin to Wiltmere; on the Monongahela Division, from Pittsburg to Thompson; on the Maryland Division of the Philadelphia, Baltimore & Washington, from Philadelphia to Wilmington; and from Allegheny to Homewood on the Eastern Division of the Fort Wayne.

The first installation made by the Pennsylvania was on the division between Philadelphia and Paoli, about three years ago. The signals between these points are spaced approximately 3,000 ft., and in the base of each semaphore are from two to four cells of "Chloride Accumulator," type 5-E, capacity 80 ampere hours. One cell is discharged upon the track and signal circuits, while the other cells are being charged. Each day an inspector goes over the route and changes the batteries from charge to discharge. While the batteries are thus inspected each day and charged every second day, the cells are of sufficient size to operate the signals for five or six days. With the old system of gravity cells it would be necessary to install about 24 primaries in the place of each of the two storage cells, and it would require five or six times the number of men for handling the batteries. With gravity it was customary to have two distinct batteries, one upon the track circuit and one upon the signal circuit. With the storage battery one cell operates both.

The Southern Pacific Railway has storage batteries which are carried from the signals to the generating station, charged and returned. This road is using a cell of 50 ampere hours capacity, these cells being contained in rubber jars, mounted in wood cases —two cells to each case, with handles so that they can be readily transported. The weight of each of these cells is approximately 12 pounds.

Each of these storage cells replaces eight primary cells. Four of these cells are used to each signal, or to each pair of signals where the signals are near enough together to permit this. Once a month the cells are returned to the charging station, inspected and recharged. The cells are charged in sets of seven, four to each set, making 28 cells in all. These charged batteries are then returned and exchanged for others which have been in use for one month.

Many of the principal railroads of the country use chloride accumulators in signal service.