

July 4, 1939.

C. SMITH

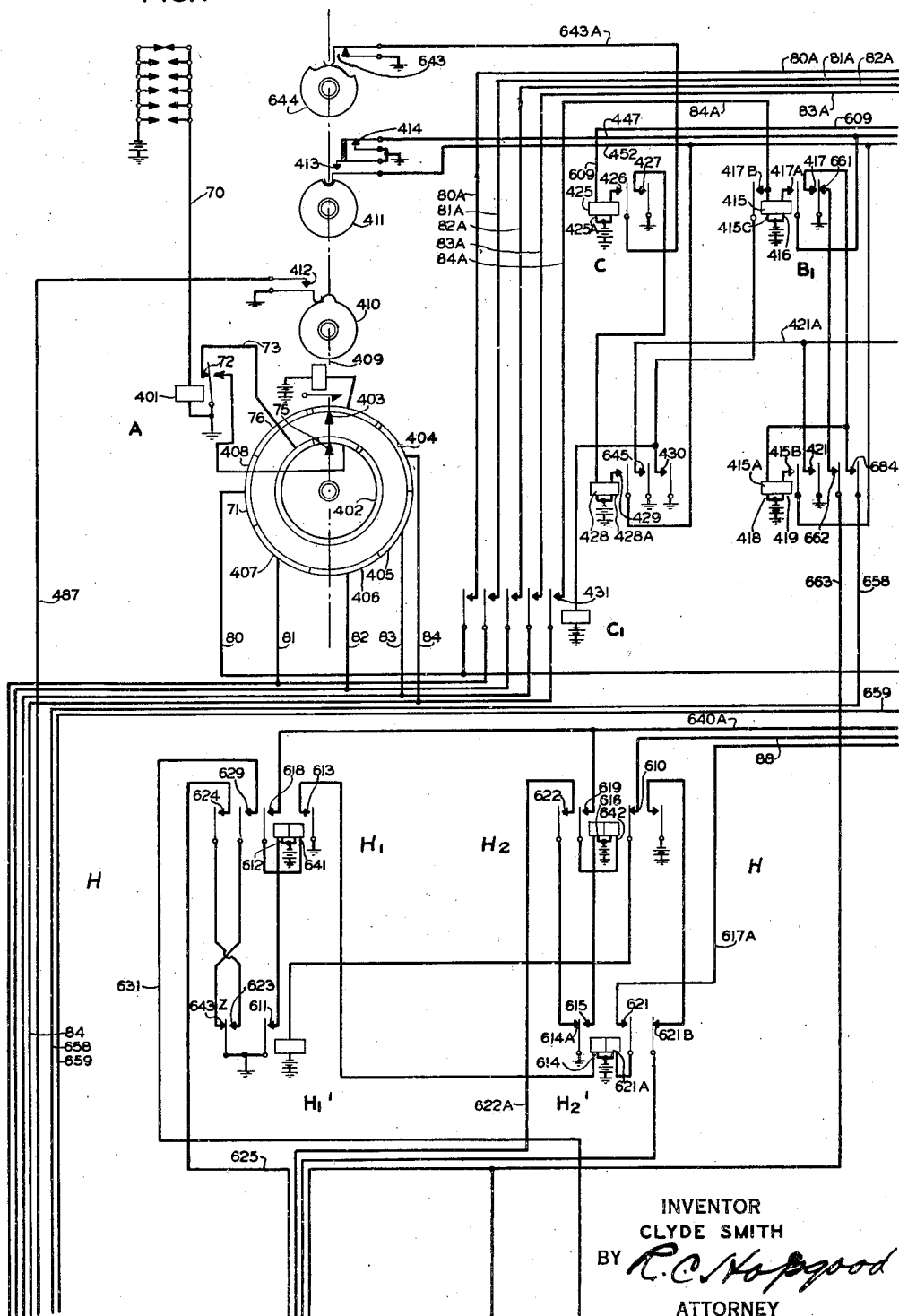
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 1

FIG. 1.



INVENTOR
CLYDE SMITH
BY *R. C. Hopgood*
ATTORNEY

July 4, 1939.

C. SMITH

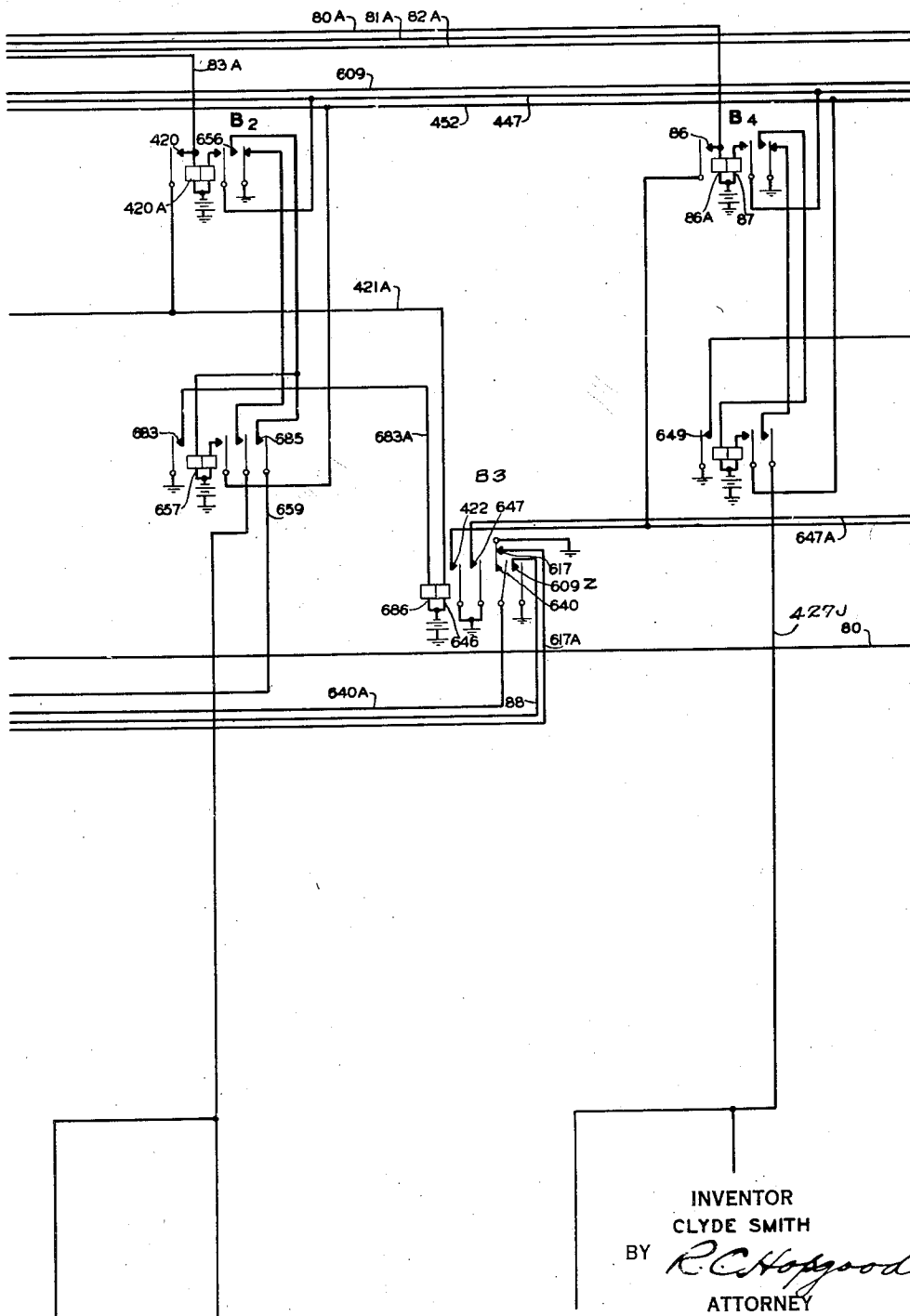
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 2

FIG. 2



July 4, 1939.

C. SMITH

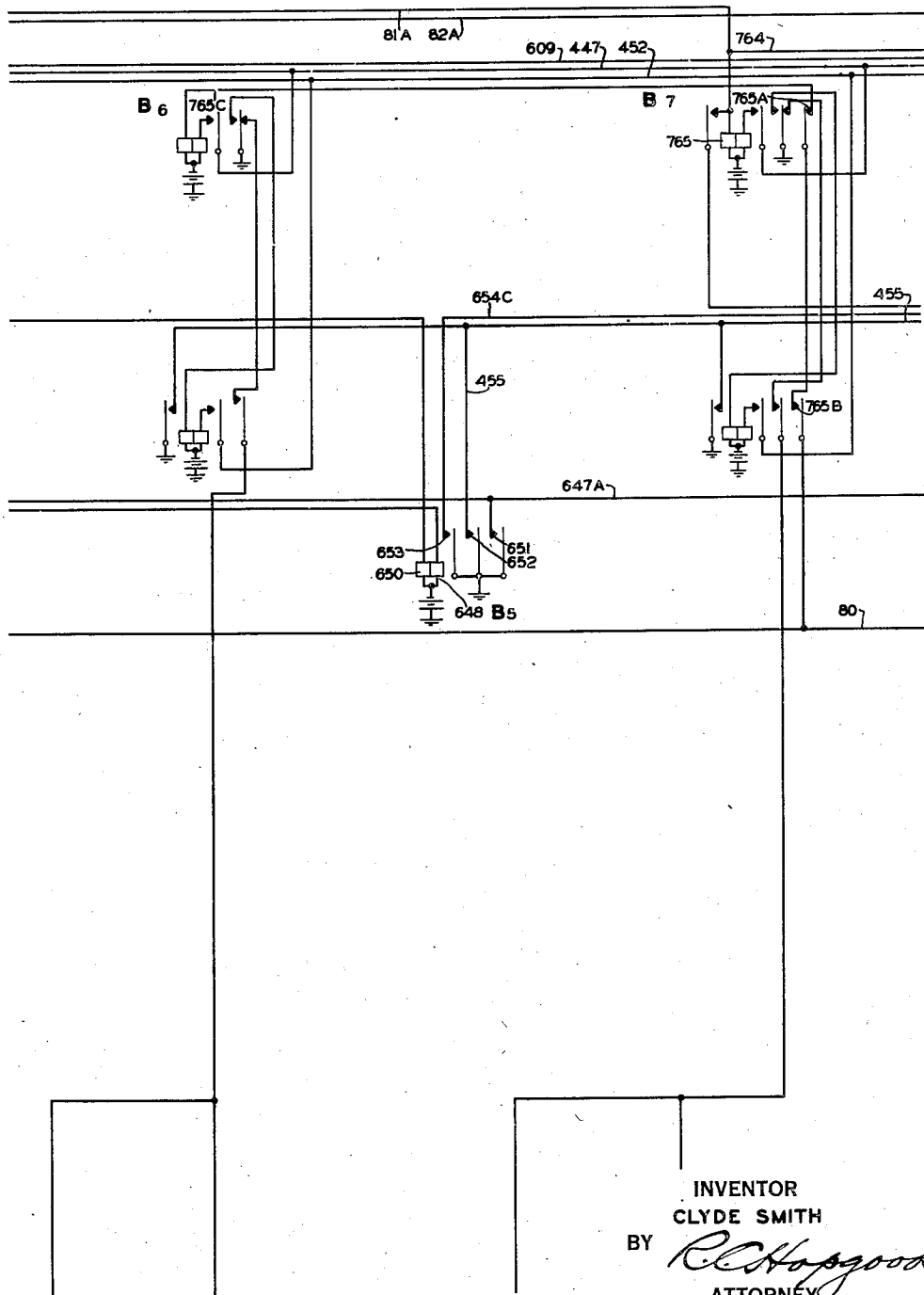
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 3

FIG. 3



INVENTOR
CLYDE SMITH
BY *R. C. Haggood*
ATTORNEY

July 4, 1939.

C. SMITH

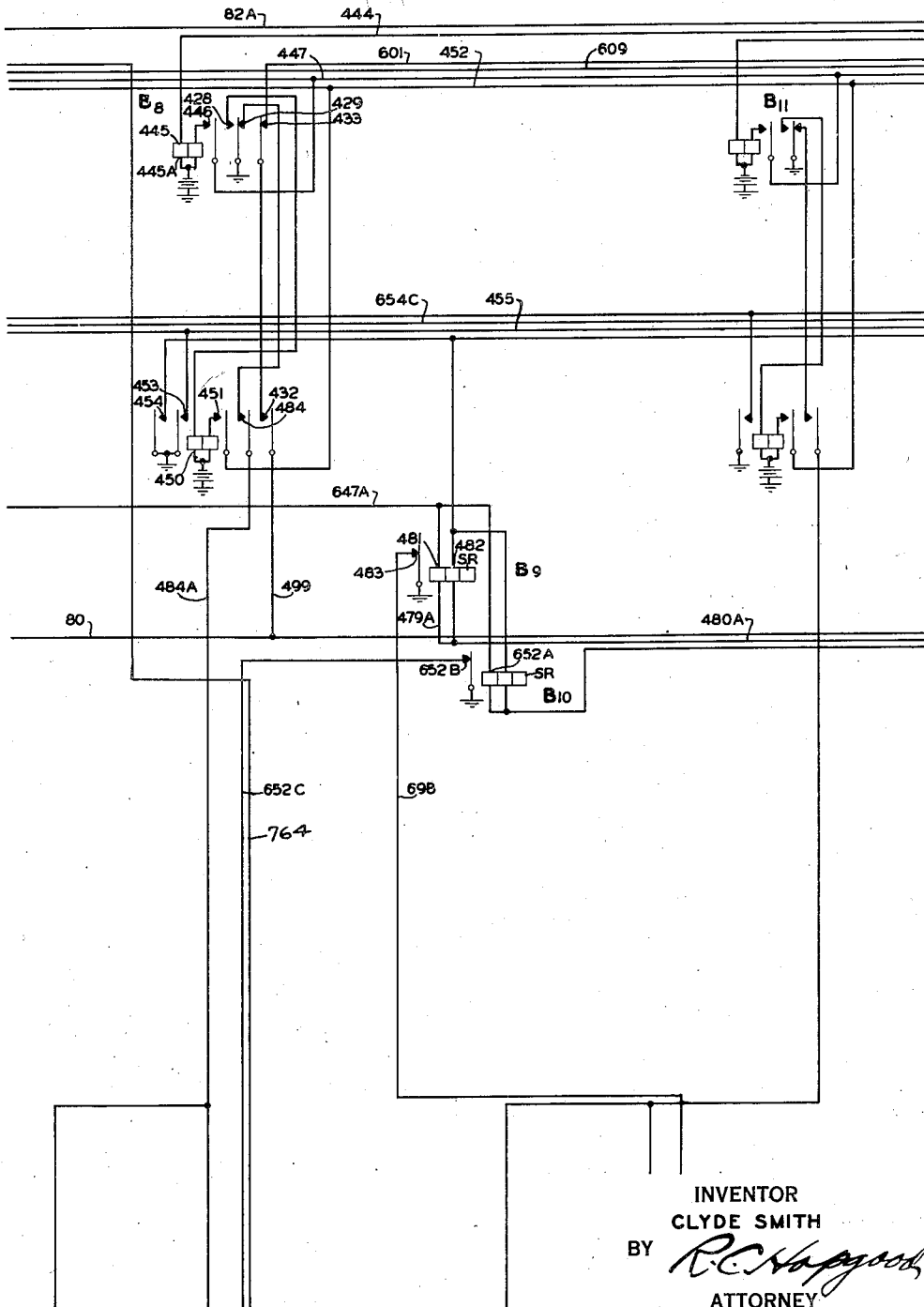
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 4

FIG. 4



INVENTOR
CLYDE SMITH
BY *R.C. Haggood*
ATTORNEY

July 4, 1939.

C. SMITH

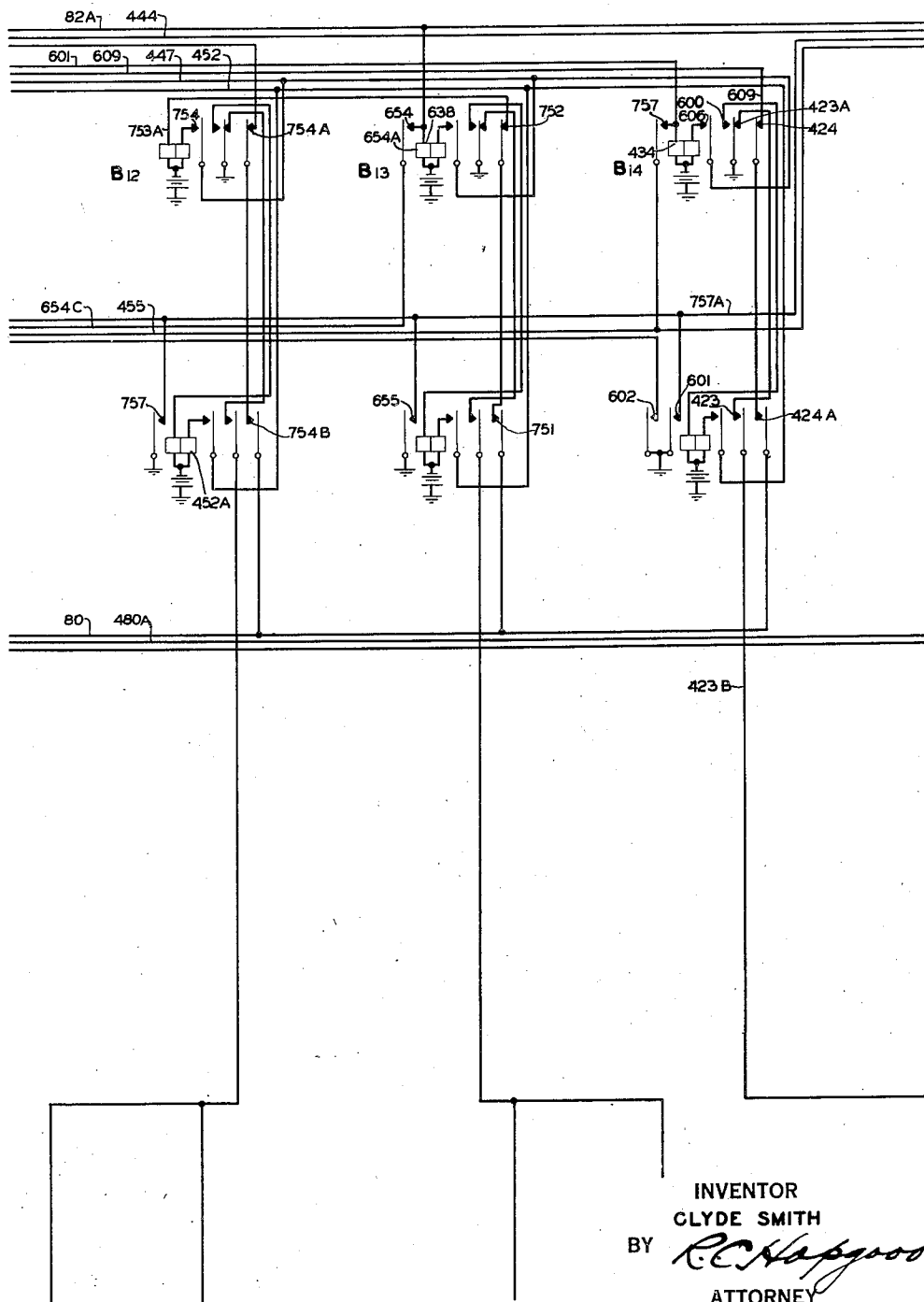
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 5

FIG. 5



July 4, 1939.

C. SMITH

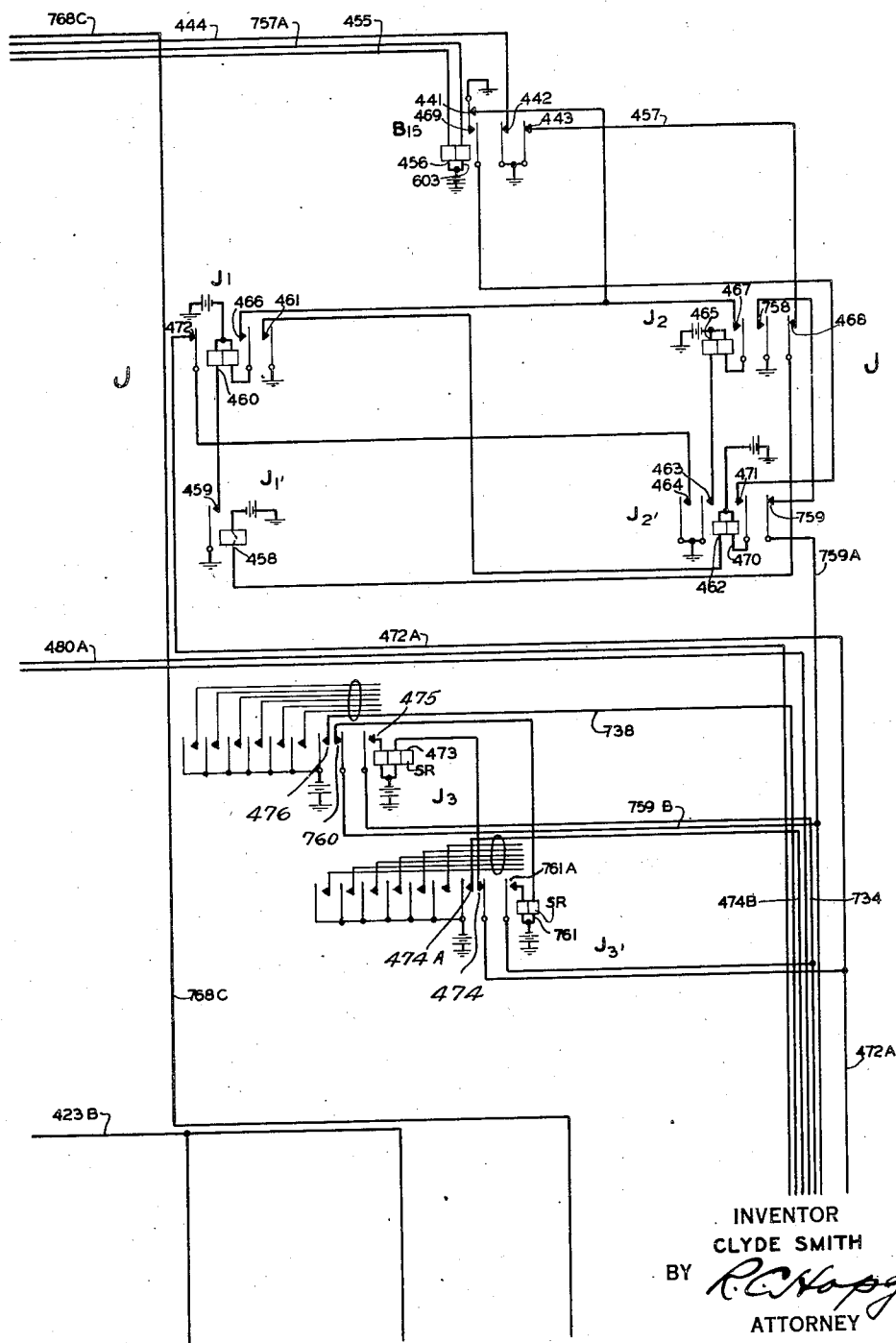
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 6

FIG. 6



July 4, 1939.

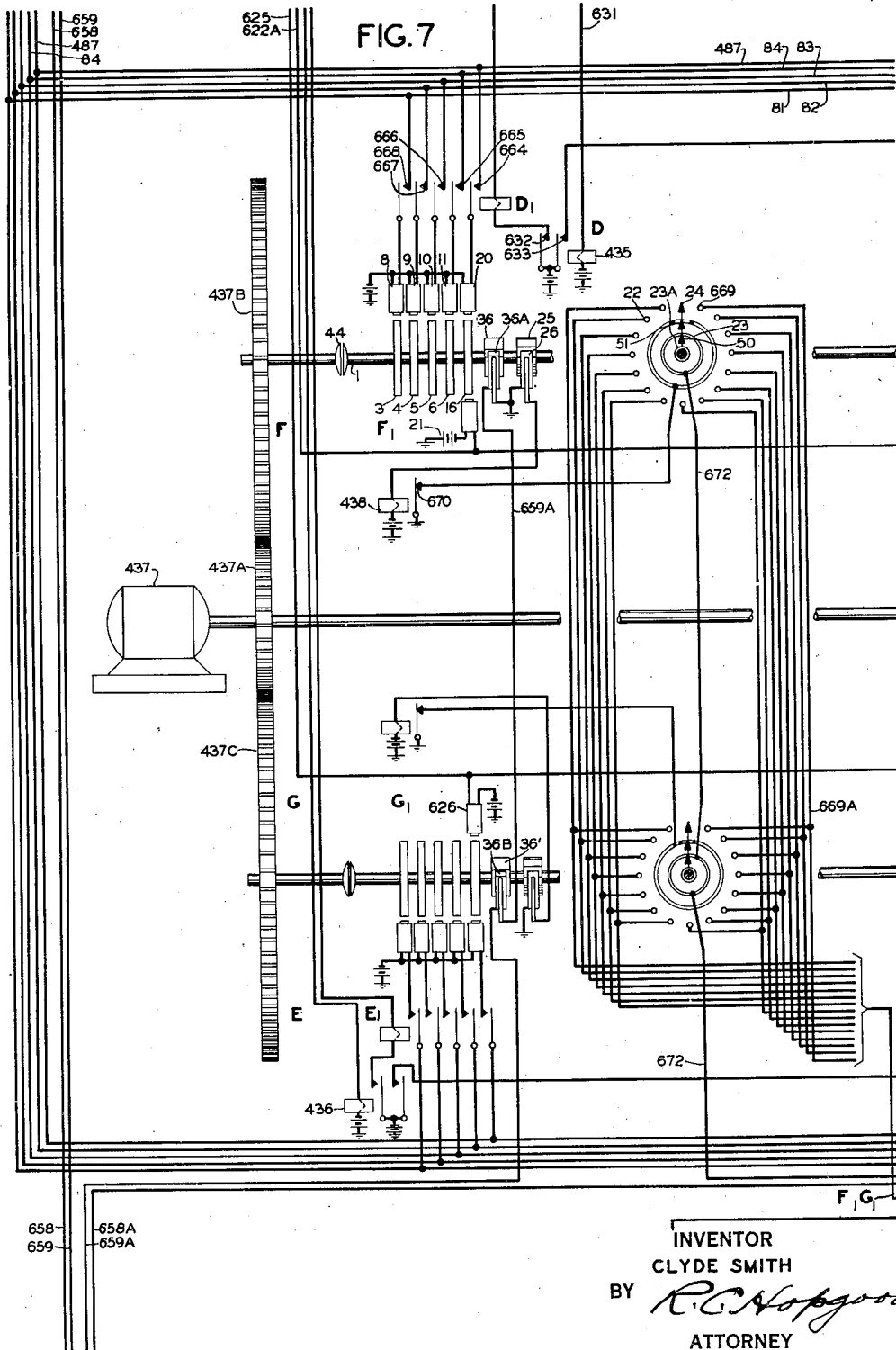
C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 7



July 4, 1939.

C. SMITH

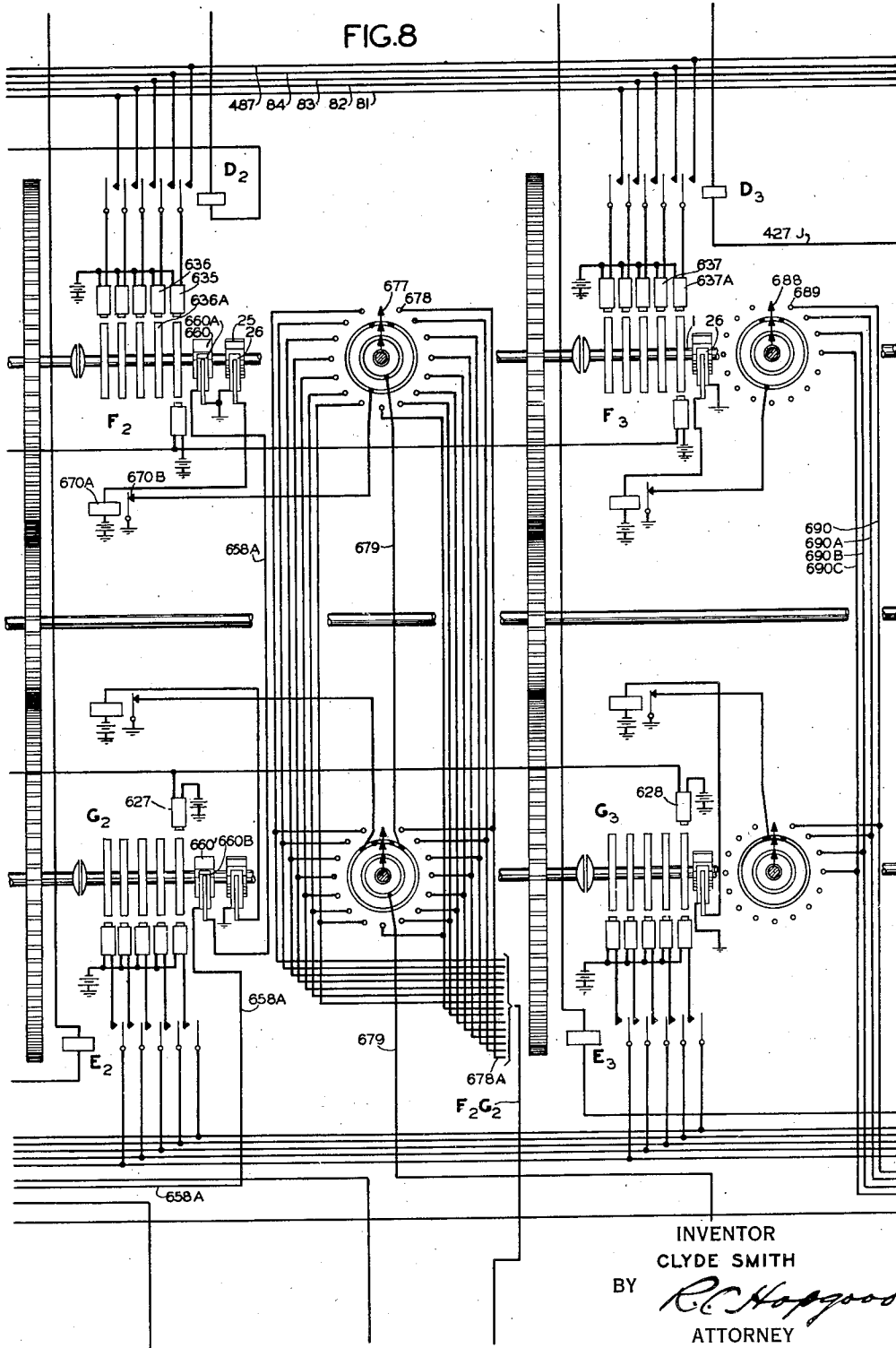
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 8

FIG. 8



July 4, 1939.

C. SMITH

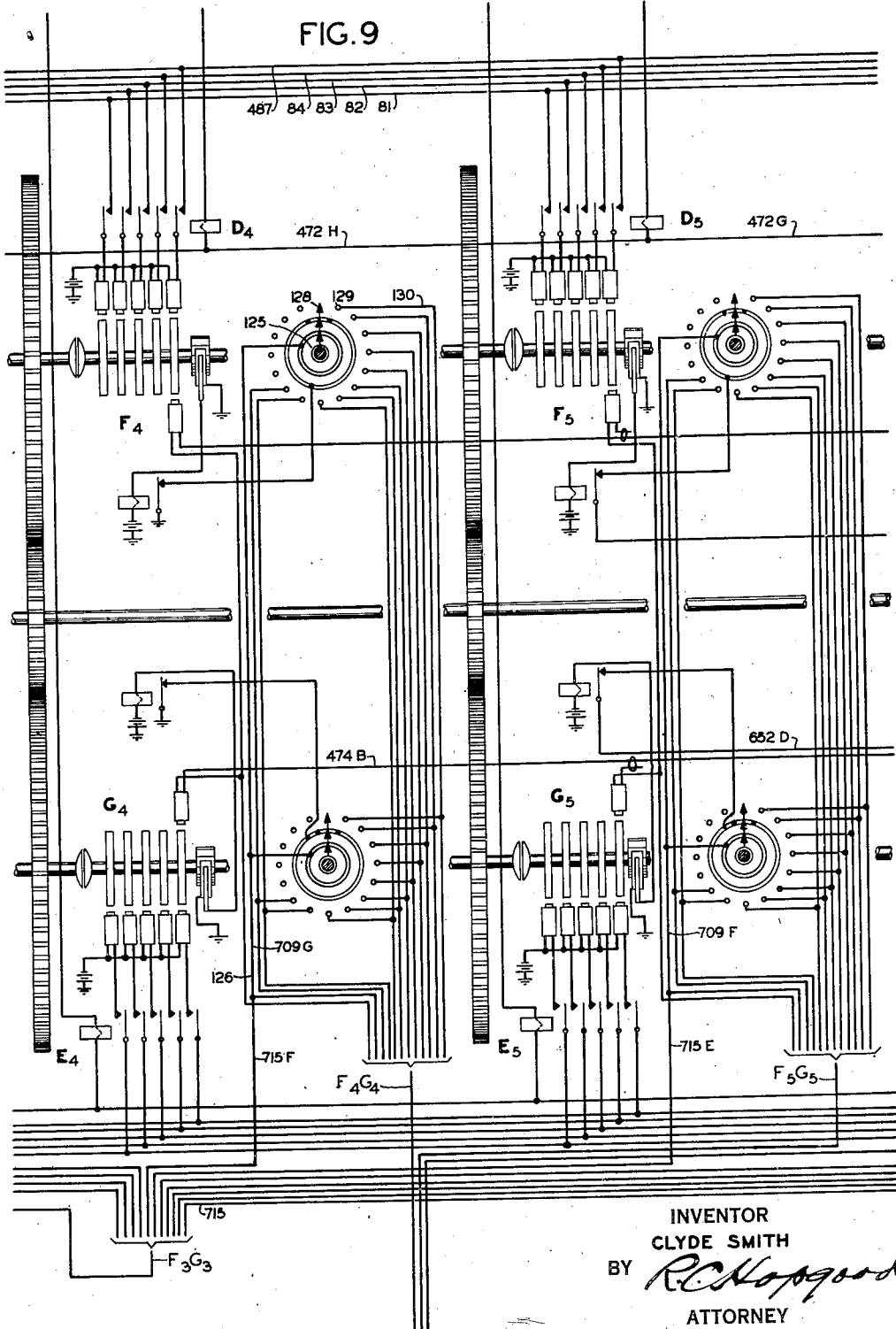
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 9

FIG. 9



INVENTOR
CLYDE SMITH
BY *R. C. Hoppard*
ATTORNEY

July 4, 1939.

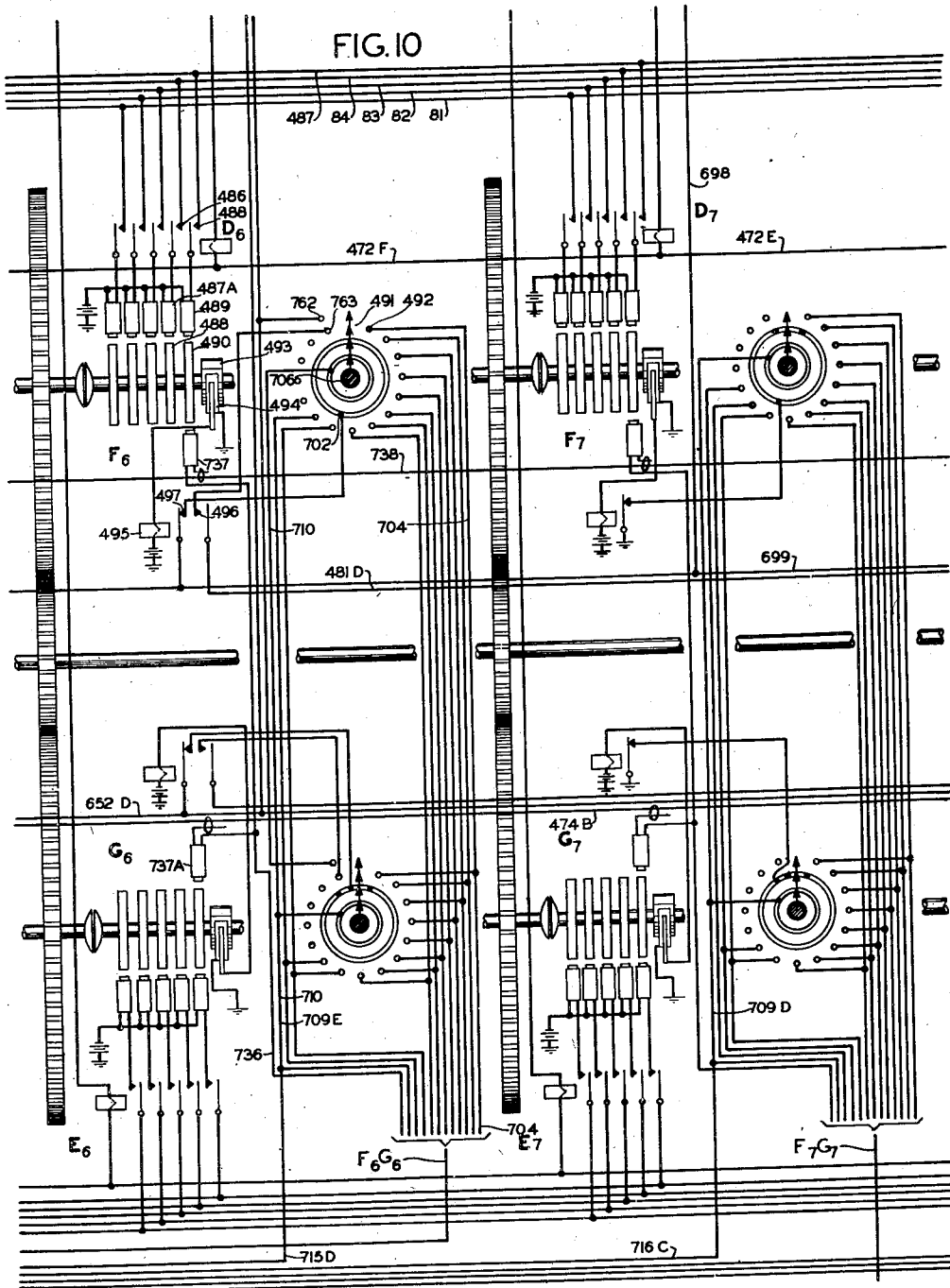
C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 10



INVENTOR
CLYDE SMITH

BY

R. C. Hoppard
ATTORNEY

July 4, 1939.

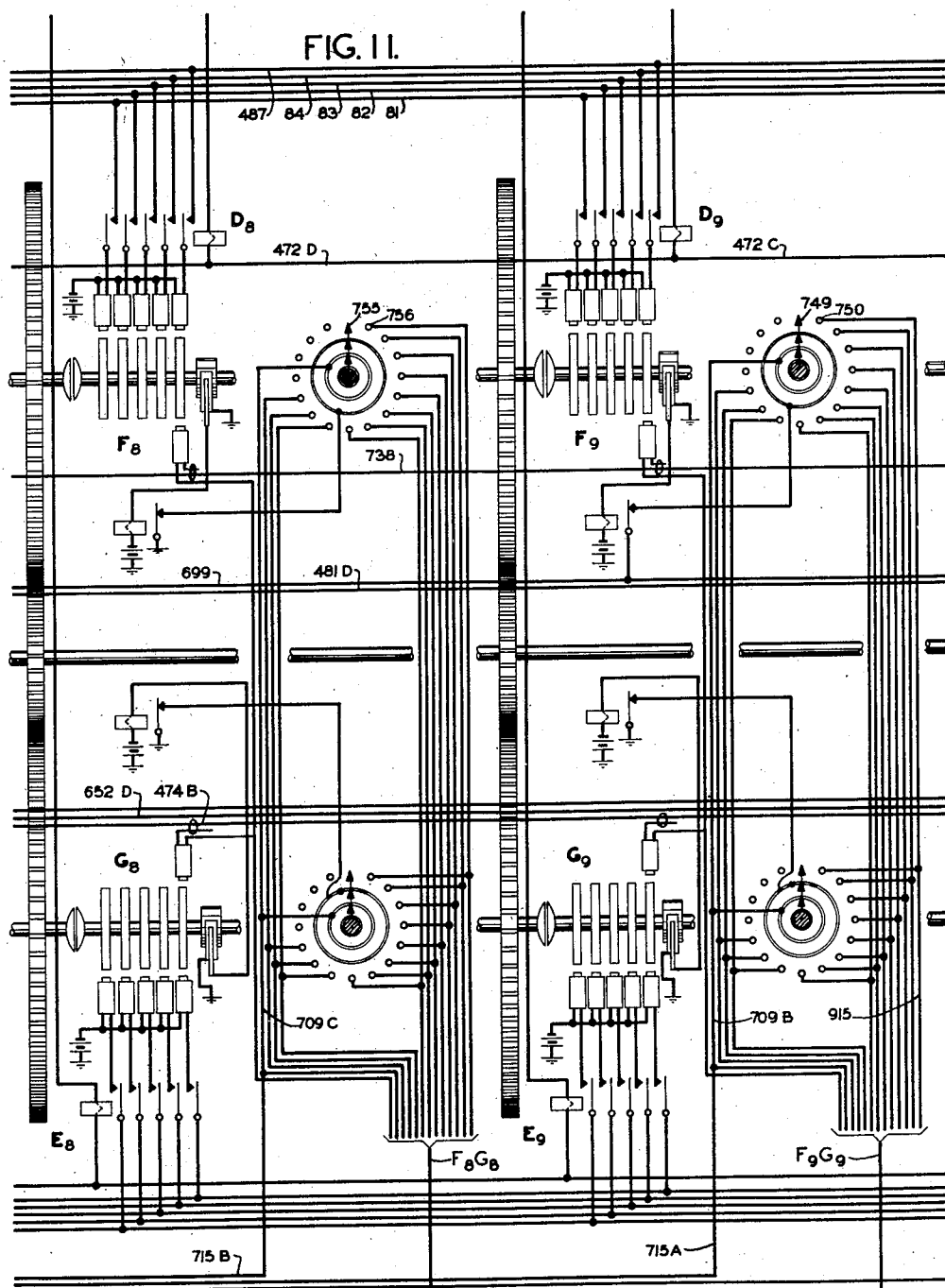
C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 11



INVENTOR
CLYDE SMITH
BY *R. C. Hopgood*
ATTORNEY

July 4, 1939.

C. SMITH

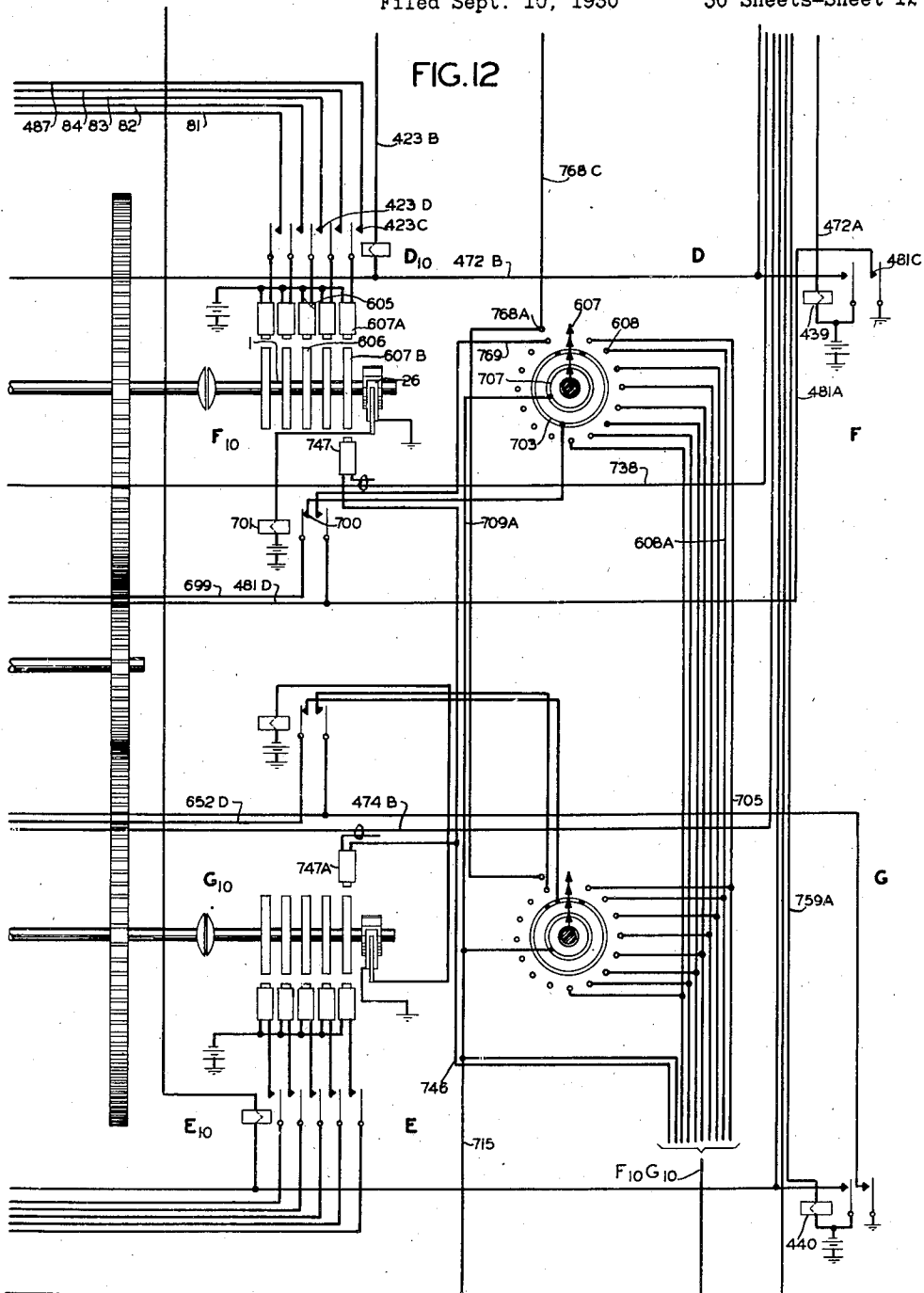
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 12

FIG.12



INVENTOR
CLYDE SMITH
BY *R.C. Hoppood*
ATTORNEY

July 4, 1939.

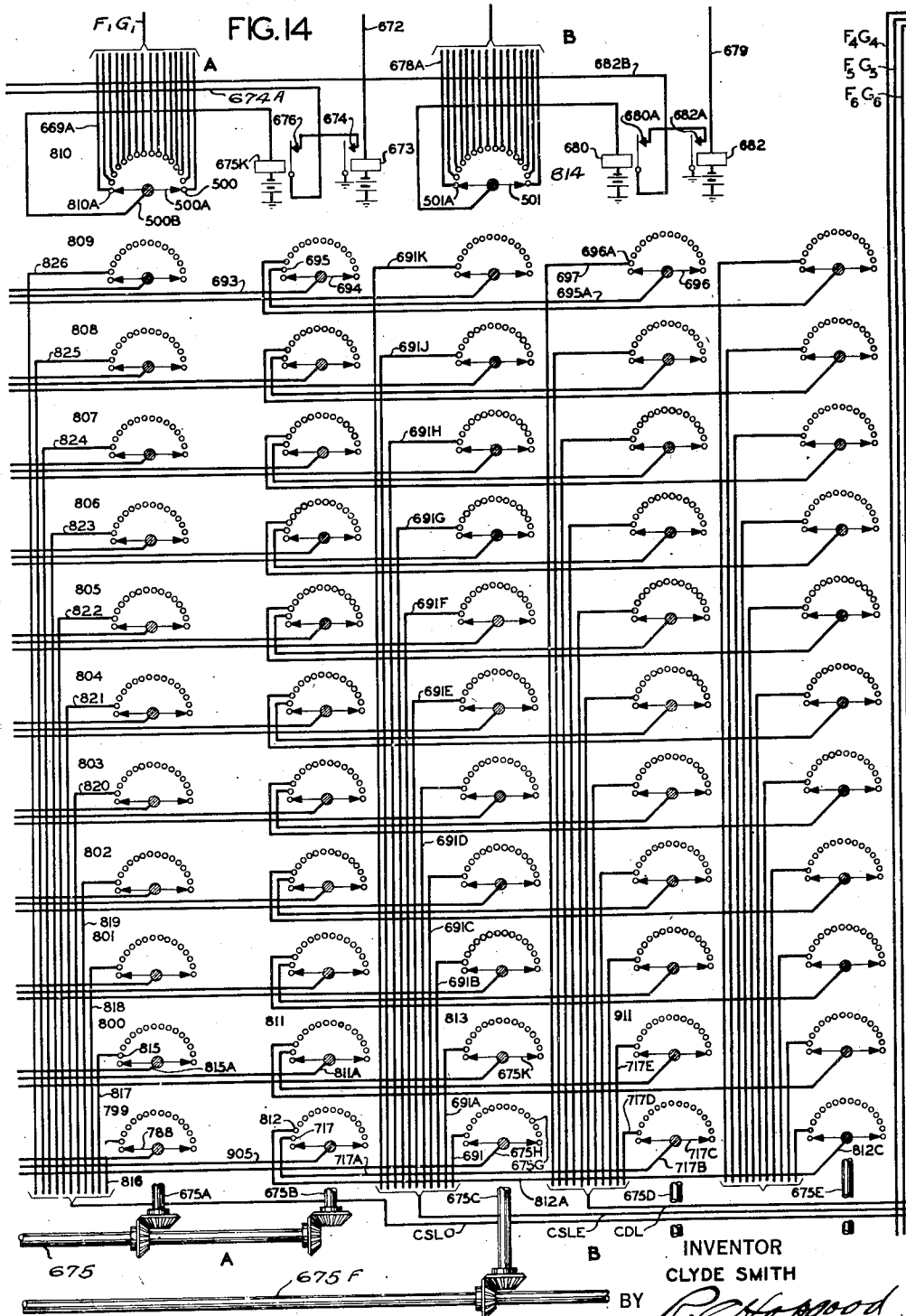
C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 14



INVENTOR
CLYDE SMITH

BY

ATTORNEY

July 4, 1939.

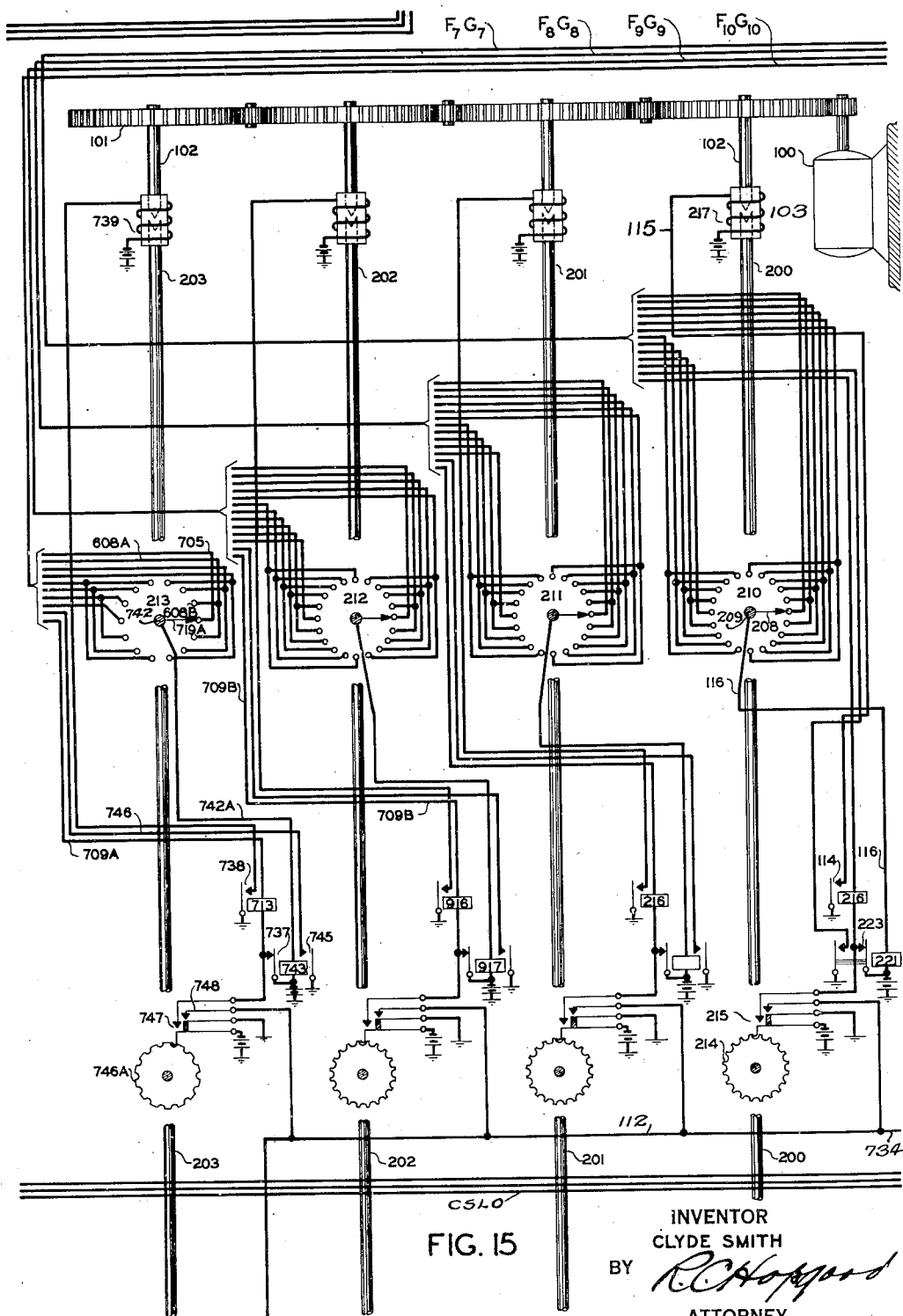
C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 15



July 4, 1939.

C. SMITH

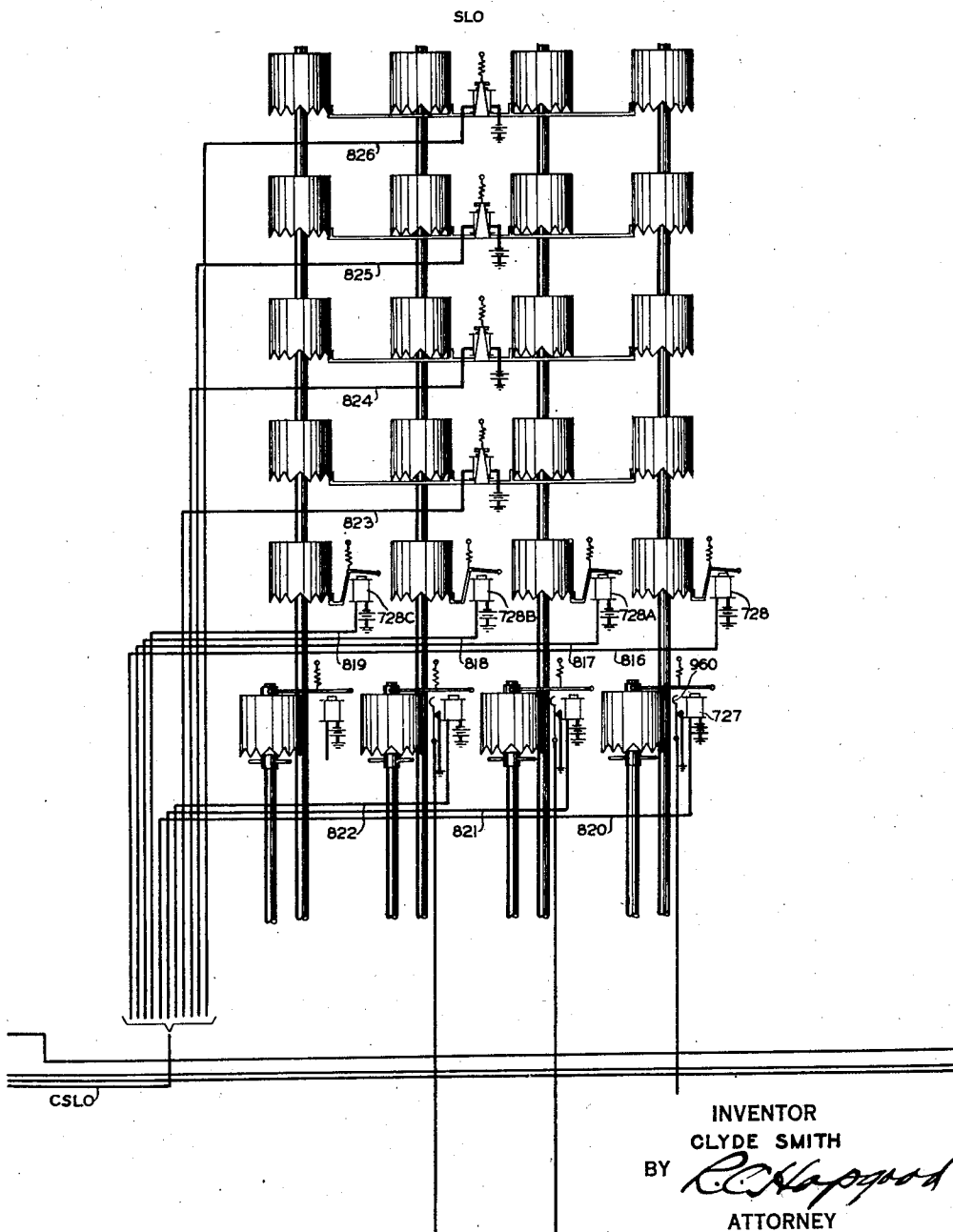
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 16

FIG. 16



INVENTOR
CLYDE SMITH
BY *R. C. Hapgood*
ATTORNEY

July 4, 1939.

C. SMITH

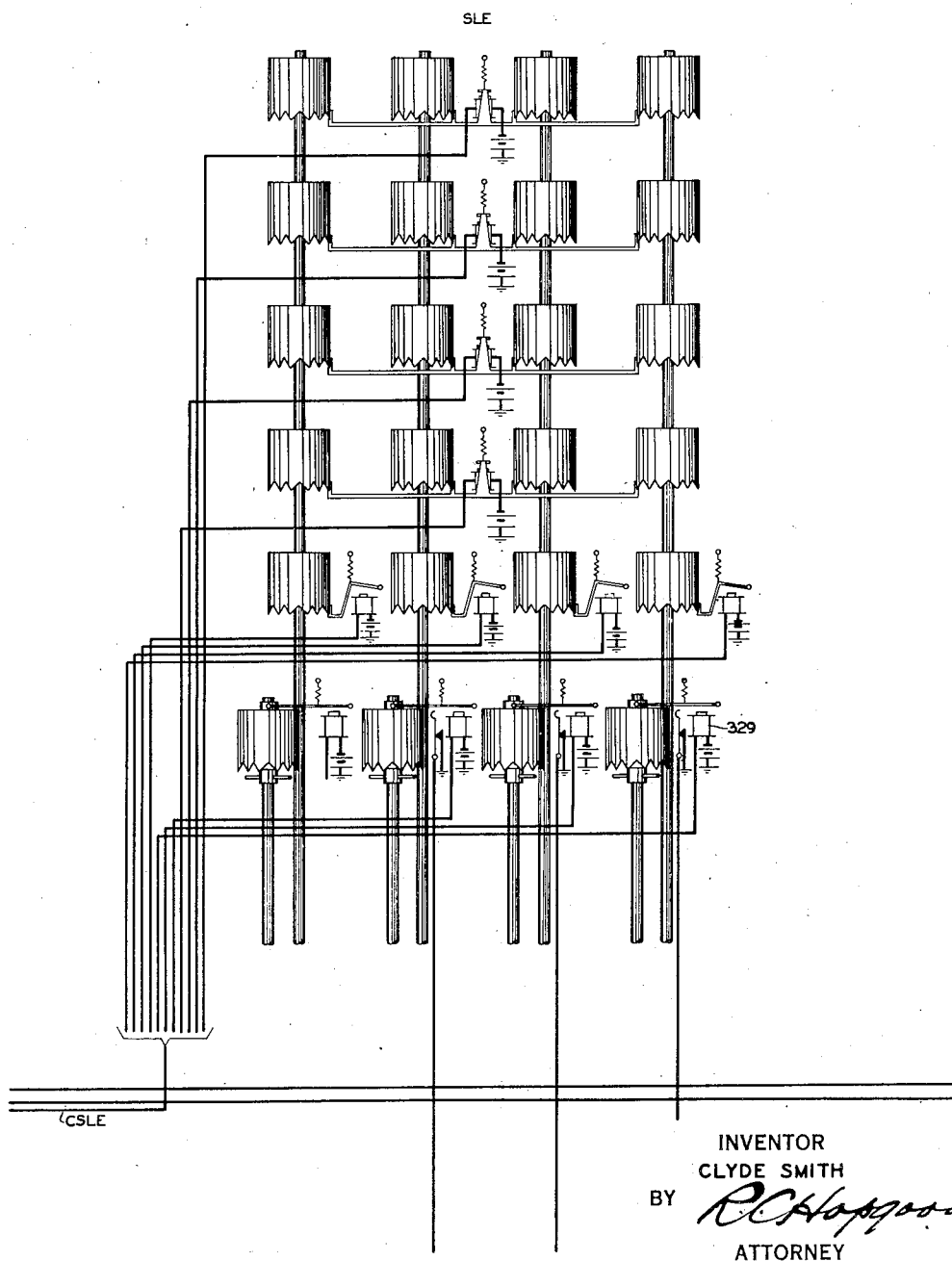
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 17

FIG. 17



July 4, 1939.

C. SMITH

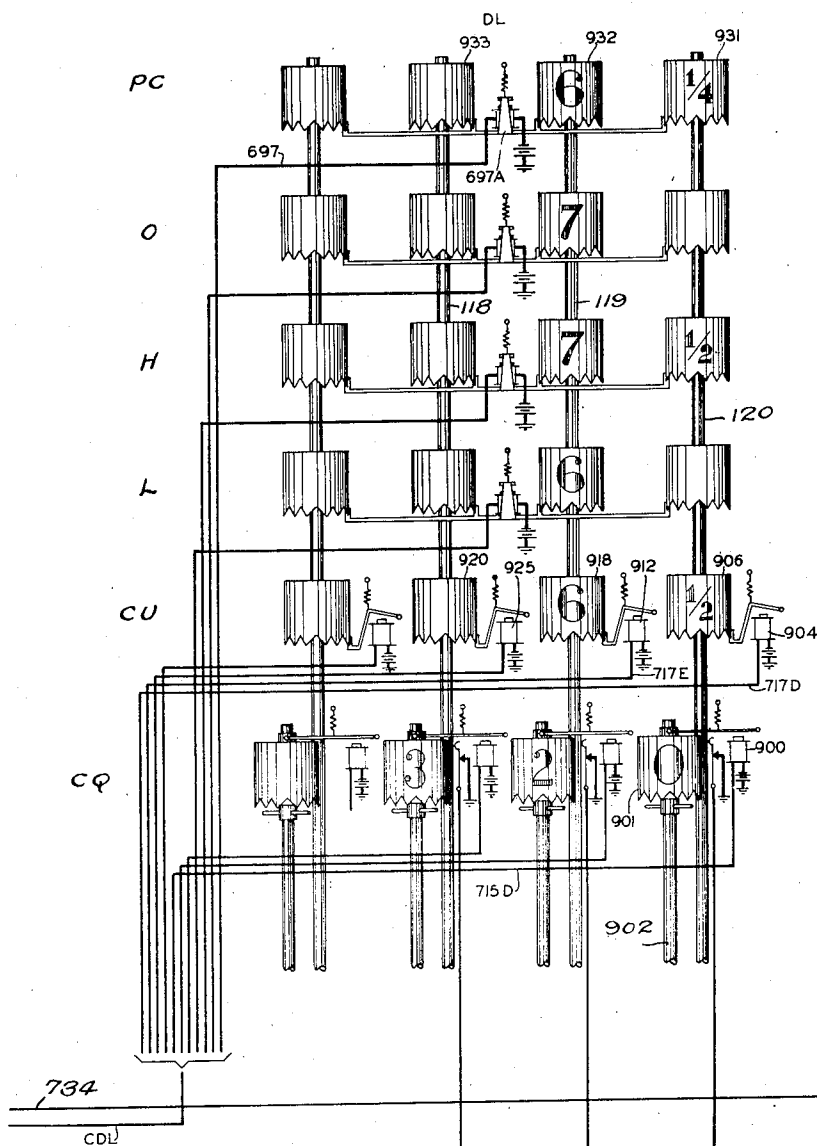
2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 18

FIG. 18



INVENTOR
CLYDE SMITH
BY *R. C. Hoppes*
ATTORNEY

July 4, 1939.

C. SMITH

2,164,956

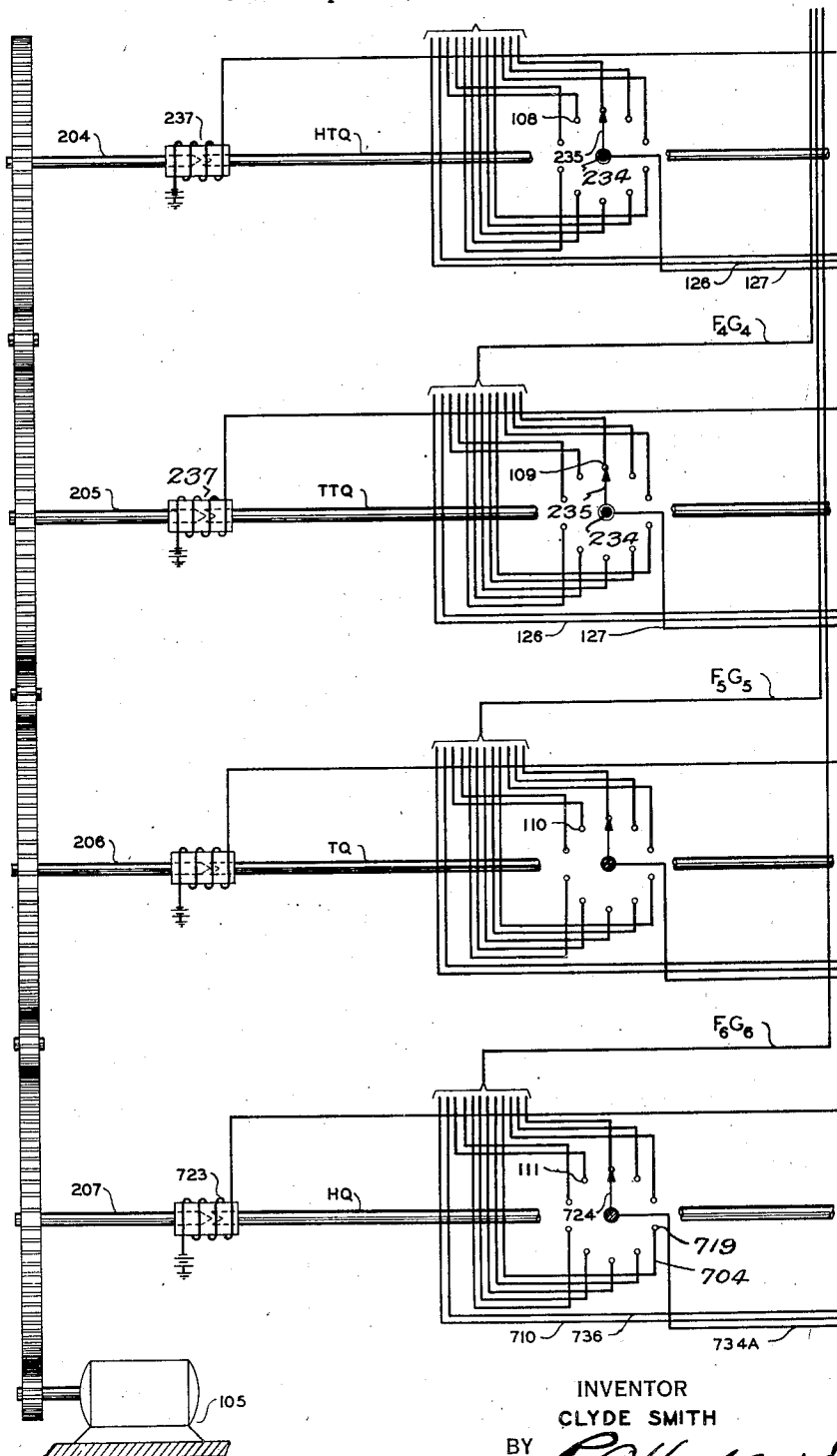
AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 19

FIG. 19

106



INVENTOR
CLYDE SMITH
BY *R. C. Haggood*
ATTORNEY

July 4, 1939.

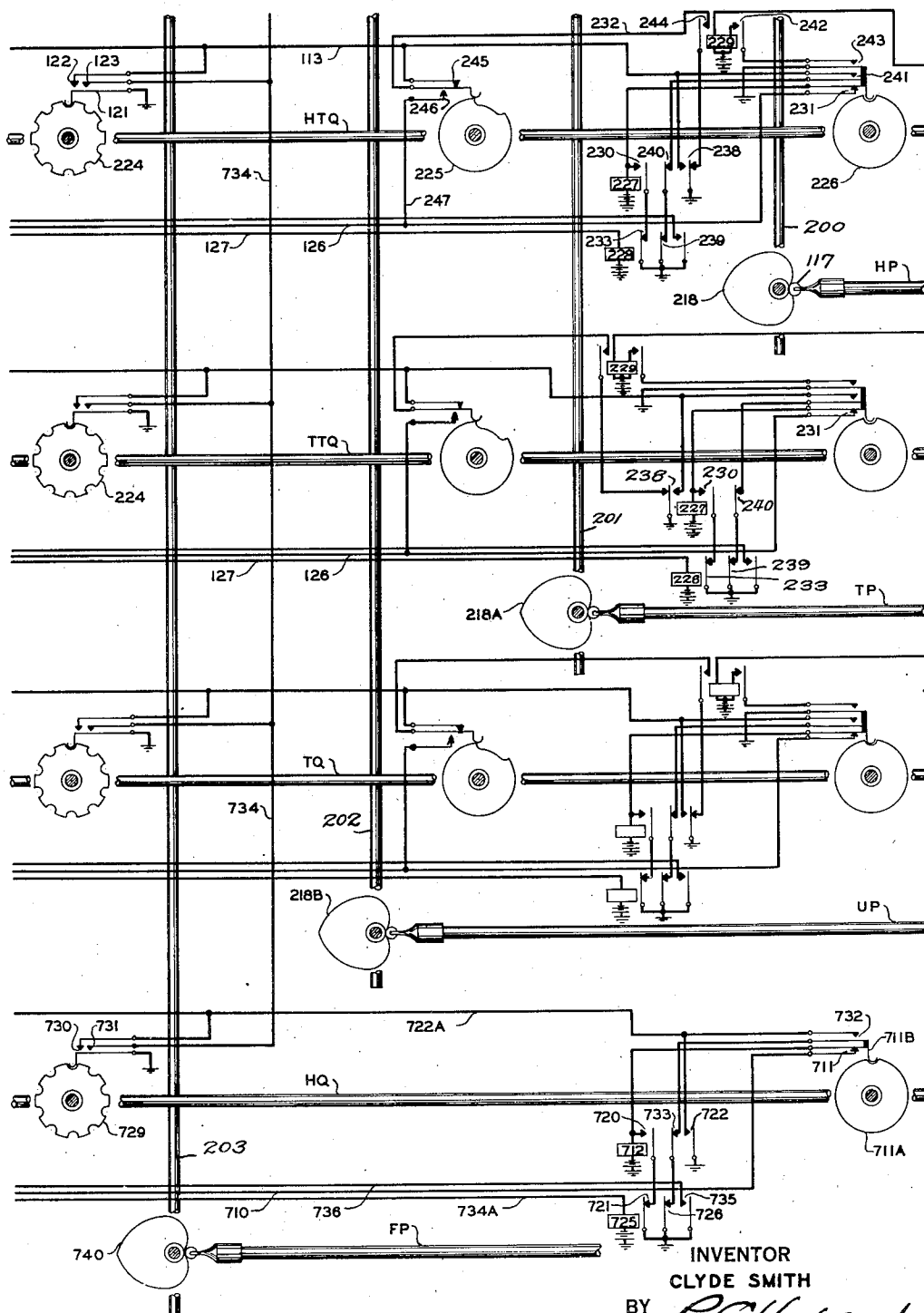
C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 20



INVENTOR
CLYDE SMITH
BY *R.C. Haggood*
ATTORNEY

July 4, 1939.

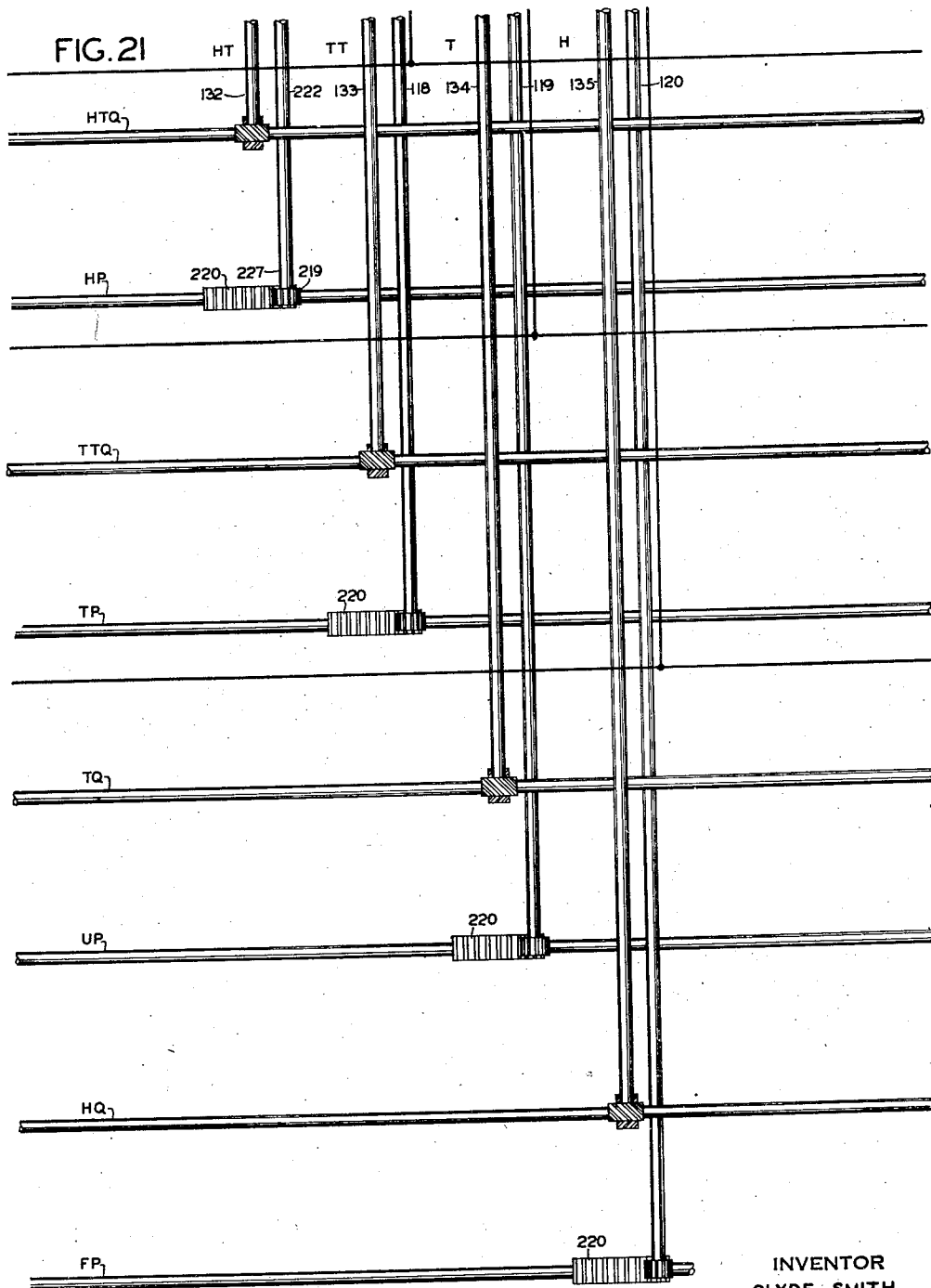
C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 21



INVENTOR
CLYDE SMITH
BY *R.C. Hoppod*
ATTORNEY

July 4, 1939.

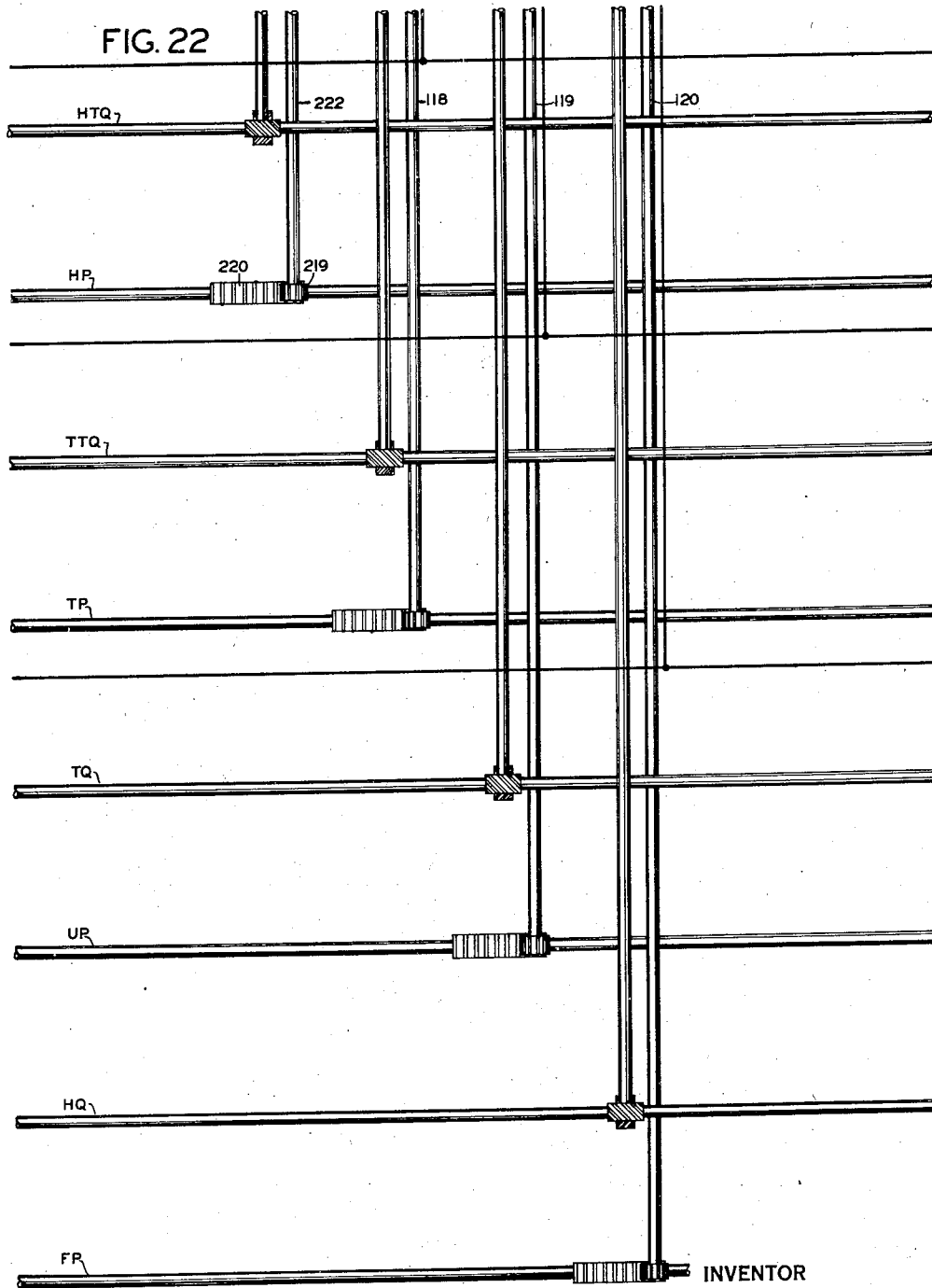
C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 22



INVENTOR
CLYDE SMITH
BY *R. C. Haggood*
ATTORNEY

July 4, 1939.

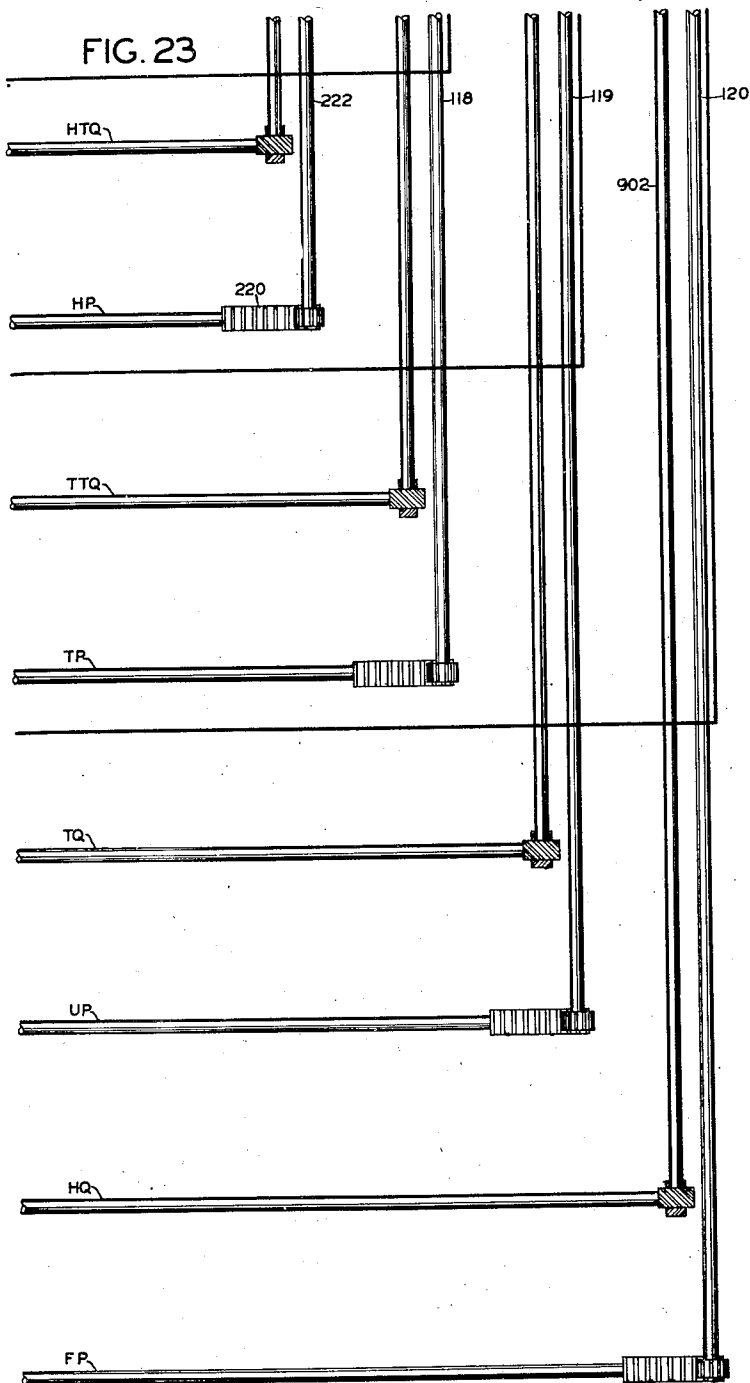
C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 23



INVENTOR
CLYDE SMITH
BY *R. H. Haggood*
ATTORNEY

July 4, 1939.

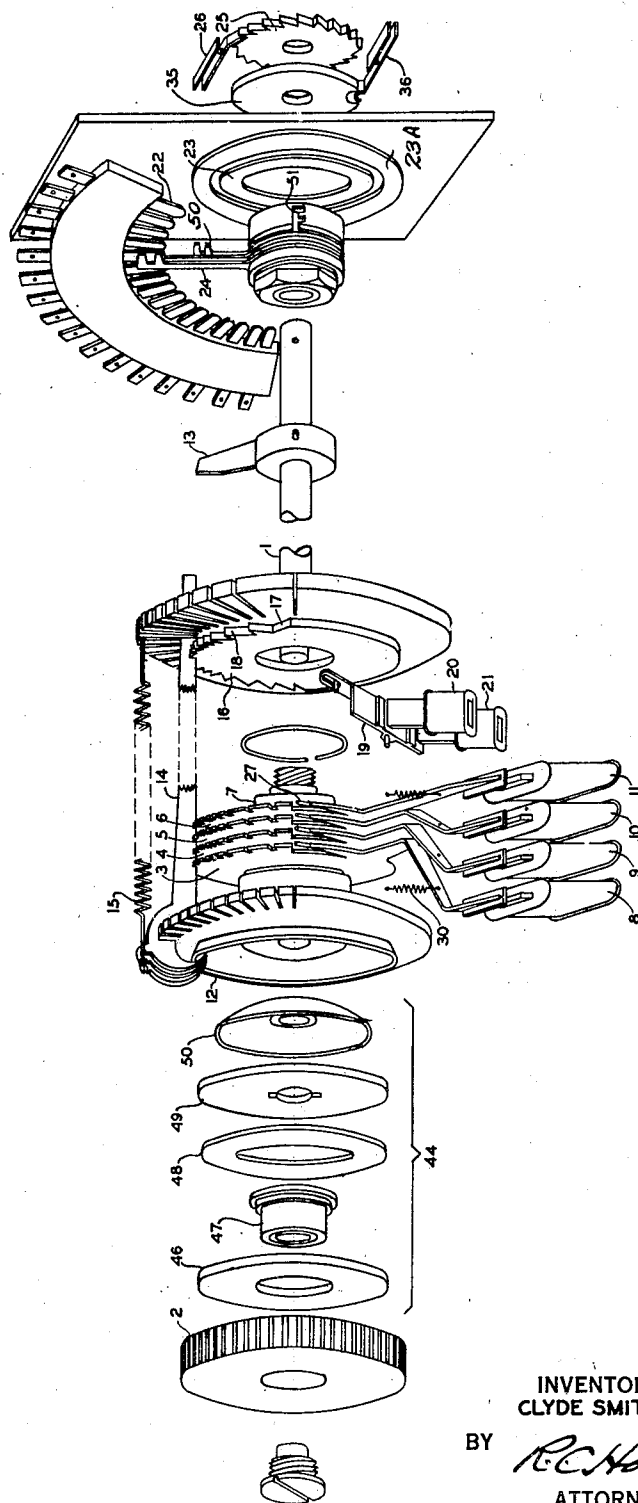
C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 24



INVENTOR
CLYDE SMITH

BY

R. C. Hoppod
ATTORNEY

July 4, 1939.

C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 25

FIG. 27

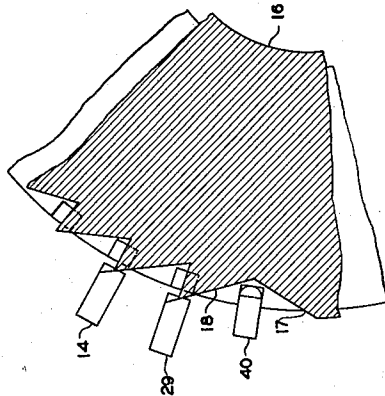


FIG. 26

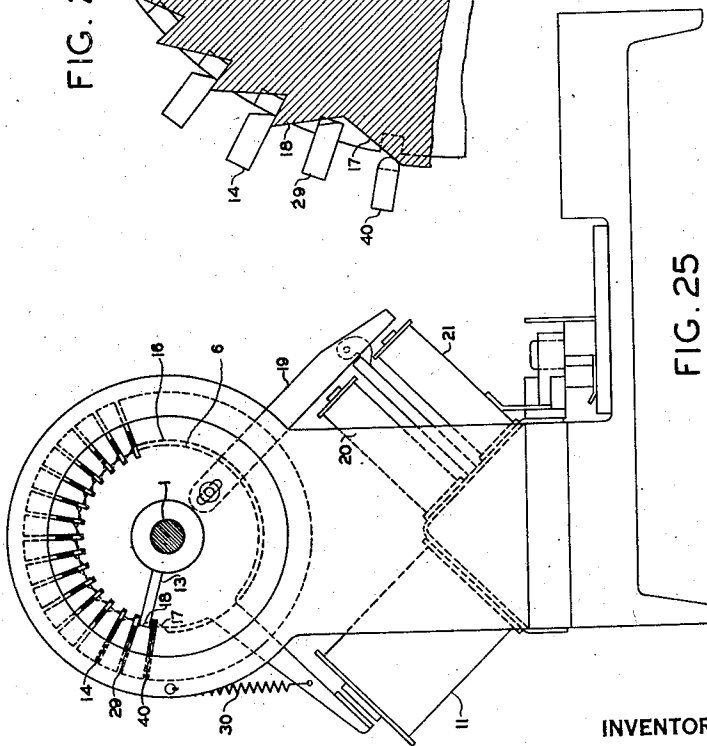
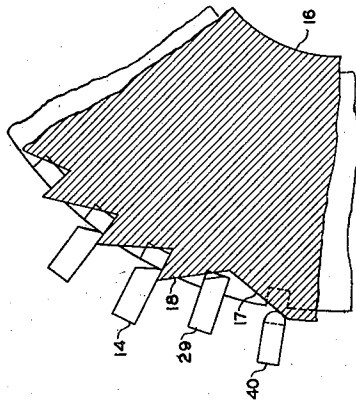


FIG. 25

INVENTOR
CLYDE SMITH

BY

R.C. Hoppood
ATTORNEY

July 4, 1939.

C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 26

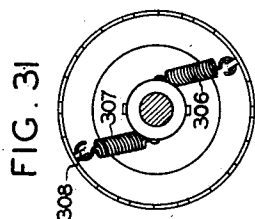


FIG. 31

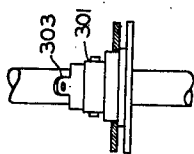


FIG. 32

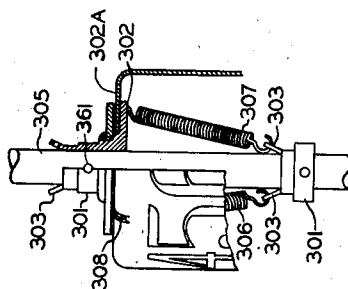


FIG. 30

FIG. 29

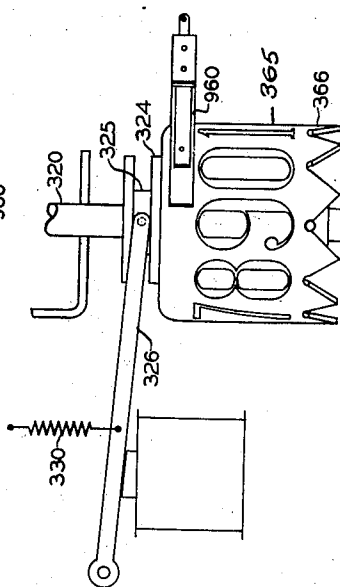
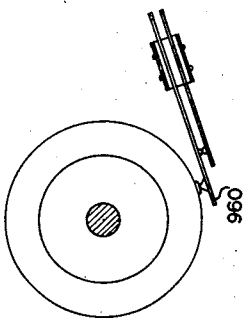


FIG. 28

INVENTOR
CLYDE SMITH
BY *R.C. Hoppard*
ATTORNEY

July 4, 1939.

C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 27

FIG. 33

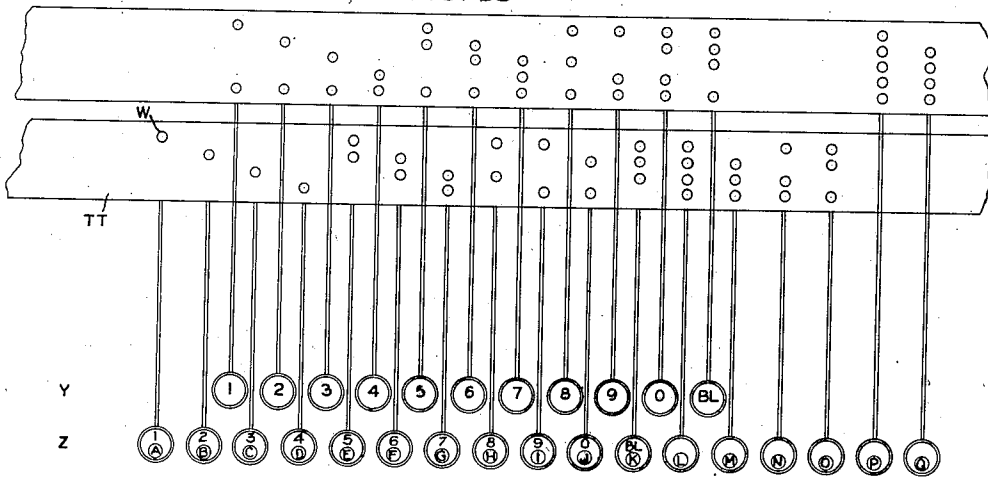


FIG. 37

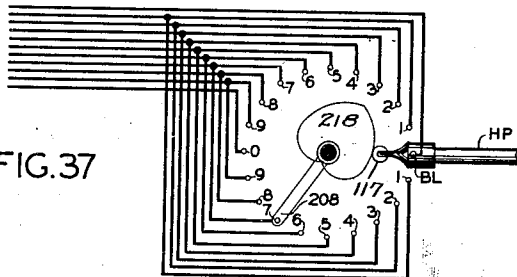


FIG. 38

FIG. 1	FIG. 2	FIG. 3	FIG. 4	FIG. 5	FIG. 6
FIG. 7	FIG. 8	FIG. 9	FIG. 10	FIG. 11	FIG. 12
FIG. 13	FIG. 14	FIG. 15	FIG. 16	FIG. 17	FIG. 18
FIG. 19	FIG. 20	FIG. 21	FIG. 22	FIG. 23	

BY

INVENTOR
CLYDE SMITH

ATTORNEY

July 4, 1939.

C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 28

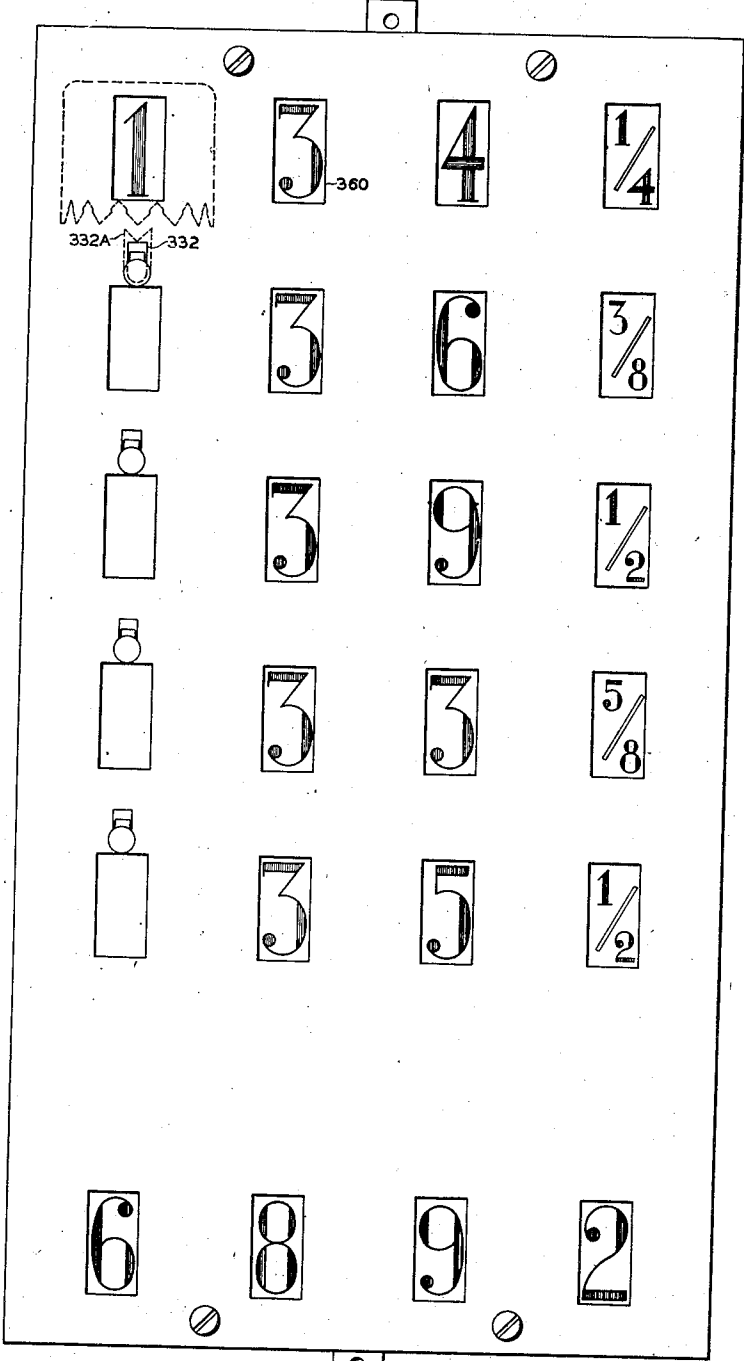


FIG. 34

INVENTOR
CLYDE SMITH
BY *R. C. Hoppood*
ATTORNEY

July 4, 1939.

C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 29

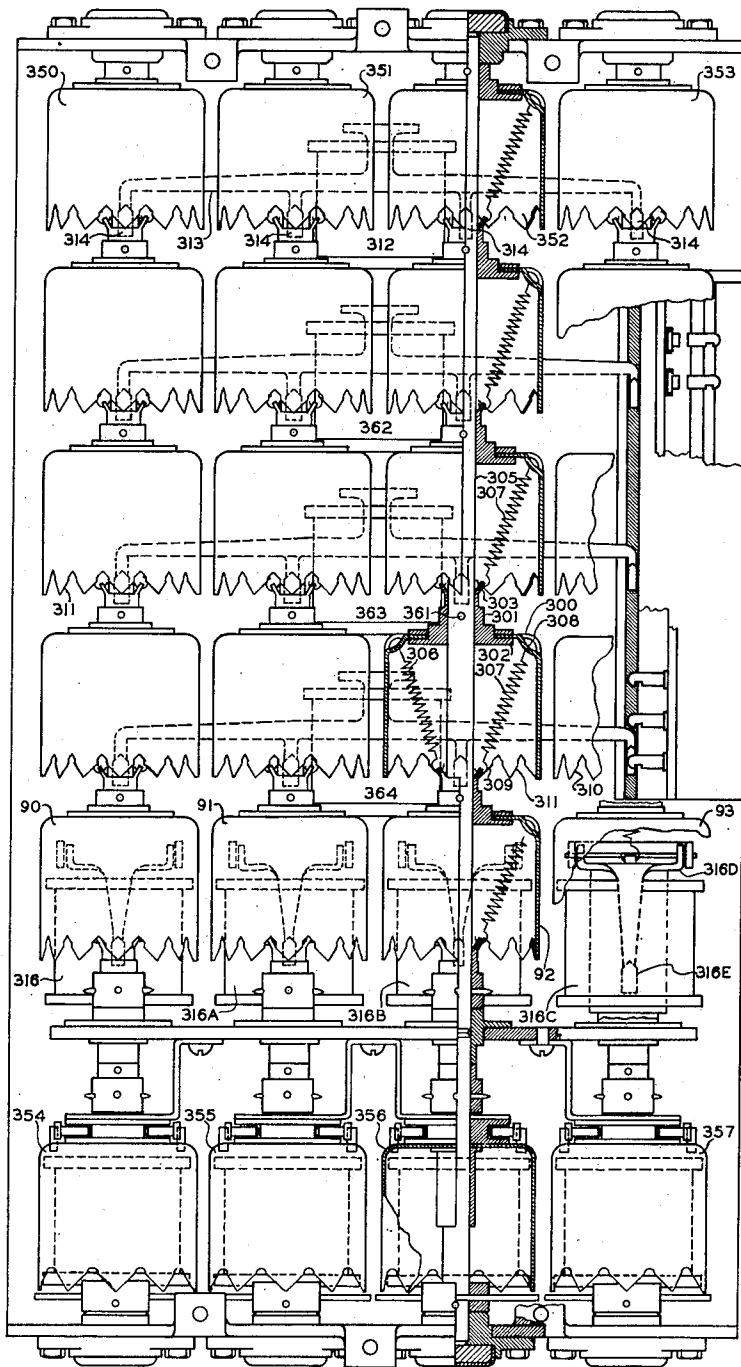


FIG. 35

INVENTOR
CLYDE SMITH
BY *R.C. Hoppood*
ATTORNEY

July 4, 1939.

C. SMITH

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Filed Sept. 10, 1930

30 Sheets-Sheet 30

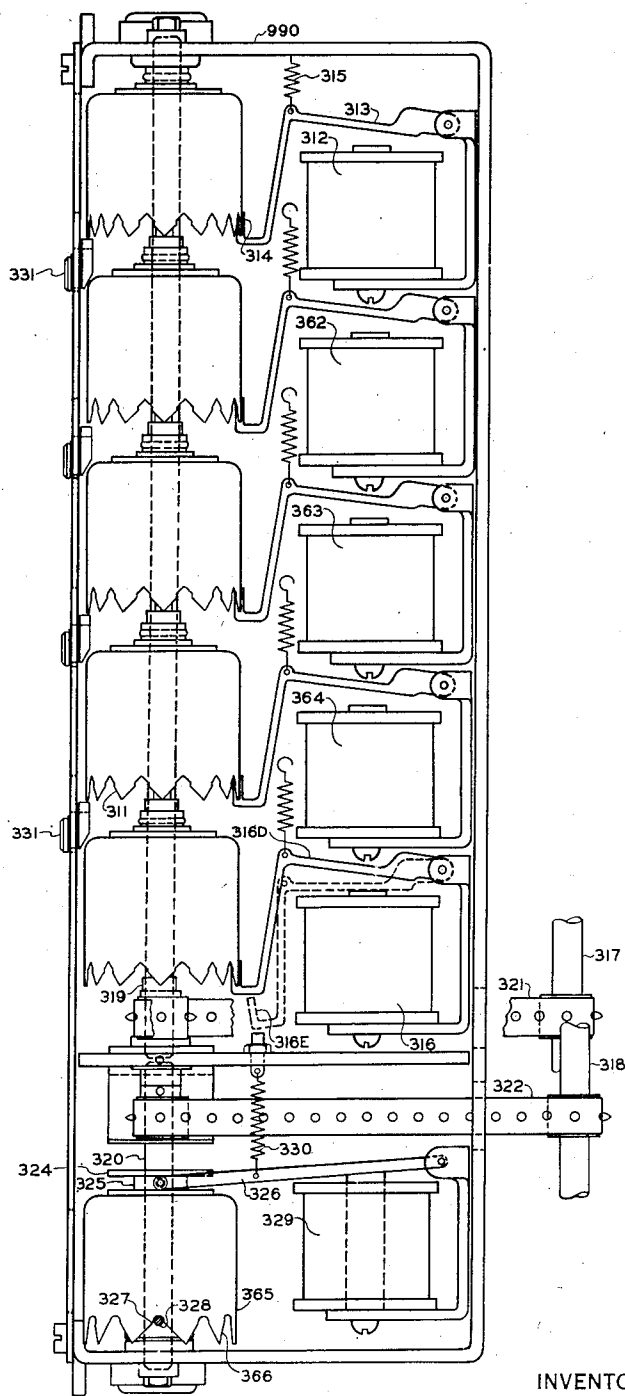


FIG. 36

INVENTOR
CLYDE SMITH
BY *R. C. Hoppood*
ATTORNEY

UNITED STATES PATENT OFFICE

2,164,956

AUTOMATIC STOCK QUOTATION BOARD

Clyde Smith, Hopkinsville, Ky., assignor, by
mesne assignments, to International Standard
Electric Corporation, New York, N. Y., a cor-
poration of Delaware

Application September 10, 1930, Serial No. 480,935

6 Claims. (Cl. 177—353)

The present invention relates to a stock or com-
modity quotation registering system and more
particularly to an automatic stock quotation
board and receiving circuit for selecting a stock
and registering price changes and accumulative
quantity of sales of the selected stock in a cor-
responding dial group or register unit generally
comprising a plurality of shelves for the previ-
ous close, open, high, low, current and quantity
quotations.

An object of the invention resides in the novel
method of and means for setting up a quotation
with a minimum amount of apparatus movement
and employing a minimum number of impulses to
effect such operation.

Another object of the invention is to provide
means for carrying out a full range of selections
with a minimum number of impulses, namely, to
select a stock, shelf, quantity and price or alter-
natively select such portions of a register unit
as need be operated.

Another object is to provide a novel receiving
circuit of simple design operated from a central
transmitting point to set up circuits to select the
stock, shelf, quantity involved in each transac-
tion and the price change.

Broadly speaking, there are ten different selec-
tions possible with the receiving circuit of the
present invention: two for selecting the stock
to be price changed, one for shelf, three for
quantity and four for price. Seldom are all used.
In actual practice three selections will probably
be the average.

A feature of the invention is to provide a plan
of operation for registering successive quotations
on the same stock, whereby the full price is trans-
mitted and registered on the dials on the previous
close shelf and the open, high and low shelves
and only so much of the quotations as may be
significant are posted in the current price shelf.
In previous systems, new current quotations re-
quired the full price to be sent. With the present
system there is no need to send the hundreds and
tens digits of the price unless it be the changing
figure and not then except to show the unthink-
ing observer that the hundreds or tens figure, as
the case may be, has changed. It is obvious that
this feature effects an appreciable saving in time
and apparatus movement over previous systems.

More particularly, another object of the inven-
tion comprehends means for nominating the steps
to be made in certain quotations and then sending
only such pulses as may be needed, as against
always sending the maximum number of pulses

and repositioning the unchanging dials to their
original position.

In my earlier application for an automatic
stock quotation board, Serial Number 398,634,
filed October 10, 1929, the plan described for se-
lecting a stock to be price changed by the single
letter odd, even and the double letter method of
selection is adhered to in carrying out the opera-
tion of the present invention, as it affects great
savings in apparatus, time and movement of ap-
paratus.

With this plan of selection a greater number
of stocks can be selected with single letter than
there are letters in the alphabet, and a far greater
number of stocks can be selected with two letters
than are actively traded in. The most popular
stocks will be selected by a single letter, no matter
what the ticker designation may be. As the
twenty most popular stocks will often account
for more than fifty percent of the transactions,
this method of selection offers real savings in
sending time and movement of apparatus.

Another feature of the invention is to transmit
a plurality of quantities as 5.6.4.3.9 on a pre-
selected stock with maximum of four selecting
pulses for each operation. The series of quanti-
ties set out represent respectively 500, 600, 400,
300 and 900 shares.

For a preselected stock, a transaction as
5.6.4.3.9.¾, with a significant price change in
the fraction of the last sale, is effected with a
maximum of four selecting pulses for the first
four sales and five for the last sale to nominate
the fraction of the last sale, and to set the frac-
tion dial to three quarters, a maximum of four
selecting pulses may be utilized. That is to say,
where no nominating operation is to be made,
as in the case of registering hundreds in the
quantity only without a subsequent price change,
a maximum of four selecting impulses may be
used. Where, however, in selecting the hun-
dreds quantity, it is also necessary to nominate for
a price change to be made in the fraction of the
price, then a maximum of five selecting impulses
may be used. In other words, to set up the quo-
tation 5.6.4.3.9.¾, a maximum of four impulses
for each of the first four sales may take place,
a maximum of five for the last quantity to
nominate the price, and a maximum of four
selecting pulses to effect registration of the ¾,
making a total of twenty-five pulses for the en-
tire group of five quotations, if all selecting pulses
in each group are used. This type of quotation
is often found during the course of a day's trans-
action.

In accordance with the invention, the system includes permutation devices or selectors which respond to the line pulses and translate the coded pulses to an arithmetical count, setting up circuits to position the stock selectors and actuate the quantity and price dial shafts to predetermined positions. Also provision is made for receiving line impulses of subsequent quotations while the stock selectors and dial shafts are in motion, thus providing what is commonly called "overlap" operation. To this end, two sets of permutation devices are provided, so arranged that they are used alternately. In other words, one set operates the dials to display one quotation while the other set stores the next subsequent quotation, each set being used alternately for receiving and for controlling the dials, so that it is not necessary to interrupt the transmission of quotation signals over the line to allow time for setting the dial shafts, etc.

Another feature of the invention is to register and display the accumulative total of the number of shares sold of each stock. Previously, quotation boards displayed prices only, without indicating to the observer the quantities involved in the transaction, whether it be in 100, 1,000, 10,000, etc. share lots. Obviously, it is of fundamental importance to all concerned to have knowledge of the number of shares involved in each transaction and to know from minute to minute the accumulative total of the number of shares sold of each stock.

Accordingly, the invention contemplates the provision of four quantity dials for each stock dial group or stock register unit for registering accumulatively quantities up to 999,900 shares, that is, as each transaction occurs it is added to the quantities of the previous sales.

Only those quantity dials that need be quantity changed are operated. Where, for example, in a transaction involving 500, 5,000 or 50,000 shares, only the 5 is transmitted, all other quantity dials of an order lower than the one to be advanced 5 steps remain unchanged. It is thus seen that the means employed for registering quantity is extremely simple from a cost, mechanical and transmission standpoint.

More particularly, another object is to provide a novel carry-over on the quantity dials whereby a quantity shaft of a next succeeding higher order may receive a full step, due to the operation of the adjacent quantity dial of the next lower order having electrical means for initiating the operation of said carry-over, comprising circuit closing means including a relay and cam for grounding said circuit momentarily and energizing a clutch magnet to insure a full step of said shaft of the next higher order.

Apropos of the means providing carry-over registrations, an important feature in this connection is the time that the carry-over is effective, which is from the ninth to the tenth position of the driving shaft. Assume, for example, that the totalizer wheels stand at 548(00) and that 55(00) is transmitted, both the thousands and hundreds quantity shafts take motion, the 5 in the hundreds causes the hundreds dial to change from 8 to 3. However, in passing from 9 to 0, the hundreds dial causes a contact to close and energize a transfer relay associated with the thousands quantity shaft. The thousands shaft also takes motion and changes the thousands dial from 4 to 9. Through the operation of the closed contact of the hundreds dial, the thousands shaft received an additional step,

positioning the thousands dial to register 0. Likewise in passing from 9 to 0, the thousands dial operated a contact, causing the ten thousands shaft to take an additional step and the operated ten thousands dial registers 6.

In attaining another object of the invention, the system provides price dial driving mechanism of simple design for positioning the main price shafts with a minimum of power. A selected price shaft takes motion and then moves but a scant distance only. Where, for example, a price shaft stands at 8 and an operation is effected that calls for 9, the shaft is advanced one step, or one eleventh of a revolution. If the next operation calls for 7, the shaft is advanced from 9—0—9—8—7, that is, four elevenths of a revolution.

For effecting price changes with this time movement and power saving feature, a heart shaped shaft positioning cam is utilized, having two faces and two positions for each character on the dial except blank and zero, the highest and lowest points. The heart shaped cam moves only in one direction for positioning an associated main price dial shaft forward to a higher order of numbers if the advance is upward as from 1 to 9, and backward if the movement is downward as from 9 to 1. With this arrangement and the novel design of the price dial, the dial shaft never makes a complete revolution.

Where transactions are in less than 1,000 share lots with the price change only in the fractions, only two shaft movements will be necessary for a preselected stock. For example, where a quotation reads as 9.5/8, that is, 900 shares with the price change in the fractions, the hundreds quantity and the fraction positioning shafts only need be operated. Seldom, with the present system, will all the four price dial positioning shafts take motion.

The invention is designed to employ a stock selecting unit of simple, inexpensive design which comprises a well known "rotary" type of clutch to position the wiper shafts, and in practice two switch units are provided to effect connection from the receiving circuit to the selected dials. Either one of the two units may be used independently of the other to effect stock selection, that is, for single letter stocks, or both units may be jointly used to cover a wider range of selection for double letter stocks. When so used the second unit does not trunk hunt and is not dependent upon the first unit reaching its selected position before the second unit takes motion.

Accordingly, this method of selection permits a wide range of stock selection with a small number of impulses, the pulses being sent on the basis of a five unit code and translated by means of permutation devices or selectors to an arithmetical count, which in turn positions a stock selector at a point corresponding to the register setting of the associated permutation device. In practice it may be advisable to mount the stock selectors on a rack remote from the board room and protected from dust and mechanical injury by suitable metal covers.

Another object of the invention is in the provision of novel quantity and price dials. In a register unit there are twenty price dials arranged four to a shelf for registering hundreds, tens, units and fraction price changes. There are five price shelves, one each for previous close, open, high, low and current price quotations respectively. The first four mentioned shelves

are infrequently operated. The price dials of the current shelf are more frequently operated. Each register unit also includes four quantity dials for indicating total quantities.

5 Another object of the invention provides means for operating the price dials whereby the latter respond to spring tension caused by the positioning shaft movement.

10 Another object is to provide each character of a price dial with an aligning tooth to permit a tolerance in either direction in positioning the shafts. These teeth will insure that the characters will always be centered in their windows.

15 Still another aspect of the invention is to connect the quantity dials or registers of a dial group to their corresponding quantity positioning shafts at the beginning of a revolution, if selected, and to disconnect the selected quantity dial from its shaft during the course of a revolution of the latter, concomitantly stopping said shaft, momentarily maintaining the selected dial in its new registering position and permitting the selected quantity shaft to pick up power and complete the revolution and return to normal or zero position.

20 In the accompanying drawings, there is shown for purposes of illustration the preferred arrangement of the present invention, disclosing a layout of a system for operating a plurality of register units, it being understood that the drawings show by way of example only one of the many embodiments of the invention wherein,

25 Fig. 1 is a portion of the receiving circuit illustrating, inter alia, the receiving distributor, the nominating relays, control relays for a single letter odd stock selection and a group of control relays for connecting the receiving circuit with one set of stock permutation devices, together with a schematic illustration of the transmitting keyboard or tape transmitting device shown connected with the line relay of the receiving circuit.

30 Fig. 2 shows the control relays for single letter even stock selection, control relays for shelf selection and a guard relay for the nominating and stock control relays.

35 Fig. 3 illustrates the control relays for the hundred thousands and ten thousands quantity and an associated guard relay.

40 Fig. 4 is a view of the control relays for the hundreds quantity and hundreds price and the guard relays for removing ground from wipers of the selected quantity and price permutation devices of a set until the stock selection terminates.

45 Fig. 5 illustrates the price control relays for the tens, units and fractions.

50 Fig. 6 is a view of the final guard relay for the quantity and price control relays, together with a group of relays for controlling the selection of a set of permutation devices for quantity and price, and a pair of relays for preparing a circuit for associated quantity and price permutation devices.

55 Fig. 7 is a portion of the receiving circuit showing schematically corresponding permutation devices of the two impulse recording sets for single letter odd stock selection.

60 Fig. 8 shows corresponding permutation devices for single letter even stock and shelf selection.

65 Fig. 9 shows corresponding permutation devices for hundred thousands and ten thousands quantity selections.

70 Fig. 10 is a view of corresponding hundreds quantity and price permutation devices.

Fig. 11 illustrates corresponding tens and units permutation devices.

Fig. 12 shows the corresponding permutation devices for fraction selection in the price.

Fig. 13 is a portion of the circuit illustrating the shift relays for a single letter odd and single letter even stock selection, and also, in schematic form, the driving mechanism for the stock switch selectors.

Fig. 14 is a fragmentary and schematic view of the stock selector switches.

Fig. 15 is a schematic broken view of the price shafts and associated distributors, together with relay means for starting and stopping the shafts at predetermined positions.

Fig. 16 is a schematic view of a dial group or register unit for a single letter odd stock.

Fig. 17 also illustrates a register unit schematically for a single letter even stock.

Fig. 18 is a view schematically illustrating a register unit for a double letter stock.

Fig. 19 is a schematic and broken view of the quantity main shafts and associated distributors.

Fig. 20 is a broken and schematic view illustrating the quantity shafts with associated relays, and additionally disclosing fragmentary portions of the main price positioning shafts and respective heart shaped cams to facilitate the setting of the main price position shafts laterally, either forwardly or backwardly.

Figs. 21, 22 and 23 show the system of shafting comprising main and common quantity and price positioning shafts for respective dial driving shafts of the several register units.

Fig. 24 is a schematic view illustrating in perspective one of the permutation devices of the recording sets, however only such parts thereof necessary for descriptive purposes being disclosed.

Fig. 25 is an end view in elevation, partly in section, of one of the permutation devices, however, without disclosing the common conductors.

Fig. 26 is a fragmentary view of a permutation device illustrating the set and reset disc in section and one of the stop arms in a selection position.

Fig. 27 is a view similar to Fig. 26 disclosing the zero stop arm in the neutral position of the set and reset disc.

Fig. 28 is a view in elevation of the quantity dial showing the operating mechanism therefor.

Fig. 29 is a plan view, partly in section, of one of the quantity dials showing the carry-over contact closing means.

Fig. 30 is a fragmentary view in elevation illustrating a price dial and showing the interior mechanism.

Fig. 31 is an underneath view of the price dial showing the interior mechanism.

Fig. 32 is a fragmentary view illustrating the collar fixed to a price shaft providing a bearing for an associated price dial.

Fig. 33 is a schematic view of the transmitting keyboard.

Fig. 34 is a front broken view in elevation of a panel board for a register unit.

Fig. 35 is a front view in elevation of a register unit with the front panel thereof removed showing a few of the dials broken away, and partly in section to illustrate the interior mechanism of the dials.

Fig. 36 is a transverse view of a register unit and also disclosing in fragmentary form the quantity and price dial driving shafts.

Fig. 37 shows the plan of a cam for driving the price shafts, the arrangement of contacts and fragmentary portion of a wiper.

Fig. 38 is a diagrammatic view, illustrating the

arrangement of views of the transmitting means and receiving circuit above briefly described.

Referring to the drawings, the price dial driving mechanism includes motor 100 (Fig. 15) suitably connected to gears as 101 for driving the several stub shafts 102 associated with the several price shafts 200, 201, 202 and 203. Each of the stub shafts 102 and associated price shafts comprise a clutch schematically illustrated and broadly denoted 103, each of which includes a solenoid as 217 which, if energized, actuates a corresponding price shaft to predetermined positions corresponding to the duration of energization. Shafts 200, 201, 202 and 203 are respectively associated with the main price dial positioning shafts HP, TP, UP and FP (Figs. 20, 21, 22 and 23), that is, the hundreds price, tens price, units price and fraction price dial positioning shafts, in a manner hereinafter set forth.

The driving mechanism for the quantity shafts includes motor 105 (Fig. 19) for driving the gear train generally designated 106, actuating stub shafts 204, 205, 206 and 207. Each of the quantity stub shafts includes a magnetically controlled clutch as 237 for setting associated main quantity driving shafts, that is, the hundred thousands quantity shaft HTQ, the ten thousands quantity shaft TTQ, the thousands quantity shaft TQ, and lastly the hundreds quantity shaft HQ to predetermined positions depending, of course, upon the duration of energization of their respective clutch solenoids.

Each of the main quantity and price shafts carries a wiper as 208 (Fig. 15) which serves to establish contact between collector rings as 209 and the several contacts as 210 arranged in a circle and fixedly mounted on a stationary base plate. These contacts are for the purposes of setting up a circuit to stop the several shafts at a selected position. As illustrated, the price contact groups 210, 211 and 212 each include twenty contacts and the fraction group 213 contains fourteen contacts. The quantity groups 108, 109, 110 and 111 (Fig. 19) each comprises ten contacts.

To insure a full step on each shaft movement to take care of such variations in voltage and mechanical adjustment that arise in practice, the price and quantity shafts each include a guard circuit as 112 (Fig. 15) associated with the price shafts and a guard circuit as 113 (Fig. 20) associated with the quantity shafts. Included in the several guard circuits for the price shafts is a cam or ratchet wheel 214 (Fig. 15), a guard contact 215 and a start relay as 216. Guard contacts 215 are so adjusted that they close at the beginning of each step and open at the completion of each step of their corresponding shafts, to hold energized clutch magnets as 217 through closed contact 114 and grounded conductor 115. Stop relays as 221, if energized, disable their associated start relays as 216, opening contact as 114 which removes ground from conductors as 115 and deenergizes their associated clutch magnets. Stop relays as 221 are energized when corresponding wipers as 208 find the busy contact, that is, a selected contact of groups as 210, grounding a respective collecting ring and conductor as 116 to energize stop relay 221, opening contact 223, causing start relay 216 to deenergize which in turn opens contact 114, disabling its corresponding clutch magnet after having set the shaft to a predetermined position.

Associated with each of the price shafts 200, 201, 202 and 203 and suitably mounted thereon is a cam as 218 (Fig. 20), preferably heart shaped,

for setting the hundreds, tens, units and fractions price dial positioning shafts HP, TP, UP and FP laterally in either direction, and in practice, a suitable spring or double acting cam may be employed for holding these shafts against contiguous heart shaped cams.

Each of the main horizontal price positioning shafts include a plurality of racks as 220 (Figs. 21, 22 and 23) to which are geared corresponding vertical price dial shafts as 222 of the several register units generally denoted SLO, SLE, DL (Figs. 16, 17 and 18), that is, the price dial shafts of the several register units, either for single letter odd or even, or for double letter stocks, include a pinion as 219 (Figs. 21, 22 and 23) operatively connected or in mesh with a corresponding rack 220 of an associated main price dial positioning shaft. Secured to the main price positioning shafts HP, TP, UP and FP and co-acting with the periphery of the heart shaped cams 218 are rollers as 117 (Fig. 20). Any movement of the hundreds price shaft 200 (Fig. 15) causes cam 218 (Fig. 20) to move the corresponding horizontal shaft HP laterally which in turn through its racks and pinions sets the vertical dial shafts as 222 (Figs. 21, 22 and 23) to predetermined positions.

In like manner, corresponding price dial driving and positioning shafts as 118, 119, 120 of the several register units may be set to predetermined positions corresponding to the selected positions of their respective price shafts 201, 202 and 203 (Fig. 15) respectively.

Single letter odd register unit SLO (Fig. 16), single letter even register unit SLE (Fig. 17) and double letter register unit DL (Fig. 18) each include six shelves as PC, O, H, L, CU and CQ, that is, for showing the previous close price, the opening, high, low, and the current price and the total quantity. For purposes of description but three register units or dial groups have been illustrated operatively connected to their corresponding price and quantity positioning shafts. In actual practice, however, many single letter odd, single letter even, or double letter register units would be operatively connected to their corresponding main price and quantity positioning shafts.

Quantity shafts HTQ, TTQ, TQ and HQ (Fig. 20) are each provided with a contact closing wheel or ratchet as 224 for insuring a complete movement of the shafts, that is, spring tongues as 121 normally rest in one of the notches of the wheel 224 withholding ground from ground contact 122. When a quantity shaft takes motion, contact 122 is closed at each step, providing a supplemental ground to the guard circuits as 113 and retaining the corresponding clutch magnet as 237 (Fig. 19) engaged. Also mounted on the main quantity shafts HTQ, TTQ and TQ are transfer cams as 225 (Fig. 20) and zero setting cams as 226. The transfer cams are for the purpose of transferring the carry-over from a lower to a higher order of numbers and close a contact as 245 on all positions from 0 to 9, concomitantly opening contact 246, and opening contact 245 on all positions from 9 to 0, simultaneously closing contact 246 for this time interval.

The quantity shafts always start from zero position and are driven to a selected position where they momentarily stop and then continue forward to the zero position ready for their next operation. For resetting the quantity shafts to zero after they have momentarily stopped at the selected positions, zero setting cams as 226 are

provided. The purpose of each zero setting cam is to close certain contacts in its zero position and open other contacts in its off zero position, and in its zero position contacts as 231 are closed, and contacts 241, 243 are open, and in its off zero position contacts 231 are open and contacts as 241 and 243 are closed.

Except for shaft HQ, the other main quantity shafts are each provided with a start, stop and transfer relay as 227, 228 and 229 respectively (Fig. 20), the shaft HQ, however, has associated with it a start and a stop relay 712 and 725. The start relays are first energized from a corresponding permutation device or selector as F4 (Fig. 9) hereinafter more fully referred to, which grounds common conductor 125 after having been operated in reaching its selected position, and conductor as 126, closed contact 231 (Fig. 20) during the zero position of the zero setting cams as 226, energizing the start magnet as 227. Once energized, the start relays remain locked up from closed contacts 230 and 233 until the corresponding quantity shaft reaches its selected position.

The quantity shafts start to rotate when their start relays and clutch magnets are initially energized and continue in motion until the stop relays are energized, which causes the deenergization of the associated start relays and clutch magnets. A stop relay as 228 in circuit with conductor 127 and a corresponding collector ring as 234 (Fig. 19) is energized when wiper 235 reaches a contact of the collector made busy by the associated permutation device, as for example, at a time when wiper arm 128 of the permutation device F4 (Fig. 9) stops on a permutation device contact, say, 129 to ground conductor 130 and a corresponding contact as 109 (Fig. 19) of the group of contacts associated with the TTQ shaft, causing energization of the stop relay 228 which opens contact 233 to release the associated shaft starting relay 227 and deenergization of the latter opens contact 238, removing ground from conductor 113, freeing clutch 237 (Fig. 19), causing shaft TTQ to stop and remain in its stopped position until stop relay as 228 is deenergized by the action of the associated permutation device, as will be hereinafter disclosed. On deenergization of stop relay 228 (Fig. 20), contacts 239 and 240 are closed and since the zero set cam 226 is in off zero position, contact 241 is closed which energizes clutch magnet 237 (Fig. 19), advancing shaft TTQ to its zero position and opens contact 241 (Fig. 20).

Where a transfer is made from a lower to a higher order of numbers, a transfer relay as 229 is momentarily energized due to the movement of a quantity dial from 9 to 0, as will be later described. Having been once energized, transfer relay 229 locks up through contacts 242 and 243 when zero set cam 226 is off zero position, grounding contacts 244 and 245 and conductor 113, energizing clutch magnet 237 (Fig. 19) until cam 225 (Fig. 20) reaches its ninth position, at which time contact 246 closes and provides a supplementary ground to conductor as 126 and maintains energized start relay 227 for one step of the shaft.

Clutch magnet 237 (Fig. 19) remains energized through closed contacts 239, 240 and 241 (Fig. 19) until zero set cam 226 reaches its zero position. It should be noted that 0 is never transmitted in the quantity and that the quantity dial shafts 132, 133, 134 and 135 (Fig. 21) of the several register units which are suitably geared to their corresponding main quantity shafts HTQ,

TTQ, TQ and HQ, serve two purposes on one revolution, namely, first to register quantity in any amount up to 9, and secondly to effect transfer of a carry-over from 9 to 0. As the capacity of the present system is designed to register accumulative quantities up to and including 999,900 shares, the hundred thousands quantity dials of the register units are without any contact closing means such as 960 (Fig. 16) for carrying into effect a carry-over operation, although it should be understood that the system may be extended to register quantities greater than 999,900 shares, as is well apparent from the teachings of the present disclosure.

In Fig. 37 there is illustrated a heart shaped cam of the type connected to each of the price shafts 200, 201, 202 and 203 (Figs. 15 and 20) for setting the main horizontal positioning shafts HP, TP, UP and FP (Figs. 20, 21, 22 and 23), and also the arrangement of contacts corresponding to graduated positions of an associated cam and a fragmentary portion of a wiper 208 which is representative of the wipers cooperating with the spaced groups of contacts as 210, 211, 212 and 213 (Fig. 15). Except for the fraction price shaft cam 740 which is graduated to fourteen positions, the other heart shaped cams, namely 218A, 218B and 218 of corresponding price shafts are graduated to twenty positions.

Each of the main price shafts includes a roller as 117 (Fig. 20) adapted to ride against the periphery of a respective heart shaped cam, that is, from the reentrant portion to the crown portion thereof and from the latter to the reentrant portion, it being understood that the roller is held against the cam by a suitable spring (not shown). The operation of these cams moves the main positioning shafts HP, TP, UP and FP laterally to set the price dial shafts as 222, 119, 119 and 120 (Fig. 21) of the several register units as SLO, SLE, DL, etc. (Fig. 16). It should be noted that the price shafts 200, 201, 202 and 203 always move in one direction, but that the cam actuated thereby may set the corresponding horizontal positioning shaft forwardly or backwardly. All the price shafts remain in their last operative position and their next movement causes them to move to their next selected position.

Where, for example, wiper 208 (Fig. 15) stands at 8 and the next selected position is 9, cam 218 advances one step, actuating shaft as HP one step laterally, which in turn drives the corresponding price or dial shaft as 222 (Fig. 21) one step forward. If the next selected position be 8 and cam 218 advances 3 steps, shaft HP first moves forward from 9 to 0, that is, one step, and then recedes from 0 to 8, two steps, that is, shaft 222 is driven from 9—0—9—8, three steps. This movement is made possible by the heart shaped cam and by multiplying such contacts as there are two like positions on the heart shaped cams (see Fig. 37).

The illustrations of Figs. 34, 35 and 36 disclose a register unit or dial group comprising six shelves PC, O, H, L, CU and CQ respectively for the previous close quotations, the open, high, low, current and accumulative quantity. Each price shelf includes four dials or registers, as for example, 350, 351, 352 and 353 (Fig. 35) and each accumulative quantity shelf includes dials or registers as 354, 355, 356 and 357. Corresponding dials of all the price shelves as 350 of a dial group register changes in hundreds of the price, dials as 351 indicate price changes in the tens; 75

corresponding dials as 352 are employed to show the effect of the price change in the units, and corresponding dials as 353 of the several price shelves of each register unit show price change in the fractions. The hundreds, tens and units price dials have eleven positions ranging from 1 to 0 and a blank space, and the fractions dials have eight positions, namely, from $\frac{1}{2}$ ranging through intervals of eighths to and including $\frac{7}{8}$ and one blank position. Each of the quantity dials includes ten positions.

Three types of dials are illustrated, namely, previous close, open, high and low shelves include the first type. The current dials CU are another type, and lastly the accumulative quantity dials comprise the third type. The first two types are of the same mechanical design, but as the dials of the previous close, open, high and low shelves are infrequently operated, they include the simplest mechanisms having one release magnet as 312 and one common actuating stub shaft as 319 (Fig. 36) for corresponding dials of the several price shelves, which in turn are moved to predetermined positions by means of endless belts as 321 which may be actuated by corresponding dial drive shafts as 317, which in turn are representative of the dial shafts as 222 (Fig. 21) of the several register units, which are directly connected by rack and pinion to the main corresponding horizontal positioning shafts as HP, TP, etc.

Associated with each register unit are four quantity vertically disposed stub shafts as 320 (Fig. 36) on which are mounted the several dials as 354, 355, 356 and 357 (Fig. 35), which are representative of the third type, for indicating the accumulative quantity changes, and for each dial of an accumulative quantity shelf there is provided a magnet as 329 (Fig. 36).

Typical of the second type are the price dials of the current shelves CU of a register unit, and inasmuch as these are frequently operated, they are so designed that any one of the four dials as 90, 91, 92 or 93 (Fig. 35) may be independently operated at will, and for this purpose each dial has a release magnet as 316, that is to say, the previous close, open, high and low shelves include but one operating dial magnet, and the current and accumulative shelves each comprise four dial operating magnets.

The price dials are adjusted forwardly or backwardly in accordance with the extent of price change due to the tension imparted to their springs as 306 and 307. The stub shafts as 305 for corresponding dials of the several price shelves are first set to a selected position, causing the springs to tension an amount equal to the displacement of the shaft from the previously set position of the dial. Normally the price dials are held locked by a latch pawl 314. It will be noted that the magnets 312, 362, 363 and 364 (Fig. 36) cooperate with a longitudinally disposed armature 313 which carries four pawls 314, there being one pawl for each associated dial. On the other hand, the price dial magnets 316, 316A, 316B, 316C (Fig. 35) each cooperate with an armature as 316D having pawl 316E to coact with their respective price dials 90, 91, 92 and 93. When the price dials are released by their corresponding electro-magnets, they instantly take movement to relieve the spring tension and display a numeral in the window as 360 (Fig. 34) corresponding to the setting of their respective shafts.

The accumulative quantity dials are driven

directly from stub shafts as 320 (Fig. 36) and each individual stub shaft is independently driven by means of an endless belt as 322 suitably operatively connected to quantity driving shafts as 318 which may represent the quantity shafts as 132, 133, 134 and 135 (Fig. 21). The quantity dials add the quantity involved in each transaction to the accumulative total of all previous transactions, omitting the zero from all operations and each quantity dial is selectively and independently operated as previously disclosed. Illustrating this idea, if a sale of 5000 shares is made, the thousands dial as 356 (Fig. 35) will advance five steps. If the transaction involves a carry-over of one, as when 5 is added to 7; if the transaction be in, say, the hundreds, a transfer of 1 is effected to the thousands dial without utilization of a carry-over comprising the usual transfer pinions connecting the several dials.

Spacially disposed and rigidly fixed to the price stub shafts as 305 (Figs. 30 and 35) of a register unit are a plurality of hubs or collars 301, comprising a bearing 302 on which an inwardly disposed portion 302A of a price shell or dial is freely mounted and a pair of opposed outwardly extending lugs 303 to which are attached the lower portions of associated springs 306 and 307 of the next upper dial, the upper portions of the springs being connected to anchoring portions or ears as 308 carried by each shell. That is to say, the upper portion of each spring is attached to the dial and the lower portion thereof is attached to the shaft by being connected to the hub of the next lower dial.

The lower marginal portion of each price dial includes a plurality of notches as 311 defining teeth as 310, there being a notch for each numeral and blank designating position on the dial. Their purpose is to align and seat an associated latch pawl as 314. It should be noted that the first four price shelves of a register unit include one latch arm or armature as 313 which is provided with four pawls as 314, there being one pawl for each dial, which serve to align and lock the four dials at their selected positions by the tension of spring 315 normally urging the terminal portion of pawls 314 to interlock with one of the marginal notches of each dial.

When the magnet as 312 is energized, the armature as 313 is moved downwardly, which tensions springs 315 suitably fixed to frame 990 of the register unit, permitting the dials to position forwardly or backwardly until springs 306 and 307 are without excess tension. Electro-magnets 362, 363 and 364 serve a similar purpose for the dials of the open, high, low quotation shelves, that is, each of the armatures include four positioning pawls, which normally hold the dials of these shelves at their selected position. However, for each dial of the current shelf there is an electro-magnet as 316 and each armature includes but one pawl to lock its associated dial, as previously set forth.

Quantity dials as 357 (Fig. 35) are driven directly from their stub shaft as 320 (Figs. 28 and 36) and remain in their advanced position on each operation. Each quantity dial comprises a shell as 365 rigidly attached to a collar or hub 324 in which the stub shafts 320 revolve freely. Each hub includes a contracted or cut-away or yoke receiving portion 325 providing a bearing for yoke 326 which serves as an armature for moving a corresponding dial downwardly so that the indentations 327 merging with notches between teeth 366 will abut and lock pin 328 rigidly

attached to the quantity shafts 320. Pins as 328 are set at the zero position of their shafts.

An electro-magnet as 329 is energized during the forward movement of the associated quantity shaft, that is, as illustrated, the dial is seated against the locking pin ready for operation and moves with the stub shaft 320 to the selected position. On the completion of the operation, the magnet 329 deenergizes and yoke 326 moves upwardly by reason of spring 330, carrying the dial with it, disengaging the latter from the shaft pin 328. In this position the tension of spring 330 presses yoke 326 against hub 324 and prevents it from drifting idly with the shaft, during subsequent rotation to set quantity dials of other stock registers.

Not all stocks sell in three integers and a fraction, but for economic reasons it will be found advisable to make the register units of one size, as there is no reason why the full price should be displayed in all the shelves except the previous close unless a stock is in a price range of, say, three integers as 195 to 205. If the hundreds digits dials in all the shelves of a register unit except for the previous close are locked against movement, time will be saved as no pulses need be sent for the hundreds digit except for the previous close, and these but once a day. Also, not all stocks sell in three integers and a fraction. In such cases all of the hundreds dials may be locked, as well as all the tens dials except the previous close. For rendering inoperative the dials not selected, a latch 332 (Fig. 34) is provided which is slidably mounted so that its rear V-shaped portion as 332A may be moved upwardly by the manipulator 331 (Fig. 36) to engage a dial tooth and lock the dial against movement.

The code register or permutation device illustrated in Figs. 24, 25, 26 and 27 is for the purpose of receiving coded pulses from the single line circuit 70 (Fig. 1) through the several code disc operating coils as 8, 9, 10 and 11 (Figs. 7 and 24) and translating them into an arithmetical count, that is, to position wiper 24 on a selected contact of bank as 22 due to the operation of the four code discs 3, 4, 5 and 6. Broadly speaking, a permutation device, if operated, establishes circuits for positioning the several associated quantity and price main shafts a previously described, and also for setting up various circuit combinations, such as the selection of a register unit or dial group or the selection of a shelf of dials, or a particular dial in a quantity shelf or a price dial in a price current shelf of a dial group.

As illustrated, in Figs. 7-12 inclusive, two sets of registers or permutation devices F and G are shown, each set comprising ten registers for the purpose of carrying out the various selections to set up a quotation, namely, permutation devices F1 or G1 for single letter odd stock selection; F2 or G2 for a single letter even stock; F3 and G3 for the selection of a shelf; F4 or G4 for the ten thousands quantity; F5 or G5 for the thousands quantity; F6 or G6 for the hundreds quantity, and permutation devices F7 or G7, F8 or G8, F9 or G9, and F10 or G10 for the hundreds, tens, units and fractions respectively in the price. The permutation devices are arranged so that one set will take up the line signals while the other set is maintaining the record set up on a previous quotation, the receiving circuit being designed to operate each set in its turn, as will be more fully hereinafter set forth.

While each permutation device, as disclosed,

is shown with four code discs for positioning wipers as 24 on any one of the sixteen contacts as 22, it should be understood, however, that the number of discs may be increased to any reasonable number where it is desired to increase the range of selections.

Each permutation device includes a trip and reset disc or cam 16 for a dual purpose, first, to remove the zero stop arm 40 (Fig. 25) from the path of the striker arm 13 and to set a selected stop arm as 14 or 29 in the path of a striker arm 13 after the selected code discs have been positioned for a selecting operation, and secondly, to reset the selected stop bar as 14 or 29 on completion of the operation and to position the zero stop arm in the path of the striker arm, that is, in the reset position, as shown in Fig. 27 cam 16 guards all the stop arms except the zero bar 40 from engagement with the striker arm 13. In the trip position, as shown in Fig. 26, a selected bar as 29 is positioned in the path of the striker arm 13, stopping the wiper on a selected contact.

The several permutation device shafts 1, when operated, are driven through gear 2 and a suitable friction clutch broadly designated 44 (Fig. 24) comprising, in addition to the holding plate 12 and a friction disc 46, a bushing 47, a felt washer 48, a friction disc 49 and a spring cup 50.

The code discs 3, 4, 5, 6 of each permutation device or register are cut in the conventional manner and are loosely mounted on bearing 7 and are set by their respective operating electromagnets 8, 9, 10 and 11 which are energized in a predetermined order by line pulses. When the code discs are set, they provide a path for a selected stop bar as 14 or 29, as hereinbefore disclosed, to position in the path of the striker arm 13.

Suitably disposed on the mounting plate 12 of each permutation device are sixteen stop bars as 14 and each bar cooperates with a spring 15 to provide inward tension for positioning the free end of the selected stop bars in the path of the striker arm 13.

The free ends of the stop arms normally rest against the set and reset disc 16, permitting free movement of the code discs. The set and reset disc 16 is provided with fifteen teeth as 18 to free the selected stop bar and permit it to position in the bottom of a tooth and in the path of the striker arm. Tooth 17 of the set and reset disc 16 raises the zero bar 40 out of the path of the striker arm on a selecting operation, and on this selection, a selected stop arm as 29 rests in the bottom of selected notches between a pair of teeth of the several code discs. On a reset operation, namely, on the completion of a selection, the zero bar is between a pair of teeth and against the striker arm, and in this position the previously selected stop arm, say 29, is out of the aligned notches of the code discs, due to the action of a tooth as 18.

Associated with the set and reset disc and suitably loosely pivoted thereto is a rocker arm 19 which is actuated either by trip coil 20 or reset coil 21. Trip coil 20 is operated by a special contact 412 associated with cam 410 on the receiving distributor shaft 409 (Fig. 1), and the cam being so arranged as to close momentarily just after the transmission of a fifth pulse, or, in other words, when the wiper of distributor 71 has passed over the fifth selecting segment 408 and before it is stopped by the latch of the start 75

magnet, permitting any or all code disc operating coils 8, 9, 10 and 11 to position their respective discs 3, 4, 5 and 6 before the trip coil 20 is energized. Following the energization of the trip coil, the zero stop bar 40 is moved out of its notch by the set and reset disc and a selected stop bar falls in the aligned notches of the code discs after operation of any combination of operating coils 8, 9, 10 and 11. The striker arm 13 then advances, positioning the wiper on the selected contact.

To retain the selected code discs in their operated position, each disc at its zero position is fitted with a spring as 27 (Fig. 24) normally in contact with the bottom of the zero stop arm. When the code discs take their operated position, the end of spring 27 clears the zero bar and raises upward by its own tension, engaging the side of the zero stop arm, holding its disc in its operated position.

At the energization of trip coil 20, zero stop bar 40 is raised and clears the springs 27, but at this time a selected stop bar as 29 falls into the aligned notches of the code discs, preventing them from restoring. On the resetting operation, springs as 30 restore the selected code discs to their normal position. Tooth 17 for the zero stop arm 40 and teeth as 18 for the numerical stop bars as 29 are designed to reset a selected stop bar before the zero stop bar 40 reaches the position to engage its spring 27.

Each permutation device is provided with sixteen contacts as 22, spaced common contacts 23 and 23A, a wiper 24 adapted to extend ground to the several contacts through radially disposed wipers or brushes 50 and 51 rotatable with wiper 24 and forming parts thereof. Ratchet or tooth wheel 25 is mounted on permutation device shaft 1 causing contact 26 to close momentarily on each movement thereof. Cam wheel 35 is also mounted on shaft 1 for the purpose of opening contact 36 on all off zero positions of the permutation shaft. Only the stock selector registers F1, G1, F2 and G2 (Figs. 7 and 8) are provided with a pair of contact closing means as a ratchet 25 and a cam wheel 35. Their function, as will be later apparent, is to energize a slow relay as 438 and also to open or close the locking circuits for stock shift relays S and T. Shelf permutation devices as F3 (Fig. 8), quantity as F4, F5 and F6 (Figs. 9 and 10) and price as F7, F8, F9 and F10 (Figs. 10, 11 and 12) of each of the code register sets, are provided with one contact closing wheel as 26 and an associated slow acting relay as 701 (Fig. 12), for the purpose of withholding ground from their respective permutation device wipers and associated commons until the respective shaft and wipers have reached their predetermined positions.

The receiving circuit previously referred to is for the purpose of receiving the coded pulses from the single line circuit 70 (Fig. 1) for establishing channels for the transmission of pulses and translating the coded pulses into an arithmetical count for positioning the stock selector switches (Fig. 14), the several quantity and price shafts as HQ and HP, and the dials of a selected register unit. The receiving distributor, generally denoted 71 (Fig. 1), is of the conventional five-unit code, start-stop type as employed with telegraph typewriter receivers for receiving the line impulses through the operation of line relay 401, contact 72, conductor 73 and the common conductor or collector ring 402 which is grounded when contact 72 is closed. Such re-

ceiving distributor may be of the general type disclosed in U. S. Patent 1,434,290 to Krum or 1,311,915 to Rainey.

Through wiper 78, ground from contact 72 is extended through common conductor 402 and wiper 403 to the several segments 404, 405, 406, 407 and 408. Segment 408, if grounded, receives the fifth pulse which is used only for the purpose of energizing such control relays as the operator may elect, as will be later described. Cams 410, 411, 644 and wiper 75 are all mounted on the common shaft 409. Cam 410 closes contact 412 when shaft 409 reaches its sixth position for momentarily energizing a trip coil as 20 of a selected permutation device through circuit 487, as previously explained.

For each step in recording a quotation, a pair of control relays is utilized, as for example, B1, generally denoting the pair comprising relays 415 and 415A, is employed if a single letter odd stock is to be selected. For selecting a stock of a single even letter, control relays of pair B2 (Fig. 2) would be utilized. Where the stock selection is for a double letter, pairs B1 and B2 are both selected. A shelf of a register unit is selected by operating the pair of control relays B4. Pair B8 (Fig. 3) is used to register ten thousands in the quantity, B7 for thousands and B8 (Fig. 4) for hundreds in the quantity. Pairs of relays B11, B12, B13 and B14 (Fig. 5) are employed separately or jointly when hundreds, tens, units and fractions or any combination of these in the price is to be set up in the shelf of the register unit selected. The control relays are pre-energized for operation according to the character of the quotation and one pair operates for each step of the quotation in a predetermined order.

Associated with each pair of control relays is a pair of transfer relays as D1 or E1 (Fig. 7) for pair B1, D2 or E2 (Fig. 8) for B2, D3 or E3 for B4, D4 or E4 (Fig. 9) for B6, D5 or E5 for B7, D6 or E6 (Fig. 10) for B8, D7 or E7 for B11, D8 or E8 (Fig. 11) for B12, D9 or E9 for B13, and D10 or E10 (Fig. 12) for B14. Each pair of control relays controls its associated transfer relay for a single revolution of the receiving distributor and directs, through conductors 80, 81, 82, 83 and 84 from the receiving distributor, the coded pulses into the several registers of set F or G of permutation devices where they are translated into an arithmetical count.

Common to the pairs of relays B1 and B2 is the guard relay B3 (Fig. 2); to the pair B4, guard relay B5 (Fig. 3); to the quantity pairs of control relays B6, B7 and B8, the guard relays B9 and B10 (Fig. 4) in multiple, and to the price pair of control relays B11, B12, B13 and B14, the final guard relay B15 (Fig. 6). Their purpose is to set up a holding circuit to retain energized such control relays of a pair initially grounded from contact 414 associated with cam 411 (Fig. 1), until their order of operation is reached, as it often happens that one or more pairs of each of the groups, that is, relays of the stock, quantity and price groups, are energized. When a pair of control relays has been energized, they are freed for operation in their order of operation by the release of the holding guard relays. For example, guard relay B3 (Fig. 2) sets up a holding circuit through closed contact 422 and retains energized, through contact 86, shelf control relay 87 of B4 for a time until its order of operation is reached, providing, of course, a shelf has been nominated.

In addition to operating a guard circuit for 75

the odd shelf relay 87 of pair B4 and energizing guard relays B9 and B10 (Fig. 4) through conductor 647A, guard relay B3, if energized, also serves another purpose, namely, to control the action of the group of relays broadly designated H—H (Fig. 1), that is, if contact 609Z of relay B3 is closed, ground is extended over conductor 88, through closed contact 610 initially energizing relay H1'. Group H—H includes two pairs of relays as H1 and H1', and H2 and H2'. Pair H1 and H1' operates relay 435 (Fig. 7) of the set of permutation devices F—F. Pair H2 and H2' operates relay 436 of the set of permutation devices G—G. Due to the action of pairs of relays H1 and H1', and H2 and H2', relays 435 and 436 are operated alternately for controlling in turn the operation of code permutation devices of sets F—F and G—G.

Corresponding transfer relays as D1 and E1 of sets F—F and G—G are common to conductors as 663, that is, in the relay group E—E are ten transfer relays E1, E2, E3, etc., associated with permutation devices G—G which are connected with corresponding transfer relays D1, D2, D3, etc., respectively, of permutation devices F1, F2, F3 of register set F—F. Transfer relays as E1 serve the same purposes as their corresponding transfer relays as D—D, except that they direct the line pulses from the receiving distributor to the operating coils of an associated permutation device of a different set. Only one set of transfer relays D—D or E—E operates at a time, the sets being employed alternately. The sets of permutation devices are connected into the circuit for alternate use by their associated transfer relays, and when selected, respond to the coded line pulses and translate them into an arithmetical count.

A pair of relays designated C (Fig. 1) are employed on the nominating operation, and control relay C1 which, if energized, directs the line pulses in a selected order to the several pairs of control relays B1, B2, B3, B7 and B4, energizing them for a later operation.

The group of relays J—J (Fig. 6) comprises pairs of relays J1, J1' and J2, J2', and associated with this group of relays is the pair of relays J3, J3'. Pairs J1, J1'; J2, J2', in addition to those of group H—H, previously described, are used alternately for cutting in and out the two sets of transfer relays D—D and E—E. Relays H—H control only transfer relays D1, D2, E1 and E2, that is, the stock selecting relays, as it often happens that the stock selectors remain on a selected stock for several successive quotations. Relays J—J serve a like purpose for the shelf, quantity and price transfer relays of sets D—D and E—E. Relays J3 and J3', as will later appear, prepare a release circuit for the quantity and price permutation devices.

On the zero position of shaft 409 (Fig. 1), contact 413 is open and contact 414 is closed. On the off zero position of cam 411, contact 413 is closed and 414 is open; that is, the purpose of cam 411 is to release the odd control relays as 415 of the pairs of control relays as B1 in their order of operation and at the beginning of each revolution, and hold energized corresponding mate or even control relays as 415A for one revolution of the distributor. If, say, relay as 415 has been energized by a pulse from the distributor, it will be held locked up at the beginning of a revolution of the distributor so long as contact 414 is closed through contact 417A and the common conductor 447. If relay 415 is ener-

gized, contact 417 is closed which in turn energizes even or mate relay 415A. At this time cam 411 reaches its off zero position, opening contact 414 and closing contact 413. Relay 415 is de-energized as ground is removed from locking contact 417A, but mate relay 415A is locked up for the remainder of the revolution of the distributor through closed contact 415B, conductor 452 and closed contact 413. At the end of the revolution, cam 411 reaches its zero position, opening contact 413 which disables mate relay 415A.

The purpose of cam 644 is to close and ground contact 643 at the end of the fifth pulse and to remain closed until after contact 413 of cam 411 is closed on the next revolution of the distributor. Closed contact 643 provides ground through conductor 643A for holding energized the odd relay 425 of the C pair through the locking contact 426, after relay 425 has been first energized by the fifth pulse, in a manner later described.

All the pairs of control relays as B1 are substantially the same in operation and in the number of contacts. Each pair controls the operation of its associated transfer relays for one revolution of the distributor, as for example, B1 operates either of the transfer relays D1 or E1, depending upon whether common transfer relays 435 or 436 (Fig. 7) of sets of permutation devices F—F or G—G have been operated; that is to say, at a time when contacts as 661 and 662 (Fig. 1) are closed of the odd and even control relays 415 and 415A of pair as B1. All of the odd relays as in pairs B1. All of the odd relays as in pairs B1 are first energized through windings as 415C. Once energized, they lock up through windings as 416 and remain locked up until released in their order of operation. Certain of the odd relays as in the B2 and B4 pairs (Fig. 2) are also locked up through contacts as 420 and 86. Contact 420 is grounded from closed contact 421 of even relay 415A, if the latter is energized. Contact 86 is grounded from contact 422 of guard relay B3 which has two sources of energization, namely, windings 686 and 646, the former being energized from contact 683 when even control relay 657 is energized, and the latter is effective from contacts as 645 and 421 of the mate relays of pairs C and B1. Contacts 420 and 86 are for the purpose of holding their respective relays energized until their order of operation is reached.

As previously disclosed, winding 419 of even relay of pair B1 (Fig. 1) is energized from closed contacts 415B and 413 on one revolution of the distributor, but so long as contact 417 is closed it is without effect. On opening of contact 417, and closing of contact 661, which occurs when winding 416 is deenergized by contact 414 opening, winding 419 becomes effective and serves to hold relay 415A energized for one revolution of the receiving distributor. This arrangement permits such odd relays as are needed to be energized and released in their order of operation.

Guard relays as B3 (Fig. 2) serve to extend a holding circuit to the next higher order of control relays, either directing as by grounding contacts as 422 to lock the odd relay in the B4 pair, or indirectly as by grounding contact 422, energizing guard relay B5 (Fig. 3) which in turn, through closed contacts 653, 652 and 651, extends a holding circuit to odd control relay of pair B13 (Fig. 5) through conductor 654C and through conductor 455 to guard relay B15 (Fig. 6), and lastly through conductor 647A to energize guard

relays B8 and B10 (Fig. 4) which are connected in common to conductor 647A.

Where a series of successive quotations for a preselected stock is to be transmitted, the control nominating relays C (Fig. 1) are not energized. They are energized only when a stock is to be selected and only if a fifth selecting pulse is received on the fraction operation. Odd control relay 425 is energized, first, over a circuit from ground at contact 72 of the line relay 401, through wiper 75 and fifth pulse segment 408, conductor 80, closed contacts 424A and 424 of the B14 pair of fraction control relays (Fig. 5) and conductor 609. Relay 425, (Fig. 1) closes contacts 426 and 427, the former holding relay 425 energized through closed contact 426, conductor 643A and closed contact 643 from the fifth pulse to the beginning of the first pulse.

Contact 427 also being closed, winding 428 of even relay 428A is energized when contact 414 closes, closing contacts 429 and 430. The even relay locks up through contact 429 and closed contact 413 for one revolution of the distributor. Closed contact 430 energizes relay C1 which closes its several contacts as 431 and transfers such pulses from the receiving distributor that the operator may elect to send for nominating a predetermined order of control relays for stock, shelf, quantity or price. That is, if the #1 pulse is sent, it is transmitted through segment 404, conductor 84, closed contact 431 of relay C1 and conductor 84A, energizing odd control relay of pair B1.

If #2 pulse is sent, odd relay of B2 (Fig. 2) is energized from segment 405, through a closed contact of relay C1 and conductor 83A. If #3 pulse is transmitted, odd relay of pair B13 (Fig. 5) is energized from segment 406, a closed contact as 431 and conductor 82A. If #4 pulse is sent, odd relay of B7 (Fig. 3) is energized from segment 407, conductor 81A, through a closed contact of relay C1 and conductor 81A. The fifth pulse, if sent from segment 408, also grounds a closed contact of relay C1, conductor 80A to energize odd shelf relay of pair B4 (Fig. 2). In this way, five or any combination of five pairs of control relays B1, B2, B4, B13 and B7 may be made effective. This combination may be changed to meet the operating needs as the needs arise.

In accordance with the invention, quantity is sent first as the odd quantity relay of the hundreds pair B8 (Fig. 4) normally stands energized, since it was operated through closed contact 442 of final guard relay B15 (Fig. 6) and conductor 444, and, as it locks itself through its own contact 446 over conductor 447 to ground at contact 414 (Fig. 1). The even quantity relay 450 of pair B8 (Fig. 4) is also normally energized through contact 428 of the odd relay. Contact 453 of relay 450 grounds conductor 455 to energize relay B15 (Fig. 6), thus opening the original operating circuit of the odd B8 relay. The odd B8 relay releases when the distributor shaft starts to rotate, opening contacts 414, but the even B8 relay remains energized over its own contact 451 and conductor 452 to ground at contact 413 (Fig. 1) until the distributor shaft completes its first revolution.

Registering hundreds in the quantity may be the only operation on a transaction, as for example, when a series of successive sales are to be made on the same stock without a significant price change. To effect a registration in hundreds of the quantity and where the transaction is with-

out a significant price change, a key with a possible maximum of transmitting four selecting impulses is operated, as will be more fully herein-after set forth. If, however, a price change were to be made effective, say, in the fractions, a key using the fifth pulse would be used for transmitting the hundreds of the quantity and the fifth pulse is transmitted over segment 408, conductors 80 and 499 (Fig. 4), contacts 432 and 433 of the hundred quantity pair B8 and conductor 601 to winding 434 of the odd fraction control relay of pair B14 (Fig. 5). In a word, it may be said, if a quotation on a preselected stock is, say, 8 1/4, a fifth pulse key of a transmitting keyboard is operated to select the quantity and this operation nominates, that is, locks up the odd fraction price control relay.

In a like manner, upon the transmission of a fifth pulse, the odd tens control relay of pair B12 may be energized from closed contacts 751 and 752 of the units pair of control relays B13 through conductor 753A, and the odd control relay of pair B11 (Fig. 4) may be energized due to transmission of a fifth pulse through closed contacts 754A, 754B of the tens price pair B12 (Fig. 5). Also upon the transmission of a fifth pulse, the tens thousand quantity odd control relay of pair B6 (Fig. 3) may be operated from closed contacts 765A, 765B and conductor 765C. Not always are there price changes in the fractions or sales in the thousands of the quantity. Accordingly, provision is made on the fraction permutation device to energize the units price control relays and the hundreds quantity register to energize the thousands control relays as will be later set forth.

As previously pointed out, group of relays H—H are utilized for determining which one of the two sets of stock selection transfer relays D—D or E—E will be used. Relays H1 and H1' (Fig. 1) control the #1 set or set D—D and when operated energize common relay 435 (Fig. 7) to provide battery to the stock transfer relays D1, D2. Relays H2 and H2' (Fig. 1) control the #2 or set E—E and when operated energize the common transfer relay 436 (Fig. 7) to supply battery to transfer relays E1, E2. Relays H1, H1'; H2 and H2' are controlled from the guard relay B3 (Fig. 2), which in turn is energized when either of the even relays of pairs B1 or B2 is energized, that is, upon closure of contacts 421 or 623. It is apparent, therefore, that relays H—H are operative only when a stock to be selected, as a series of successive quotations may be made on the same stock, and consequently the setting of the stock selectors must not be changed until a new stock selection is made.

Group of relays J—J (Fig. 6) serve a like purpose for the shelf, quantity and price transfer relays and are controlled by guard relay B15, that is, to put into operation one of the two sets of transfer relays for shelf, quantity and price, as for example, transfer relays of #1 set, comprising relays as D3 (Fig. 8) for shelf, D4 (Fig. 9) for quantity, D10 (Fig. 12) for price, or the #2 set including relays E3, E4, E10 respectively for shelf, quantity and price.

A transfer relay in each set is energized by the operation of a corresponding pair of control relays, as for example, the operation of the pair of control relays B1 (Fig. 1) may energize either transfer relay D1 or E1 (Fig. 7), depending upon whether common transfer relay 435 or 436 is energized. If relay 435 is operated, then transfer relay D1 would be energized for one revolution of the receiving distributor, due to the closure of

of contacts 661 and 662 of the B1 relays (Fig. 1) which ground conductor 663. If transfer relay D1 is energized, contacts as 665, 666, 667 and 668 are closed for the purpose of connecting bus bars 81, 82, 83 and 84 from the receiving distributor to operate the operating coils as 8, 9, 10 and 11 of the stock permutation device F1, and transferring from the distributor to the other permutation devices such pulses as may be received.

Contact 664 of relay D1 connects distributor cam contact 412 over conductor 487 to trip coil 20. Relays 435 and 436 also serve to prevent by paths between the several windings of corresponding transfer relays as the latter are common to conductor 663, that is, only one of these relays operate at a time, namely, either D1 or E1. Relays 439 and 440 (Fig. 12) common to the #1 and #2 set of shelf, quantity and price permutation devices and associated with group of relays J—J are for a similar purpose and prevent by paths between the windings of the corresponding transfer relays as D10 and E10. Relays 439 and 440 are controlled from relays J1 and J2 (Fig. 6), which in turn are controlled from final guard relay B15.

Each set of permutation devices F—F and G—G includes ten permutation devices for each of the ten permutation steps in a quotation requiring a maximum number of operations; that is, to register a quotation 253.112½ in a current shelf for a double letter stock, say AB, would require ten permutation operating steps, first, permutation device F6 operates to select the hundreds quantity; secondly, permutation device F10 operates to select the fraction price; thirdly, the third signal controls the nominating operation; fourthly, permutation device F1 operates to select the first stock letter; fifthly, permutation device F2 operates to select the second letter of the stock; sixthly, permutation device F3 operates to select the shelf designated; seventhly, permutation device F9 operates to select the units price digit; eighthly, permutation device F8 operates to select the tens price digit; ninthly, permutation device F7 operates to select the hundreds price digit; tenthly, permutation device F5 operates to select the thousands quantity digit; and eleventhly, permutation device F4 operates to select the ten thousands quantity digit, providing of course, the #1 set of transfer relays are selected through the combined operation of group relays H—H, J—J. It will be noted, therefore, that, in addition to the ten permutation operating steps, there is an additional step, namely that for the nominating operation, thus making a total of eleven operating steps. In the event the #2 set of transfer relays were selected, the quotation would be taken up by the recording set of permutation devices G—G.

The permutation devices of both recording sets are driven from motor 437 (Fig. 7) and a common system of shafting, actuated by gears as 437A, 437B and 437C. For purposes of description, the permutation devices of each recording set are shown in schematic form with their contacts as 669 (see permutation device F1) arranged in a circle. Such parts of the permutation devices as F1 as are necessary for this description bear like reference characters to those shown in Fig. 24.

Each permutation device, additionally, cooperates with a slow relay as 438 (Fig. 7) which is energized through closure of contact 26 by ratchet 25 (see Fig. 24) as its register shaft 1 takes motion. In energizing, contact 670 of relay 438 is

opened, removing ground from collector rings 23 and 23A during the movement of the ratchet 25. When the shaft of permutation device F1 stops, slow relay 438 releases, closing contact 670 which grounds collector ring 23A, and through brushes or wipers 51, 50 and collector ring 23, conductor 672 associated with the single letter odd stock motor control relay 673 is grounded. In like manner, slow relay 670A is controlled by the action of the jockey roller or ratchet 25 and withholds ground from the collector rings of stock register or selector F2 until the wiper 677 of this register has reached a predetermined contact and slow relay 670A releases, closing contact 670B, grounding the associated collector rings and conductor 679 connected to the single letter even stock motor control relay 682, energizing the latter.

For selecting a single letter odd, even or double letter stock, a rotary switch is employed and as illustrated, only two units A—A, B—B (Fig. 14) thereof are shown. Unit A—A includes shafts 675A and 675B operatively associated with shaft 675, and unit B—B comprises shafts 675C, 675D and 675E, all suitably geared to their common drive shaft 675F. As shown, unit A—A includes two vertical banks of contacts as 799, and unit B—B is provided with but three vertical banks of contacts as 675G. In practice, however, there would be as many verticals in unit B—B as there are contacts in a bank of the second vertical of unit A—A.

The first vertical of unit A—A comprises twelve banks of contacts 799, 800, 801—810, and each bank includes fifteen active contacts. Contacts as 500 of the bank 810 are connected to the single letter odd permutation device F1 or G1 for the purpose of stopping the stock selector shaft 675 at a selected position. The second vertical includes eleven banks of contacts as 811 and each includes fifteen active contacts, the first corresponding contacts of the several banks of the second vertical as 717 being connected through conductor as 717A to common conductor 717B of banks of contacts associated with shaft 675D or fourth vertical employed to select a double letter stock.

Corresponding second contacts as 812 of the several banks of contacts associated with shaft 675B through conductors as 812A are connected to commons as 812C of the bank of contacts associated with the third vertical of unit B—B, which is also employed for double letter stock selection.

The third vertical includes twelve banks of contacts as 813 and the fourth and fifth each contain eleven banks. The fourth and fifth verticals are used for selecting stocks with two letter designations. The third vertical is employed for selecting a single letter even stock. Corresponding contacts of banks at 813 of the third vertical are wired directly to corresponding magnets of the single letter even stock register units as SLE (Fig. 17). Contacts as 501 of bank 814 are connected to the single letter even circuits of register F2 or G2 for the purpose of stopping stock selector shaft 675F at a selected position.

Corresponding active contacts of the first vertical are connected to respective dial magnets of a register unit or dial group as SLO for single letter odd stocks, as for example, conductors 816, 817, 818 and 819 which are connected to first contacts as 815 of the fractions, units, tens and hundreds price banks 799, 800, 801, 802, respectively, are wired to the fractions, tens, units and hundreds

dial magnets 728, 728A, 728B and 728C respectively of register unit SLO (Fig. 16).

Conductors 820, 821 and 822 are connected to corresponding contacts of the quantity banks 803, 804 and 805, and the dial magnets as 727 associated with the accumulative quantity dials of shelf CQ of register unit SLO. Also conductors 823, 824, 825 and 826 connected to corresponding contacts of the low, high, open, and previous close banks of the first vertical (Fig. 14) are wired to their respective magnets of the low, high, open, and previous close shelves, of the register unit SLO (Fig. 16). Also dial magnets circuits 691, 691A, 691B . . . 691K, connected to corresponding contacts to the first vertical of unit B—B (Fig. 14), are connected to respective dial magnets of register unit as SLE (Fig. 17) for a single letter even stock selection.

In like manner, corresponding contacts of the banks of contacts of the fourth and fifth verticals, etc. would be wired to corresponding dial operating magnets of double letter register units as DL (Fig. 18).

A driving mechanism is provided for each main shaft of the stock switch units A—A, B—B, that is, the mechanism broadly denoted N (Fig. 13) is employed for setting shaft 675 to a predetermined position, and mechanism P for setting shaft 675F to a selected position. Both driving mechanisms P and N include a well known type of clutch and each comprises a flexible disc gear as 502 for driving the shafts of the corresponding switch units, a pivoted armature as 503 comprising an arm 504 for disengaging gear 502 from driving gear 505 under tension of spring 506, and a magnet as 507 for overcoming the tension of spring 506, permitting disc gear 502 to mesh with driving gear 505.

Magnet 507 is energized when a stock permutation device as F1 or G1 has been set to a predetermined position and its wiper on a selected contact, and due to the release of an associated slow relay as 438 (Fig. 7), conductor 672 is grounded, energizing start relay 673 (Fig. 14), causing contact 674 to close, grounding conductor 674A to energize magnet 507 (Fig. 13). Armature 503 is attracted towards magnet 507, causing disc gear 502 to mesh with the driving gear 505, setting in motion shaft 675 of stock unit A—A, driving shafts 675A, 675B and wipers as 788 (Fig. 14) to predetermined bank contacts, and at this time clutch magnet 507 is released, as will appear hereinafter. In like manner, clutch magnet 681 of the driving mechanism P is operated when stock permutation device F2 or G2 (Fig. 8) has been set, grounding conductor 679 to energize start relay 682 (Fig. 14), closing contact 682A, which grounds conductor 682B, causing shaft 675F to move wipers 675K of shafts as 675G to predetermined positions.

Corresponding contacts as 669 (Fig. 7) of stock permutation devices F1 and G1 are multipled to conductors as 669A and the latter are illustrated as passing through cable F1 G1 and terminate on contact as 500 on the bank 810 (Fig. 14) associated with the stop relay 675 K for stopping shaft 675 of the stock selecting switch unit A—A at a predetermined position. Assume that start relay 673 has operated to set shaft 675 in motion and shaft 675 will continue in motion until wiper 500A reaches a busy contact, that is, one which has been grounded. Thus, ground is extended to common conductor 500B, energizing stop relay 675K, removing ground from contact 676 and conductor 674A (Fig. 13), deenergizing magnet 507, disengaging disc gear 502,

causing shaft 675 to stop, which in turn has set shafts 675A, 675B and their wipers to predetermined positions.

In connection with stock permutation devices F2 and G2 (Fig. 8), their corresponding contacts as 678 are multipled to conductors as 678A which pass through cable F2 G2 and terminate on contacts as 501 of bank 814 (Fig. 14) associated with stop relay 680 for stopping shaft 675F at a selected position, provided of course, that the start relay 682 has been previously energized.

Conductors 690, 690A, 690B and 690C (Fig. 8) multiple to corresponding contacts as 689 of the shelf permutation devices F3 G3 and pass through cable F3 G3, terminating in spring contacts *pc*, *op*, *h* and *l* of the single letter even stock shift relay T (Fig. 13). Other circuits as 715 for controlling the dial magnets of the several shelves of the register units also pass through cable F3 G3 and terminate in spring tongue contacts *ttq*, *tq*, *hq*, *hp*, *tp*, *up* and *fp* of shift relay T.

The conductors of cables F4 G4; F5 G5; F6 G6; F7 G7; F8 G8; F9 G9; F10 G10 (Figs. 9, 10, 11, 12, 15 and 19) connect corresponding contacts of their associated permutation devices in multiple and terminate in contacts of respective distributors as 108 (Fig. 10) associated respectively with the TTQ, TQ, HQ, HP, TP, UP and FP main positioning quantity and price shafts. It should be noted that each of the quantity and price cables also includes a conductor as 746 (Fig. 12) which is connected in multiple with corresponding reset coils as 747 and 747A (see permutation devices F10 and G10) and contacts as 745 of corresponding stop shaft relays as 743 (Fig. 15); that is to say, if stop relays as 743 are energized, as previously explained, contact 745 is grounded, grounding conductor 746, operating the reset coils 747 or 747A, depending upon which one of the permutation devices has been operated.

Also passing through the several quantity and price cables is a common operating circuit as 709A, connected in multiple to commons as 707 of corresponding permutation devices as F10 and G10 (Fig. 12), which is wired to start relays as 713 (Fig. 15) through conductors as 709A. Attention is directed to the fact that the common operating circuits as 709A have a dual function, first to energize their associated start shaft relays as 713, and secondly to ground the common dial magnet operating circuits as 715, 715A . . . 715F which are in multiple with their respective common operating circuits as 709A, 709B, 709C—709G and dial magnet operating circuits 715, 715A, 715B—715F terminate respectively, as previously disclosed, in spring contacts *fp*, *up*, *tp*, *hp*, *hq*, *tq* and *ttq* of shift relay T (Fig. 13).

The common dial magnet operating circuits 690, 690A, 690B, 690C, 715, 715A—715F from the several permutation devices may be shifted to the wipers of the first or second stock switch selector units A—A or B—B by shift relays S and T. When relay S is energized (for single letter odd selection by control relay B1 (Fig. 1), due to closure of contacts 417 and 684, grounding conductor 658, spring contacts as *pc*—*fp* of relay S (Fig. 13) shift to front contacts as X, extending the dial magnet operating circuits to conductors 693A, 693B, 693C . . . 693L to commons and wipers as 815A and 788 respectively of the first vertical of unit A—A (Fig. 14).

When control relays B2 (Fig. 2) operate closure of contacts 656 and 685 grounds conductor 659 and energizes stock shift relay T (Fig. 13)

for single letter even selection, the common dial operating circuits are extended through the front contacts as X of relay T to the commons as 675H and their wipers of the first vertical of unit B—B (Fig. 14). When deenergized, shift relays S and T condition the common dial operating circuits for double letter selection through their back contacts as Y and commons as 811A of the second vertical bank of unit A—A, which transfers through its several contacts the dial operating circuits to the several wipers and commons as 717C and 717B of the second vertical of banks B—B.

The dial or indicator magnet circuits extending from corresponding stock contacts of the units A—A, B—B, are confined in cables as CSLO, CSLE, CDL, which are extended to their respective dial register units and are suitably connected to their corresponding dial operating magnets.

The present system is designed to be operated either by a conventional printing telegraph keyboard transmitter or by a printing telegraph tape transmitter adapted to receive tape previously perforated in accordance with a predetermined order of signals by the operation of keys of a printing telegraph perforator keyboard, whereby corresponding signals or impulses are transmitted by the keyboard or tape transmitter over a single line circuit and received on a receiving distributor of an associated stock quotation receiving circuit. U. S. Patent No. 1,595,472 to Krum, patented August 10, 1926, discloses a printing telegraph keyboard transmitter of a type suitable for use in a system according to the present invention. U. S. Patent 1,378,978 to Rainey and Dowd, patented May 24, 1921, discloses a printing telegraph tape transmitter of the type suitable for use in a system according to the present invention. In fact, the last-mentioned patent discloses both types of transmitters, namely a keyboard as well as a tape, and shows how either may be connected to control the transmission of signals. The Rainey-Dowd patent also discloses the printing telegraph receiver in a system operating upon the closed circuit principle wherein the line relay is normally energized. In Fig. 33 there is schematically illustrated a telegraph typewriter perforator keyboard with twenty-eight keys. It should be understood, however, that this figure is intended only as a simplified schematic diagram to illustrate the selecting code used. In actual practice, a keyboard such as that shown in the Krum patent, or the usual keyboard perforator of known type, would be used. In this Fig. 33 there are shown two tapes associated with the key levers, but this is merely to illustrate the code signal perforated or transmitted by the corresponding key. None of the keys in row Z, except keys P and Q, perforate or transmit a No. 5 selecting pulse. To illustrate this fact these keys are shown with a four-unit code tape. Actually, only a single tape would be used but the fifth hole would be omitted when keys of the four-unit code group are struck. At the transmitting station there may be provided one or more keyboards for transmitting pulses to several quotation boards; the keyboard being employed for all selecting purposes, as selecting the stock, the shelf, quantity and price.

As shown, the keys are divided into two groups, namely, Y and Z. Keys of the Y group and P and Q of the Z group perforate or transmit what may be called five unit code signals and the Z group, except keys P and Q, perforate or transmit four unit code signals, i. e., signals having

no fifth selecting pulses. Keys of the five unit code group always send the selecting pulse, and the four unit code keys never send a selecting pulse during the fifth interval. For example, of the Z group, key marked A perforates tape for transmitting the first pulse only, this being indicated by the perforation W or tape TT; key B perforates the tape for sending the second pulse only; key C perforates the tape for sending the third pulse; key E perforates the tape for the first and second pulses; key L perforates for the first, second, third and fourth pulses; and key H for the first and third, etc. Of the keys of group Y and keys P and Q of group Z, key marked 1 perforates the tape for transmitting the first and fifth pulse; key 2 for the second and fifth; key 4 for the fourth and fifth; key BL for the first, second, third and fifth pulse; key P for the first, second, third, fourth and fifth pulse; and key Q for the second, third, fourth and fifth pulse, etc.

Both groups of keys are employed to register quantities and prices, the BL keys being used for blank price settings, i. e., to set certain of the price dials to their blank positions, as the hundreds dial of a stock selling for less than 100, and in certain cases they may also be used for nominating or stock selection. The Z keys except P and Q are used for selecting stocks either for a single letter odd or even or a double letter stock and for certain nominating operations as will be later described. The P and Q keys are used for nominating. The key P is provided for nominating purposes involving a double letter stock selection with a price change requiring movement of the units price dial, the thousands quantity dial and a shelf selection. Key Q transmits a signal which does not have a fifth selecting pulse but does have the second to fifth selecting pulses inclusive. This key, therefore, is employed for nominating purposes involving a single letter even stock selection with a price change requiring movement of the units price dial, the thousands quantity dial, and a shelf selection. The fifth pulse on a quantity or price operation serves to energize certain control relays and set up circuits to extend the operation of the receiving circuit and other effects, as will be later more fully described.

Additionally, keys of group Z are for registering quantity and price under certain conditions. For example, it often happens that a series of successive sales on the same stock without a significant change in the price occurs. On the ticker tape such a quotation is printed in the following manner: TT 8.6.4.8.9. Generally, these are sales in less than 1000 share lots. Under these conditions only the hundreds quantity keys are operated, one for each sale. It is obvious that with this arrangement a vast amount of wire and operating time is saved as against older systems, also employing remote control for posting quotations.

Often, sales are in even thousand share lots, as 10.20.30 on the same stock without a significant price change, or a quotation may read as 2.3.20.2 on the same stock without a significant change in price. With this system, as will be later described, the thousands quantity may be registered without affecting the hundreds quantity dial. A similar circuit to skip the fraction dial is set up for the price dials when the price ends in an integer, that is, without a fraction.

In the first instance, if the hundreds quantity dial had to be operated to condition the thou-

sands quantity dial for operation, provision must be made to prevent the idle movement of the hundreds dial from being accumulated and also to prevent a transfer of one from the lower to the higher order of numbers by the movement of the hundreds dials in the event it passes from 9 to 0.

Keys of row Y are also used for registering quantity and price, and when used for quantity, the fifth pulse sets up a circuit to energize the odd fraction control relay and the next group of pulses direct the movement of the selected fraction dial. When used to record the fraction pulses, the fifth pulse sets up a circuit to continue the operation for the selection of a stock shelf or other such selections as may be needed. Keys of group Y may be also used to record the quantity and the keys Z for recording a price change in the fraction. This constitutes a full sending operation and is highly useful to record a transaction in hundreds in the quantity and a significant price change in the fraction.

The use of keys transmitting the fifth pulse, when recording quantities in excess of 99(00) shares and a price in the tens, permits at the will of the operator the selection of the ten thousands quantity and the hundreds price control relays. On a quotation involving quantities from 10(00) to 99(00) shares and a price change in the tens, the Z keys are used for the thousands quantity and the tens price change. This operation omits cutting into circuit the ten thousands quantity and the hundreds price control relays.

Not often do sales in excess of 10,000 shares occur. However, such sales do occur and with sufficient frequency to call for apparatus to meet this need, as it is of prime importance to have knowledge of single sales in large blocks. It is awkward to record a sale of, say, 50,000 shares by resorting to the expedient of adding 9900 shares five times and 500 shares once to complete the transaction, which could be done and the ten thousand quantity control relays omitted. With this arrangement facilities are always had for recording all sales up to and including 99,900 shares in one operation and this is carried out without providing for wire time in each operation for this infrequently used feature.

Submitted below are samples of perforations for several types of quotations:

A.

```

1  o   o   o   o   o   o   o   o
2  o   o   o   o   o   o   o   o
3  .   .   .   .   .   .   .   .
4  .   .   .   .   .   .   .   .
5  o   o   o   o   o   o   o   o
   Y Y Z Z Z Z Y Y Z Y Z
   5 4 P A D B 7 8 1 9 9

```

B.

```

1  o   o   o   o
2  o   o   o   o
3  .   .   .   .
4  .   .   .   .
5  o   o   o   o
   Y Y Z Z
   5 6 A A

```

C.

```

1  .
2  .
3  o
4  o
5  .
   Z

```

At A is the longest operation; the selection of a two letter stock as AD, a shelf selection, 99,500 shares sold at, say, 187½.

At B—about the average operation; the selection of a single odd letter stock, 500 shares sold and a significant price change in the fraction. It should be noted that the third signal perforated

in the above example represents the nominating operation, indicating that a single letter odd stock is to be selected. If a single letter even stock were selected key B of row Z would be used, instead of key A, for the nominating operation, thus actuating the B2 control relays instead of the B1 relays. The operation of these relays will be described later.

At C—the minimum operation; recording, say, 700 shares on a preselected stock without a change in price.

In carrying out the operation of the receiving circuit for controlling the dials or indicators of the several register units, an arbitrary quotation will be given for, say, a two letter stock, a shelf; the quantity is in hundreds and the price is in two integers and a fraction. This quotation may be written as follows: AA 1.11¼, and the quotation is to be registered on the previous close shelf.

Analyzing the steps required for this quotation, it will be apparent, after an understanding of the hook up of the receiving circuit, that the first operation requires a five unit code to operate the hundreds quantity permutation device, and this operation also nominates the fraction control relays; secondly, a five unit code is also necessary to set the fraction permutation device, which also on this operation conditions the nominating control relay C; thirdly, a five unit code is also necessary after the nominating relays C have been prepared, to prepare for operation the stock and shelf control relays, together with the units price control relays; fourthly, a four unit code selects the single letter odd; fifthly, a four unit code selects the single letter even; sixthly, a four unit code selects the previous close shelf; seventhly, a five unit code sets the units price permutation device, simultaneously nominating the tens control relays; and lastly, a four unit code is utilized to set the tens permutation device. The steps required in setting up this quotation, as well as the character of the code needed for each step in the quotation, may be understood at a glance upon the inspection of the following tabulation, bearing in mind that abbreviation NRSS refers to the nominating control relay C1.

	NRSS	Stock	Shelf	Quantity	Price
Quotation.....		AA	PC	1	11¼
Unit code used.....	5	44	4	5	455
Sequence of operation of keys of keyboard transmitter.....	3	45	6	1	872

In setting up this quotation in the previous close shelf, the following keys are used by the operator (see Fig. 33); Y1 for the quantity; Y2 for the fraction in the price; BL of row Y for nominating the stock and shelf and units of the price; A of row Z for the single letter odd A; A again of row Z for the single letter even of the stock designation; A of row Z for selecting the previous close shelf of price dials; Y1 for the units in the price, and lastly Z1 for the tens in the price.

Normally, at the beginning of operations, as previously explained, guard relay B15 (Fig. 6) is deenergized and its contacts 441, 442 and 443 are closed and grounded. Closed contact 442 grounds conductor 444, energizing winding 445 of relay 445A (Fig. 4), the odd hundreds quantity control relay of pair B8. Relay 445A locks up through contact 446, common conductor 447 and

contact 414 of the receiving distributor (Fig. 1) in the zero position thereof. Closed contact 428 of relay 445A energizes winding 450 of the even control relay of pair B8. When the distributor shaft takes motion, even control relay of pair B8, as well as other like relays, locks itself through its contacts, as 451, conductor 452 to ground through contacts 413 of the distributor (Fig. 1). Contacts 413 close before contacts 414 open so that the odd relay, as 445A, of pair B8 (Fig. 4) does not release and open the original operating circuit of the even relay until after the locking circuit of the even relay is closed. The even relay, therefore, remains energized until the distributor shaft and cam 411 have completed one revolution. Contacts 453 and 454 of the even control relay of pair B8 are now grounded. Closed contact 453 grounds conductor 455, energizing winding 456 of guard relay B15, (Fig. 6) opening contacts 441, 442 and 443. Contacts 442 open the original energizing circuit for relay 445A (Fig. 4), permitting it to release when cam contacts 414 (Fig. 1) open.

However, before guard relay B15 (Fig. 6) became energized, contact 443 thereof grounded conductor 457 and closed contact 468, energizing through winding 458 relay J1', which in turn through closed contact 459 energized winding 460 of relay J1, and the latter through closed contact 461 energized winding 462 of relay J2', grounding contacts 463 and 464. Closed contact 463 energizes winding 465 of relay J2. As previously stated, the action of these four relays is for the purpose of putting into operation one of the two sets of transfer relays for shelf, quantity and price, namely, D4, D5, D6, D7, etc. or E4, E5, E6, E7, etc. and for establishing a circuit for the release of the register reset coils as 737 or 737A of permutation devices as F6 and G6 (Fig. 10) respectively on the completion of their respective shaft movements, it being noted that the reset coils of permutation devices as F4, F5, F6 are connected to common conductors 738 which terminate in contact 476 of relay J3, and if relay J3 is energized, battery is supplied to conductor 738. When relay J3' is energized, contact 474A thereof provides battery for conductor 474B to which reset coils as 747A (Fig. 12) are multipled.

Relays J1 and J2 are held locked by their contacts 466 and 467 and contact 441 of relay B15. Relay J2, in being energized, opens contact 468, causing relay J1' to release, leaving relay J1 under control of contact 466 and contact 441 of guard relay B15. At this time relay B15 energizes, opening contacts 441, 442 and 443 and closes contact 469. As ground is removed from contact 441, relay J1 releases and J2' and J2 continue energized, due to contact 469, energizing winding 470 of relay J2' through contact 471.

It should be noted that the release of relay J1 and the energization of J2' grounded contacts 464 and 472, causing common transfer relay 439 (Fig. 12) of permutation set F—F for shelf, quantity and price to energize through conductor 472A, closing its several sets of contacts as 478 and applying battery to conductors as 472B, 472C—472J (Figs. 8-12 incl.) associated with the transfer relays D10, D9—D3 of the #1 or F—F set of permutation devices.

Winding 473 of release control relay J3 (Fig. 6) is in multiple with conductor 472A and is energized when common transfer relay 439 is energized. Relay J3 is slow to release and is provided with two sources of energization, namely, one through winding 473 as before described, and

another through contact 475, common conductor 734 associated with the several tooth or jockey wheels as 746A (Fig. 15) of the price shafts as 203 and wheels as 224 (Fig. 20) of the main quantity shafts as TIQ. That is to say, so long as any one of the price or quantity shafts is in motion, common conductor 734 is grounded to hold release control relay J3 energized. As the latter is now energized, contact 476 is closed providing battery for the several register release coils as 747 (Fig. 12) through conductor 738.

Common transfer relay 439 closed contacts 478 and 481C. Closed contacts 478 supplied battery to conductors 479A and 480A in circuit respectively with windings 481 and 482 of guard relay B9 (Fig. 4), and the latter now becomes effective operating relay B9 through winding 482 and closed contact 454 of the even hundreds quantity control relay of pair B8, thereby opening contact 483, relieving conductors 698 and 699 of ground, and consequently the wipers of the selected permutation devices (Fig. 10), until the stock selection is complete, if there be a stock selection, as the armatures associated with the back contacts of the slow to release relays as 495 are connected to the common conductor 699. Guard relay B9 may continue to be energized through winding 481 from contact 647A of guard relay B3 (Fig. 2) in the event a stock selection is made. If this provision were not made, the wipers of the permutation devices for shelf, quantity and price would ground their several contacts as the wipers passed over them.

The receiving circuit is now prepared for the reception of the first group of pulses, in starting to transmit the assumed quotation A. A. L. 11¼, and the perforations from the Y1 key transmit the first and fifth pulse over the single transmitting circuit 70 (Fig. 1), to transmit the hundreds quantity digit "1". The receiving distributor takes motion, contact 413 is closed and 414 is opened. Thus, contact 446 of the odd control relay of pair B8 (Fig. 4) is relieved of ground, causing the odd relay 445A to release, closing contact 429 which grounds closed contact 484 and conductor 484A, energizing transfer relay D6 (Fig. 10), closing its contacts as 486 and 488 to the bus wires as 84, 487 etc. of the receiving distributor.

Wipers 75 and 403 of receiving distributor A (Fig. 1) continue to advance and, as a first selecting pulse is transmitted, relay 401 will apply ground through the wipers to the #1 segment 404, conductor 84, closed contact 486 of transfer relay D6 (Fig. 10), energizing operating coil 487A, tripping the #1 code disc 488. Relay 401 releases and operates again just as the distributor wiper reaches the fifth position grounding conductor 86 to operate relay B14 as described later, and subsequently cam 410 (Fig. 1) closes contact 412, grounding conductor 487, closed contact 488 (Fig. 10), energizing trip coil 489, actuating the set and reset disc 490 to remove its associated zero stop arm, and dropping into place the #1 stop arm, permitting the striker arm as 13 (see Fig. 25) and wiper 491 (Fig. 10) of permutation device F6 to advance to the #1 contact 492.

Movement of shaft 1 of permutation device F6 caused jockey wheel 493 to take motion, momentarily closing contact 494, energizing slow to release relay 495, closing contact 496 and opening contact 497. Closed contact 496 is now in circuit with conductor 481D and the grounded closed contact 481C of the common transfer relay 439 (Fig. 12), and this circuit extends to con-

tacts 763 and 762 (Fig. 10) and conductor 764 over the conducting rings of permutation device G5 and conductor 651D, which is wired to the thousands quantity odd control relay of pair B7 (Fig. 3), but this circuit is without effect, namely, to energize the thousands quantity permutation relays from the hundreds quantity permutation device, as wiper 491 (Fig. 10) does not bridge contacts 762 and 763 for the wiper is now on the #1 contact 492. However, on the fifteenth position of the wiper 491, when the latter cuts in contacts 762 and 763, the odd control relay of pair B7 may be energized when the quantity is in even thousands from the hundreds quantity permutation device.

When shaft 1 of permutation device F6 stops, relay 495 deenergizes, closing contact 497, extending the circuit comprising conductors 608 and 609 to the common 762, but this circuit is without effect as contact 483 of guard relay B9 (Fig. 4) is open, guard relay B9 being energized from closed contact 478 of the common transfer relay 439, conductors 480A and closed contact 454 of the even or mate control relay of pair B8, as previously explained. In other words, even though slow relay 495 is deenergized, ground is not extended to commons as 762 and associated wipers until stock selection is complete, if there is to be a stock selection.

As previously pointed out, the operation of key Y1 perforates the tape for the first and fifth pulses. The first pulse in this connection has already been employed to set the hundreds quantity permutation device. The fifth pulse is utilized to nominate in this instance the odd fraction price control relay of pair B14 (Fig. 5). The fifth pulse is received when the wiper is on segment 408 of the receiving distributor (Fig. 1), and causes ground to be applied to conductor 80, conductor 499 (Fig. 4), closed contacts 432 and 433 of the hundreds quantity control relays of pair B8, conductor 601 to winding 434 (Fig. 5), energizing odd relay of pair B14 which in turn energizes, in a manner hereinbefore set forth, its mate or even control relay. Energization of even control relay in the B14 pair grounds contacts 601Z and 602. Closed contact 601Z energizes winding 603 of guard relay B15 (Fig. 6). Closed contact 602 retains guard relay B9 (Fig. 4) energized through winding 482. At this time the receiving distributor completes its first revolution, opening contact 413 and closing contact 414, and the even relay of pair B8 releases as ground is removed from its locking contact. This relay now opens, at its contact 484, the circuit of transfer relay D6 (Fig. 10), which thereupon releases and disconnects permutation device F6 from the distributor bus pairs. The other contacts of the even B8 relay have no effect at this time because relay B9, formerly energized through contact 454, is now held through contact 602 of the B14 relay, which has locked itself over lead 447 to distributor contact 414. The ground on lead 455 from contact 454 is no longer needed as relay B15 (Fig. 6) is now held by ground from the even B14 relay over lead 757A.

When the distributor starts its next revolution contact 413 is again closed and contact 414 opens. The even B14 relay (Fig. 5) is, therefore, locked to ground on lead 452 while the odd B14 relay releases. Ground is now applied from contacts 423A, 423 and conductor 423B to energize transfer relay D10 (Fig. 12). Relay D10 connects the magnets of permutation device F10 to the distributor over leads 81, etc.

On the next operation, the perforations from the Y2 key are employed to send the second and fifth pulse, in order to transmit the fraction signal $\frac{1}{4}$. The second pulse grounds segment 405, conductor 83, closed contact 423D of relay D10, energizing operating coil 605 for operating its associated #2 code disc 606. After the distributor passes the fifth position, cam 410 grounds conductor 487 and through closed contact 425C energizes trip coil 607A, actuating trip disc 607B, raising its zero stop arm and dropping into place the #2 stop arm, permitting its corresponding striker arm and the wiper 607 to advance to the #2 contact 608.

Also on this operation, the fifth pulse becomes effective to operate the nominating control relays C. The fifth pulse from segment 408 grounds conductor 80, closed contacts 424A, 424 of pair of control relays B14 (Fig. 5) and conductor 609, energizing winding 425 of the odd control relay in pair C (Fig. 1). Odd control relay 425A having energized, contacts 426 and 427 are closed. The former locks up relay 425A from contact 643 which remains closed for the remainder of this revolution, and at the beginning of the next revolution due to the cut away portion on cam 644 maintaining contact 643 grounded.

Closed contact 427 energizes even control relay 428A, which locks up through contact 429 and closed contact 413 after the distributor starts its next revolution. Contact 430 is also closed, causing relay C1 to energize, closing its contacts as 431 to transfer from the receiving distributor to the control relays such pulses as may be sent. Closed contact 645 of relay 428A energizes winding 646 of guard relay B3 (Fig. 2), grounding contacts 422 and 647 for extending the operation of the receiving circuit to such other control relays of a higher order that later will be energized.

Contacts 609Z and 640 of guard relay B3 are also grounded, and the former sets up a circuit through conductor 88, closed contact 610 of relay H2 (Fig. 1) to energize successively relays H1', H1, H2' and H2; that is, relay H1' is first energized through closed contacts 609Z and 610. Relay H1' closes contact 611 which energizes relay H1 through winding 612, closing contact 613, and the latter energizes relay H2' through winding 614, closing contact 615, which in turn energizes relay H2 through winding 616.

Contact 640 of relay B3 (Fig. 2) is a make before break contact and it is now operated, grounding conductor 640A contacts 618 and 619 (Fig. 1), holding energized winding 641 of relay H1 and also energizing winding 642 of relay H2. Relay H1' was energized only momentarily, as it was released by contact 610 when relay H2 was energized. Thus, contact 623 was momentarily grounded, grounding closed contact 624 and conductor 625, energizing reset coils 626, 627 and 628 (Figs. 7 and 8) of the #2 set of permutation devices, a part of set G—G, releasing such permutation devices for stock and shelf as may have been set on the last operation.

As relay H1' is now released, contact 643 is closed, grounding closed contact 629 and conductor 631, and hence energizing common transfer relay 435 (Fig. 7) which closes contacts 633 and 632 to energize transfer relays D1 and D2 (Fig. 8), if their corresponding stock control relays are nominated for operation. Guard relay B3 (Fig. 2) will continue energized during the stock selecting operation, grounding contact 640, holding energized winding 641 of relay H1 (Fig. 7).

1), closing its contact 613, energizing winding 614 of relay H2', which opens contact 621B, preventing the operation of common transfer relay 436 for stock selection of the #2 set of permutation devices.

The circuit is now prepared for the third step of the operation, and the BL key of the Y row transmits the first, second, third and fifth pulse; that is, schematically these pulses or signals may be represented as:

0 1
0 2
0 3
4
0 5

These pulses serve, respectively, for nominating the odd and even stock letters, the units price digit, and the shelf selection. The receiving distributor takes motion for the next revolution. Contact 643 of cam 644 is opened, releasing odd control relay 425A in the C group, the even relay 428A is held locked up by closed contacts 429 and 413. Ground is found on segments 404, 405, 406 and 408, momentarily grounding respectively on each pulse, conductors 84A, 83A, 82A and 80A, thereby energizing odd control relays of pairs B1, B2 (Fig. 2), B13 (Fig. 5) and B4 (Fig. 2) through windings 415C, 420A, 654A and 86A respectively. Each of these odd control relays is held locked up by grounded contacts as 430 and 417B (Fig. 1) until its order of operation is reached, which takes place on the next or later revolutions of the distributor.

The receiving distributor completes the revolution, contact 413 opens, releasing even relay 428A of pair C, opening contact 430 which releases relay C1, freeing segments 404, 405, 406, 407, 408 from the windings of the several control relays and freeing the odd relay of pair B1 from control by the C relays.

Since the odd relays of pairs B1, B2, B4 and B13 (Figs. 1, 2 and 5) have been energized, the mate or even control relays thereof are also energized, grounding contacts 421 and 683 which hold energized, through conductors 421A and 683A, guard relay B3. Guard relay B5 (Fig. 3) is also energized from two sources, namely, from closed contact 422 of B3 (Fig. 2) and winding 648 so long as guard relay B3 is energized, and from closed contacts 649 and winding 650 so long as the even relay of pair B4 is energized.

Guard relay B3 energizes guard relay B5 (Fig. 3) and the latter extends guard circuit 647A to energize guard relay B9 from closed contact 651. For restraining certain of the quantity and price control relays from further operation, once they are energized, until their order of operation has been reached, contacts 652 and 653 are provided on guard relay B5. If closed, contact 653 grounds conductor 654C to continue energized winding of odd control relay of pair B13 (Fig. 5) through the locking contact 654, provided this relay has been nominated. If closed, contact 652 grounds conductor 455 and energizes winding 456 of the guard relay B15 (Fig. 6). Also guard relay B15 is energized, if any of the even quantity and price control relays is energized, through contacts as 453 of pair B8, or contact 655 of pair B13, if closed, guards circuit 757A and winding 603 of the final guard relay B15.

As both pairs of stock control relays B1 and B2 have been energized, a double letter stock selection is to be made. Through closure of contacts

417 and 684 of pair B1 (Fig. 1), conductor 658 is grounded, momentarily energizing the single letter odd stock shift relay S (Fig. 13). Through closure of contacts 656 and 685 of pair B2 (Fig. 2), conductor 659 is grounded, momentarily energizing the single letter even stock shift relay T (Fig. 13). Attention is directed to the fact that locking circuit 658A of odd shift relay S is controlled from cams 660 and 660' of the even single letter permutation devices F2 and G2 (Fig. 8), that is to say, cams 660 and 660' normally ground their spring contacts 660A and 660B, grounding locking circuit 658A of the odd shift relay S. If either the permutation devices F2 or G2 are in motion, their shafts operate cams as 660 and interrupt this locking circuit. Also, it should be noted that the locking circuit 659A for the even shift relay T is controlled by cams 36 and 36' of the single letter odd permutation devices F1 and G1 (Fig. 7). Normally, cams 36 and 36' close their spring contacts 36A and 36B and ground locking circuit 659A, but if either permutation devices F1 and G1 take motion, the movement of cams 36 and 36' interrupts this locking circuit.

It follows that on a double letter stock selection both shift relays S and T will first be momentarily energized, but inasmuch as both stock permutation devices F1 and F2 are set in motion as will be later described, both of the locking circuits 658A and 659A for shift relays S and T will be interrupted and both of these relays accordingly will deenergize. However, on a single letter stock selection a selected shift relay will be energized and will remain locked up until a new stock selection is made.

The receiving circuit is now prepared for the selection of the stock, shelf and units of the price. AA is transmitted and the receiving distributor starts rotating to receive the first character signal. Consequently, contact 414 (Fig. 1) is opened and 413 is closed. Closed contact 413 energizes winding 419 of control relay 415A and retains it energized for this revolution of the distributor. Contact 414 opening, released through winding 416, odd relay 415, grounding contacts 661, 662, conductor 663, energizing transfer relay D1 (Fig. 7) through closed contact 632 of the common transfer relay 435. Transfer relay D1 will remain energized for this revolution of the distributor.

As key A of row Z transmits only the first selecting pulse, ground is now found on segment 404, conductor 84 energizing operating coil 11 of device F1 (Fig. 7) to displace code disc 6 to permit the #1 stop bar to become effective when the trip coil 20 is energized, which takes place after the wiper crosses the fifth selecting segment 408 of the distributor (Fig. 1) as the latter continues in motion, causing contact 412 to close and ground conductor 487 and closed contact 664 (Fig. 7), and accordingly energize trip coil 20, releasing its associated striker arm and setting it into the path of the #1 stop bar, and in this position wiper 24 comes to rest on the #1 contact 669.

Continuing in motion, the receiving distributor completes its revolution, opening contact 413 and closing contact 414, releasing the even control relay of the B1 pair and the corresponding transfer relay D1. The even relay of pair B1 opened contact 421, freeing winding 420A of the B2 odd relay so that it may release on the next revolution of the distributor.

It should be noted that on the movement of shaft 1 of permutation device F1 (Fig. 7) tooth

wheel 25 momentarily closed contact 26 to energize slow relay 438, freeing contact 670 from ground so that wiper 24 will be free from ground until the selected contact is reached. Relay 438 now deenergizes, grounding commons 23, 23A and contact 669 through wiper 24.

Now, on the movement of shaft 1 of permutation device F1, cam wheel 36 was advanced out of its zero position, opening locking circuit 659A of shift relay T, bearing in mind that control relays of pair B1, when both energized, initially energize shift relay S and the pair B2 relays initially energize shift relay T, but that the locking circuit 659A of S is controlled by the permutation devices as F2 or G2 of pair B2, and that of the T relay is controlled by the permutation device as F1 or G1, as previously explained.

Ground on common 23A grounds conductor 672, energizing start relay 673 (Fig. 14), closing contact 674 which grounds conductor 674A, energizing clutch magnet 507 (Fig. 13), causing gear 502 to mesh with the driving gear 505 and to drive shaft 675. The several wipers as 788 of the A—A unit (Fig. 14) now advance. Wiper 500A of bank 810 finds ground on the #1 contact 810A, as ground was extended thereto from the #1 contact 669 of permutation device F1 through conductor 669A, the latter passing through cable F1G1. Consequently, stop relay 675K is energized, opening contact 676, removing ground from circuit 674A, releasing clutch magnet 507 (Fig. 13) and the several wipers of the switch unit A—A come to rest on the #1 contacts.

For setting the wipers of verticals of stock switch unit B—B to predetermined contacts of associated banks, the second of the A° characters is now received on the next revolution of the distributor. The B2 control relays, having been selected, transfer relay D2 (Fig. 8) is energized and remains energized until this revolution is completed. Ground is found on segment 404, conductor 84 to energize operating coil 636 and set its corresponding disc when the trip coil 635 is energized from closed contact 412, after the fifth pulse position of the receiving distributor, causing the #1 stop bar to fall in position and comprise an abutment for the respective striker arm, and the wiper 677 comes to rest on contact 678.

Due to the operation of jockey wheel or ratchet 25, ground is removed from contact 670B and conductor 679 of start relay 682 (Fig. 14), but on stoppage of shaft of permutation device F2, contact 670B is closed, grounding conductor 679, energizing start relay 682, closing contact 682A, which in turn energizes magnet 681 (Fig. 13) through conductor 682B. Consequently, shaft 675F takes motion. Also, the #1 contact 678 and conductor 678A are grounded, grounding the #1 contact 501A of bank 814 of the switch unit B—B. Hence ground is extended to wiper 501, energizing stop magnet 680, opening contact 680A, deenergizing clutch magnet 681, causing shaft 675F to stop with wipers as 717C of unit B—B on the selected contacts, and in this particular instance, on the #1 contacts.

In the movement of permutation device F2, cam 660 opened contact 660A, freeing the locking conductor 659A for the odd shift relay S of ground, and deenergizing closed its back contacts as Y. Consequently, since permutation devices F1 and F2 both operated, shift relays S and T are both deenergized, connecting the various shelf magnets and dial magnet circuits passing through cable F3G3 through the back contacts of

shift relays S and T to the wipers of the second or transfer vertical of unit A—A. In this instance, as the wipers of the second vertical of unit A—A are on the #1 contacts, the shelf magnet and dial magnet circuits of cable F3G3 extend to commons as 717B of the second vertical of switch unit B—B.

The receiving distributor completes its revolution, releasing the even relay of pair B2 and the corresponding transfer relay D2. Contact 421 of even relay 415A (Fig. 1) and contact 683 of the even relay of pair B2 (Fig. 2) are now open, freeing windings 646 and 686 of guard relay B3 of ground. Thus, guard relay B3 deenergizes and opens 422, removing ground from winding 86A of the odd relay for shelf pair B4, preparing it for release on the next revolution of the distributor. As the odd control relay of pair B4 has been nominated, its mate relay is energized and contact 649 is closed. Thus it is evident that, although ground has been removed from contact 422 of guard relay B3, still guard relay B5 (Fig. 3) will be energized through winding 650 and closed contact 649 of even relay of pair B4.

In deenergizing, guard relay B3 also removed ground from contact 640, conductor 640A and locking contact 618 of relay H1 (Fig. 1), deenergizing the latter. Consequently, contact 629 is opened, releasing the common transfer relay 435 (Fig. 7). Also contact 613 of relay H1 is opened, freeing winding 614 of relay H2' from ground. But as contact 617 of guard relay B3 makes before contact 640 breaks, conductor 617A is grounded, grounding closed contact 621 and winding 621A of relay H2', and relay H2' continues energized until another stock selection is made to set up circuits to energize the common transfer relay 436 and associated transfer relays as E1, E2 of the #2 set of permutation devices.

Open contact 647 of guard relay B3 (Fig. 2) removes one source of ground from windings 481 and 652A, which are in multiple, of guard relays B9 and B10 (Fig. 4), placing the latter under control of closed contact 651 (Fig. 3) and guard circuit 647A associated with guard relay B5.

In the selection of the previous close shelf of the stock register unit AA, the signal transmitted by key A of the Z group characters is now received on the receiving distributor on the next revolution thereof, and inasmuch as the shelf control relays of pair B4 (Fig. 2) have been previously nominated and are now energized and common transfer relay 439 is still energized, circuit 421J will be established on the off zero position of cam 411, to energize, relay D3 (Fig. 18) which closes its contacts, connecting the receiving distributor with the shelf permutation device F3. Ground is found on segment 404, and conductor 84, energizing coil 637, and when trip coil 637A has been energized due to cam 410 closing contact 412, wiper 688 is positioned on the #1 contact 689. The previous close shelf magnet circuit 690, however, is free of ground until the slow relay associated with permutation device F3 deenergizes, and when this occurs on stoppage of its shaft 1, ground is now extended to back contacts as Y of shift relays T and S (Fig. 13) through circuit 690, conductor 693, wiper 694 (Fig. 14), the #1 contact 695, conductor 695A, wiper 696, the #1 contact 696A, and the previous close shelf magnet conductor 697 confined in cable CDL, which extends to and operates magnet 697A (Fig. 18) of the previous close shelf PC of register unit DL, that is, the #1 dial group for the double letter stock AA under consideration.

Now the receiving distributor completes its revolution and the even relay in the B4 pair (Fig. 2) is deenergized in a manner as before described, freeing contact 649 of ground, releasing guard relay B5 (Fig. 3), opening contact 651 which removes ground from guard conductor 647A and winding 481, releasing guard relay B9 (Fig. 4) and grounding contact 483, conductors 698, 699 (Fig. 10), contact 497 of slow relay 495 of the hundreds quantity permutation device F6, common 702, and the several arms of wiper 491 which extends ground to the HQ shaft start relay over conductor 710 and to the selected contact 492. Conductor 710 is confined in cable F6G6 and terminates in contact 711 (see Fig. 20). In the zero position of cam 711A, contact 711 makes with spring contact 711B. Thus start circuit 710 is extended to start hundred quantity shaft start relay 712, energizing the latter, grounding contact 722, which in turn energizes clutch magnet 723 (Fig. 19), putting the main hundred quantity shaft HQ in motion.

As the hundreds quantity dial magnet circuit 715D is in multiple with the hundreds quantity start shaft magnet circuit 710 (Fig. 10), hundreds quantity magnet 900 of register unit DL (Fig. 18) will also be energized. Thus, as main quantity shaft HQ is in motion, dial shaft 902 actuated by shaft HQ also takes motion and since dial magnet 900 has been energized, dial or indicator 901 rotates with the dial shaft 902 until the main positioning shaft HQ is stopped, at which time magnet 900 is released from shaft HQ but the latter again picks up motion and completes its revolution and stops, this action will be more fully hereinafter disclosed.

When guard relay B5 was released, guard relay B9 also released, closing contact 481 which grounded conductors 698 and 699, and it should be observed that conductor 699 also, through closed contact 700 of slow relay 701 of fraction price permutation device F10 (Fig. 12), extended ground to common 703 and through wiper 607 to common 707. Thus, as in the case of the hundreds quantity permutation device, two circuits are established. In this instance, fraction price start shaft magnet circuit 709A is established, and secondly, the fraction price magnet circuit 715 is completed. Tracing circuit 709A, it is seen that it passes through cable F10G10 and is in circuit with start relay 713 (Fig. 15) associated with the fraction price shaft 203. Therefore this relay is energized, which in turn energizes clutch magnet 739 through closed contact 730, setting in motion shaft 203 and heart shaped cam 740 (Fig. 20), displacing the shaft FP and setting the fraction dial shaft 120 (Fig. 18).

However, a circuit is also established for fraction dial magnet 904 of register unit DL, as the fraction price dial circuit 715 is in multiple with the start circuit 709A (Fig. 12). Traced, the fraction price magnet circuit comprises conductor 715, confined in cable F3G3, spring contacts *x* (Fig. 13), contacting back contacts *y* of shift relays T and S, conductor 905, contact 717 of bank 812 (Fig. 14), conductor 717A, common 717B, wiper 717C, conductor 717D, passing through CDL and connecting dial magnet 904 (Fig. 18).

Thus it is apparent that guard relays B9, B10 comprise means for holding ground from the stock selector wipers of stock units A—A, B—B during their movement, and putting ground on the wipers immediately after each operation, or

where a series of successive quotations are made on a preselected stock.

Apropos of the permutation device F6 (Fig. 10), wiper 491 now rests on the selected contact 492. Consequently, a shaft stop circuit is established for main shaft HQ. Traced, the circuit includes grounded conductor 704, confined in cable F6G6, contact 719 (Fig. 19), brush 724, conductor 734A, and stop shaft relay 725 (Fig. 20) which now energizes, opening its contacts 721 and 726, and closing contact 735. Open contact 721 removes ground from the locking contact 720 of start relay 712 and the latter deenergizes, opening contact 722 which removes ground from conductor 722A, releasing clutch magnet 723 and accordingly stopping shaft HQ at a selected position.

Also wiper 607 of permutation device F10 (Fig. 12) is now on the selected contact 608. Hence, a stop circuit is established for stopping the fraction price shaft 203. This circuit includes grounded contact 608, conductor 608A, which passes through cable F10G10 and terminates on contact 608B (Fig. 15), now grounded, brush 719A, common 742, conductor 742A, and stop relay 743 which now energizes, opening contact 737 and closing contact 745. Open contact 737 removes battery from start relay 713, accordingly deenergizing clutch magnet 739, stopping shaft 203 at a predetermined position.

As the dial operating magnet 900 (Fig. 18) of the hundreds quantity and the fraction price magnet 904 have been operated, the quantity dial 901 is drawn into engagement with its shaft and the fraction dial 906 is ready to take its selected position. In other words, in the case of a price dial as 906, the opposed springs disposed within the dial have been tensioned upon movement of its shaft and the dial follows the position of the shaft, due to release of the tension in the springs after its dial magnet is energized. On the other hand, a quantity dial as 901 takes motion with its shaft, as previously pointed out, when its dial magnet is energized, and the dial stops and is disengaged from the shaft at its predetermined position, upon the deenergization of its magnet, however bearing in mind that its corresponding shaft as 902 continues its motion until the revolution is completed, that is to say, the quantity shafts return to zero or normal position after they have set their dials to predetermined positions and the price shafts remain in their selected positions.

On the forward movement of shaft HQ, jockey wheel 729 (Fig. 20) rotated, closing contact 731 until the shaft completed a full step closing a circuit through contacts 730, to continue energized clutch magnet 723 if stop relay 725 has been prematurely deenergized.

Also, on the movement of shaft HQ, contact 731 momentarily grounded, grounding common conductor 734 and the locking contact 475 of release control relay J3 (Fig. 6) to continue the latter energized until all the quantity and price shafts have completed their movements. This circuit is for the purpose of retaining on short operations a release circuit, already alluded to, for the quantity and price reset coils as 747 (Fig. 10), as in actual practice a subsequent quotation may be recorded on the #2 set of permutation 70 devices before the quantity and price shafts have completed their operation. Thus it is seen that with this set up each of the quantity and price reset coils as 747 is provided with an independent release circuit and it is operative on the comple-

tion of the shaft movement, namely, at a time when a stop relay as 725 (Fig. 20) is energized, closing contact as 735, grounding conductor 736 connected to a corresponding reset coil as 737 (Fig. 10) which energizes and now becomes effective as battery is supplied thereto from closed contact 476 of relay J3 (Fig. 6) through conductor 738.

If selected, quantity shafts HQ, TQ, TTQ, HTQ are first set to predetermined positions, that is, they start from the normal or zero position and are momentarily stopped at a predetermined position and then continue in motion, completing their revolution, stopping again at their normal position. Thus, permutation device as F6 (Fig. 10) would be restored to normal with wiper 491 in its zero or ineffective position, and since ground is removed from the stop relay circuit 704, stop relay 725 (Fig. 20) is deenergized, opening contact 735 and closing contacts 721 and 726. Closed contact 721 is without effect, as start relay 712 is deenergized. Hence, contacts 726, 733 and 732 are closed. Contact 732 is closed due to the off-normal or zero position of cam 711A. It follows that a circuit is again established to energize clutch magnet 723. Traced, this circuit includes grounded contact 726, closed contact 733, closed contact 732, conductor 722A, solenoid or clutch magnet 723 (Fig. 19) and battery. It is evident, therefore, that shaft 207 drives shaft HQ forward until the latter reaches its zero position, namely, at the time when contact 732 falls into its zero or normal relationship with cam 711A, opening contact 732.

Apropos of the fraction price shaft 203 (Fig. 15), start relay 713 was energized from conductor 709A, hereinbefore mentioned, closing contact 738, energizing clutch magnet 739. Shaft 203 takes motion, actuating cam 740 and moving main fraction price shaft FP to its selected position. Also wiper 719A is carried forward and finds ground on contact 608B, energizing stop relay 743. Contact 737 is opened and contact 745 is closed. The former disables the start relay 713, deenergizing clutch magnet 739 and consequently stopping shaft 203, cam 740 and main fraction price shaft FP in their new selected positions, and movement of shaft FP positions shaft 120 (Fig. 18) of register unit DL to the $\frac{1}{4}$ position, causing the fraction dial 906 to display $\frac{1}{4}$.

As contact 745 (Fig. 15) is also closed, a release circuit 746 for the fraction price reset coil 747 (Fig. 12) is also established, energizing reset coil 747 through conductor 738 and closed contact 476 of relay J3 (Fig. 6). Thus permutation device F10 (Fig. 12) is reset to normal, and as ground is removed from conductor 608A, stop relay 743 (Fig. 15) is deenergized.

Jockey wheel 748A, in movement, closes contacts 747 and 748. The latter provides pulsating ground to release circuit 734 to continue energized release relay J3 so long as price shaft as 203 is in motion. Closed contact 747 provides battery to start relay 713 to insure a full step of the fraction price shaft. Up to this point the quantity dial 901 registers 1 and the fraction price dial 906 indicates $\frac{1}{4}$.

During the above operation additional characters are being received and the units in the price is next. For this step, character Y1, consisting of the first and fifth selecting pulses, is received. The receiving distributor starts, releasing odd control relay 654A of pair B13 (Fig. 5) as ground is removed from its locking contact

414 in the off zero position of cam 411. Transfer relay D9 (Fig. 11) now energizes as before described, connecting the operating coils of permutation device F9 to the receiving distributor, and the transmitted pulses operate selected operating coils of permutation device F9 to set wiper 749 on contact 750. The operation is as before described, that is to say, upon stoppage of shaft of permutation device F9, when its wiper rests on a selected contact, three circuits are established, namely, first, start circuit 709B to energize the start relay 916 (Fig. 15) of the units price shaft 202 and to set the latter in motion; secondly, units dial magnet circuit 715A (Fig. 11), multiplied to start circuit 709B, is grounded, completing a circuit through back contacts Y of shift relays T and S (Fig. 13), conductor 910, the #1 contact of bank 811 (Fig. 14), the #1 contact of bank 911, conductor 717E, confined in cable CDL, and conductor 717E is in circuit with units magnet 912 (Fig. 18), energizing the latter; and thirdly, stop shaft relay circuit 915 is grounded, subsequently causing stop relay 917 (Fig. 15) to energize, disabling start relay 916, and the units shaft 202, cam 218B (Fig. 20), shaft UP and dial shaft 118 (Fig. 18) are set at their selected positions. The units dial 918, having been released by the energization of magnet 717E, moves to a position to register or display 1.

Particularly, attention is directed to the fact that in the transmission of pulses to set the units price permutation device F9, the receiving distributor also received a fifth pulse on segment 408, grounding conductor 80 and closed contacts 751 and 752 of control relays B13 (Fig. 5), energizing through conductor 753A odd control relay of pair B12. In other words, the operation of the units control relays sets up a circuit adapted to receive the fifth pulse from the receiving distributor and nominate or prepare for operation the tens pair of control relays B12, which are effective on the next revolution of the receiving distributor.

For completing the registration of the quotation, in this instance to set the tens dial 920 to a selected position, the signal Y1 is now received. It should be noted, however, that operation of control relays of pair B12 energizes transfer relay D8 (Fig. 11) to close its contacts to receive any pulse from the distributor, which in this case operates the tens permutation device F8 and positions wiper 755 on contact 756. Thus, circuits are established, in a manner as before described, to advance the tens price shaft 201 (Fig. 15) and stop the latter and the tens dial 118 (Fig. 18) at a selected position. Also a circuit has been completed to energize tens dial magnet 925, releasing the dial 920 until its springs are without tension, and in this position dial 920 displays 1. The full quotation is now in view, that is, for stock AA the quotation appears on dial group DL in the accumulative quantity and current shelves CQ and CU and the quotation registered is 1(00) shares as the quantity, at $11\frac{1}{4}$ as the price, which may be written as AA.1.11 $\frac{1}{4}$.

In the example chosen, the price ($11\frac{1}{4}$) may have been registered on the previous close shelf only, that is, the fractions, units and tens shafts 120, 119 and 118 respectively, are positioned as 70 before described, and upon operation and release of magnet 697A, dials 931, 932 and 933 take a position corresponding to their associated shafts due to the release of tension in their dial springs. The receiving distributor completes its last rev-

olution, opening contact 413 which removes ground from common conductor 452 and the locking winding 452A of the even tens control relay of pair B12 (Fig. 5). Transfer relay D8 is deenergized. Contact 757 is opened, removing ground from conductor 757A, deenergizing final guard relay B15 (Fig. 6) which opens contact 469 and closes contacts 441, 442 and 443. Closed contact 442 through conductor 444 energizes the hundreds odd quantity control relay of pair B8 for the next operation. Contact 441 makes before contact 469 breaks and retains relay J2 energized through closed contact 467. Closed contact 443 is without effect as contact 468 of relay J2 is open.

Open contact 469 removed ground from locking circuit 471 of relay J2', releasing the latter and accordingly opening contacts 464, 463 and 471 and closing contact 759. Open contact 464 removed ground from contact 472 and conductor 472A, releasing the #1 set common transfer relay 439 (Fig. 12), and also deenergizing release relay J3 (Fig. 6) which opens contact 476, removing battery from common conductor 738 to which the quantity and price set and reset coils as 747 are in multiple.

Relay J2 is held up from closed contacts 441 and 467 and contact 758 is closed. Relay J2' is now disabled. Thus ground is found on closed contacts 758, 759 and conductor 759A, energizing the common transfer relay 440 (Fig. 12) for the #2 set of permutation devices. Additionally, on this operation relay J3' (Fig. 6) is energized as conductor 759B is in multiple with conductor 759A, grounding closed contact 475 of relay J3, energizing relay J3' which opens contact 474 and closes 474A. The former removed ground from conductor 473, the original operating circuit for relay J3. The latter provides battery for conductor 474B to which set and reset coils as 747A (Fig. 12) of the quantity and price permutation devices of the #2 set or set G—G are in multiple. Relay J3' (Fig. 6) is retained energized through locking contact 761A, now in circuit with common conductor 734, which receives pulsating ground, if any, of the quantity or the price shafts are in motion. Relay J3' is slow to release, as is the case of relay J3, and consequently relay J3' will be held locked up until the quantity and price shafts are without movement.

In a word, relays J1, J1' prepare circuits as previously disclosed, say, for the first quotation to be received by the #1 set of permutation devices, and while the stock, quantity and price shafts are in motion to register the first quotation, relays J2, J2' operate to prepare circuits for the second quotation which is received on the #2 set of permutation devices, and while the quantity and price shafts are in motion to register the second quotation, the third quotation is prepared for recording by relays J1, J1', etc. Thus it is seen that, while the quantity and price shafts are in the process of setting up a quotation, a subsequent quotation may be recorded for immediately setting the shafts to a new registration upon completion of their preceding registration. Overlap control is thus provided and hence with this arrangement the present system may be operated at relatively high speeds.

With the present system, a series of quantities on a preselected stock with a significant price change in the last sale may be registered. For example, a series of sales as, say, 2.13.½ on stock (AA) which was previously selected is desired to be registered. Stock selector units A—A, B—B

are permitted to remain on their last selected position in order that the series of quantities and the price of the last sale will be set up in register unit DL.

Always, at the completion of a registration of a sale, control relays of pair B8 (Fig. 4) become energized, and consequently they are now ready for the next round of operations. Thus contacts 453 and 454 are closed. The former energizes final guard relay B15, setting up circuits as before described. Closed contact 454 energizes either of guard relays B9 or B10, depending upon whether the common transfer relay 439 or 440 is energized. If energized, guard relay B9 removes ground from contact 483, conductor 698 and the common conductor 699 associated with the #1 set of permutation devices for quantity and price. If guard relay B10 were energized, contact 652B is open, removing ground from conductor 652C and common conductor 652D associated with the #2 set of permutation devices for quantity and price.

Since control relays of pair B8 have been operated, transfer relay D6 (Fig. 10) is energized on release of odd B8 relay after the off zero position of distributor and its contacts are closed, connecting the receiving distributor with operating coils as 487A of permutation device F6, preparing the receiving circuit for the reception of the signals or pulses for quotation, 2.13.½ on the preselected stock. First, the first two sales, namely, the 2(00) and the 1(00) are transmitted by the four unit codes, that is, for 2(00) key 2 of Z row would be actuated, and key 1 of the Z row would be employed for registering the second quantity 1(00). On the first operation, pulses corresponding to 2(00) are received by the hundreds quantity permutation device F6 and circuits are set up as before described, setting shaft HQ to a position corresponding to 2. Also hundreds dial 901 (Fig. 18) is actuated and accumulates the registration of shaft HQ, after which it is operatively disconnected from shaft HQ and the latter returns to its normal or zero position. Upon the transmission of pulses corresponding to the second sale, namely, 1(00) quantity, permutation device F6 is again operated and circuits are set up to actuate again shaft HQ to a position corresponding to 1. Dial 901 also takes motion to include this registration in its total. Dial 901 is released and shaft HQ returns to zero or normal position.

It should be noted that for the last sale, viz. 3.½, key 3 of the five unit code or row Y is employed, and this operation accomplishes, inter alia, two salient operations, first, the hundreds quantity shaft HQ is set to a position corresponding to 3 which is accumulated on dial 901, and secondly, the fraction pair of control relays B14 (Fig. 5) is nominated and upon the off normal position of cam 411 transfer relay D10 energizes, connecting the operating coils of permutation device F10 (Fig. 12) with the receiving distributor. And to register the ½ in the price, a key of the four unit code is utilized, for the fraction control relays already have been nominated. In this instance, pulses corresponding to those from key 4 of the Z row would be received, operating the fraction permutation device F10 which sets the respective positioning shafts and operates dial magnet 904 (Fig. 18) and fraction dial 906 registers ½. The operation is thus completed and the quotation 2.13.½ on the preselected stock has been registered.

Where, for example, a quotation as 10.½ is to 75

be registered, that is, 1000 shares with a price change in the fractions on a preselected stock, operation of the hundreds quantity permutation device F6 nominates the thousand permutation device F5 without, however, effecting a registration in the hundreds quantity dial, and additionally this operation nominates the fractions control relays B14. Dual nomination of this type is brought about by the use of a five unit code as, for instance, the 0 key of the five unit code Y is operated, which sends a code to position hundreds quantity permutation device F6 (Fig. 10) to its fifteenth position, placing wiper 491 on contacts 762 and 763. Movement of shaft 1 of permutation device F6 energized slow relay 495 and upon stoppage of the shaft, wiper 491 grounded contacts 762, 763, conductor 764, energizing control relays of pair B1 (Fig. 3) and corresponding transfer relay D6 (Fig. 9) in off zero position of cam 411, and for this revolution connecting thousands quantity permutation device F5 with the receiving distributor.

But as a fifth selecting pulse was transmitted, fraction control relays of pair B14 were nominated. Pulses for positioning the fractions permutation device F10 are now sent, employing a key of the four unit code, in this instance, the 4 key of the Z row. Upon completion of this revolution pulses for positioning the thousands quantity dial are sent. For this purpose a four unit code is also employed, and in this instance the 1 key of the Z row is used.

Where a quantity is in hundreds, thousands and ten thousands, for example, as 110, it is seen that the operation of the hundreds quantity permutation device may nominate the thousands quantity control relays B1 and upon the operation of the latter and provided further that a five pulse code is utilized, thousand control relays B7 nominate the hundred thousands control relay B6, as before set forth. In sending this quotation, keys Z0, Y1 and Z1 are operated in the order named. The first signal transmitted as a result of the operation of key Z0 sets the hundreds quantity permutation device F6 on contact 762 to operate the thousands quantity control relay B7, as previously explained; however, inasmuch as no fifth selecting pulse was sent, the fractions relays B14 were not operated. The second signal transmitted as a result of the operation of key Y1 causes the thousands quantity dial to advance one step and the fifth selecting pulse of this signal causes the operation of the B6 relays. The third signal transmitted as a result of the operation of key Z1 controls the ten thousands dial, and as this signal has no fifth selecting pulse it ends the quotation.

In the event a quotation is without a fraction and ends in an integer, fraction permutation device as F10 and G10 may be operated to nominate the units control relays B13. Thus, if the quotation to be transmitted is 15 then, after the transmission of the signals representing the hundreds quantity have been sent, keys Z0, Y5 and Z1 are operated in the order named. By the operation of key Z0 a signal is transmitted to position wiper 687 (Fig. 12) on contacts 768 and 768A. When shaft 1 of permutation device F10 stops, ground from closed contact 700 is extended to conductor 768C, energizing the units pair of control relays B13 (Fig. 5). Operation of this units pair of control relays B13 energizes transfer relay D8 (Fig. 11) in the off zero position of cam 411, connecting units permutation device as F9 with the receiving distributor for reception

of the group of selecting pulses representing the operated key Y5 to record and register the units in the price and set the units dial as 918 (Fig. 18) to a predetermined position, without effecting any price change in the fraction price dial as 806. The fifth selecting pulse of the signal represented by the operation of key Y5 causes the operation of the B12 relays (Fig. 5) which operate the transfer relay D8 (Fig. 11) for connecting permutation device F8 with the receiving distributor to receive the tens signal. The operation of the Z1 key causes the transmission of the signals representing the tens digit "1" which is received and causes the tens dial of the register to display the tens digit "1".

In the event that there is sent a quotation such as 7500 shares of a single letter odd stock selling at a four-digit price, such as 132½, the following keys are operated in the order named: (1) key Y5 for the 500 shares, the fifth selecting pulse nominating the fractions by operating the B14 relays; (2) key Y4 for the "½" digit of the fractions of the price, the fifth selecting pulse now operating the C relays (Fig. 1) for further nominating purposes; (3) key ZN which causes the transmission of the first, third and fourth selecting pulses for nominating purposes now to be identified: the first selecting pulse from key ZN operates the B1 relays for selecting a single letter odd stock, the third selecting pulse operates the B13 relays for nominating the units price digit, and the fourth selecting pulse operates the B7 relays for nominating the thousands quantity digit. As no second or fifth selecting pulse is transmitted by the operation of key ZN, the even stock control relays B2 and the shelf control relays B4 will not be operated. As a result of the operation of certain of the above-mentioned relays guard relays B3, B5 and B9 will be operated; (4) a key such as ZA is now operated for selecting the odd letter stock, the operation of such key causing the selection of register SLO (Fig. 16); (5) key Y2 for selecting the "2" units price digit, the fifth selecting pulse operating the tens relays B12 (Fig. 5); (6) key Y3 for the "3" tens digit involves a signal having a fifth selecting pulse which operates the B11 relays (Fig. 4); (7) key Z1 for the "1" units digit of the price, the transmitted signal containing no fifth selecting pulse; (8) key Z7 for the "7" thousands quantity digit transmits a signal which does not contain a fifth selecting pulse because no ten thousand digit is to be sent.

The detailed description given hereinabove in connection with the transmission of other quotations makes it evident that when the above-mentioned keys are operated for the transmission of a quotation of 7500 shares of a single letter odd stock selling at 132½ the proper permutation devices are caused to operate to set up this quotation.

If the quotation had been for a single letter even stock, the key ZM, instead of key ZN, would have been used for the nominating step and the second selecting pulse of the signal transmitted thereby would have operated the B2, instead of the B1, relays to select an even letter stock.

If this quotation had involved a two-digit price, such as 9¼, instead of the four-digit price 132½, key Y2, instead of Y4 (for the second operation), would have operated to select the "¼" instead of "½", and key Z9 instead of Y2 (for the fifth operation), would have been operated to select "9" instead of "2" for the units price digit. As a key in the Z row was used

no fifth selecting pulse was transmitted. Therefore, the B12 relays were not operated. In this case the tens and hundreds digits of the price are omitted and the sixth operation would select the thousands quantity digit.

For the purpose of illustrating the use of keys P and Q (in row Z), which are employed for nominating purposes, it will be assumed that a quotation involving 1100 shares of a double letter stock AA at a new high price of 85 $\frac{3}{4}$ is to be posted. To send this quotation the following keys would be operated in the order named: (1) Y1, (2) Y3, (3) ZP, (4) ZA, (5) ZA, (6) ZC, (7) Y5, (8) Z8, (9) Z1. From the foregoing description of the operation of the system, it will be apparent that the signal represented by key Y1 records the 100 shares and its fifth selecting pulse nominates the fraction price digit by operating the B14 relays (Fig. 5); the second signal represented by key Y3 causes the recording of the " $\frac{3}{4}$ " digit of the price and its fifth selecting pulse operates the nomination control relays C (Fig. 1); the third signal which is sent by key ZP nominates a double letter stock, the units of the price, the thousands digit of the quantity, and a shelf selection by operating the B1, B2, B13, B7 and B4 relays. The fourth and fifth signals represented by a successive operation of key ZA select stock register "AA" (represented by register DL, Fig. 18); the sixth signal represented by key ZC controls the "high" shelf selection by advancing the wiper of permutation device F3 to its third contact, thereby grounding conductor 690B which connects through the "h" contacts of relays T and S (Fig. 13) and the rotary switch banks (Fig. 14) to the high shelf unit of the register DL; the seventh signal represented by key Y5 causes the units dial shafts to be set at "5" and nominates the tens digit by operating the B12 relays (Fig. 5); the eighth signal represented by key Z8 sets the tens dial shafts at "8", but does not actuate the hundreds price relays B11 as this signal has no fifth selecting pulse; the ninth signal represented by key Z1 causes the thousands quantity dial to be advanced to record 1000 shares, and terminates the quotation.

If the foregoing quotation had been for a single letter even stock, instead of a double letter stock, the key ZQ, instead of ZP, would have been used, and a signal representing only a single stock letter would have been sent. Thus, in sending this quotation the following keys would be operated in the order named: (1) Y1, (2) Y3, (3) ZQ, (4) ZA, (5) ZC, (6) Y5, (7) Z8, (8) Z1. As the signal represented by the ZQ key has no first selecting pulse, the B1 relays would not be operated and a single letter even stock would be selected.

The above disclosure has been given by way of preference, for clearness and understanding of the method and means utilized to carry out the principles of my invention. Hence no unnecessary limitations should be understood and the appended claims should be construed as broadly as the state of the art permits.

What is claimed is:

1. In combination, apparatus for posting quotations, comprising transmitting and receiving means, a receiving circuit including groups of pairs of control relays for stock, shelf and price, guard relays associated with each group, sets of recording means, means responsive to the operation of the guard relays associated with said stock and price control relays for selecting one of said

sets of recording means, means responsive to said transmitting means for setting portions of said selected set to predetermined positions, positioning means rendered effective through the operation of said set portions of said selected set, quotation registering means, and means for setting the latter to predetermined positions of said positioning means.

2. The apparatus defined in claim 1, in which said transmitting and receiving means are operatively connected by a single wire circuit.

3. The apparatus defined in claim 1, characterized further in that said positioning means is held ineffective until the guard relay of the stock and shelf group is rendered ineffective.

4. In a stock quotation board, including, in combination, transmitting and receiving means, a receiving circuit comprising stock, shelf, quantity and price control means, recording means, means normally holding a portion of said quantity control means operative, means operative in response to the character of the code transmitted for setting a corresponding portion of said recording means concomitantly preparing for operation a portion of said price control means, means operative in response to the character of the code transmitted to set a corresponding price recording portion to a predetermined position simultaneously preparing for operation a portion of said control means for connecting a certain order of said control means in circuit with said receiving means, means operative in response to the character of said code transmitted for nominating a predetermined order of portions of said control means for stock, shelf, quantity and price, and means operative in response to the character of the code transmitted for operating one or more stock portions of said recording means to predetermined positions.

5. In a stock quotation board, including, in combination, transmitting and receiving means, a receiving circuit comprising stock, shelf, quantity and price control means, recording means, means normally holding a portion of said quantity control means operative, means operative in response to the character of the code transmitted for setting a corresponding portion of said recording means concomitantly preparing for operation a portion of said price control means, means operative in response to the character of the code transmitted to set a corresponding price recording portion to a predetermined position simultaneously preparing for operation a portion of said control circuit for connecting a certain order of said control means in circuit with said receiving means, means operative in response to the character of said code transmitted nominating a predetermined order of portions of said control means for stock, shelf, quantity and price, means operative in response to the character of the code transmitted for operating one or more stock portions of said recording means to predetermined positions, and means for selecting a single or double letter stock rendered effective by said stock control means and held operative by said recording means.

6. In a stock quotation board, including, in combination, transmitting and receiving means, a receiving circuit comprising stock, shelf, quantity and price control means, recording means for stock, shelf, quantity and price, means normally holding a portion of said quantity control means operative, means operative in response to the character of the code transmitted for setting a corresponding portion of said recording

means concomitantly preparing for operation a portion of said price control means, means operative in response to the character of the code transmitted to set a corresponding price recording portion to a predetermined position simultaneously preparing for operation a portion of said control circuit for connecting a certain order of said control means in circuit with said receiving means, means operative in response to the character of said code transmitted nominating a predetermined order of portions of said control means for stock, shelf, quantity and price, means operative in response to the character of the code transmitted for operating one or more

stock portions of said recording means to predetermined positions, stock selective means rendered effective by said stock portions of said recording means, control circuits common to said stock selective means and associated with said shelf, quantity and price recording means, a plurality of dial groups, means controlled by said stock portions of said recording and said control means for extending said circuits to one of said groups, and means for grounding several of said circuits to complete a circuit for setting selected portions of the dial group selected to predetermined positions.

CLYDE SMITH.