

THE ESTERLINE-ANGUS COMPANY, INC.

P. O. BOX 596 • INDIANAPOLIS 6, INDIANA, U. S. A.

RECORDER DATA SHEET for Model AW SPRING CHART DRIVE

Sold to Grote Reber, T.H.
Pur. Order No. Letter Order 6-1-54 MO No. _____ SO No. K-1825 Date 6-11-54

For use by _____
CASE _____ For _____ panel. Lamp _____

Other Case Features _____
MEASURING ELEMENT _____ NP No. _____ ME No. _____

Scale _____ Sc. No. _____ CHART No. _____
Calibrated for Use With _____ Damping No. _____

Calibration or Rating: Wire _____ Phase _____ Cycles _____ Pressure _____
Voltage _____ (Max. Volts _____)
Current _____ (Max. Amps _____)

Watts _____
Millivolts _____ at _____ amp. (_____) at 30° C. at Shunt End of Leads.

Mult. Box _____ No. _____ Volts _____ Mult. NP No. _____
Mult. Box _____ No. _____ Volts _____ Mult. NP No. _____

Range _____ Total Ohms: A _____ B _____ Mult. Ohms: A _____ B _____ MV at Meter: A _____
Range _____ Total Ohms: A _____ B _____ Mult. Ohms: A _____ B _____ MV at Meter: B _____

Range _____ Total Ohms: A _____ B _____ Mult. Ohms: A _____ B _____ Comp. Ohms: A _____
Range _____ Total Ohms: A _____ B _____ Mult. Ohms: A _____ B _____ Comp. Ohms: B _____

Range _____ TC _____
Armature Ohms: A _____ B _____ Parallel Cir. Ohms _____ Meter Ohms _____ FS Grams Torque _____

LEADS—Current: No. _____ ft. long, No. _____ wire. Potential: No. _____ ft. long, No. _____ wire.
ID No. _____ Connection Diagrams _____ Lead ohms _____ Lead MV _____

Other Measuring Element Features _____

CHART DRIVE: Type No. 2, Minute Feed Spring
Feeds: In. per Hr. 3/4-1 1/2-3-6-12 In. per Min. 3/4-1 1/2-3-6-12 In. per Sec. _____

FS No. 80-M Internal Motor: Volts _____ Cycles _____
Int. Trip Coil: No. _____ Volts _____ Cycles _____ Ohms _____ Series Ohms _____

External Motor: FS No. _____ Volts _____ Cycles _____ No. _____ Rheo. _____
Ext. Trip Coil: No. _____ Volts _____ Cycles _____ Ohms _____ Series Ohms _____

Other Chart Drive Features _____

ATTACHMENTS
Right Hand Chron. Pen: No. _____ Volts _____ Cycles _____ Ohms _____ Series Ohms _____
Left Hand Chron. Pen: No. _____ Volts _____ Cycles _____ Ohms _____ Series Ohms _____

INSULATION TESTS (AC Volts): Meter Element _____ Internal Motor _____ Ext. Motor _____
Lamp Circuit _____ Chronograph Pens _____ Trip Coils _____ Aux. Transf. _____

AUXILIARY APPARATUS FURNISHED BY ESTERLINE-ANGUS

POT. TRANSF: _____ Mfr. _____ Model _____ Volts: Pri. _____ Sec. _____ Cycles _____
CUR. TRANSF: _____ Mfr. _____ Model _____ Amperes: Pri. _____ Sec. _____ Cycles _____

Phase shifting Network: _____ No. _____ Volts _____ Cycles _____ Volts _____ Cycles _____
SHUNTS: _____ Type _____ Rated amperes _____ MV _____ Amp. at Rated MV _____

Furnish one (1) chart drive complete with spring chart drive.

DS by JEH DS check by _____ Calib. by _____
Inspections: 1st _____ Final Gross Date JUN 28 1954
Meter card entry _____

SERIAL No. 69513
Mention this number in correspondence.

INSTRUCTIONS FOR THE OPERATION AND CARE
OF
ESTERLINE-ANGUS SPRING POWERED CHART DRIVES
MODEL AW - SERIES NO. 80

Most chart drives have an instruction plate on the front giving briefly the essential instructions for using the drive. A plain black plate is substituted for this instruction plate on drives with special chart feeds or other features to which the regular instruction plate does not apply.

These printed instructions give complete information on the drives and they should be read carefully by the person who installs the instrument or services it with charts and ink.

WINDING

Esterline-Angus Spring Powered Chart Drives are shipped stopped with the springs wound up. The power for feeding the chart is stored in four identical springs connected in series. The springs are wound simultaneously by inserting the square on the winding crank into the winding arbor, pushing the arbor in as far as it will go and, at the same time, turning steadily in a clockwise direction.

If the springs are allowed to run down completely, it requires about 110 turns of the winding crank to rewind. The chart drive is designed to operate for 8 days at any of the hourly feeds. Approximately 65 turns are required to wind for 8 days operation. Winding once per week or each time the chart is renewed (whichever is oftener) is recommended.

When the springs are fully wound, the winding crank will refuse to turn. Be sure the chart drive is fully wound but do not try to overwind. A partial turn in the reverse direction, at the same time withdrawing the winding crank, completes the winding operation. The winding arbor is forced out to its original position by a spring which disengages the worm from the worm gear.

The spring units have one end of the springs connected to the time train and the other end connected to the reroll train by a clutch. By this means the springs supply power to both the escapement and reroll at all times when wound.

The winding crank is kept on the right side of the chart drive. The square end projects through a hole near the top of the mounting plate and the handle end snaps into the spring clip located just above the winding arbor.

INSERTING THE RECORD CHART

Keep charts dry. Use Esterline-Angus record charts and keep the instrument closed to protect the chart and chart drive from moisture and dirt. To thread a chart into the chart drive refer to the threading diagram on the

instruction plate, if the drive has an instruction plate, and proceed as follows:

Remove the chart reroll assembly by pressing down on the spring clip on either end and pulling outward. Lay the chart reroll aside and remove the arbor which is used to hold the new chart. This arbor comes out by lifting up and pulling forward. Hold the new chart in the left hand with time figures on the chart at the left and push the arbor into the chart core with the right hand until the hexagon end pieces are about even with the ends of the chart. Push the chart supply roll and arbor back until the arbor pivots snap into place and the chart turns freely.

Unwind the end of the chart, cut or tear to approximately a 90° included angle point and insert the end in the slot beneath the drive roll marked "Insert end of chart here". Push the chart until the point appears over the pen table. Holding the point on the chart, pull the chart over the drive roll, carefully engaging the chart perforations with the drive roll pins. Advance the chart by turning the set knob on the right hand end of the drive roll until the full width of chart reaches the position of the chart reroll.

Insert chart reroll in place by holding it with the gear end to the left, lay the pivots on the clip springs and snap the chart reroll in place. Note, that this reroll assembly gear on the left hand end engages a gear on the chart drive reroll train. The chart reroll is made in two pieces, the main tubular part which carries the gear and the removable plug on the right hand end which can be pulled out to remove the used chart from the reroll. When this plug is pushed back in the tube be sure it is in as far as it will go.

Push the pointed end of the chart about one inch into the slot in the reroll tube aligning the left edge of the chart with the chart between supply roll and drive roll. Release reroll catch by giving chart reroll a part of a turn in the backward direction. Let chart reroll take up slack chart and set the chart to correct time. The portion of the chart from the drive roll to the reroll must be stretched tightly and it must be free from wrinkles or bulges on either edge.

The instruction plate back of the chart serves as a large writing surface for making notes on the chart. A writing opening with a sliding door can be furnished on all but instruments in twin flush cases.

STARTING AND STOPPING THE CHART DRIVE

The chart is started by raising the control lever on the left hand side of chart drive up from stop position to hour feed position. A white target moving up and down, which is visible through the small window at the left hand edge of the chart, shows when the escapement is running. If the escapement does not start immediately, move the control lever up and down a few times. When the control lever is in the hour feed position, the chart will be driven at a chart feed of $\frac{3}{4}$, $1\frac{1}{2}$, 3, 6 or 12 inches per hour, depending on the change gears being used. The chart is set to correct time by advancing the chart with the set knob until the time of day appears under the glass writing pen.

HOURLY CHART FEEDS

These instructions tabulate only standard chart feeds, standard gearing and gears. For special chart feeds and gears to obtain them, see special page in this instruction book.

The most commonly used chart feed is three inches per hour. Change gears for other feeds, if required, will be found on a clip at the top of the left hand side plate. The following table shows the combinations of gears to obtain different chart feeds. In order to make it easy to select a set of gears for given feed, pairs of gears used together are colored alike.

Chart Feeds Inches Per Hour or Minute	Change Gears		Color Code
	No. of Teeth Driver	No. of Teeth Driven	
.75	18	72	Gold
1.5	30	60	Green
3.	45	45	Red
6.	60	30	Green
12.	72	18	Gold

To change the chart feed, remove the change gears in use; select the proper gears from the extra gear clip and put the gears for the desired chart feed in place. The keyways in the gear hubs must engage the keys on the staffs. To tighten the change gear nuts it is necessary to hold the gear on one of the staffs while the nut on the other staff is being tightened. Gears are held by gripping the teeth with the fingers of the left hand while screwing the change gear nut on with the right hand.

CAUTION: Do not pry off the gears. Remove by a straight pull or the gear studs may be bent. After affixing change gears for a different chart feed, be sure the escapement is running. If it has stopped, start it by moving the control lever up and down. Be sure the chart feed on the chart corresponds to the feed of the change gears and set the chart to the correct time.

MINUTE FEEDS

When the chart is started in minute feed there is a slight lag in getting up to correct speed. This is due to the flyball governor requiring time to reach full speed.

Minute Feed chart drives provide the five standard feeds in inches per hour and the same in inches per minute.

Chart feeds in inches per minute, corresponding to the chart feeds in inches per hour, are obtained by raising the control lever to its highest position. These feeds are provided on minute feed chart drives only. An hour feed chart drive (providing feeds in inches per hour only) can be changed to a minute feed drive by installing a different escapement. When running the chart at the minute feeds wind the springs after about every four hours of continuous operation. Minute feed chart drives are necessary for recording tests which require a fast movement of the record chart.

INSPECTING THE RECORD

The chart can be pulled from the reroll to examine the record. The chart should be pulled on each edge using the thumb and fingers of both hands and pulling straight out and not up. A sudden release of tension on the unrerolled chart will lock the reroll, allowing the record to be examined. To rewind the chart, first pull it slightly forward to release the reroll catch, then let it wind slowly on the chart reroll. Any amount of chart can be pulled from the reroll without damaging the mechanism.

COUPLING CHART DRIVES

Do not couple two spring chart drives together to synchronize the timing. They will run only a short time and stop. The coupling shaft is used to connect the chart drives in twin instruments and for driving the chart with external motor drive attachments or by other external means.

REGULATING THE CHART TIMING

All chart drives are regulated and given a long test run before shipment. The escapements are accurately timed. The balance wheel is temperature compensated. It is seldom necessary to change the regulation. The regulator lever is visible through the slot back of the nameplate. To regulate the hour feed timing move the regulator up to make the drive run faster and down for slower timing. Although all escapements do not respond alike, a movement of one division on the regulator scale affects the timing approximately four minutes per day.

The regulation of chart speed on minute feeds is accomplished by turning the small screw located above the control lever on the escapement. Direction to turn for faster and slower adjustments is shown by the arrows. This adjustment is very sensitive. Adjust by turning slightly and noting the effect on the chart speed.

The part number of the escapement assembly is stamped on the portion of the escapement plate which is visible through the opening in the left side chart drive plate.

OILING THE CHART DRIVE

It is not necessary to oil the bearings of the chart drive often. Most of the staffs run in oil retaining bronze bearings. Oiling about once per year by dipping a small wire into clock oil and transferring the drop, which adheres to the wire, to the bearing will prevent the bearing from running dry. Any good grade of clock oil can be used. The Esterline-Angus Company can supply a suitable oil. Do not use ordinary heavy lubricating oil.

CHART DRIVE CLEANING AND REPAIRS

In the course of time a chart drive will require cleaning, oiling or repairs. The chart drive mechanism can be removed, and returned to the factory without disturbing the remainder of the instrument, by loosening the four corner screws which hold the mounting plate in the case. These screws should not be completely removed. Unscrew them only enough to loosen the chart drive and

take the drive out with the screws left hanging in the mounting plate. The chart drive is so designed that the escapement assembly and the complete reroll train, as well as the mainspring assembly, which are most likely to need attention, can be removed without dismantling the entire mechanism. (See following paragraphs.)

UNWINDING THE SPRINGS

Before undertaking any repair work on the chart drive, the springs must be completely unwound. This is very important because failure to unwind the springs may release their power suddenly and damage the chart drive. To let down or unwind the springs, take the chart drive out of the case as described in preceding paragraph. Remove the chart reroll and then take off the reroll gear cover by removing the four screws holding it in place. Insert winding crank into arbor, push in on crank, forcing the winding arbor back. Hold tightly to the crank with the right hand and push the reroll release pin to the left. The release pin will slide easily if the crank is held so the pressure on the pin is relieved. Do not force it over. This pin projects out of the left hand side plate. Its location is shown on the instruction plate. Holding firmly to the winding crank, allow it to turn slowly in a counter-clockwise direction until the springs are completely unwound. Springs are unwound when the crank does not tend to turn anymore. Do not let go of the crank until the springs are unwound. When the work for which the springs have been let down is completed, push the reroll release pin to the right into its original position. Replace the reroll gear cover and the chart drive is then ready to rewind in the usual manner.

REMOVING THE ESCAPEMENT UNIT

The escapement assembly is a complete unit in itself and it can be removed from the chart drive without taking the chart drive apart. The first operation required in removing the escapement is to completely unwind the springs as described in the preceding paragraph. Take off the instruction plate to reach the escapement. Remove the control lever and then take out the three black screws which hold the escapement to the left side plate. The escapement unit is accurately positioned by two dowell projections on the plate. This insures correct mesh of the escapement gear with the gear in the train. Pull the escapement off of the dowells and remove carefully.

There are two kinds of escapements for spring chart drives. One is the hour feed type which provides chart speeds in inches per hour only. The other is the minute feed type which provides chart speeds both in inches per hour and in inches per minute. The first type contains only the escapement, whereas the second type contains both the escapement proper and the flyball governor. The part number will be found stamped on the escapement plate.

If trouble develops in the escapement, it should be replaced with a new escapement. Repairs to escapements outside of our factory, are not recommended. If a spare escapement is carried in stock, any escapement trouble can be quickly taken care of by installing a new escapement.

REMOVING THE MAINSPRING ASSEMBLY

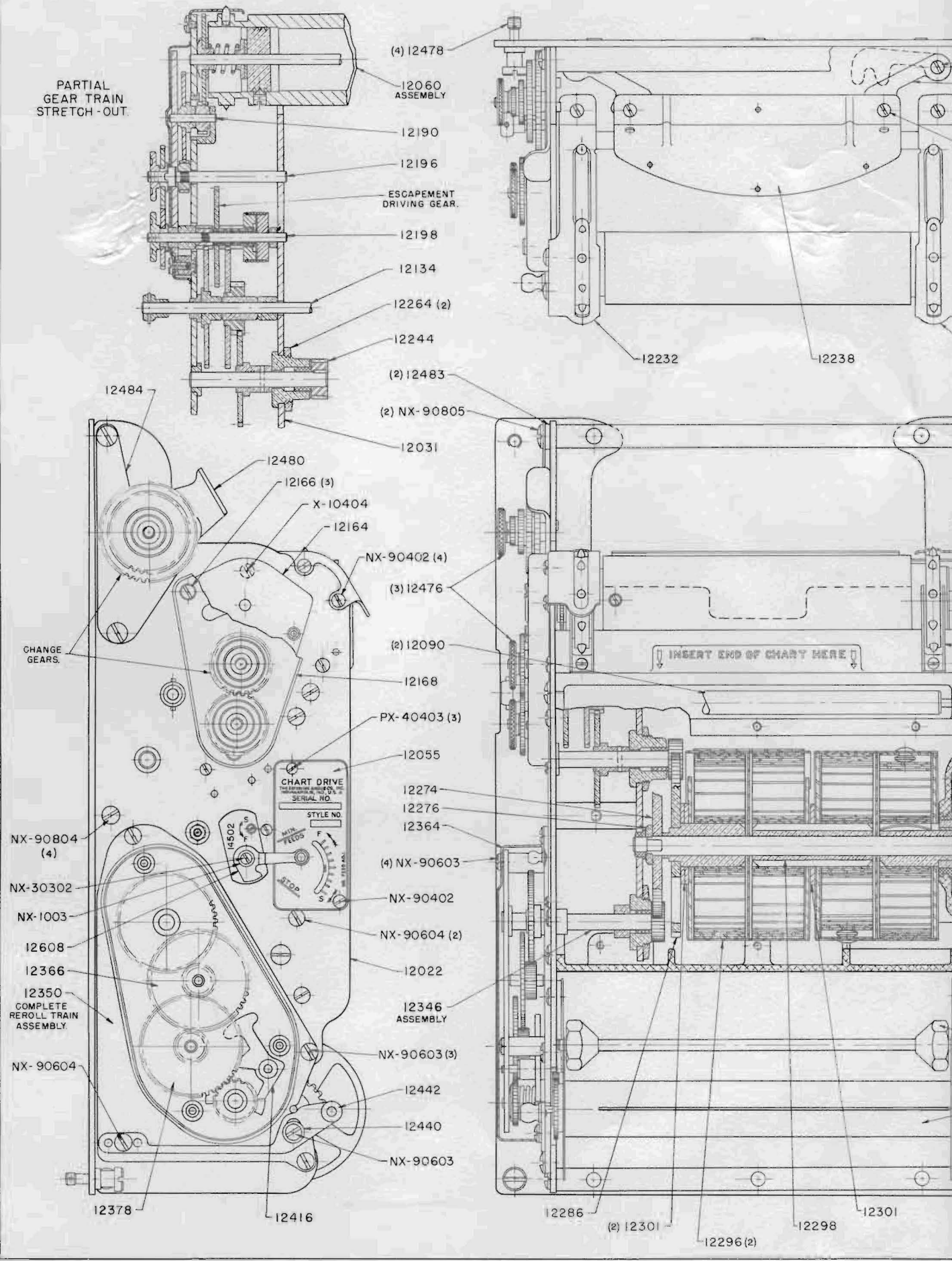
To remove the mainspring assembly, the chart drive must first be taken out of the instrument case. Let down the springs according to the directions

already given. Take off the winding bracket by removing the four screws which hold it to the right side plate. With the instruction plate off, the spring assembly can be withdrawn through the hole in the right side plate. New mainspring assemblies can be installed and the spring can be pushed back in place ready for winding.

ORDERING PARTS

Unit construction of the chart drive, which makes it easy to install new units in case of trouble permit repairs to be made right and in a short time. When ordering parts or writing to the factory about a chart drive the style number and serial numbers should be given. These numbers are stamped on the nameplate.

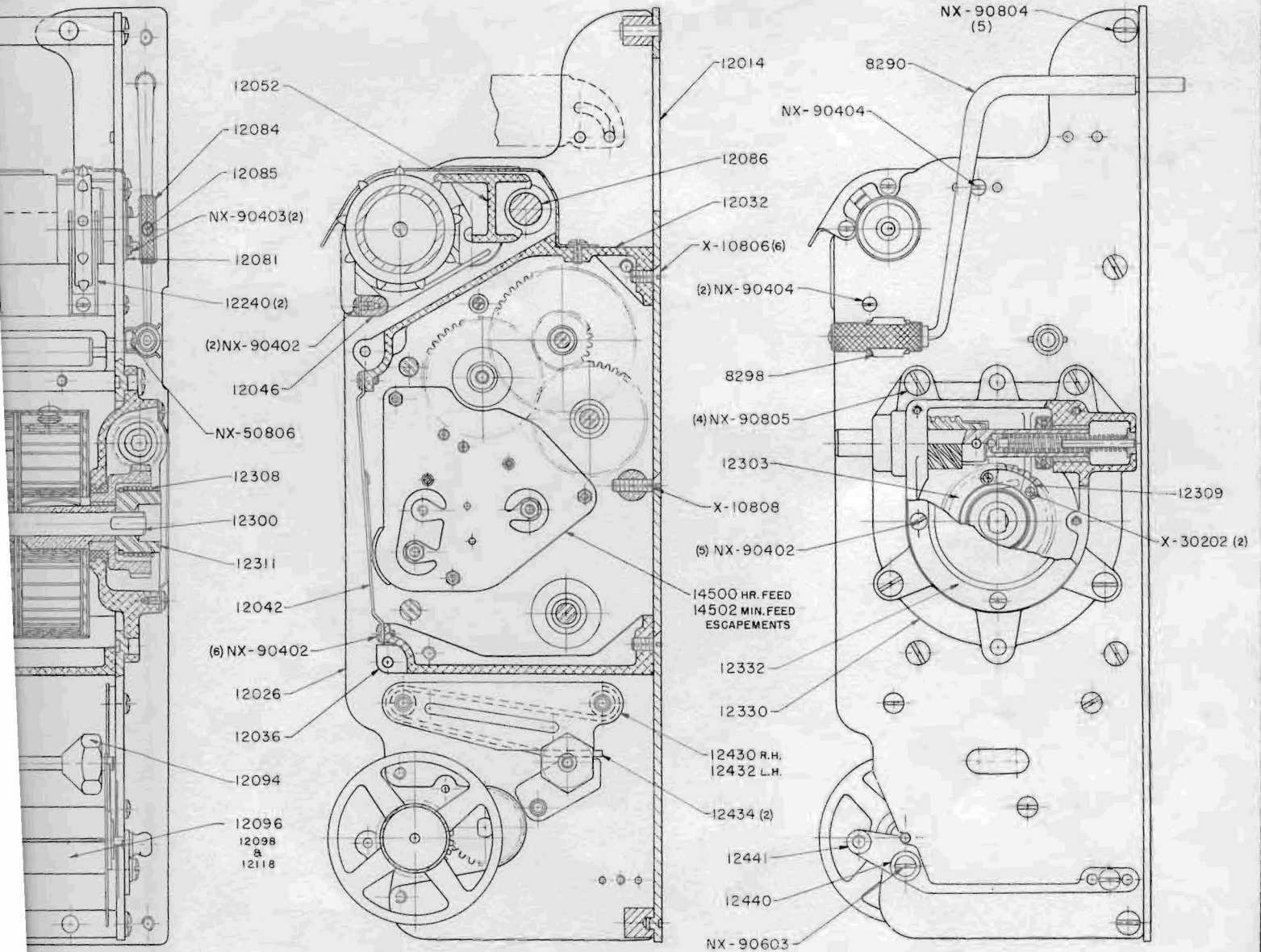
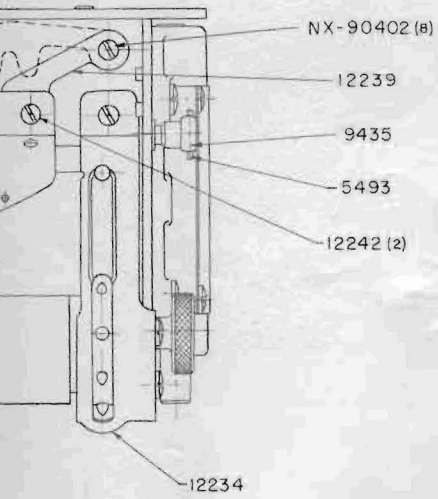
PARTIAL
GEAR TRAIN
STRETCH-OUT



THE ESTERLINE - ANGUS Co., Inc.
 INDIANAPOLIS, INDIANA U.S.A.

SPRING CHART DRIVE
 ASSEMBLY.

SERIES No. 80.



ADDRESS CORRESPONDENCE TO COMPANY - NOT TO INDIVIDUALS

ATLANTA BALTIMORE CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON LOS ANGELES MILWAUKEE
NEW YORK PHILADELPHIA PITTSBURGH ST. LOUIS SAN FRANCISCO SEATTLE SPRINGFIELD, MASS. UTICA

BOSTON *gear*



BOSTON GEAR WORKS

OFFICE AND WORKS
QUINCY 71, MASS.

TEL. PR 3-0400

September 8, 1954

Mr. Grote Reber
General Delivery
Wailuku, Maui, T.H.

Dear Mr. Reber:

We wish to acknowledge your letter of September 3, 1954, inquiring as to the delivery of our stock G 142 and G 146 which you had on order with us.

We wish to inform you that these gears were shipped on August 26, 1954, via Parcel Post against our invoice 0-48829 to complete this order.

Very truly yours,

BOSTON GEAR WORKS

by:

M. Altieri

SALES DEPARTMENT

M. Altieri/es-8

WE RESPECTFULLY CALL TO YOUR ATTENTION THE FACT THAT BOSTON GEAR STANDARD PRODUCTS ARE STOCKED BY AND CAN BE PURCHASED FROM YOUR NEAREST AUTHORIZED BOSTON GEAR DISTRIBUTOR WITHOUT PRICE PENALTY.

(OVER)

BOSTON GEAR WORKS



BOSTON *gear*

QUINCY 71, MASS.

INVOICE DATE 8-31-54

INVOICE NO. O-48829

SOLD TO

GROTE REBER
 WAILUKU, MAUI
 TERRITORY OF HAWAII

SHIP TO

GOOD RETURNED WITHOUT OUR PERMISSION
 WILL NOT BE ACCEPTED FOR REFUND
 YOUR ORDER NUMBER IS 7/31
 & RETURN TO BOSTON GEAR WORKS

YOUR ORDER NO. LTR 7/31

ORDER RECEIVED 8/4/54

DATE SHIPPED 8-26-54

SHIP VIA

TERMS: 2% 10 DAYS - NET 30 DAYS. F. O. B. POINT OF SHIPMENT. INTEREST CHARGED ON OVERDUE ACCOUNTS.

QUANTITY			CATALOG NUMBER OR DESCRIPTION	PRICE	GROSS AMT.	% DISC.	NET AMOUNT
ORDERED	BACK ORD.	SHIPPED					
1		1	G 142	.60		+42	.85
1		1	G 146	.85			1.21
							2.06
							PP .03
							NS .05
							2.14

G 22935

L

WE HEREBY STATE THAT THE PRICES FOR THE COMMODITIES HEREIN INVOICED ARE NOT ABOVE THE CEILING PRICES FOR SUCH COMMODITIES PURSUANT TO THE GENERAL CEILING PRICE REGULATION ISSUED JANUARY 26, 1951, OR ANY SUPPLEMENTARY REGULATIONS, AMENDMENTS, OR ORDERS WHICH HAVE BEEN ISSUED.

REMITTANCE SHOULD BE MADE TO QUINCY 71, MASS.

THIS MATERIAL HAS BEEN MANUFACTURED IN CONFORMITY WITH THE PROVISIONS OF THE FAIR LABOR STANDARDS ACT OF 1938, AS AMENDED. TAX CLAUSE AND CONDITIONS ON REVERSE SIDE.

September 3rd, 1954
General Delivery
Wailuku, Maui, T.H.

Boston Gear Works
Quincy 71, Massachusetts

Att: Mr. M. Altieri

Gentlemen:

This letter is in regard to my order of July 31st, your reference G22935. I ordered one special gear plus stock gears G142 and G146. These seem to have become separated. Your acknowledgment O-48829 covered the stock gears. Your invoice O-55824 states the special gear was shipped by boat parcel post on 8-24-54 and is marked complete.

My order of 7-31-54 paid for air parcel post on all three gears in compliance with your quote 70801. Please send to me at your earliest convenience the two stock gears still outstanding via air parcel post.

Yours truly,

Grote Reber

Acknowledgment

BOSTON *gear* WORKS

(Main Office and Factory)

QUINCY 71, MASSACHUSETTS

BRANCHES IN
New York - Philadelphia
Cleveland - Chicago
Springfield, Mass.
San Francisco, Calif.

Gentlemen:

Date: Aug 6, 1954

Thank You for Your

{ INQUIRY # _____
ORDER # Ltr 7/31
FOLLOW-UP # _____ }

Our Ref. No. G 22935

Which Will Be Handled by Our MAIN OFFICE & FACTORY As Follows: _____

Price and delivery - see
our quote # 70801

NOTE: BILLING WILL BE
AT PRICES IN EFFECT
AT TIME OF SHIPMENT
F 518-B

Yours Very Truly, BOSTON GEAR WORKS

By:

[Handwritten Signature]

ATLANTA BALTIMORE CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON LOS ANGELES MILWAUKEE
 NEW YORK PHILADELPHIA PITTSBURGH SAN FRANCISCO SEATTLE SPRINGFIELD, MASS. ST. LOUIS UTICA



BOSTON GEAR WORKS

QUINCY 71, MASS.

INVOICE DATE 8/26/54

INVOICE NO. O-55814
 G 22935

SOLD TO

GROTE REBER
 WAILUKU, MAU
 TERRITORY, OF HAWAII

SHIP TO

LET 7/31

ORDER RECEIVED 8/5/54

DATE SHIPPED 8/24/54

SHIP VIA PP

YOUR ORDER NO.

TERMS: 2% 10 DAYS - NET 30 DAYS. F. O. B. POINT OF SHIPMENT. INTEREST CHARGED ON OVERDUE ACCOUNTS

QUANTITY			CATALOG NUMBER OR DESCRIPTION	PRICE	GROSS AMT.	% DISC.	NET AMOUNT
ORDERED	BACK ORD.	SHIPPED					
1		1	BRASS SPUR COMPLETE	16.25		NET	16.25
						PP	.03
						INS	.05
							16.33

MM
 Postmarked 8-24-54
 Arrived 9-7-54

WE HEREBY STATE THAT THE PRICES FOR THE COMMODITIES HEREIN INVOICED ARE NOT ABOVE THE CEILING PRICES FOR SUCH COMMODITIES PURSUANT TO THE GENERAL CEILING PRICE REGULATION ISSUED JANUARY 26, 1951, OR ANY SUPPLEMENTARY REGULATIONS, AMENDMENTS, OR ORDERS WHICH HAVE BEEN ISSUED.

REMITTANCE SHOULD BE MADE TO QUINCY 71, MASS.

THIS MATERIAL HAS BEEN MANUFACTURED IN CONFORMITY WITH THE PROVISIONS OF THE FAIR LABOR STANDARDS ACT OF 1938, AS AMENDED. TAX CLAUSE AND CONDITIONS ON REVERSE SIDE.

BOSTON GEAR WORKS

QUINCY 71, MASS.



INVOICE DATE

INVOICE NO. **O- 48829**

WHEN CORRESPONDING ALWAYS REFER TO ABOVE NUMBER.

SOLD TO

SHIP TO

GROTE REBER
 WAILUKU, MAUI
 TERRITORY OF HAWAII

GOODS RETURNED WITHOUT OUR PERMISSION WILL NOT BE ACCEPTED FOR CREDIT.

NO CLAIMS FOR DAMAGES FOR LOSS OF OR DAMAGE TO GOODS WILL BE ACCEPTED UNLESS MADE WITHIN FIFTY DAYS OF THE DATE OF RECEIPT.

YOUR ORDER NO. **LTR 7/31**

ORDER RECEIVED **8/4/54** DATE SHIPPED

SHIP VIA

TERMS: 2% 10 DAYS - NET 30 DAYS. F. O. B. POINT OF SHIPMENT, INTEREST CHARGED ON OVERDUE ACCOUNTS

QUANTITY			CATALOG NUMBER OR DESCRIPTION	PRICE	GROSS AMT.	% DISC.	SCHEDULED TO BE SHIPPED
ORDERED	BACK ORD.	SHIPPED					
1			G 142			+42	
1			G 146				
G 22935							

ACKNOWLEDGMENT

CUST. MARK.

WHERE PROMISED SHIPPING DATE IS NOT INDICATED WE SHALL ADVISE DELIVERY AS SOON AS INFORMATION IS AVAILABLE.

July 31st, 1954
General Delivery
Wailuku, Maui
Territory of Hawaii

Boston Gear Works
Quincy 71, Massachusetts

Gentlemen:

This letter is in reply to your quotation #70801 dated 7-19-54. Please enter my order for the following gears. Each to be 48 pitch, $14\frac{1}{2}^{\circ}$ pressure angle, $\frac{1}{8}$ " face, $\frac{1}{2}$ " diameter hub, $\frac{1}{4}$ " projection, $\frac{1}{4}$ " bore, $\frac{1}{2}$ hard brass.

1 48 teeth 1" P.D. G142	.85
1 58 teeth 1.2" approx. P.D. per quote	16.25
1 72 teeth 1.5" P.D. G146	1.21
Air parcel post & insurance	<u>1.01</u>
Total	\$19.32

Enclosed is a check for this sum. Your prompt attention to this matter will be appreciated by me.

Very truly yours,

Grote Reber

ADDRESS CORRESPONDENCE TO COMPANY - NOT TO INDIVIDUALS

ATLANTA BALTIMORE CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON LOS ANGELES MILWAUKEE
NEW YORK PHILADELPHIA PITTSBURGH ST. LOUIS SAN FRANCISCO SEATTLE SPRINGFIELD, MASS. UTICA

BOSTON
Gear



QUOTATION # 70801



BOSTON GEAR WORKS

OFFICE AND WORKS
QUINCY 71, MASS.
TEL. PR 3-0400

General Delivery
Wailuku, Maui
Territory of Hawaii

July 19, 1954

Attn: Mr. Grote Reber

In reply to your request of **July 6, 1954**

we are pleased to quote as follows:

QUANTITY	DESCRIPTION	LIST	DISCOUNT	DELIVERY*
1	G 142	\$.60 ea.	plus 42%	from stock subject to prior sale
1	G 146	.85 ea.	plus 42%	" "
1	58 teeth, 48 diametral pitch, 14 1/2° pressure angle, spur gear, 1/8 face, 1/2 hub diameter, 1/4 projection, 3/8 overall, 1/4 bore to be made of commercial 1/2 hard brass, Boston Gear Works' limits	16.25 ea.	net	2-3 weeks
Plus air parcel post and insurance charges of \$1.01				
TERMS —				

NOTICE

1. Delivery quoted is tentative only and is entirely dependent upon our ability to obtain the necessary raw material.
2. Unless otherwise specified, commercial limits are figured on.
3. If order is received for the above parts, it will not be subject to cancellation without indemnifying us against loss.
4. Prices quoted herein are subject to revision by us for any goods ordered by you to prices which may be in effect at the time shipment is made.
5. This quotation subject to conditions above and on reverse side.

It will be a pleasure to be of service to you.

Very truly yours,

BOSTON GEAR WORKS

BY *Mattieri*
SALES DEPARTMENT

When placing your order please refer to our quotation number

* Delivery from date order is received.

M. ALTIERI/pb

We respectfully call to your attention the fact that Boston Gear Standard Products are stocked by and can be purchased from your nearest authorized Boston Gear Distributor without price penalty.

BGW S-5

July 6th, 1954
General Delivery
Wailuku, Maui
Territory of Hawaii

Boston Gear Works
Boston, Massachusetts

Gentlemen:

I wish to purchase three
small brass gears of 48 pitch, 1/8"
face, 1/4" bore, 1/2" diameter hub
1/4" long. One each as follows.

Teeth	P.D.
48	1"
58	1.2" approx.
72	1.5"

Please quote price including air
parcel post and insurance to Hawaii on
the above. Upon receipt of this infor-
mation by air mail I will be pleased
to remit by check.

Very truly yours,

Grote Reber

Esterline - Angus Recorder

Speeds of $\frac{3}{4}$, $1\frac{1}{2}$, 3, 6, 12 inches/min & /hr.

Chart crosswise divisions every $\frac{3}{4}$ inch

Feed drum $1\frac{7}{16}$ " = $\frac{4.5}{\pi}$ " diameter, circumference $4\frac{1}{2}$ "

Drive pins every 40° around drum,

Chart holes $\frac{1}{2}$ " apart

For $\frac{3}{4}$ "/min speed of rotation is $\frac{1}{6}$ rpm or 10 rpm.

" $1\frac{1}{2}$ "/min " " " $\frac{1}{3}$ " " 20 "

" 3"/min " " " $\frac{2}{3}$ " " 40 "

" 6"/min " " " $1\frac{1}{3}$ " " 80 "

" 12"/min " " " $2\frac{2}{3}$ " " 160 "

On basis of discussion about Brush oscillographs it seems that three new drive gears should be obtained as follows.

Pitch	P.D.	Teeth	Face	Hub	Bore
48	1"	48	$\frac{1}{8}$ "	$\frac{1}{4}$ " x $\frac{1}{2}$ " dia	$\frac{1}{4}$ "
48	$1\frac{1}{5}$ "	58	$\frac{1}{8}$ "	"	"
48	$1\frac{1}{2}$ "	72	$\frac{1}{8}$ "	"	"

7-3-54

Brush Oscillograph

Speeds of 5, 25, 125 mm/second are provided.

Chart crosswise divisions every 5 mm.

Feed Drum diameter $15/16$ " Circumference = 75 mm.

Drive Gear 48 teeth, 1" P.D., $1/8$ " face.

For 5 mm/sec speed of rotation is $1/15$ rev/sec = 4 rpm.

" 25 " " " " " $1/3$ " = 20 "

" 125 " " " " " $1 2/3$ " = 100 "

For 25 mm/min, speed of rotation is $1/3$ rpm = 20 rpm
Thus if a 1 to 1 gear is used from the Esterline-Angus drive and its gears are set for $1 1/2$ "/minute a chart speed of 25 mm/minute will be secured on the Brush. Each chart division will be 12 seconds of time.

A somewhat more desirable speed would be 30 mm/minute. Then each chart division will be 10 seconds of time. To secure this a drive ratio of $30/25$ will be needed. The drive gear on Esterline-Angus will have to have $30/25 \times 48 = 57.6$ teeth. This is impossible. However if a 56 or 58 tooth gear can be obtained an adjustment in clock rate can probably take care of difference.

The idler gear has 48 teeth, 1" P.D., $1/8$ " Face, $1/4$ " shaft, and a hub $1/2$ " dia + $1/4$ " long.

(over)

Using a 1 to 1 drive the following chart speed in mm/minute and /hour will be secured.

12.5 mm	2 1/2 divisions	24 sec. or minutes / division
25 mm	5 "	12
50 mm	10 "	6
100 mm	20 "	3
200 mm	40 "	1 1/2

If a 58 tooth gear can be secured the following chart speeds in mm/minute and /hour will be secured.

15 mm	3 divisions	20 sec or min / division
30 "	6	10 "
60 "	12	5 "
120 "	24	2.5 "
240 "	48	1.25 "

If a 72 tooth gear can be secured the following chart speeds in mm/minute and /hour will be secured.

18.8 mm	3 3/4 divisions	16 sec or min. / division
37.5 "	7 1/2 "	8 "
75 "	15 "	4 "
150 "	30 "	2 "
300 "	60 "	1 "

The J.W. Murphy Company

Metering and Control Specialists

ESTERLINE GRAPHIC METERS
DUNCAN WATTHOUR METERS
STICHT MEGOHMERS & TACHOMETERS
NIAGARA WATER & OIL METERS
HICKOK INDICATING INSTRUMENTS

431 SOUTH DEARBORN STREET
TELEPHONE HARRISON 8351

Chicago

HAYS BOILER ROOM INSTRUMENTS
HAYS COMBUSTION CONTROL
COCHRANE FLOW METERS
COPE'S FEED WATER REGULATORS
TAYLOR TEMPERATURE INSTRUMENTS

October 24, 1940

Research Foundation,
Armour Institute of
Technology,
Att: Mr. Grote Reber,
35 West 33d Street,
Chicago, Illinois.

Gentlemen:

Re: D.C. MILLIAMMETER
SERIAL NO. 30968

We are attaching the blue prints which we advised we would get relative to the chart drive mechanism of the meter referred to above.

The attached blue print #9328 shows the gear train used in the clock of this meter. The top view shows the multiple tooth cone clutch which is shifted back and forth and which engages one member or the other of a differential reduction train in order to get the 60 to 1 speed ratio that is used between hourly and minute speeds. Our factory advises that if you are using this instrument in the 12" position and particularly if the chart is not attached to the reroll but is being fed through the bottom of the case, it is possible under these conditions that when the chart is in the 12" per minute speed and the lever is shifted back to the hourly speed, that the shift will not actually take place. This is because the torque transmitted through the clutch under these conditions - particularly with the reroll removed - is great enough so that occasionally it may produce sufficient friction in the teeth to overcome the thrust of the spring which returns the clutch to the slow feed position. They advise that this is not likely to occur if the reroll is in use, but may occur if the chart is not connected to the reroll because in this case the pull of the reroll is lost and the driving train must supply the additional torque. If the reroll is not in use and the mechanism refuses to return from rapid to slow feed, usually a repeated action of the shift lever will make the shift satisfactory, or a slight pull on the chart will accomplish the result perfectly.



The J.W.Murphy Company

Research Foundation,
Armour Institute of
T e c h n o l o g y.

-2-

October 24, 1940

They further advise that this occurs only with the 12" gears in position and is another reason why this speed is not guaranteed.

If this is the nature of the trouble experienced, a drop of clock oil in each of the two clutches will probably overcome the trouble by reducing the friction in the clutch teeth and allowing them to slip in and out of engagement more freely.

We do not believe that the trouble which you encounter is serious, however we are forwarding the above comments to you in order that you might become more familiar with your instruments.

We are also attaching a copy of blue print #8233 showing the construction of the drive roll and its slipping clutch. As mentioned to you the stiffness of this clutch is adjustable by changing the spring tension. However it is not ordinarily necessary to change this adjustment in the field as it is satisfactorily made in the factory. The friction is produced at the two washers which are marked in yellow pencil on the print. This clutch should never be oiled. If oil gets on these washers the clutch will slip much to easily. Therefore, this clutch should remain perfectly dry at all times.

We believe this fulfills your requirements, but if we can be of further service, do not hesitate to get in touch with us.

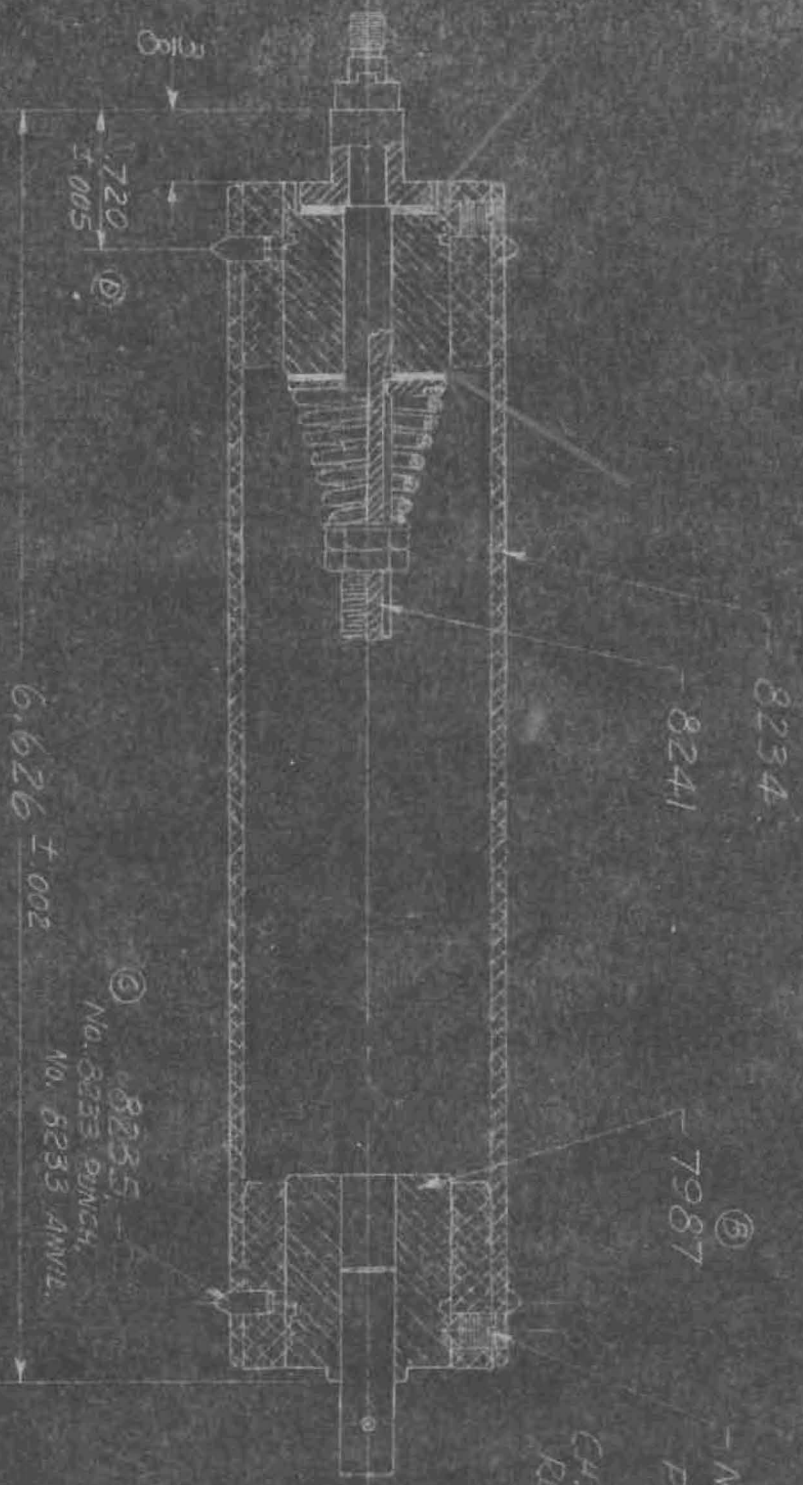
Very truly yours,

THE J. W. MURPHY COMPANY

D. S. Dickey

D. S. Dickey

DSD:LT
Enc.



No. 10-32 x 1/4 x 90° CONE
 FT. HOLES STEEL
 SET SCREW (TWO)
 CH. HOLE SLIGHTLY TO
 REMOVE BURR.

6.626 ± 0.002

8235
 NO. 8233 PUNCH,
 NO. 8233 ANVIL.

1.639 ± 0.002

NO.	LET.	CHANGE	DATE	DATE OF PRINT	FINISH
K					
H					
G					
F					
E					
D					
C					
B					
A					

NOTES
 RING GAUGE NO. 8235
 ASSEM. IN NO. 8233.

DES.	REQ.	DES.	REQ.	CLASSIFICATION

THE ESTERLINE-ANGUS CO.
 MANUFACTURERS OF ELECTRICAL INSTRUMENTS

DRIVE ROLL ASSEMBLY

SCALE FULL SIZE

5/29/34 No. 8233



THE ESTERLINE-ANGUS COMPANY, INC.

Manufacturers of Electrical Instruments

INDIANAPOLIS 6, INDIANA

P. O. Box 596

June 30, 1954.

MR. GROTE REBER,
General Delivery,
Wailuku, Maui,
Territory of Hawaii.

Dear Sir:

Replying to your letter of June 26th, it is unfortunate that the chart drive was already packed and out of our plant when your letter arrived. Our Credit man says he has already done enough business with you that he is not going to worry about your paying for 20 charts.

So we are entering your order for 20 charts #4305-X, and will make shipment of them by Parcel Post. You can send us your check for the charts plus the shipping charges after you receive our invoice.

Yours very truly,

THE ESTERLINE-ANGUS COMPANY, INC.

HLH.JL

H. L. Hildenbrand
H. L. Hildenbrand.

THE ESTERLINE-ANGUS COMPANY, Inc.

Manufacturers of Electrical Instruments

P. O. BOX 596

INDIANAPOLIS 6, INDIANA U. S. A.

CUSTOMER'S
ORDER NO. & DATE
REQUISITION NO.

LETTER 6-1-54

INVOICE DATE

INVOICE NO. **K 4825**

OUR ORDER DATE **K 4825
6-14-54**

SOLD TO

GROTE REBER
GENERAL DELIVERY
WAILUKU, MAUI
TERRITORY OF HAWAII

SHIPPED TO AND DESTINATION

GROTE REBER, KAHULUI, MAUI, T.H. NOTIFY GROTE REBER
~~XXXX~~ GENERAL DELIVERY AT WAILUKU, MAUI, T.H.

PACKED BY
CHECKED BY

DATE SHIPPED

HOW SHIPPED

EXPRESS ~~XXXXX~~ PREPAID OR COLLECT
NO. BOXES

WEIGHT

X

QUANTITY			DESCRIPTION
ORDERED	SHIPPED	BACK ORDER	
1	1		AW #2 SPRING FEED CHART DRIVE - ALL GEAR FURNISH COMPLETE WITH SPRING CHART DRIVE SER. #69513.
1	1		INSTR & DATA SHEET

PAID

Paid 7-20-54

EXAMINE PACKING CAREFULLY. THIS MATERIAL HAS BEEN CAREFULLY PACKED. IF THE CONTENTS DO NOT AGREE WITH THIS LIST, NOTIFY US AT ONCE AND RETURN THIS LIST.

PURCHASER'S COPY OF PACKING LIST

THE ESTERLINE-ANGUS COMPANY, Inc.

Manufacturers of Electrical Instruments

P. O. BOX 596

INDIANAPOLIS 6, INDIANA U. S. A.

CUSTOMER'S ORDER NO. & DATE
REQUISITION NO.

LETTER 6-26-54

INVOICE DATE

INVOICE NO. **K 5743**

OUR ORDER DATE **7-1-54**

SOLD TO

MR. GROTE REBER
GENERAL DELIVERY
WAILUKU, MAUI,
TERRITORY OF HAWAII,

SHIPPED TO AND DESTINATION

SAME.

PACKED BY

DATE SHIPPED

CHECKED BY

HOW SHIPPED

PP

PREPAID OR COLLECT
NO. BOXES **XXXXXX**

FOREIGN

WEIGHT

QUANTITY			DESCRIPTION
ORDERED	SHIPPED	BACK ORDER	
20	20		4305-X CHARTS
<p><i>Received 7-20-54</i> <i>\$ 2.49 parcel post charges</i></p>			

EXAMINE PACKING CAREFULLY. THIS MATERIAL HAS BEEN CAREFULLY PACKED. IF THE CONTENTS DO NOT AGREE WITH THIS LIST, NOTIFY US AT ONCE AND RETURN THIS LIST.

PURCHASER'S COPY OF PACKING LIST

THE ESTERLINE-ANGUS COMPANY, Inc.

Manufacturers of Electrical Instruments

INVOICE

P. O. BOX 596 — INDIANAPOLIS 6, INDIANA U. S. A.

CUSTOMER'S ORDER NO. & DATE
REQUISITION NO.

LETTER 6-1-54

6-28-54

INVOICE DATE

INVOICE NO. **K 4825**

OUR ORDER DATE **K 4825**
6-14-54

SOLD TO

GROTE REBER
GENERAL DELIVERY
WAILUKU, MAUI
TERRITORY OF HAWAII

SHIPPED TO AND DESTINATION

GROTE REBER, KAHULUI, MAUI, T.H. NOTIFY GROTE REBER,
~~XXXXX~~ GENERAL DELIVERY AT WAILUKU, MAUI, T.H.

DATE SHIPPED

6-28-54

HOW SHIPPED

EXPRESS ~~XXXXXX~~ PREPAID OR COLLECT

SALESMAN **X**

TERMS—NET 30 DAYS—No DISCOUNT—F. O. B. INDIANAPOLIS, IND.

FOR CUSTOMER'S USE ONLY

REGISTER NO.	VOUCHER NO.	
F. O. B. CHECKED		
TERMS APPROVED	PRICE APPROVED	
CALCULATIONS CHECKED		
TRANSPORTATION		
FREIGHT BILL NO.	AMOUNT	
MATERIAL RECEIVED		
DATE	SIGNATURE	TITLE
SATISFACTORY AND APPROVED		
ADJUSTMENTS		
ACCOUNTING DISTRIBUTION		
AUDITED	FINAL APPROVAL	

6-12-54

QUANTITY			DESCRIPTION	UNIT PRICE	AMOUNT
ORDERED	SHIPPED	BACK ORDER			
1	1		AW #2 SPRING FEED CHART DRIVE - ALL GEARS. FURNISH COMPLETE WITH SPRING CHART DRIVE. SER. #69513.		125.00
1	1		INSTR & DATA SHEET		
PAID					

"SELLER REPRESENTS THAT WITH RESPECT TO THE PRODUCTION OF THE ARTICLES AND/OR THE PERFORMANCE OF THE SERVICES COVERED BY THIS INVOICE, IT HAS FULLY COMPLIED WITH SECTION 15(2) OF THE FEDERAL LABOR STANDARDS ACT OF 1937, AS AMENDED."

THE ESTERLINE-ANGUS COMPANY, Inc.

**DUPLICATE
INVOICE**

Manufacturers of Electrical Instruments

P. O. BOX 596 — INDIANAPOLIS 6, INDIANA U. S. A.

LETTER 6-1-54

6-28-54

CUSTOMER'S ORDER NO. & DATE

REQUISITION NO.

INVOICE DATE

INVOICE NO. **K 4825**

OUR ORDER DATE **K 4825
6-14-54**

SOLD TO

GROTE REBER
GENERAL DELIVERY
WAILUKU, MAUI
TERRITORY OF HAWAII

SHIPPED TO AND DESTINATION

GROTE REBER, KAHULUI, MAUI, T.H. NOTIFY GROTE REBER,
~~XXXXX~~ GENERAL DELIVERY AT WAILUKU, MAUI, T.H.
6-28-54

DATE SHIPPED

HOW SHIPPED

EXPRESS ~~XXXXXX~~ FOR COLLECT

SALESMAN **X**

TERMS—NET 30 DAYS—No Discount—F. O. B. INDIANAPOLIS, IND.

FOR CUSTOMER'S USE ONLY

REGISTER NO.	VOUCHER NO.
F. O. B. CHECKED	
TERMS APPROVED	PRICE APPROVED
CALCULATIONS CHECKED	
TRANSPORTATION	
FREIGHT BILL NO.	AMOUNT
MATERIAL RECEIVED	
DATE 19	SIGNATURE
SATISFACTORY AND APPROVED	
TITLE	
ADJUSTMENTS	
DISTRIBUTION	
AUDITED	FINAL APPROVAL

6-12-54

QUANTITY			DESCRIPTION	UNIT PRICE	AMOUNT
ORDERED	SHIPPED	BACK ORDER			
1	1		AW #2 SPRING FEED CHART DRIVE - ALL GEARS. FURNISH COMPLETE WITH SPRING CHART DRIVE. SER. #69513.		125.00
1	1		INSTR & DATA SHEET		
PAID					

June 26th, 1954
General Delivery
Wailuku, Maui
Terr. of Hawaii

Esterline-Angus Company
P.O. Box 596
Indianapolis 6, Indiana

Att: Mr. H. L. Hildenbrand

Gentlemen:

I wish to purchase 20 rolls of 4305-X chart paper. If the spring drive has not yet been shipped please include the paper with the drive and I will remit by check. If the drive is on its way please advise what the cost of the chart paper will be including the parcel post and insurance charges to Hawaii. Upon receipt of this information I will be pleased to remit by check.

Very truly yours,

Grote Reber

THE ESTERLINE-ANGUS COMPANY, Inc.

ACKNOWLEDGMENT OF ORDER

Manufacturers of Electrical Instruments

P. O. BOX 596

INDIANAPOLIS 6, INDIANA U. S. A.

CUSTOMER'S ORDER NO. & DATE
REQUISITION NO.

LETTER 6-1-54

INVOICE DATE

INVOICE NO. **K 4825**

OUR ORDER DATE **K 4825 6-14-54**

SOLD TO

GROTE REBER
GENERAL DELIVERY
WAILUKU, MAUI
TERRITORY OF HAWAII

SHIPPED TO AND DESTINATION

GROTE REBER, KAHULUI, MAUI, T.H. NOTIFY GROTE REBER
~~XXXX~~ GENERAL DELIVERY AT WAILUKU, MAUI, T.H.

SHIPPING DATE

DATE SHIPPED

HOW SHIPPED

EXPRESS XXXXXX

SALESMAN **X**

6-12-54

TERMS-Net 30 Days-No Discount-F. O. B. INDIANAPOLIS, IND.

QUANTITY			DESCRIPTION	UNIT PRICE	AMOUNT
ORDERED	SHIPPED	BACK ORDER			
1	1		AW #2 SPRING FEED CHART DRIVE - ALL GEAPS. FURNISH COMPLETE WITH SPRING CHART DRIVE. SER. #69513.		125.00
1	1		INSTR & DATA SHEET		

PAID

ACKNOWLEDGMENT
CANCELLATION OF THIS ORDER CAN BE MADE ONLY WITH OUR CONSENT AND UPON TERMS THAT WILL INDEMNIFY US AGAINST LOSS.

June 1st, 1954
General Delivery
Wailuku, Maui
Territory of Hawaii
U. S. A.

Esterline-Angus Company
P.O. Box 596
Indianapolis, Indiana

Att: Mr. H. L. Hildenbrand

Gentlemen:

Thank you for your letter of May 18th. After examining your drawings I believe the most practical thing for me is to purchase one of your complete spring chart drives shown on drawing #12003. The set knob #12084 can be removed and a fitting made to take off power at that point. I will then have a simple system with all the many various speeds available which your drive is capable of producing. Also, if desired at some future time, I can mount the whole assembly on my old Sma recorder and convert it to spring drive.

Enclosed is a check for sum of \$125.00 in payment for one spring chart drive. Please send it via express collect. The REA has an office at Kahului, Maui, T.H.

Yours very truly,

Grote Reber



THE ESTERLINE-ANGUS COMPANY, INC.

Manufacturers of Electrical Instruments

INDIANAPOLIS 6, INDIANA

P. O. Box 596

May 18, 1954
AIR MAIL

Mr. Grote Reber,
General Delivery,
Wailuku, Maui,
Terr. of Hawaii.

Dear Sir:

Replying to your letter of May 12th, we are enclosing a copy of our print #12003 which is an assembly drawing of our spring chart drive showing dimensions. Also enclosed is print #12005 showing part numbers. The escapement unit goes in the spot marked A on print 12005. It is shown separately on print #14502.

The complete minute feed spring chart drive sells for \$125.00. The escapement unit alone is priced at \$37.50. The mainspring barrel and spring assembly, part 12296, is \$6.50 and two are required in this spring chart drive.

These prices are f.o.b. Indianapolis, Indiana; terms net 30 days. Shipment can be made within a couple of weeks after receipt of your instructions. We are not quoting on any further parts because we hardly know what to mention. If you can mark up a print with the parts you want or send us a list of the part numbers on which you would like to have prices, we will be glad to send you a supplementary quotation.

Yours very truly,

THE ESTERLINE-ANGUS CO., INC.

H. L. Hildenbrand
H. L. Hildenbrand

HLH:dr

May 12th, 1954
General Delivery
Wailuku, Maui
Terr. of Hawaii
U.S.A.

Esterline Angus Co.
P.O. Box 596
Indianapolis 6, Indiana

Att: Mr. H. L. Hildenbrand

Gentlemen:

Some apparatus I am constructing needs a small motor which does not operate with electricity. It appears that a clock type motor similar to the one in the recorder which you recently sold me will be satisfactory. I need this instrument and do not wish to take it apart. Please send to me some drawings which show the clock motor, governor and gear shift mechanism and give the part numbers. After I have had an opportunity to examine these things I will advise you what parts I can use. Your aid and assistance on this matter will be greatly appreciated.

Very truly yours,

Grote Reber

October 14, 1952

Esterline Angus Company
Indianapolis, Indiana

Attention Export Department

Gentlemen:

For one of your standard recorders we wish to purchase
the following:

50 rolls #4305X Chart paper
1 pint red ink
1 pint green ink
3 fine glass pens

Please ship this material via express collect to us
at Pier #2, Kahului, Maui, T. H. It should be sent via
railroad to San Francisco, via Matson Lines to Honolulu,
via Young Brothers Barge Ltd. to Kahului.

Upon receipt of a statement we will be pleased to
remit by check.

Yours very truly,

Grote Reber

GR:mc