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· VALUE ANALYSIS STUDY  
of  
TWO TELECHRON CLOCK PINS

By  
Manufacturing  
Engineering  
Purchasing

January 3, 1949

TELECHRON CLOCK PINS

Present Cost

<u>Purchase Cost/M</u>	<u>Quantity/Year</u>	<u>Cost/Year</u>	
[REDACTED]	47,000,000	\$172,000	
[REDACTED]	11,000,000	<u>63,000</u>	
	Annual Cost		\$235,000

New Cost

1.90	47,000,000	\$ 89,000	
3.15	11,000,000	<u>34,000</u>	
	Annual Cost		<u>123,000</u>

Yearly Saving \$112,000

How Accomplished

- 1) Use all of allowable diameter tolerance.
- 2) Use smaller stock. Eliminate one centerless grinding Pass.
- 3) Charge for only sampling inspection approved by our engineers, rather than 100%.
- 4) Eliminate some handling.
- 5) Determined Purchasing pressure.

JOB CALENDAR

September 1948

Herb Schnell of Manufacturing Policy Division--

"We annually use 50,000,000 of these pins at \$3.65/M.  
Take a look at them."

October 1948

Getting samples, costs, specifications, illustrative assembly using pins, etc.

Present supplier wrote, "We originally (1946) quoted \$4.70--  
later \$3.95--now \$3.65." "Obviously we are not able to  
make any further price reductions (now)."

November 1948

Arthur Wyman, Telechron engineer, discussed the factors and problems surrounding design and use of the pin.

Other suppliers and methods of fabrication were being investigated.

December 1948

Meeting was arranged with:

-Mr. Bernard--Telechron Purchasing  
-Mr. Wyman --Telechron Engineering  
-Supplier's Sales Manager  
-Supplier's factory Superintendent.

Each step of manufacture--each item of cost build-up was questioned and studied. Reduced quotations were the result.

January 1949

Lower costs became effective January 1, 1949.

VALUE ANALYSIS DIVISION  
PURCHASING DEPARTMENT  
January 3, 1949

M/

C O R R E S P O N D E N C E

TELECHRON INC.  
Ashland  
Massachusetts

September 14, 1948

Mr. Herbert L. Schnell  
Bldg. 36, Room 114  
General Electric Company  
Schenectady, New York

Dear Herb:

In accordance with our recent telephone conversation I am enclosing 12 prints of Pivot #41626-8. We also have two longer pivots with all dimensions the same except length.

<u>Name</u>	<u>Length</u>	<u>Drg. No.</u>	<u>Yearly Requirements</u>	<u>Present Cost</u>
Pivot	.354 -.000 -.002	A1626-8	47,168,000	\$3.65/M
"H" Rotor Shaft	.778 -.003	M-324-3	11,040,000	\$5.80/M
"B" Rotor Shaft	1.000 -.003	41626-10	752,000	\$6.65/M

We will certainly appreciate any assistance that you may be able to give us in obtaining these pivots at a reduction in cost.

With personal regards, I remain

Yours very truly,

TELECHRON INC.

Factory Engineer

FE Mangan:HL

Enc.

THE TORRINGTON COMPANY  
Torrington, Connecticut

October 6, 1948

General Electric Company  
Schenectady  
New York

Attention: Mr. L. D. Miles  
Building No. 2

Dear Mr. Miles:

Thank you for the courtesies shown to our representative, Bud Dean, who has reported to us regarding his conversation with you concerning the possibility of reducing the price on Telechron pivot part No. 41626-8.

Incidentally, this part is now known as O-SK-4053, this change having been made several months ago by Telechron.

We realize that this part is used in large volume, and for that reason we have been very conscious of the cost of these, and we feel that we have done right well in the matter of holding the price down, and perhaps you will agree when you consider the following.

This pin was first made by us for Telechron when they resumed manufacture of electric clocks right after the war. At that time they stated that they thought they could pay approximately \$5.00 per thousand for this piece. We originally quoted a price of \$4.70 per thousand, which was quoted in early 1946.

After we had made these for a short time, we found that we could do a little better than we had originally estimated, so on March 10, 1946, we reduced the price to \$3.95 per thousand.

On June 6, 1946, we had increased costs and also because of allowances made by O.P.A., we increased the price 8%.

On October 28, 1946, we were able to effect still further manufacturing economies which not only wiped out the 8% increase, but allowed us to reduce the price to \$3.65 per thousand.

This same price has been maintained right through, and is still in effect today. In other words, this means that we absorbed our increased costs due to wage increases given to our workers in July 1947, and we have also absorbed the increased costs due to substantial wage increases granted to our workers on July 15, 1948.

General Electric Company

October 6, 1948

In other words, since we originally quoted, there has been one price increase of 8%, and the equivalent of four reductions in price.

This part is not only made from stainless steel and heat treated, but requires fifteen different operations in its manufacture, some of which are rather expensive due to the desired tolerances.

Obviously, we are not able to make any further price reductions on this pin the way it is drawn up. It is quite possible that if the length tolerance were increased considerably, we could make some saving, but we doubt very much whether this is feasible from an engineering standpoint.

As a matter of fact, we have just been notified yesterday by Telechron that a recent shipment of 575,000 pieces has been rejected because it is .001 over the length tolerance, which would indicate that their length tolerance of .002 must be followed.

We will appreciate your further comments.

Very truly yours,

THE TORRINGTON COMPANY

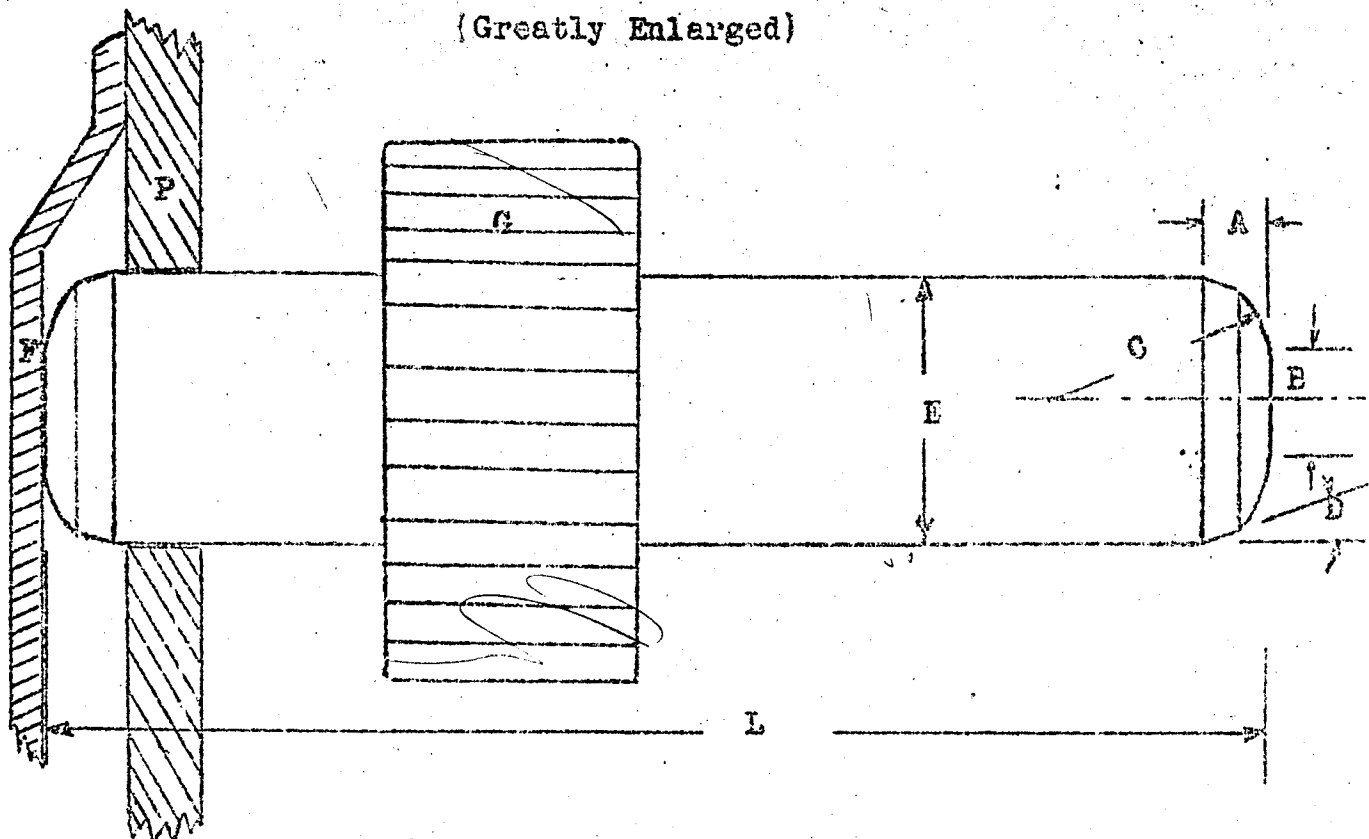
Sales Manager -  
SPECIALTIES DIVISION

WLBowen:IK

## CLOCK PIN

Annual Requirement	50,000,000
Cost	\$3.45/M
Value - Bogy	1.45/M
Savings - Bogy	100,000/year
	\$170,000/year
	70,000/year

(Greatly Enlarged)



- A - .010"  $\pm$  .005"
  - B - Permissible flat .050" maximum diameter on ends
  - C - .089" radius
  - D - 20° chamfer
  - E - .0625"  $\pm$  .00025" diameter
  - F - Pivot support bearing
  - G - Alignment Plate
  - L - .354"  $\pm$  .000"
- Material - 440 stainless  
 Treatment - Harden  
 Actual size

Value Analysis Division  
 November 19, 1948



VALUE ANALYSIS STUDY OF CLOCK PIN  
November 22, 1948

Questions raised by the discussion group and tentative answers, to be reviewed with the product engineer.

1. Why does it cost \$3.65 instead of \$.45 per M?

Because of the  $\pm .001$ " length tolerance, the  $2\frac{1}{2}$  tenths OD tolerance, the chamfer-radius-end construction, the 440 stainless steel and the hardening.

2. What purpose does the pin serve?

It is the pivot used to support the pinions and gears in the electric clock. Several of them are used in each clock.

3. How is it made now?

We don't know exactly. We do know that it is cut off too long and is made of material over the desired diameter. Then, after hardening the ends are ground to length and the OD is ground to size. The vendor says there are 12 operations in the making of this pin.

4. Could the entire unit be made smaller in order to save material on all parts?

We don't know, we'll ask that of the engineer.

5. How is the gear put on to the pin?

Pressed on. The pinions are made from thin laminated carbon steel which are blanked in a small punch press and pressed directly on to the pin. Gears and pinions are held in place by friction with the pin.

6. Why is stainless used?

To avoid corrosion.

7. How much does the stainless material only cost?

\$.45 per M pieces.

8. How much would carbon steel cost?

Around \$.10 per M.

9. Why use #440 stainless which is twice as hard to machine as the others?

Because it has 100 points of carbon and can be satisfactorily hardened.

10. Why harden it?

In pressing on the tight gears and pinions, the surface is some times otherwise slightly scored and unfortunately on the pin, this is the bearing surface so that it provides a very poor bearing surface with erratic and short life. The sole function of the hardening is to avoid damage to the pin surface while the gears are being pressed on. Since the pins are running in copper bearings, it is felt that the steel would be sufficiently hard for good bearing operations even without hardening.

11. If the gears are carbon steel and they do not corrode or rust, why would the pins?

That is something we don't quite understand -- we have tried carbon steel for the pins and it does corrode. The gears are made of a very thin cold rolled steel and it seems probable that the supplier must use some rust inhibitor in his process which is good enough. If we acid clean, or otherwise thoroughly clean the pinion steel, they too will rust.

12. Why the chamfer D?

To provide entry into the gear.

13. Why chamfer both ends?

To save labor. Otherwise each pin must be picked up and examined before it is used to locate it with the proper end up.

14. Why the flat B?

The flat presses against the end plate and locates the pin axially. It is desirable for the flat surface to be a minimum in order to reduce end friction.

15. Why the radius C?

The radius is for the purpose of connecting the chamfer to the flat.

16. Why have both the chamfer D and the radius C when the combined length of both is .010" and may, within tolerances be

as little as .005"?

A chamfer or suitable radius is necessary to provide entry into the gear and a small end bearing surface is necessary to limit end friction. We presume that the other details best fit into the manufacturing arrangement of the supplier who helped to work it out. A desirable end from this viewpoint would be a semi-spherical surface. However, such surface would extend clear back into the bearing P and eliminate the cylindrical portion which is now the bearing surface.

17. Why only  $\pm .001$ " on the length tolerance when it is observed from actual assembly that there is an end plate of around .015" on each pin?

We are advised that due to the build-up of tolerances there may be friction between gear faces if more than .001" is allowed. We are further advised that the tolerance on the studs which separate the end plates is  $\pm 2$ " and that if it were more economical to hold them to a closer tolerance than the pins, the tolerances might be reversed allowing  $\pm .002$ " on the pin and making the stud to  $\pm .001$ " without adversely affecting the assembly.

18. Why only  $2\frac{1}{2}$  tenths diameter tolerance?

To provide dependable interference fit when mounting the gears and pinions.

19. There are other ways of providing the features which have been discussed. In general what prompted this particular design?

We understand that the part has quite a history, that it was made by ourselves and possibly others, but one vendor showed particular interest in an aptitude for the job and it is probable that some of the design details are prescribed to coincide with his manufacturing processes.

20. Can wire be purchased to the diameter tolerance required?

Yes.

21. Will automatic screw machines cut it off to  $\pm .001$ " length tolerance?

Probably not. We would expect  $\pm .003$ " from them.

22. How close will wire forming equipment shear it into length?

Good equipment will hold  $\pm .002$ ".

23. Why not cut it off on a form cutter which will provide in one operation the necessary chamfer, radius, and end flat?

It might work -- the problem would be to cut it off to the tolerance of  $\pm .001$ " and the maintenance of the form cutter.

24. Some cutoff methods would normally leave a small tip in the center -- wouldn't it be desirable to do so?

We would expect so providing the tip was close enough controlled so that the distance from end to end of the tips would come within the length tolerance.

25. I believe that an abrasive cutoff machine can be obtained which will cut to a tolerance of  $\pm .001$ ". Why not use it and tumble the parts to provide the necessary radius for entry into the gear?

Let's determine if such machine is available. There are certain problems. Ordinarily such a part tumbled before hardening would secure a slight dumb-bell shape at the end which would cause looseness of the gears after they have been pressed on. The tumbling might be done after hardening but would be slower and a somewhat different operation. We have a most outstanding tumbling laboratory in West Lynn, however, and they advise that they believe they could prescribe a tumbling cycle which would not produce a dumb-bell effect.

26. If the wire is bought to exact diameter tolerance, hardening becomes a problem. Could it be gas hardened or hardened in some other manner which did not produce discoloration or other undesirable surface conditions on the material?

We don't know. That should be investigated.

27. We have one supplier who is doing such a spectacular job of millions of small parts somewhat similar to this. Don't you believe that if we put the problem up to him and went into these details with him that he would find a way to do it for around \$1.00 or \$1.50 per M?

Possibly -- we'll try it.

VALUE ANALYSIS DIVISION  
PURCHASING DEPARTMENT

LD Miles:LHE

November 29, 1948

Mr. A. W. Wyman  
Telechron, Inc.  
Ashland, Massachusetts

Dear Mr. Wyman:

We have been following through some of the suggestions which you made while here in Schenectady concerning the clock pivot pin which we now secure from the Torrington Company.

Mr. Bowen of the Torrington Company advises that they have been giving serious consideration to some possible changes which might result in substantial cost improvement and, if acceptable, we will come to Ashland and go into every phase of the matter with you and any other interested parties.

Mr. Bowen will bring the superintendent of the factory doing the work so that we can handle the matter pretty thoroughly. We have tentatively established the date of December 14 if that is agreeable to you. Mr. Bowen will expect to arrive about 10 o'clock in the morning and I will investigate connections and advise you later concerning my arrival.

I am sending a copy of this letter to Mr. Bernard of our Purchasing Department in Worcester whom Mr. Bowen advises has been constantly pressing him for action toward reducing prices on this item. By this copy we are asking Mr. Bernard if he and/or others from the purchasing group would like to be present for the discussions on the 14th.

GENERAL ELECTRIC COMPANY

L. D. Miles  
Purchasing Department

LDM:AEM

CC: Mr. Bernard - Worcester  
Mr. Burens - Ashland  
Mr. Schnell - Schenectady, Bldg. 36-1

December 20, 1948

Mr. W. L. Bowen  
The Torrington Company  
Torrington, Connecticut

Dear Mr. Bowen:

We confirm arrangements made during the recent study of yourself, Mr. Smith and several of us at the Telechron plant in Ashland, Tuesday.

I Based upon the various discussions, you will quote Mr. Eernard with a copy to the writer, as follows:

- 1) Based upon using the entire .0005" diameter tolerance which will also allow a substantial reduction in rejected pins. Also, inspection cost will be re-evaluated based upon the sampling methods worked out with Mr. Wyman.
- 2) Quote based upon the above excepting that wire of smaller diameter is to be used reducing the number of passes from three to two and also reducing attendant losses.
- 3) Quote as in (2) above excepting allowable length tolerance is to be .003" instead of .002".
- 4) Quote same as (2) above excepting that allowable tolerance is to be .004" instead of .002".
- 5) Quote as in (2) above excepting substitute #1090 carbon steel for the #440 stainless steel.

II Investigate for employment at a little later date the following:

- 1) Purchasing suitable stock so that the diameter can be made in one centerless grinder pass.
- 2) Making from pre-tolerance steel.
- 3) Consider hardening in wire form and cutting off later.
- 4) Consider any other new possibilities.

We are appreciative of your thorough consideration and handling of this matter.

GENERAL ELECTRIC COMPANY

L. D. Miles  
PURCHASING DEPARTMENT  
Value Analysis Division

LDM:AEM

THE TORRINGTON COMPANY  
Torrington, Connecticut

December 27, 1948

Telechron Inc.  
81 Foster Street  
Worcester, Massachusetts

Attention: Mr. Bernard

Dear Mr. Bernard:

SUBJECT: TELECHRON PIVOT NO. 41626-8

We came home with some very definite ideas and things to work on, from our discussion at Ashland on December 14 with yourself, Larry Miles and Arthur Wyman, regarding ways and means of cutting costs on the Subject pivot.

Our Production Department has been doing a lot of work in connection with better and more efficient handling and feeding methods. This, plus the concessions discussed, has resulted in some rather startling cost reductions, which are reflected in the prices shown below.

PIVOT NO. 41626-8

METHOD NO. 1

Based upon using  $\frac{1}{4}$  .00025 diameter tolerance, plus attendant drop in rejects, and lower inspection costs, we quote \$2.05 per thousand.

METHOD NO. 2

Same as No. 1, except to use only two centerless grinding passes, plus saving in inspection and reduction in scrap loss, we quote \$1.90 per thousand.

METHOD NO. 3

Same as No. 2, except to use a total length tolerance of .003", instead of the present .002". This larger tolerance should allow us to furnish radius ends instead of slight flats. Using this method, we quote \$1.79 per thousand.

METHOD NO. 4

Same as No. 2, except to use S.A.E. 1090 carbon steel instead of Type 440 stainless, would allow us to quote \$1.55 per thousand.

METHOD NO. 5

Same as No. 2, except to increase the length tolerance to .004". Our costs would be same as under Method No. 3, so same selling price would apply.

Telechron Inc.

December 27, 1948

We can apply these new prices very shortly after you advise which method you wish us to follow.

ROTOR SHAFT NO. M-324-3

The volume on this part is not so heavy, but it has been averaging about 700,000 per month. Since that is enough to be worthy of especial consideration, we have given a lot of thought to this item also.

If Method No. 1 could be applied to this pin, we could reduce the price to \$3.15 per thousand. We haven't figured on using any of the other possible methods in making this pin, because we feel that the concession represented by Method No. 1 is all that you could possibly allow.

The above represents the cost reductions that can be put into effect with little delay. As Mr. Miles urged, we will consider and investigate other possible methods of making these two parts, with the idea of arriving at still lower costs.

We will wait for your comments and instructions before any changes are made.

Best wishes for a Happy New Year.

Very truly yours,

THE TORRINGTON COMPANY

Sales Manager  
SPECIALTIES DIVISION

WLE:owen:IK

cc: Mr. L. D. Miles  
c/o General Electric Co.