INTERNAL CORRESPONDENCE

COMPANY PRIVATE

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FROM: Advanced Programming 10-2

SUBJECT: Price Performance Evaluation, MH 800

The attached report is a study of competitive status of the MH 800. The work was accomplished by J. B. Gilbert of the Advanced Programming Department.

The same method of Cost Performance Evaluation was used to evaluate the status of the MH 800 as was used in the study conducted for the 901 in November of 1958. The package of systems tasks used as a measure of merit was the one specified for that study. The attached charts have omitted the IBM 650 on the basis of non-competition with the MH 800.

T. M. Hurewitz

T. F. Chaydleur

TMH:bh

Competitive Evaluation - Honeywell 800

The Honeywell 800 System is a high speed transistorized computer. It features a time sharing control system called "Automatic Parallel Processing". This feature complete with a 6 microsecond access time, fast tapes, and a 44 microsecond average instruction time* makes the 800 the most powerful machine in its price class (minimum system about $22,000. per month). Appendix A, "Honeywell 800 System Features", fully describes the features of the machine with the exception of "Automatic Parallel Processing" which will be covered here.

"Automatic Parallel Processing", and its component "Multi-Program Control" and "Traffic Control" presents a very interesting approach to the joint problems of simultaneity and time sharing. The basic module of memory has 4,096 words arranged in two banks of 2048 words. Up to 4 of these modules can be included in a system thus giving 8 banks of memory. Each bank is exclusive of the other bank(s) and the instruction format is such that only a portion of a complete address is included in the address portion of the instruction. The remainder, known as the bank address, is automatically obtained from a register within the bank in which the Instruction is located, thus limiting the full use of memory in a single program. Each bank has its own group of sequencing, indexing and special Registers for Program Control. This bank arrangement is the feature which permits the "Multi-Program Control" to function. Programs may be entered into each bank in the machine complement and by sequencing through each bank in its turn automatic time sharing is accomplished in the 800. "Traffic Control" is a feature that causes the machine to by-pass any bank that is not ready to execute a new instruction, thus eliminating time wasted while waiting for an instruction to be completed before going on to the next step.

*Our Estimate

This system is a clever method of improving the efficiency of the computer and appears to be quite effective in reducing Honeywell's estimates of job times. However, their most efficient system appears to be in the $32,000. range. This takes it out of the medium price range and removes it somewhat from direct competition with the RCA 501 except, perhaps, in the borderline range in the $20 to $25 thousands. In Figure 1, "Comparison of Optimum Processing Costs" the cost per transaction of the 800 (Computer D) is lowest in both the low and high activity configurations. On the other side, their rental is the highest of the field covered in both of these cases and is about twice the price of the RCA 501 optimum systems. The other systems on this chart are as follows: Computer A - IBM 7070; Computer B - Burroughs 220; and Computer C - NCR 304. As can be seen, none of these last-named computers under this criterion is superior to the RCA 501 except the IBM 7070 in the high activity configuration. The IBM 7070's high ($30,000.) monthly rental takes it out of direct price competition with the 501 for the same reason cited previously for the Honeywell 800.

Figure 2, "Price Range Performance Comparison" presents a graphic illustration of the Price/Performance ratio of the 800 and 501 over a broad range of jobs.

Figures 3 through 10 illustrate the performance of the five computers in a series of eight situations which are described in Figure 11. (Note that the Burroughs 220 drops completely out of the picture in the three largest processing situations.)

More detailed information on the Honeywell 800 hardware is to be found in Appendix "A", previously described, and Appendix B, "Instruction Repertoire and Timing" both of which are attached. Price information was included in the report dated March 10, 1959 entitled "Honeywell 800 Pricing."

John Burns Gilbert

JBG:bh

Appendix "A"

Honeywell 800 System Features

Memory Size - 4096 to 16,384 54 bit, (6 check and 48 information) words.

Word Structure - 12 decimal digits 8 alphanumeric characters, or a combination of the above, or 48 binary digits.

Average Instruction Execution Time - 44 microseconds.

Instruction Format - Three address.

Access Time - 6 microseconds.

Input-Output - 1 to 8 Output and 1 to 8 Input channels may operate simultaneously depending upon hardware configuration.

Magnetic Tape - A block is composed of from one to four hundred six frame words. A frame is composed of eight information and one parity bits across a 3/4" magnetic tape. Maximum rate of speed for tape reading and writing is 48,000 frames per second with a sustained speed of 42,500 frames per second which is equivalent to 85,000 Decimal digits or 63,750 alphanumeric characters per second. Writing can be performed during forward motion of the tape and reading can be accomplished during either forward or backward motion.

Input-Output Control - All communication between the central processor and input-output units is controlled by separate control units. A tape control unit uses one output and one input channel and controls up to 8 tape units. Other input and output control units take one channel and control one, two or three input-output units depending upon model used. These control units contain all necessary buffering and trans-

lation circuits peculiar to their related output devices. Off-line auxiliary control units connect to control units to permit peripheral operation of input-output units from tape-switching equipped tape units.

Input-Output Units

Standard Printer: Prints 150 120 character lines per minute. Paper tape carriage control.

High Speed Prints: Prints either 600 or 900 120 character lines per minute. A switch on the printer controls the selection of the speed; Paper tape carriage control.

Card Readers: In three models the card reader reads 240, 650 or 900 80 column cards per minute they have two read stations and two output hoppers for comparing transcribed information with original data and rejecting bad cards.

Card Punches: Two versions of the card punch operate at 100 and 250 cards per minute. A read station is provided for double punch and blank column detection.

Paper Tape Readers: The standard paper tape reader reads five, six, seven or eight level tape at a speed of 200 characters per second. The High-Speed reader reads the same tape at a speed of 1000 C.P.M.

Paper Tape Punch: The one type of paper tape punch operates on five, six, seven, or eight level tape at 60 characters per second.

Floating Point - A floating point optional feature is provided at additional cost.

HONEYWELL 800

INSTRUCTION REPERTOIRE AND TIMING

INSTRUCTION	OP. CODE	TIME IN MICROSECONDS
Binary Add	BA	24[1]
Decimal Add	DA	24[1]
Binary Subtract	BS	24[1]
Decimal Subtract	DS	24[1]
Binary Multiply	BM	186
Decimal Multiply	DM	150
Inequality Comparison, Numeric	NN	24
Inequality Comparison, Alpha	NA	24
Less Than or Equal Comparison, Num.	LN	24
Less Than or Equal Comparison, Alpha	LA	24
Transfer N^2 Words (-63 Words)	TC	24 + $12N^2$
Transfer From A to B, Ignore C	TX	18
Transfer From A to B, Go to C	TS	24
Proceed (NOP)	PR	12
Half Add (Binary)	HA	24
Superimpose	SM	24
Compute Orthocount	CC	30 + $6N^2$
Print A Alpha	AP	24
Print A Octal	OP	24
Print A Hexadecimal	HP	24
Check Parity	CP	24
Field Transfer	FT	30 + $12N^2$
Record Transfer	RT	30 + $12N^2$

INSTRUCTION	OP. CODE	TIME IN MICROSECONDS
Shift Preserving Sign and Substitute	PS	30-42
Shift Preserving Sign and Extract	PE	30-42
Shift Word and Substitute	WS	30-42
Shift Word and Extract	WE	30-42
Shift and Select	SL	30-48
Defined Instruction	Blank	18
Write Forward	WF	24
Read Forward	RF	24
Read Backward	RB	24
Wind	WT	24
Rewind	RW	24
	OPTIONAL[3] GENERAL INSTRUCTIONS	
Binary Divide	BD	312
Decimal Divide	DD	312
	OPTIONAL[3] FLOATING POINT INSTRUCTIONS	
Binary Add	BA	66 Avg.
Decimal Add	DA	66 Avg.
Binary Subtract	BS	66 Avg.
Decimal Subtract	DS	66 Avg.
Binary Multiply	BM	186 Avg.
Decimal Multiply	DM	156 Avg.
Binary Divide	BD	324 Avg.
Decimal Divide	DD	324 Avg.
Normalize to Floating Form	NZ	30-66, 48 Avg.

INSTRUCTION	OP. CODE	TIME IN MICROSECONDS
Inequality Comparison, Floating	NF	24
Less Than Comparison, Floating	LF	24

Notes

1. In Certain Cases 30 Microseconds
2. N = Number of Words Transferred
3. Available at Additional Cost

Figure 11

PROCESSING CHARACTERISTICS

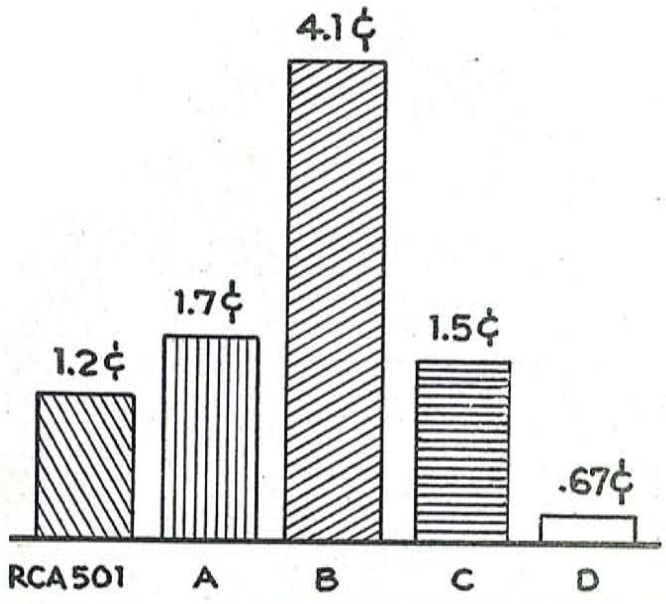
JOB TAG	A	B	C	D	E	F	G	H
INPUT VOLUME - No. of Messages								
Type 1 (50 Char.)	3,750	3,750	3,750	3,750	75,000	75,000	75,000	75,000
Type 2 (120 Char.)	1,250	1,250	1,250	1,250	25,000	25,000	25,000	25,000
REFERENCE FILE -	100,000 Messages							
Ave. No. Chars.	205	615	205	615	205	615	205	615
OUTPUT								
Listing - Lines	5,000	5,000	5,000	5,000	100,000	100,000	100,000	100,000
Documents - No.	5,000	5,000	5,000	5,000	25,000	25,000	25,000	25,000
- Lines	25,000	25,000	25,000	25,000	100,000	100,000	100,000	100,000
- Spaces	10,000	10,000	10,000	10,000	100,000	100,000	100,000	100,000
STRIKE DENSITY	5%	5%	5%	5%	100%	100%	100%	100%
COMPUTE FACTOR	Low	Low	High	High	Low	Low	High	High

Low = 50 Active 501 Instructions
High = 500 Active 501 Instructions

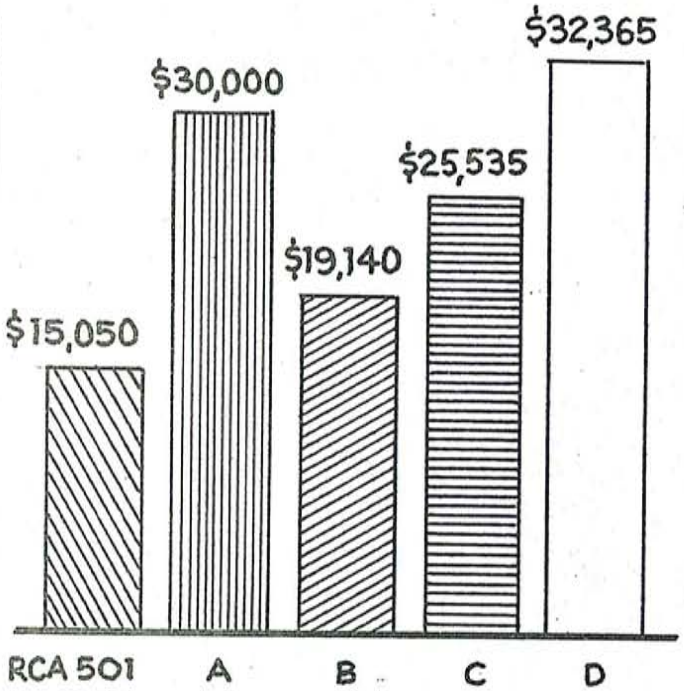
COMPARISONS of OPTIMUM PROCESSING COSTS

● OPTIMUM PROCESSING COSTS – LOW ACTIVITY

COST PER TRANSACTION *

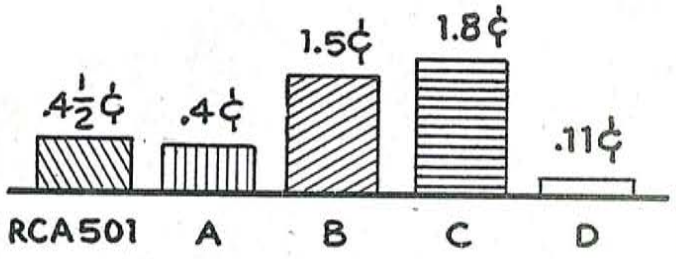


ONE SHIFT MONTHLY RENTAL +

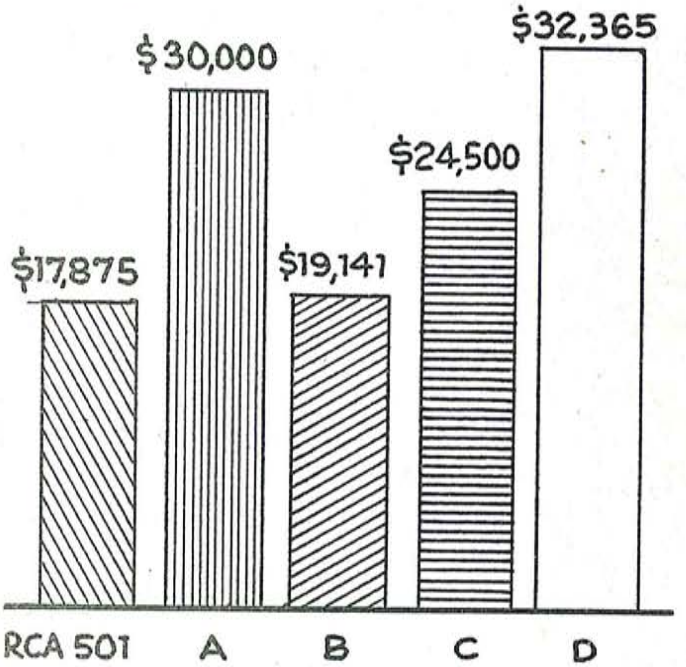


■ OPTIMUM PROCESSING COSTS – HIGH ACTIVITY

COST PER TRANSACTION *

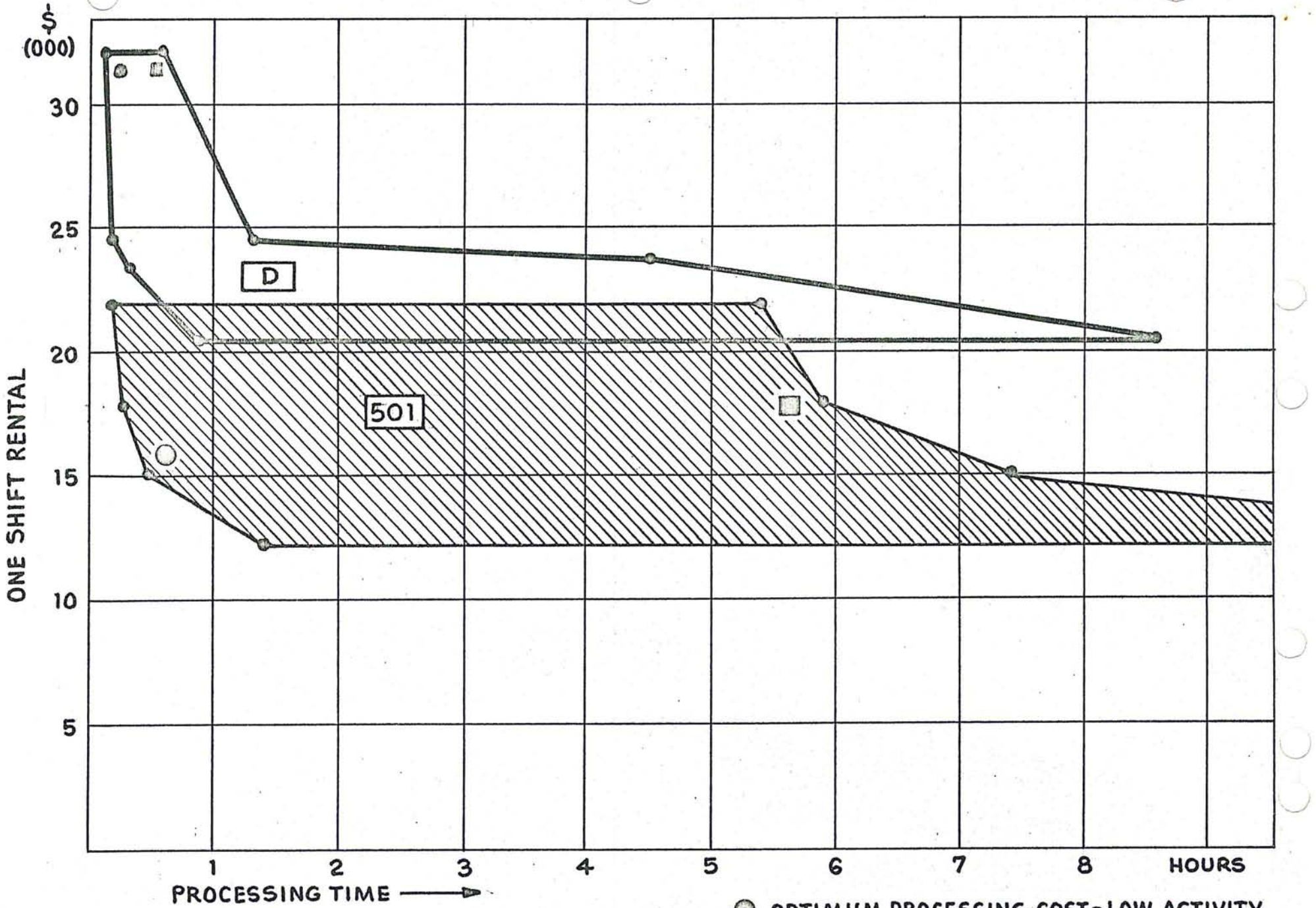


ONE SHIFT MONTHLY RENTAL +

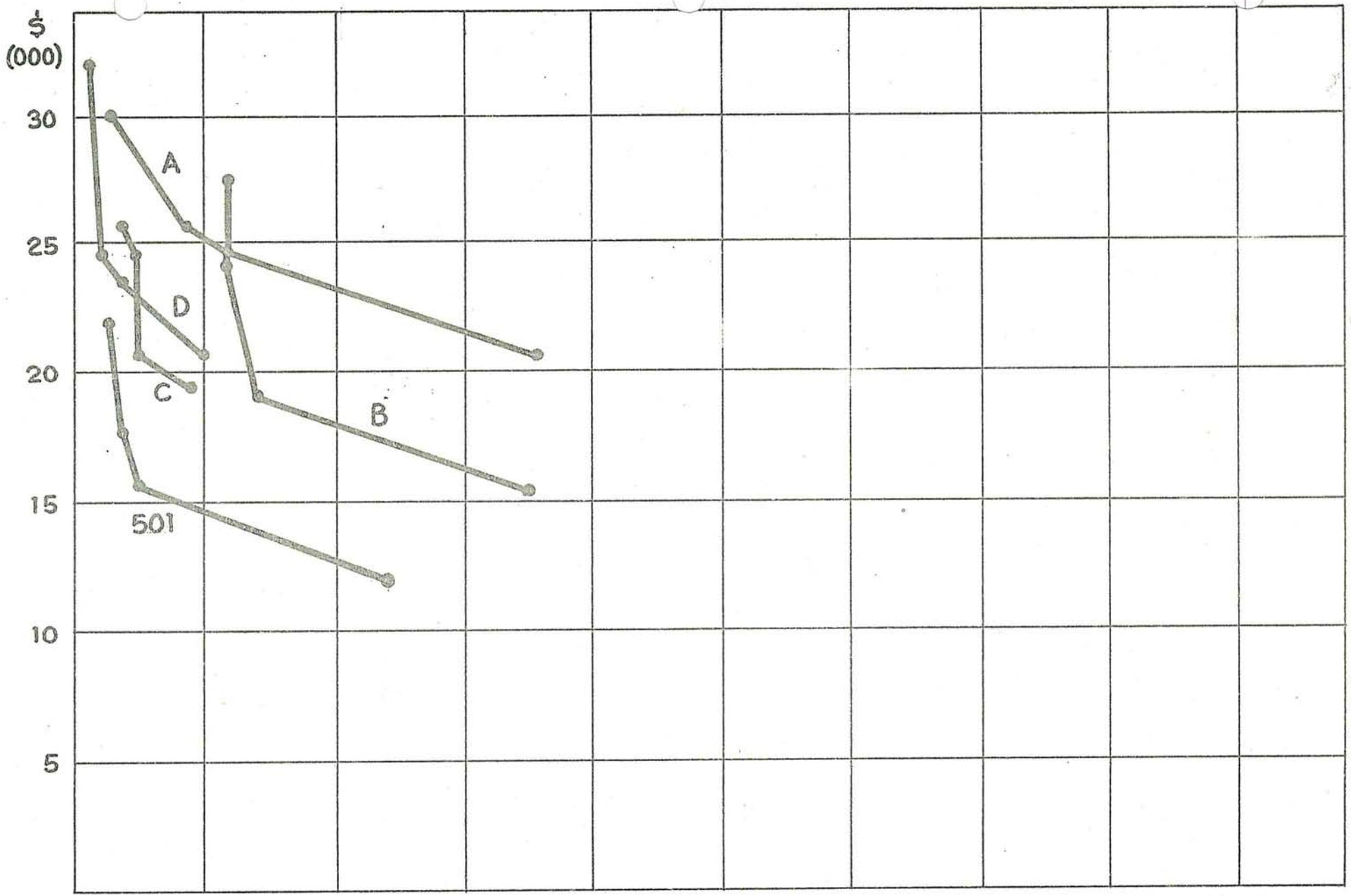


* SELECTED TYPICAL VOLUME

+ MOST EFFECTIVE EQUIPMENT COMBINATION FOR APPLICATION SELECTED.

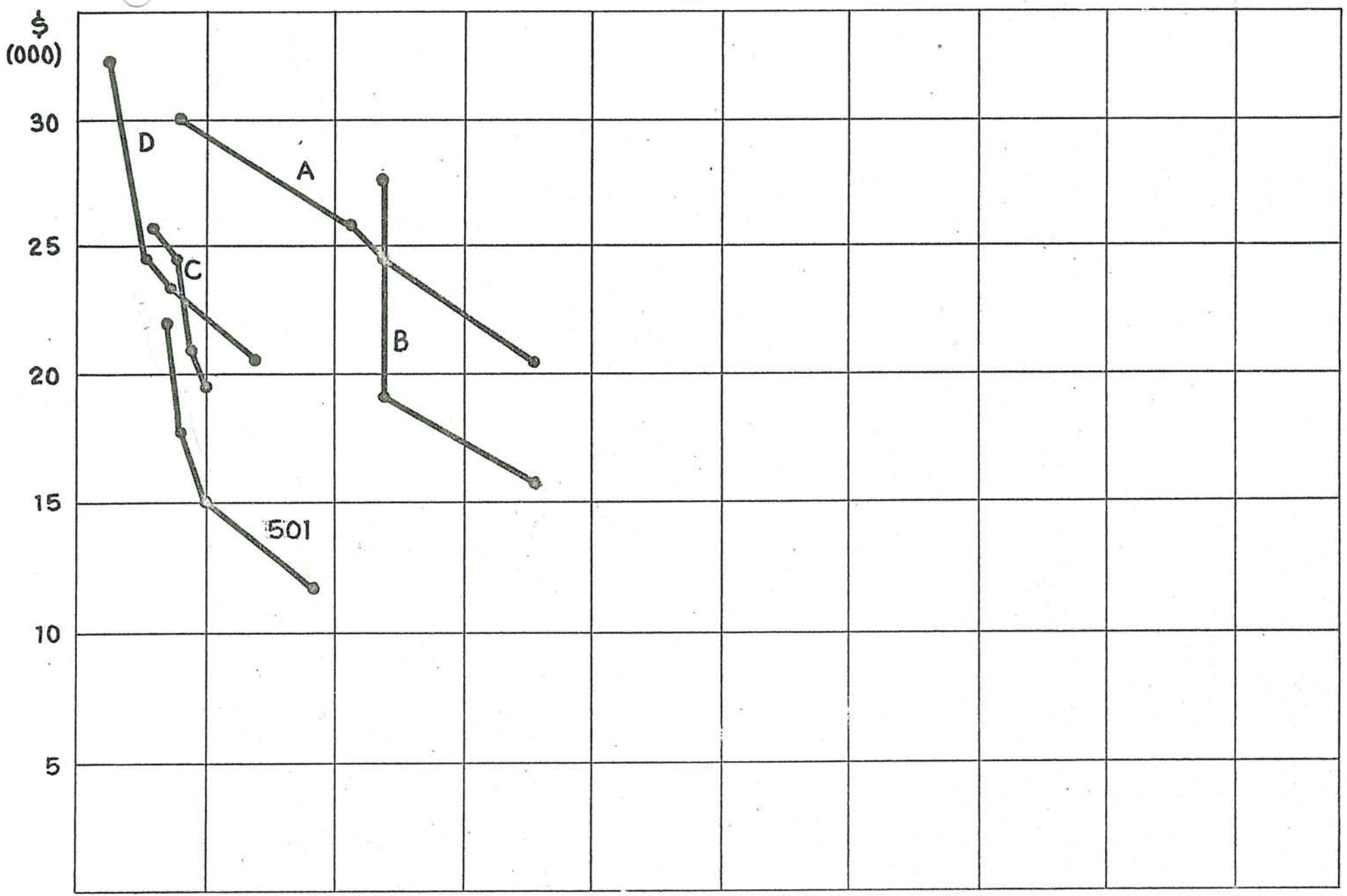


PRICE RANGE & PERFORMANCE COMPARISON

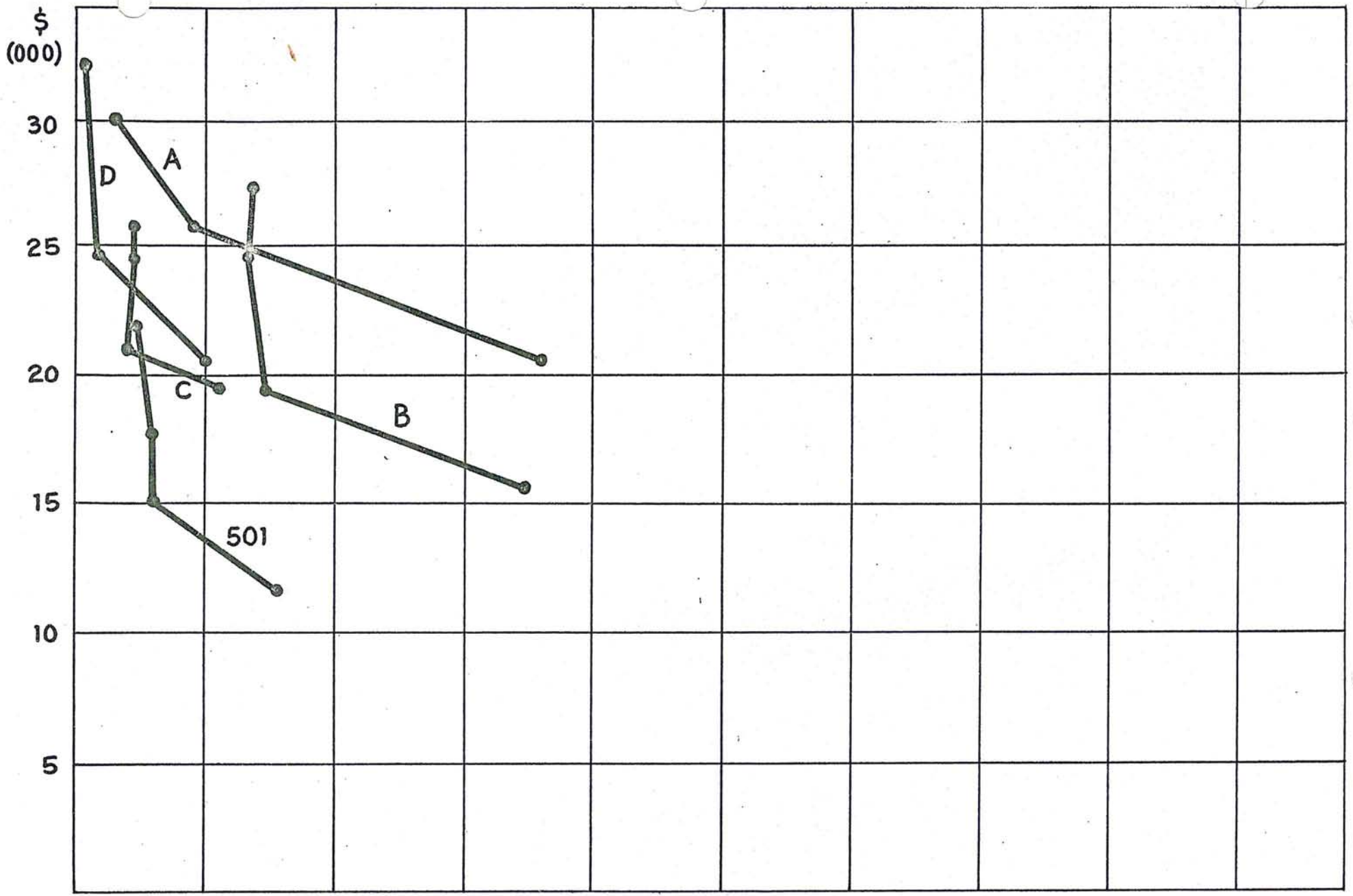


SITUATION A - STRIKES - LOW; COMPUTE - LOW; REFERENCE ITEM - SMALL

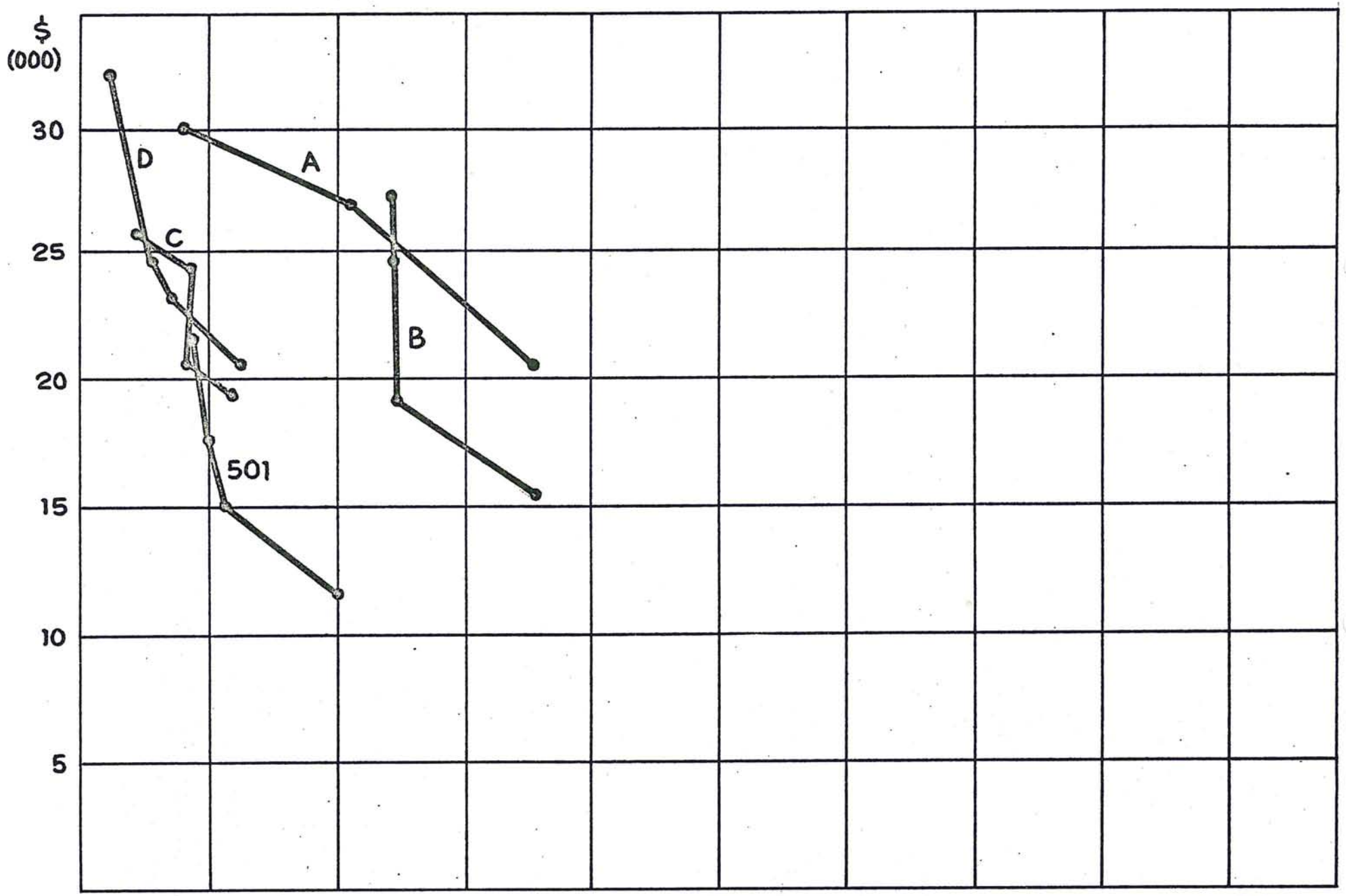
FIGURE 4.



SITUATION B - STRIKES - LOW; COMPUTE - LOW; REFERENCE ITEM - LARGE

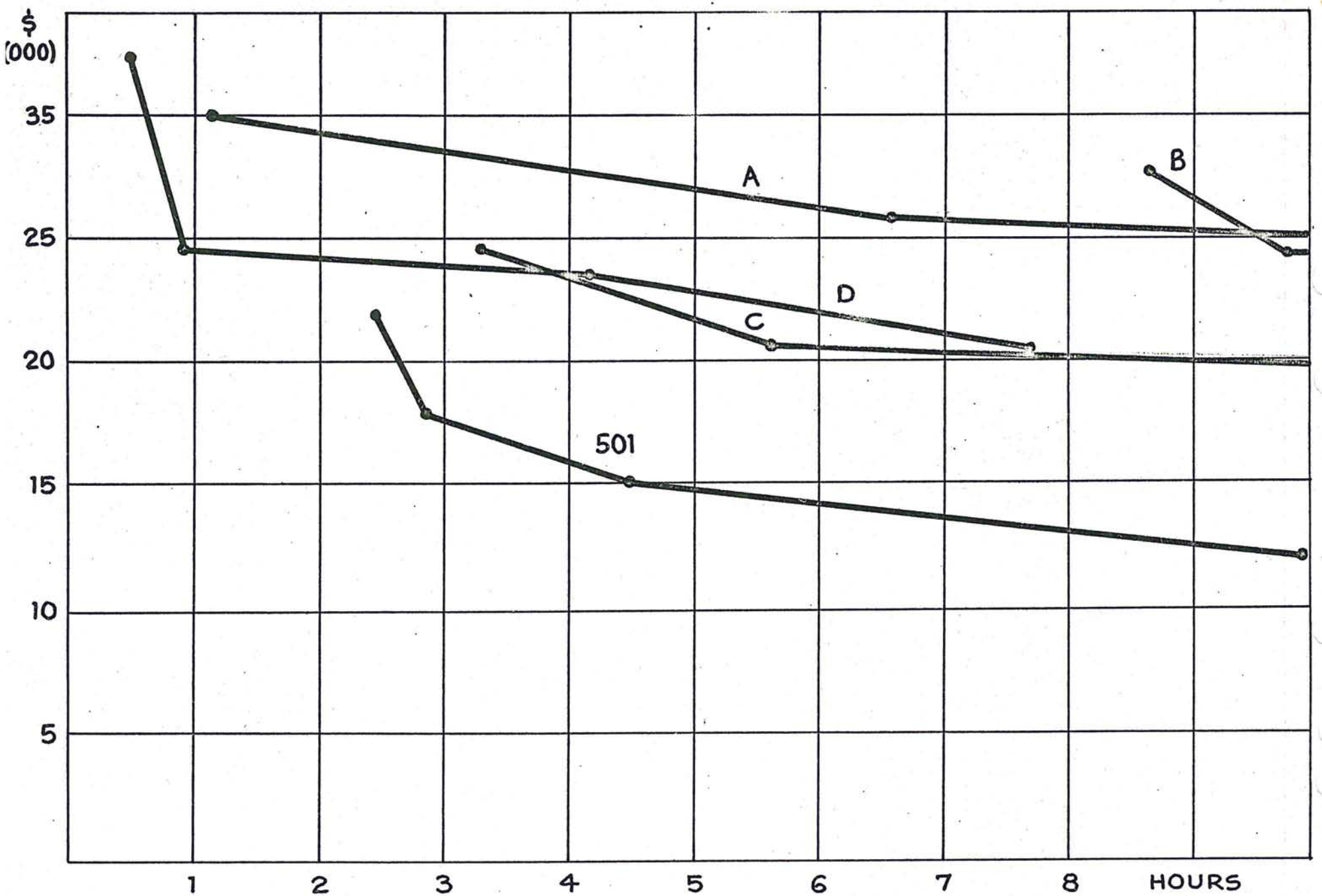


SITUATION C - STRIKES-LOW; COMPUTE-HIGH; REFERENCE ITEMS-SMALL

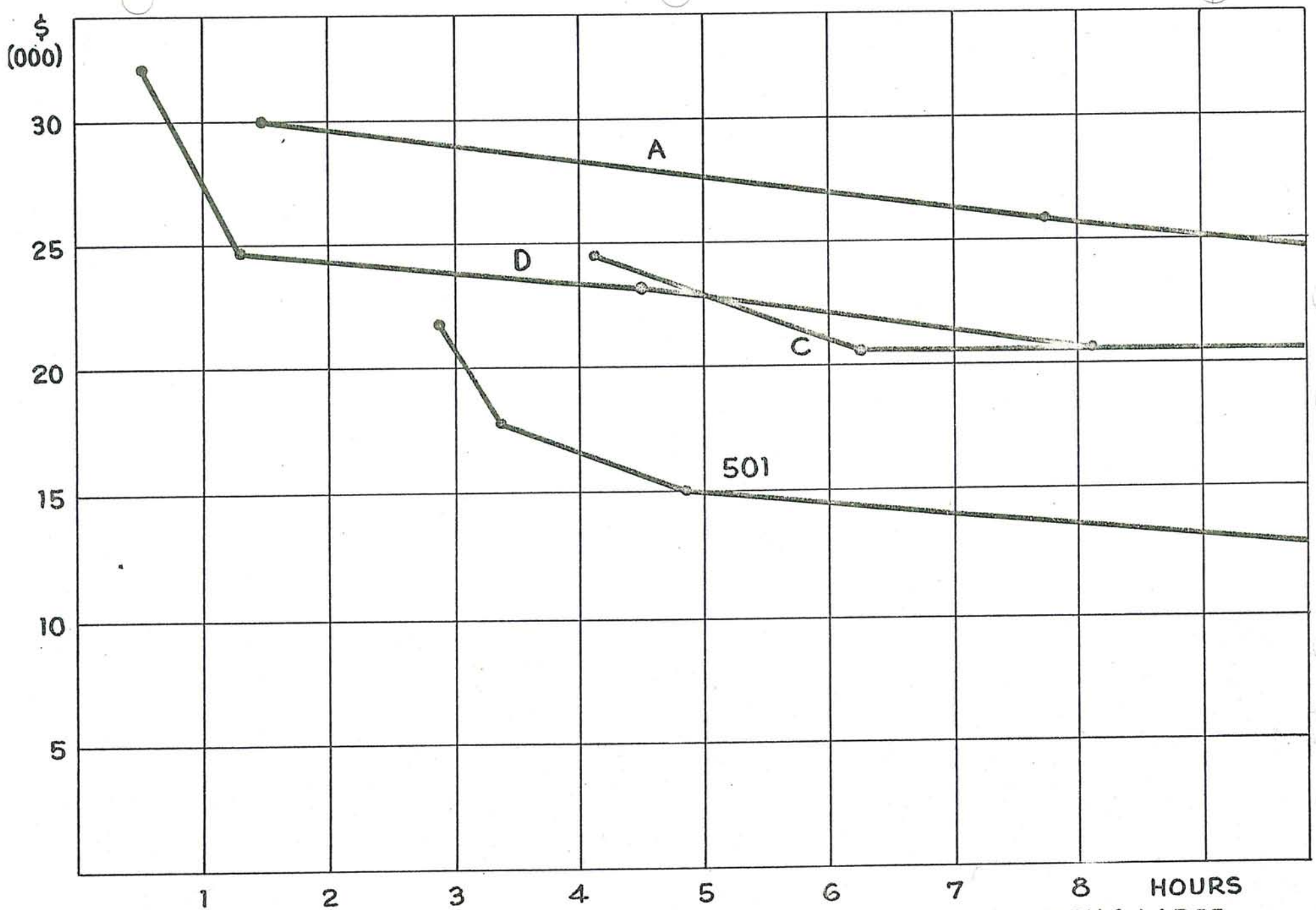


SITUATION D - STRIKES - LOW; COMPUTE - HIGH; REFERENCE ITEMS - LARGE

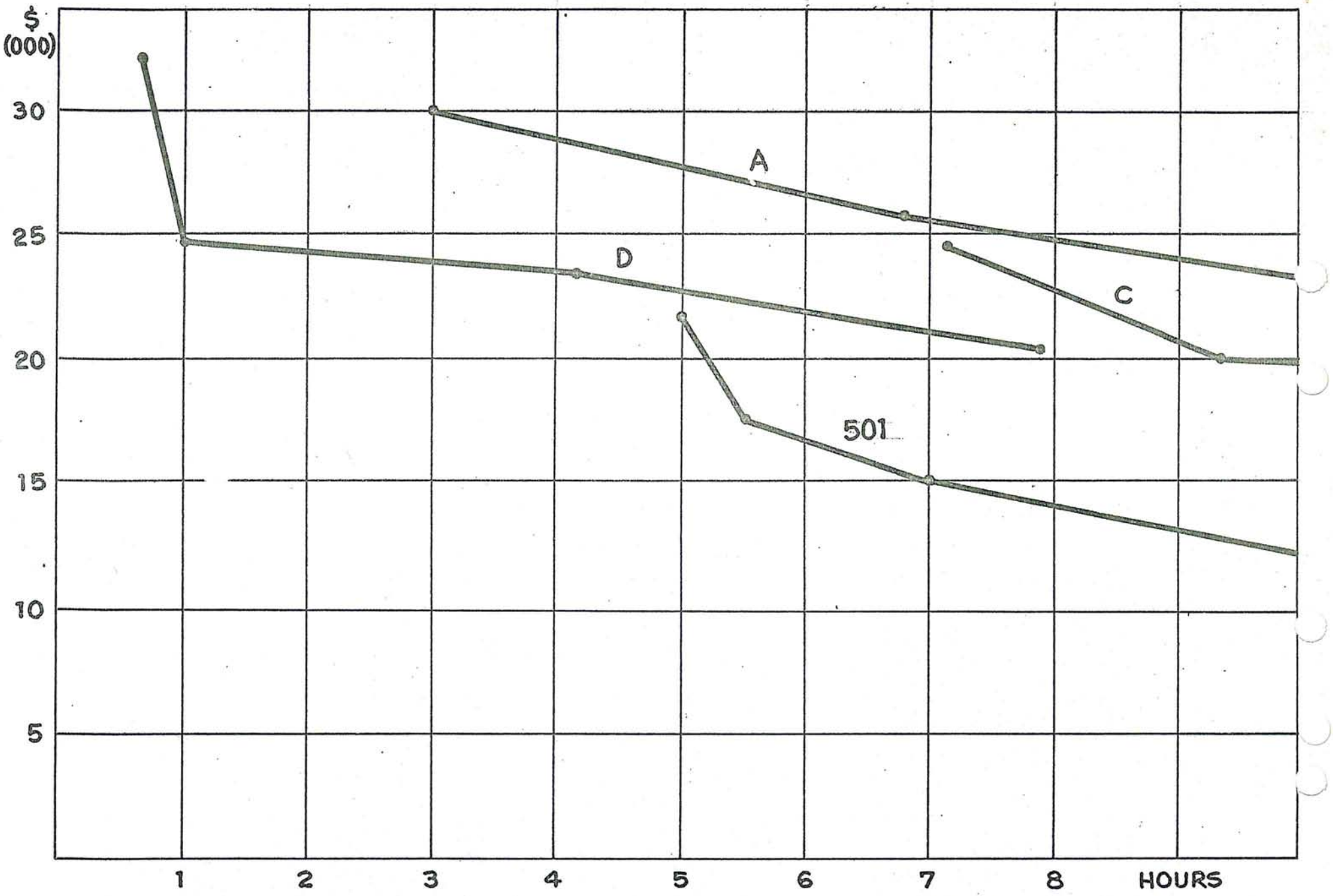
FIGURE 7



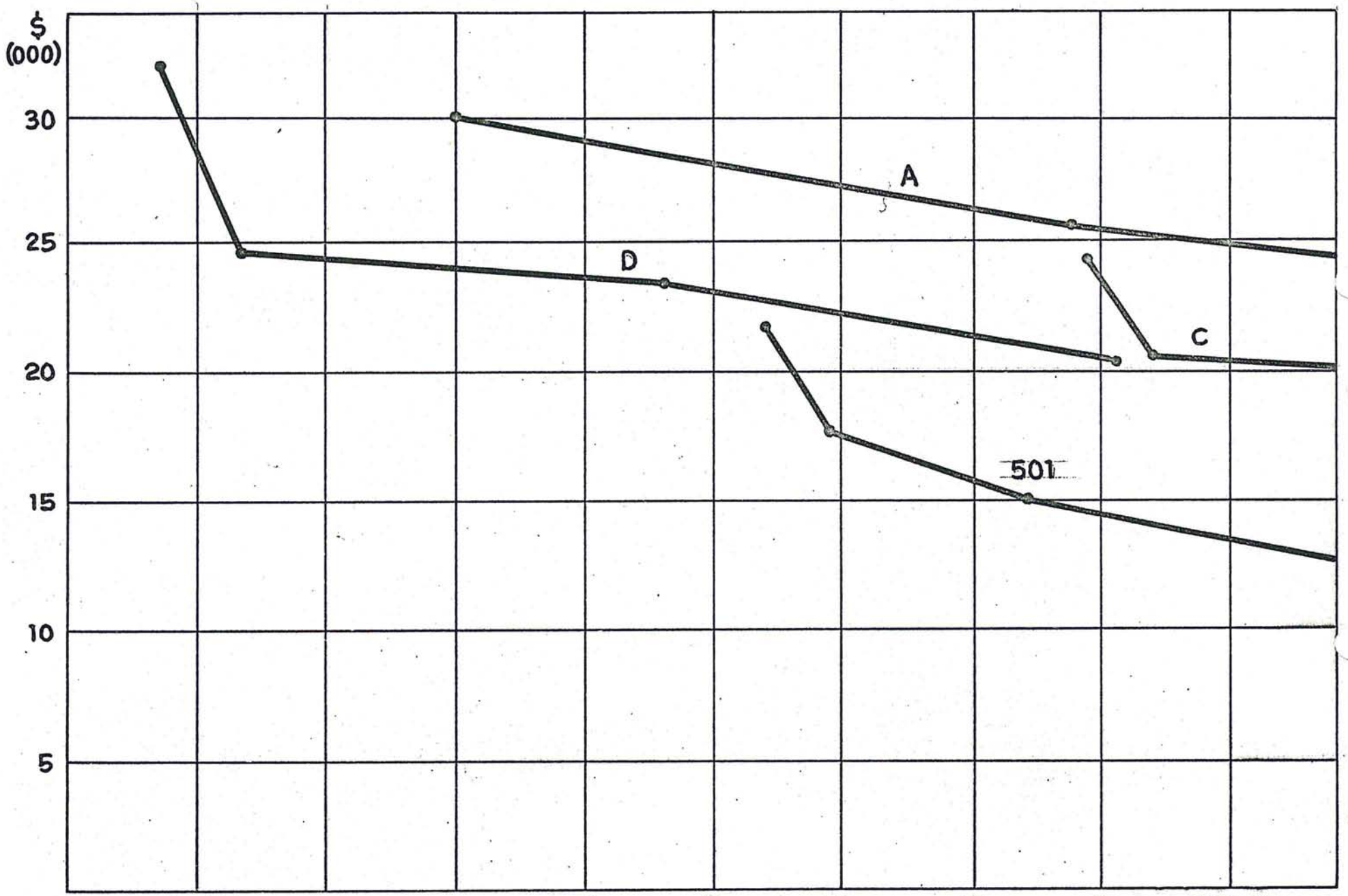
SITUATION E - STRIKES-HIGH; COMPUTE-LOW; REFERENCE ITEMS-SMALL



SITUATION F - STRIKES - HIGH ; COMPUTE-LOW; REFERENCE ITEMS-LARGE

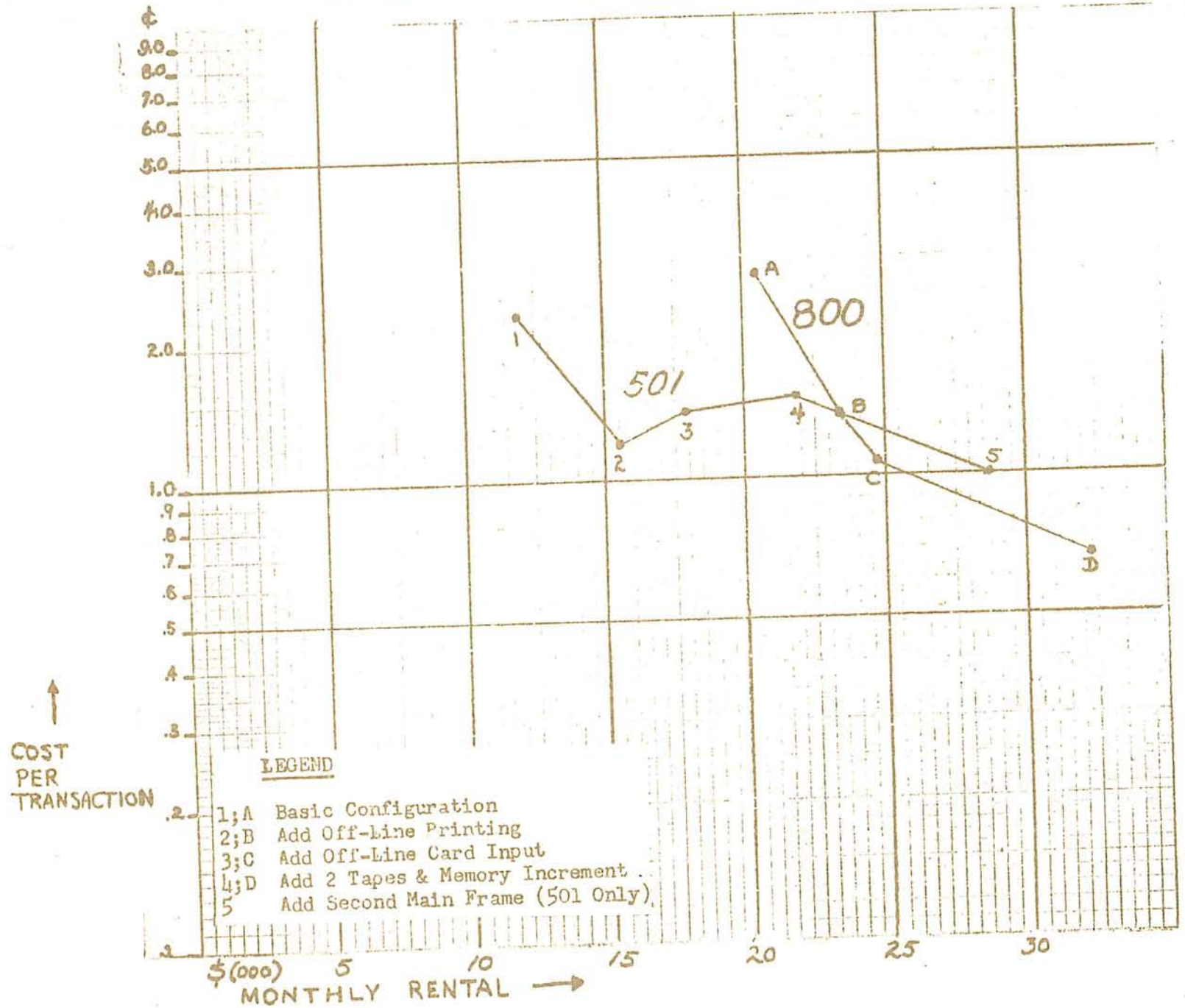


SITUATION G-STRIKES-HIGH; COMPUTE-HIGH; REFERENCE ITEMS-SMALL



SITUATION H - STRIKES - HIGH ; COMPUTE - HIGH ; REFERENCE ITEMS - LARGE

LOW STRIKE DENSITY



HIGH STRIKE DENSITY