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MAINTENANCE AND PRODUCTION COSTS
ECONOMICS OF DOWNTIME FORECASTINGS AND CONTROLLING OF COSTS

by

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Organised in co-operation with the German Foundation for Developing Countries and the Association of German Machinery Manufacturers (VDMA).

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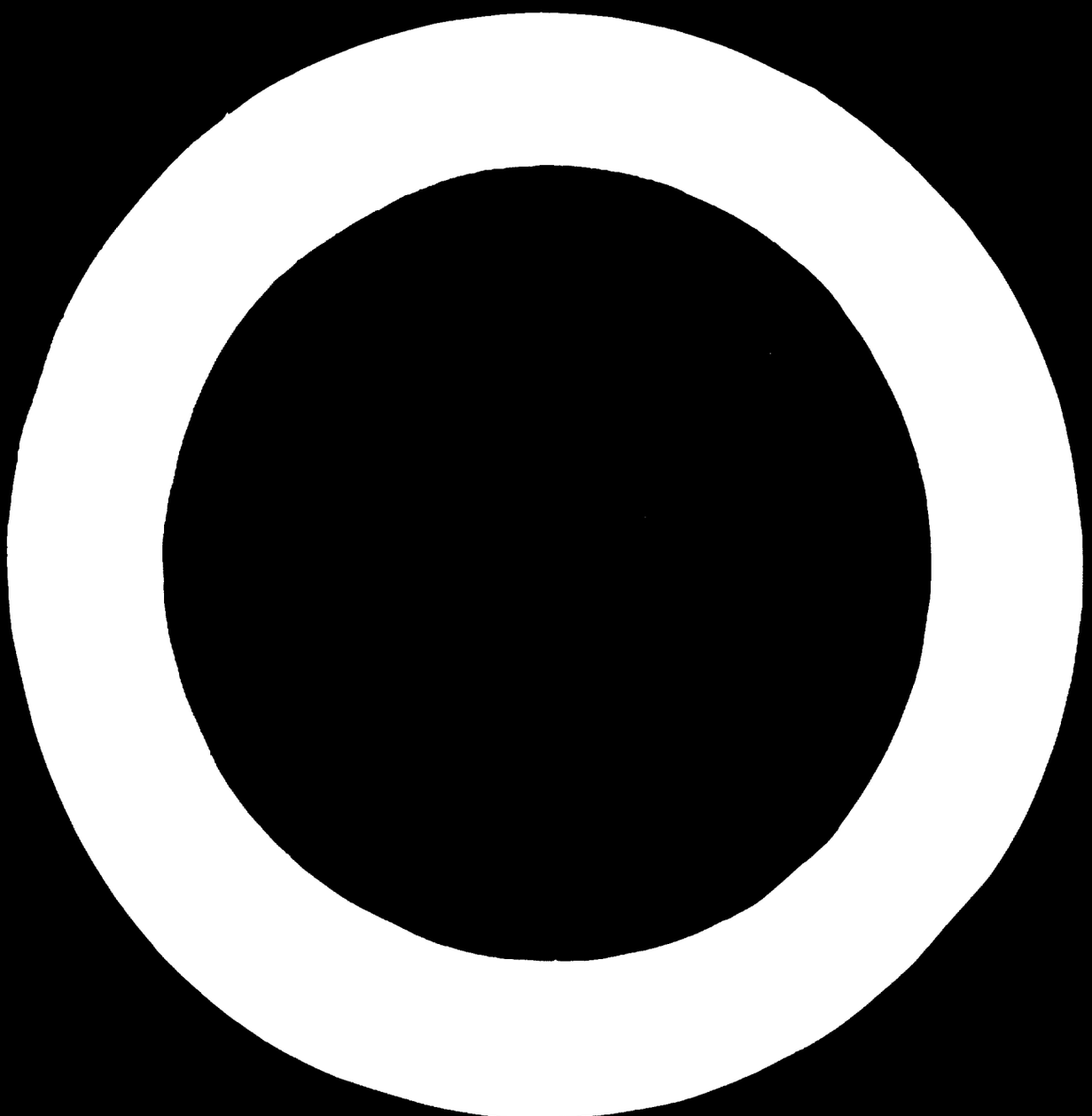
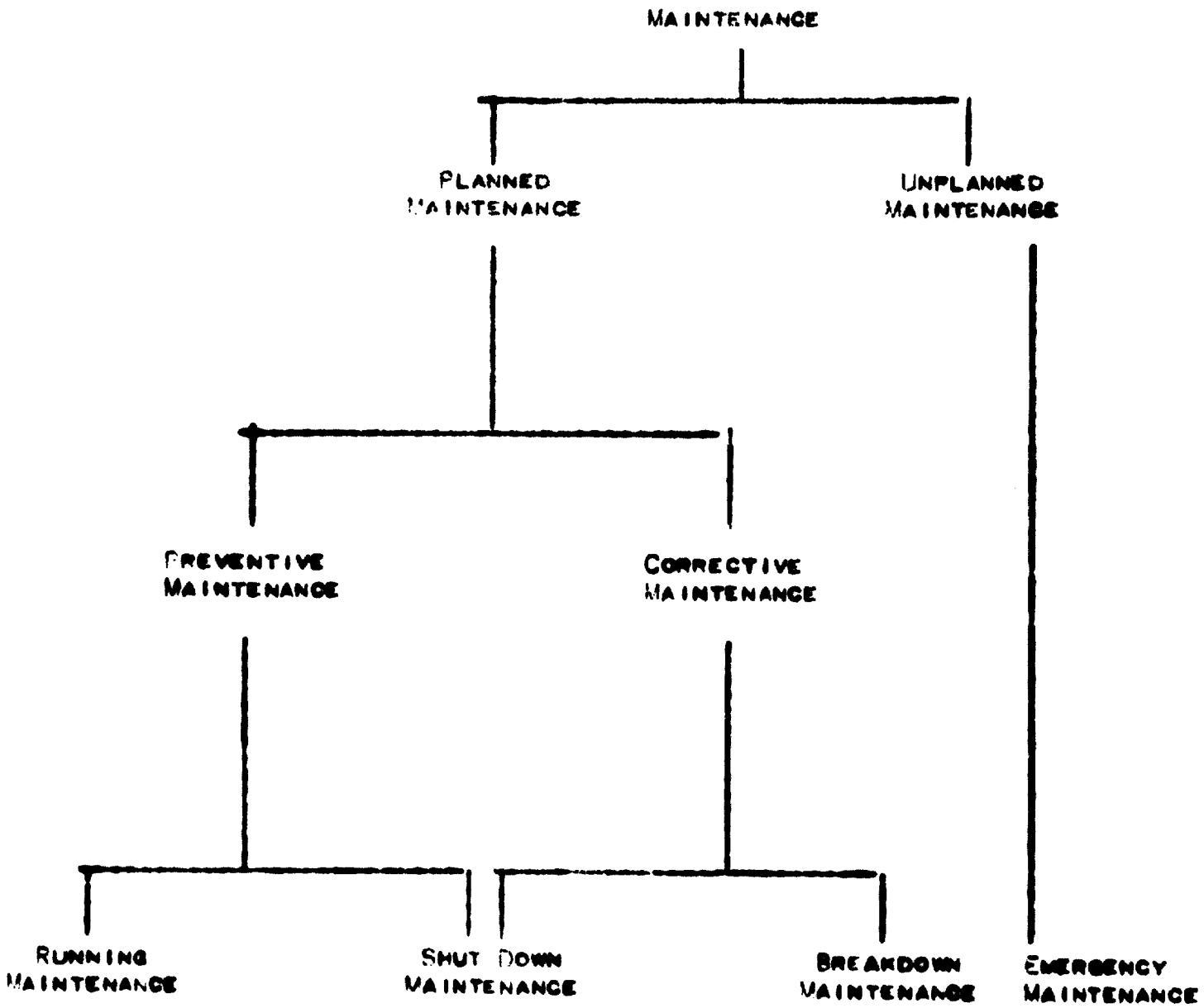


INTRODUCTION:

BEFORE THE ECONOMICS OF MAINTENANCE COSTING CAN BE CONSIDERED IT IS NECESSARY TO DEFINE THE MEANING OF "MAINTENANCE". IT MAY BE SAID THAT MAINTENANCE IN AN INDUSTRIAL ORGANISATION IS THE UPKEEP, REPAIR, RENEWAL AND REPLACEMENT OF WORN, DAMAGED OR OBSOLETE PARTS OF EQUIPMENT, PLANT, TOOLS AND BUILDINGS. SOME MANAGEMENTS ATTEMPT TO DIFFERENTIATE BETWEEN MAINTENANCE AND REPAIRS BUT GENERALLY IT IS CONSIDERED MORE LOGICAL TO INCLUDE REPAIRS IN MAINTENANCE. BETWEEN COMPANIES THE DEFINITION OF MAINTENANCE DOES SOMETIMES VARY ACCORDING TO THE NATURE OF DUTIES PERFORMED BY THE MAINTENANCE DEPARTMENT BUT THIS WORK TENDS ALWAYS TO DEAL WITH TWO ASPECTS, THAT IS "TO KEEP" AND "TO RESTORE".

THE RELATIONSHIPS BETWEEN THE VARIOUS FORMS OF MAINTENANCE MAY, IN FACT, BE SHOWN IN CHART FORM AS FOLLOWS:-


MAINTENANCE
PLANNED MAINTENANCE
UNPLANNED MAINTENANCE
PREVENTIVE MAINTENANCE
CORRECTIVE MAINTENANCE
RUNNING MAINTENANCE
SHUT DOWN MAINTENANCE
BREAKDOWN MAINTENANCE
EMERGENCY MAINTENANCE

AT THE SAME TIME, WHILE THE DEFINITION MAY VARY, THE COST OF MAINTENANCE AND THE NEED FOR EFFECTIVE CONTROL ARE GENERALLY VIEWED AS A SIGNIFICANT PROBLEM BY MOST MANAGEMENTS. DESPITE THIS, HOWEVER, IT IS ALSO EQUALLY TRUE TO SAY THAT TOP MANAGEMENT AND ACCOUNTANTS STILL GIVE INSUFFICIENT REAL ATTENTION TO THE MAINTENANCE FUNCTION. THIS MAY BE DUE TO THE MANAGEMENT ATTITUDE THAT THE COST OF MAINTENANCE IS NOT USUALLY VERY SIGNIFICANT COMPARED WITH TOTAL PRODUCTION COSTS AND CAPITAL INVESTMENT. IT BECOMES EVEN MORE PROMINENT WHEN THE ACCOUNTANT SHOWS THIS COST AS A PERCENTAGE OF SALES AND THUS CREATES AN "EFFICIENCY ILLUSION". THIS ILLUSION IS FURTHER REFLECTED IN OBSERVATIONS SOMETIMES MADE BY MANAGEMENT THAT THE MAINTENANCE DEPARTMENT IS EFFICIENT SO LONG AS IT KEEPS PRODUCTION MOVING BY SUCCESSFUL HANDLING OF EMERGENCIES AND MAJOR PROJECTS. CONSEQUENTLY, BY OBSERVING ONLY THE UNUSUAL AND INFREQUENT, MANAGEMENT OFTEN FAILS TO RECOGNISE THAT THE ROUTINE MAINTENANCE JOBS, WHICH CONSTITUTE THE LARGER PART OF THE DEPARTMENT'S WORK, ARE OFTEN HANDLED IN AN INEFFICIENT MANNER. IF THESE COSTS CAN BE CONTROLLED AND SAVINGS MADE THEN THIS IN TURN MUST INCREASE THE DIRECT CONTRIBUTION TO PROFIT.

A FURTHER AGGRAVATION OF THE SITUATION IS THE FAIRLY GENERAL IDEA THAT MAINTENANCE IS SIMPLY OVERHEAD AND, AS SUCH, DOES NOT CONTRIBUTE TO PROFITS. THE ACCOUNTANT OFTEN REPORTS THE COSTS IN TOTAL AND HIDES THEM AWAY AMONGST OVERHEADS WITH THE RESULT THAT THE TOTAL CORRECT COST OF THE MAINTENANCE FUNCTION IS NOT ORDINARILY SEEN IN THE REPORTS ISSUED TO TOP MANAGEMENT. THIS SITUATION IS KNOWN BY MANY ACCOUNTANTS AND IS DEALT WITH SUCCESSFULLY IN MANY COMPANIES, ESPECIALLY WHERE A BUDGETARY CONTROL SYSTEM IS OPERATED. AS MOST MANAGERS KNOW, THE OBJECTIVE OF BUDGETARY CONTROL IS TO CONTROL EXPENDITURE BY DECENTRALISING DEPARTMENTAL COSTS WITH A VIEW TO MAKING THE RESPECTIVE CHIEFS RESPONSIBLE FOR THE SUCCESSFUL ECONOMIC OPERATION OF THEIR DEPARTMENTS. TO THIS END MAINTENANCE HAS ITS OWN EXPENSE ACCOUNT AND THE DIRECT COST OF OPERATING THE DEPARTMENT CAN BE SEEN AND COMPARED AGAINST THE BUDGETS.

HAVING MENTIONED VERY BRIEFLY THE DIRECT COST OF MAINTENANCE, IT IS NOW NECESSARY TO BRING FORWARD THE SECOND EXPENSE ITEM, WHICH MAY BE CALLED INDIRECT MAINTENANCE COST.

THIS COST IS NOT ONLY REPRESENTED BY EQUIPMENT DOWNTIME AND A POSSIBLE CONSEQUENT LOSS OF PRODUCTION AND SALES BUT THERE IS ALSO THE EXTRA COST OF HAVING TO REPLACE PLANT AND EQUIPMENT BEFORE THE NORMAL END OF ITS USEFUL LIFE DUE TO EXTRAORDINARY DETERIORATION. IT IS PROBABLY TRUE TO SAY THAT THE COST OF LOST PRODUCTION RECEIVES MUCH MORE MANAGEMENT ATTENTION THAN THE OTHER MAINTENANCE COSTS BECAUSE OF THE INCONVENIENCES CAUSED WHEN PLANT BREAKS DOWN. SUCH COSTS ARE SEEN BECAUSE THEY ARE OBVIOUS AND HAVE A CERTAIN AMOUNT OF DRAMA BUT OFTEN THEY ARE NOT AS SERIOUS AS PRODUCTION MANAGERS WOULD HAVE EVERYONE BELIEVE. THERE ARE, HOWEVER, OTHER INDIRECT MAINTENANCE COSTS WHICH RECEIVE VERY LITTLE ATTENTION; GENERALLY BECAUSE THEY ARE HIDDEN OR ARE NOT KNOWN TO BOTH MANAGEMENT AND ACCOUNTANTS ALIKE. FOR EXAMPLE, HOW MANY CONTROLLERS ARE THERE WHO ARE ABLE TO ILLUSTRATE AND REPORT UPON THE LOW PRODUCTION RATES ACHIEVED DUE TO POOR MACHINE EFFICIENCY, THE COST OF SCRAP DUE TO MACHINE FAILURE OR THE ADDITIONAL POWER COSTS INCURRED THROUGH INADEQUATE MAINTENANCE CAUSING PLANT INEFFICIENCY? THE DIFFICULTIES OF ILLUSTRATION BECOME EVEN MORE ACUTE WHEN THE EXTRA COSTS OF

PLANT REPLACEMENT AND OTHER CAPITAL EXPENDITURE HAVE TO BE ASSESSED.

IT IS THE PURPOSE OF THIS PAPER TO ATTEMPT TO PRESENT THE ACCOUNTANT'S VIEW ON TRUE MAINTENANCE COSTS.

THE OBJECTIVES OF THE MAINTENANCE DEPARTMENT

IN ORDER TO ACHIEVE ANY DEGREE OF EFFICIENCY IT IS ESSENTIAL TO HAVE CLEAR-CUT OBJECTIVES FOR WITHOUT THESE AND THE KNOWLEDGE OF HOW THEY CAN BE ATTAINED NO DEPARTMENT CAN EXPECT TO FUNCTION TO ITS OPTIMUM ABILITY. THIS IS AS TRUE FOR THE MAINTENANCE DEPARTMENT AS FOR ANY OTHER DEPARTMENT.

THESE OBJECTIVES CAN BE SPLIT INTO TWO TYPES, NAMELY, FUNCTIONAL OBJECTIVES AND COST OBJECTIVES. TO DEAL FIRSTLY WITH THE FUNCTIONAL OBJECTIVES IT HAS TO BE REMEMBERED THAT THE "GOAL" OF MAINTENANCE IN THIS AREA IS BOTH PRECENTIVE AND CORRECTIVE. THE NORMAL FUNCTIONAL OBJECTIVES OF THE MAINTENANCE DEPARTMENT MAY THEREFORE BE AS FOLLOWS:-

(I) TO MAINTAIN PLANT, EQUIPMENT AND BUILDINGS AT THEIR BEST LEVEL TO ENSURE THAT PRODUCTION IS NOT HELD UP AND RESULTING IN LOSS OF PRODUCTION TIME AND BROKEN DELIVERY PROMISES.

(II) TO MAINTAIN THE COMPANY'S ASSETS AND KEEP THEM IN GOOD CONDITION THEREBY PROLONGING THEIR USEFUL LIFE.

(III) TO ENSURE THAT ALL PLANT AND EQUIPMENT IS SUFFICIENTLY WELL MAINTAINED IN ORDER THAT THE QUALITY OF THE FINAL PRODUCT IS KEPT TO THE AGREED COMMERCIAL STANDARD.

(IV) TO MAKE EMERGENCY REPAIRS AS QUICKLY AND AS EFFICIENTLY AS POSSIBLE IN ORDER TO ENSURE THAT PRODUCTION DOWNTIME IS KEPT TO A MINIMUM.

(V) TO SUGGEST AND ASSIST IN THE DEVELOPMENT AND IMPLEMENTATION OF IMPROVEMENTS IN THE DESIGN OF MACHINERY

AND EQUIPMENT TO DECREASE THE CHANCES OF BREAKDOWN, MAKE AVAILABLE MORE EASY METHODS OF REPAIR AND LENGTHEN THE SERVICE LIFE.

(VI) TO OPERATE SUCH SERVICE ACTIVITIES AS MANY BE REQUIRED, E.G. POWER, HEATING AND WATER.

(VII) TO CARRY OUT SYSTEMATIC INSPECTION OF ALL PLANT, EQUIPMENT AND BUILDINGS AT SUFFICIENT CONTROL INTERVALS SO THAT ANY WEAR OR IMPENDING BREAKDOWN WILL BE DETECTED AND TO KEEP ADEQUATE RECORDS OF THESE INSPECTIONS.

AS WITH OTHER DEPARTMENTS, THE MAINTENANCE DEPARTMENT MUST HAVE ITS ECONOMIC OBJECTIVES ALONG WITH ITS FUNCTIONAL OBJECTIVES. THE COSTS OF OPERATING A MAINTENANCE DEPARTMENT WILL VARY FROM COMPANY TO COMPANY DEPENDING TO A LARGE EXTENT ON THE AMOUNT OF MECHANISATION, THE AGE OF THE PLANT, THE TYPE OF WORK CARRIED OUT, THE DEGREE OF CONTINUOUS OR SHIFT WORK AND THE POLICY OF THE COMPANY IN RELATION TO THE TYPE AND AMOUNT OF MAINTENANCE CARRIED OUT. TO

AGHIEVE ECONOMIC EFFICIENCY, THEREFORE, THESE POINTS HAVE TO BE CAREFULLY CONSIDERED AND THE OBJECTIVES ARE GENERALLY STATED:-

(I) TO KEEP THE TOTAL COST OF MAINTENANCE AS STABLE OVER TIME AS POSSIBLE. IT IS GENERALLY EXPECTED THAT TOTAL MAINTENANCE DEPARTMENT EXPENDITURE WILL VARY DIRECTLY WITH CALENDAR TIME.

(II) TO ENSURE THAT TRUE MAINTENANCE COSTS WILL BE INCURRED AT A CONSTANT RATE, WHICH MAY BE RELATED TO OPERATING TIME, PRODUCTION QUANTITIES AND TIME, IN SOME COMBINATION. THIS GENERALLY MEANS THAT MAINTENANCE COSTS SHOULD BE FAIRLY STABLE WHEN RECORDED AS A PERCENTAGE AGAINST SALES OR NET PRODUCTION VALUE. AGAIN THIS MANY NOT ALWAYS BE A SATISFACTORY MEASURE AS, IF TOO GREAT AN EMPHASIS IS PLACED ON COST CONTROL, THE OBJECTIVE MAY BE REACHED BUT ONLY AT THE EXPENSE OF THE PHYSICAL CONDITION OF THE PLANT. IT IS ESSENTIAL, THEREFORE, THAT BOTH FUNCTIONAL AND ECONOMIC OBJECTIVES

BE VIEWED TOGETHER WHEN ESTABLISHING A MAINTENANCE POLICY.

(III) TO CONTROL THE DIRECT COST OF MAINTENANCE BY THE CORRECT AND EFFICIENT USE OF MATERIALS, MEN AND MECHANICAL FACILITIES.

THE ORGANISATION OF THE MAINTENANCE DEPARTMENT

IN ORDER TO CARRY OUT ITS OBJECTIVES THE MAINTENANCE DEPARTMENT MUST HAVE AN ORGANISATION CAPABLE OF CARRYING OUT ITS DEFINED TASKS.

IT IS PROBABLY CORRECT TO FIRST LOOK AT THE AREAS OF MAINTENANCE OPERATION AND THESE CAN GENERALLY BE DETERMINED QUITE EASILY AS:-

(I) PRODUCTION PLANT AND EQUIPMENT,

(II) BUILDINGS AND ROADS,

(III) SERVICES, AND

(IV) CAPITAL WORKS AND DEVELOPMENT.

AS A GREAT DEAL OF MAINTENANCE WORK IS CARRIED OUT BY SPECIALISED CRAFTSMEN IT IS SOMETIMES ALSO AS WELL TO CONSIDER THE ORGANISATION

OF THE MAINTENANCE FUNCTION BY CRAFTS, FOR EXAMPLE:-

(I) ELECTRICIANS,

(II) MILLWRIGHTS,

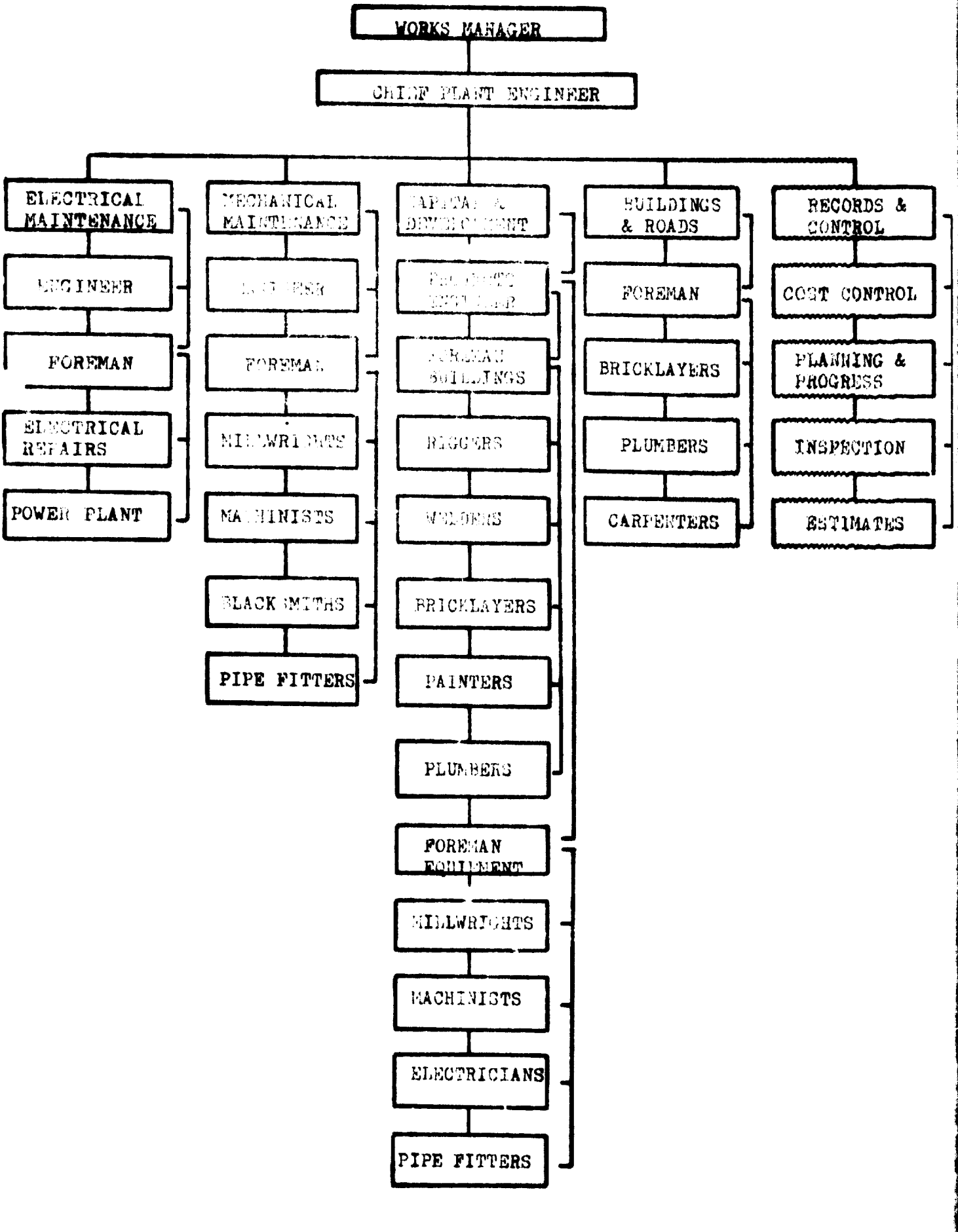
(III) MACHINISTS,

(IV) PIPE FITTERS,

(V) PLUMBERS,

(VI) BLACKSMITHS ETC.

AND SO FROM THIS INFORMATION AN ORGANISATION CHART MANY BE CONSTRUCTED SHOWING THE PROPOSED ORGANISATIONAL SET-UP. AN EXAMPLE FOLLOWS:-


WORKS MANAGER
CHIEF PLANT ENGINEER
ELECTRICAL MAINTENANCE
ENGINEER
FOREMAN
ELECTRICAL REPAIRS
POWER PLANT
MECHANICAL MAINTENANCE
FOREMAN
MILLWRIGHTS
MACHINISTS
BLACKSMITHS
PIPE FITTERS
BUILDINGS & ROADS
FOREMAN
BRICKLAYERS
PLUMBERS
CARPENTERS
RECORDS & CONTROL
COST CONTROL
PLANNING & PROGRESS
INSPECTION
ESTIMATES
BRICKLAYERS
PAINTERS
PLUMBERS
MILLWRIGHTS
MACHINISTS
ELECTRICIANS
PIPE FITTERS

THE RELATIONSHIP OF THE MAINTENANCE DEPARTMENT WITH OTHER DEPARTMENTS

IN ALL CONCERNS DEPARTMENTS MUST HAVE SOME SORT OF INTER-RELATIONSHIP WITH EACH OTHER, THE AMOUNT VARYING ACCORDING TO THE NATURE OF THEIR WORK AND TO THE EFFECT EACH DEPARTMENT'S OPERATION HAS UPON THE OTHER. WITH THE MAINTENANCE DEPARTMENT THESE RELATIONSHIPS ARE MAINLY CONCENTRATED UPON:-

(I) THE ENGINEERING DEPARTMENT, WHERE A VERY CLOSE RELATIONSHIP TENDS TO EXIST ESPECIALLY WHERE MAINTENANCE OPERATES UNDER PLANT ENGINEERING AND WHERE PREVENTIVE AND CORRECTIVE MAINTENANCE ARE EXTENSIVELY PRACTICED.

(II) THE MANUFACTURING DEPARTMENT, AS THIS DEPARTMENT DEPENDS UPON THE MAINTENANCE FUNCTION TO A LARGE DEGREE AND INITIATES MAINTENANCE WORK ORDERS. AT THE SAME TIME, THEY ARE RESPONSIBLE FOR MAKING OPERATING EQUIPMENT AVAILABLE FOR REPAIR AND OFTEN PROVIDE PRODUCTION WORKERS TO ASSIST THE MAINTENANCE WORKERS, ESPECIALLY WHERE SPECIAL CRAFT SKILLS ARE NEEDED OR WHERE EMERGENCY BREAKDOWN EXISTS.

(iii) THE PLANNING DEPARTMENT, AS SOMETIMES IT IS NECESSARY TO HAVE TO INTERRUPT PRODUCTION WHILST REPAIRS ARE BEING CARRIED OUT. PLANT DOWNTIME CAN BE MINIMISED BY CONSULTATION WITH THE PRODUCTION PLANNING DEPARTMENT.

(iv) THE MATERIAL CONTROLLER, WHO HAS THE RESPONSIBILITY FOR PURCHASING AND MAINTAINING ADEQUATE STOCKS OF MAINTENANCE MATERIALS AND FOR INVENTORY CONTROL.

(v) THE ACCOUNTING DEPARTMENT, AS THEY ARE RESPONSIBLE FOR RECORDING AND REPORTING ON ALL EXPENDITURE AND, WHERE BUDGETARY CONTROL IS PRACTISED, ADVISING UPON BUDGET ESTIMATES AND SUBSEQUENT VARIANCES AGAINST BUDGETED EXPENDITURE.

ACCOUNTING FOR MAINTENANCE EXPENDITURE

IT IS THE RESPONSIBILITY OF THE ACCOUNTANT TO ESTABLISH AND KEEP RECORDS WHICH PROVIDE, TO A LARGE EXTENT, THE BASIC DATA FOR CONTROLLING MAINTENANCE. AFTER DECIDING UPON THE DIRECT

COSTS OF MAINTENANCE, I.E. THOSE COSTS WHICH CAN BE IDENTIFIED AND MEASURED, A SYSTEM FOR RECEIVING AND PROCESSING THE INFORMATION MUST BE MADE.

FIRSTLY, HOWEVER, MANAGEMENT MUST DECIDE THE TYPE OF EXPENDITURE WHICH WILL BE RECOGNISED AS THE DIRECT COST OF OPERATING THE MAINTENANCE DEPARTMENT. IN MOST COMPANIES THE FOLLOWING GENERALLY FORMS THE BASIS:-

(I) LABOUR

THIS IS DIVIDED INTO TWO SECTIONS I.E. THAT WHICH CAN BE DIRECTLY IDENTIFIED AND CHARGED TO THE JOBS (E.G. MILLWRIGHTS, ELECTRICIANS, PIPE FITTERS, CARPENTERS) AND, SECONDLY, THAT WHICH MUST BE ALLOCATED ON SOME OTHER BASIS (E.G. LABOURERS, CLEANERS) AS OVERHEAD.

(II) MATERIALS

THE MATERIALS USED BY THE MAINTENANCE DEPARTMENT ARE ALSO DIVIDED INTO TWO SECTIONS, THE FIRST BEING MATERIALS WHICH CAN BE IDENTIFIED AS HAVING GONE INTO THE JOBS AND THE OTHER BEING GENERAL MATERIAL WHICH MUST BE ABSORBED AS OVERHEAD (E.G. COTTON WASTE, GLOVES, DRILLS)

(iii) THE OTHER OVERHEAD COSTS OF OPERATING THE MAINTENANCE DEPARTMENT ARE GENERALLY RESTRICTED TO THOSE DIRECT COSTS WHICH CAN BE IDENTIFIED WITH THE DEPARTMENT, FOR EXAMPLE:-

(A) MANAGERIAL AND CLERICAL PERSONNEL SALARIES,

(B) MACHINE POWER,

(C) MACHINE LUBRICATION AND REPAIRS,

(D) BUILDING REPAIRS,

(E) GENERAL LIGHTING,

(F) HEATING,

(G) RENT FOR SPACE USED,

(H) RATES FOR SPACE USED, AND

(I) DEPRECIATION FOR THE DEPARTMENT'S OWN MACHINES.

A BUDGET OF THE PROBABLE EXPENDITURE OF THE DEPARTMENT OVER AN OPERATING PERIOD OF ONE YEAR, THREE MONTHS OR EVEN ONE MONTH SHOULD BE MADE AND DIVIDED BY THE BUDGETED MAINTENANCE HOURS EXPECTED TO BE WORKED DURING THE SAME PERIOD. THIS WILL GIVE AN OVERHEAD RATE PER DIRECT MAINTENANCE HOUR AND ALL JOBS CARRIED OUT SHOULD BE LOADED WITH OVERHEAD ACCORDING TO THE NUMBER OF HOURS WORKED, E.G.:-

	U.S. $ Per Three Months
Clerical and Managerial Salaries	10,000
Supporting Labour	8,000
General Materials	4,000
Machine Power	2,400
Machine Lubrication and Repairs	500
Building Repairs	200
General Lighting	400
Heating	200
Rent	800
Rates	300
Machine Depreciation	1,000
Building Depreciation	200
	28,000

Against this budget there could probably be a labour force of, say, 50 direct workers each working 50 hours per week, giving for the 13 week period a possible total of:-

50 men x 50 hours x 13 weeks = 32,500 hours

It would be inadvisable to take this total figure as the true operating level, however, as allowances have to be made for absenteeism and

OTHER CAUSES. GENERALLY AN ALLOWANCE OF 20% IS MADE TO COVER THESE CONTINGENCIES AND THIS IN TURN GIVES A FIGURE OF 28,000 HOURS (I.E. $32,500 \times \frac{80}{100}$) AND AN OVERHEAD RECOVERY RATE OF:-

$$\text{U.S. } \not{\text{s}}\ \frac{28,000}{28,000} = 1 \text{ U.S. } \not{\text{s}} \text{ PER HOUR}$$

OTHER OVERHEADS SUCH AS SALESMEN'S SALARIES, TRAVEL EXPENSES, INTEREST, AUDIT AND LEGAL FEES ETC. ARE GENERALLY NOT ALLOCATED TO THE MAINTENANCE DEPARTMENT AS THIS CAUSES A GREAT DEAL OF EXTRA ACCOUNTING EFFORT AND COST, AND ALSO THE PRACTICE IS QUESTIONED.

ALLOCATING COSTS OF JOBS AND DEPARTMENTS

IN ORDER TO PROVIDE AN EFFECTIVE CONTROL OVER MAINTENANCE COSTS IN A SUFFICIENTLY DETAILED WAY, IT IS ESSENTIAL THAT ALL EXPENDITURE INCURRED IS RECORDED AGAINST SPECIFIC TASKS, MACHINES AND DEPARTMENTS. TO DO THIS, MAINTENANCE JOBS ARE INVARIABLY GIVEN ORDER NUMBERS WHICH ARE NAMED:-

(I) MAINTENANCE JOB ORDERS OR

(II) STANDING ORDERS.

THE USUAL METHOD TO IDENTIFY THE DEPARTMENT RECEIVING THE SERVICE IS TO HAVE A TWO OR THREE NUMBER PREFIX FOR EACH DEPARTMENT; FOR EXAMPLE:-

100 IF FOR THE MACHINE SHOP

101 IS FOR THE FOUNDRY

102 IS FOR THE OFFICE

ORDER NUMBERS ARE THEN GIVEN IN CONSECUTIVE ORDER AND ALL WORK CARRIED OUT AGAINST THIS JOB IS NOTED WITH THIS NUMBER ON THE OPERATOR'S WORK SHEET OR CARD. SIMILARLY ALL MATERIAL DRAWN FROM THE STORES SHOULD BE AGAINST AN ISSUE NOTE (STORES REQUISITION) WHICH SHOULD ALSO CARRY THE ORDER NUMBER.

BEFORE ORDER NUMBERS ARE ISSUED, HOWEVER, MANY COMPANIES DECIDE UPON THE MINIMUM AMOUNT OF EXPENSE WHICH SHOULD BE INCURRED BEFORE AN ORDER NUMBER IS GIVEN E.G NO ORDER NUMBER WILL BE GIVEN IF THE TOTAL EXPENSE IS NOT EXPECTED TO EXCEED (SAY) 50 U.S. DOLLARS. IN THIS WAY, SMALL JOBS CARRIED OUT ARE RECORDED IN TOTAL AGAINST THE DEPARTMENTAL STANDING ORDER.

TO POST THE DIRECT LABOUR TO THE VARIOUS JOBS, A LABOUR ANALYSIS IS CARRIED OUT AND ALL HOURS AND WAGES IN THE MAINTENANCE DEPARTMENT ARE AGREED WITH THE TOTAL ATTENDANCE HOURS AND PAY AS SHOWN ON THE WAGES BILLS. WHEN THIS RECONCILIATION HAS TAKEN PLACE, THE LABOUR HOURS AND COSTS ARE POSTED TO THE JOB ORDER COST CARDS.

IN THE SAME WAY DIRECT MATERIALS ARE ACCOUNTED FOR BY PROPER ANALYSIS OF THE STORES ISSUE NOTES AND THE MATERIAL ANALYSIS MADE AND RECONCILED.

OVERHEAD MUST THEN BE ADDED TO EACH JOB BY MULTIPLYING THE HOURS WORKED BY THE PRE-CALCULATED OVERHEAD RECOVERY RATE. THE TOTAL WEEKLY OR MONTHLY OVERHEAD RECOVERY SHOULD BE CALCULATED AND COMPARED WITH THE ACTUAL OVERHEAD EXPENSE IN ORDER TO ASSESS WHETHER THERE ARE ANY LARGE OVER OR UNDER - RECOVERY DISCREPANCIES, WHICH MAY THEN REQUIRE SUBSEQUENT RE-ADJUSTMENT OF THE RATE.

THESE POSTINGS ARE GENERALLY MADE EVERY WEEK OR MONTH AND WHEN THE JOB IS FINALLY COMPLETED THE TOTAL COSTS ARE SUMMARISED.

AN EXAMPLE OF A MAINTENANCE ORDER JOB COST CARD FOLLOWS:

MAINTENANCE JOB ORDER COST CARD No: .....

DEPARTMENT:	DETAILS:
MACHINE NO:	
LOCATION:	
DATE START:	
DATE FINISH:	
DATE COSTED:	

HOURS	ESTIMATE U.S. $	COST DETAILS	HOURS	ACTUAL U.S. $
		LABOUR - MECHANICAL ELECTRICAL OTHER		
		TOTAL LABOUR		
		MATERIAL - MECHANICAL ELECTRICAL OTHER		
		TOTAL MATERIAL		
		TOTAL OVERHEAD		
		OTHER		
		TOTAL OTHER		
		TOTAL COST		

FRONT

ON THE REVERSE SIDE OF THE COST CARD PROVISION WOULD HAVE TO BE MADE FOR THE WEEKLY OR MONTHLY RECORDING OF THE DETAILS WHICH GO TO MAKE UP THE TOTAL COST AND ACCORDING TO THE HEADINGS OF THE COST DETAILS, AS SHOWN ON THE FRONT SIDE OF THE CARD, E.G.:-

	MAINTENANCE JOB ORDER COST CARD NO.											
	WEEK/MONTH ENDING										TOTAL	
	H	₰	H	₰	H	₰	H	₰	H	₰	H	₰
LABOUR:												
MECHANICAL												
ELECTRICAL												
OTHER												
TOTAL												
MATERIAL:												
MECAHNICAL												
ELECTRICAL												
OTHER												
TOTAL												
OVERHEAD:												
OTHER:												
TOTAL												

ACCOUNTANTS SHOULD TAKE GREAT CARE THAT THEY FULLY UNDERSTAND THE MEANING OF MAINTENANCE WHEN MAKING COST ALLOCATIONS. IN MANY CASES THERE ARE PRESSURES FROM MANAGEMENT TO PLACE THE COST OF DEVELOPMENT AND OTHER CAPITAL WORKS TO THE MAINTENANCE ACCOUNT IN ORDER TO CLAIM AGAINST TAXATION. THIS IS INCORRECT AND SHOULD BE AVOIDED. IN THE SAME WAY, WORK PERFORMED BY MAINTENANCE PERSONNEL TO ASSIST PRODUCTION CHANGEOVER SHOULD BE EXCLUDED FROM MAINTENANCE COSTS.

REPORTING DIRECT MAINTENANCE COSTS AND PERFORMANCE

IN ORDER TO ENSURE THE EFFICIENT OPERATION OF ANY DEPARTMENT IT IS ESSENTIAL TO REPORT ADEQUATELY AND PROMPTLY UPON ITS ACTIVITIES. A REPORT, HOWEVER, LOSES A LARGE AMOUNT OF ITS USEFULNESS UNLESS THE ACTUAL OPERATION IS COMPARED AGAINST SOME PRE-SET TARGET OR STANDARD. THIS IS EQUALLY TRUE FOR MAINTENANCE BUT ALSO CAN SEEM DIFFICULT AS THE NATURE OF WORK, AT FIRST GLANCE, APPEARS TO MAKE IT INCAPABLE OF MEASUREMENT. CONTROLS ARE, HOWEVER, POSSIBLE.

THE FIRST AND EASIEST CONTROL RATIO IS TO EXPRESS THE COST OF DIRECT MAINTENANCE AS A PERCENTAGE OF SALES, NET PRODUCTION VALUE OR OF TOTAL COST. IT IS A VERY SIMPLE MATTER INDEED TO GRAPH THE TOTAL COST OF MAINTENANCE, BOTH IN ABSOLUTE VALUES AND AS A PERCENTAGE TO SALES OR SOME OTHER MEASURABLE PRODUCTION FIGURE. THE ABSOLUTE FIGURE WILL GIVE INDICATIONS AS TO WHETHER AND TO WHAT AMOUNT COSTS ARE INCREASING WHILST THE PERCENTAGE FIGURE WILL GIVE A TREND COMPARISON. TO ILLUSTRATE THIS POINT IMAGINE THAT THE FOLLOWING DETAILS HAVE BEEN COLLECTED FROM THE COST ANALYSIS AND STATISTICS:-

MONTH 1969	NET PRODUCTION VALUE £	DIRECT MAINTENANCE COSTS £	DIRECT % OF MAINTENANCE COST TO N.P.V.
JAN	250,000	2,500	1.0
FEB	280,000	2,520	.9
MAR	300,000	2,700	.9
APR	360,000	2,880	.8
MAY	320,000	2,240	.7
JUN	400,000	3,200	.8

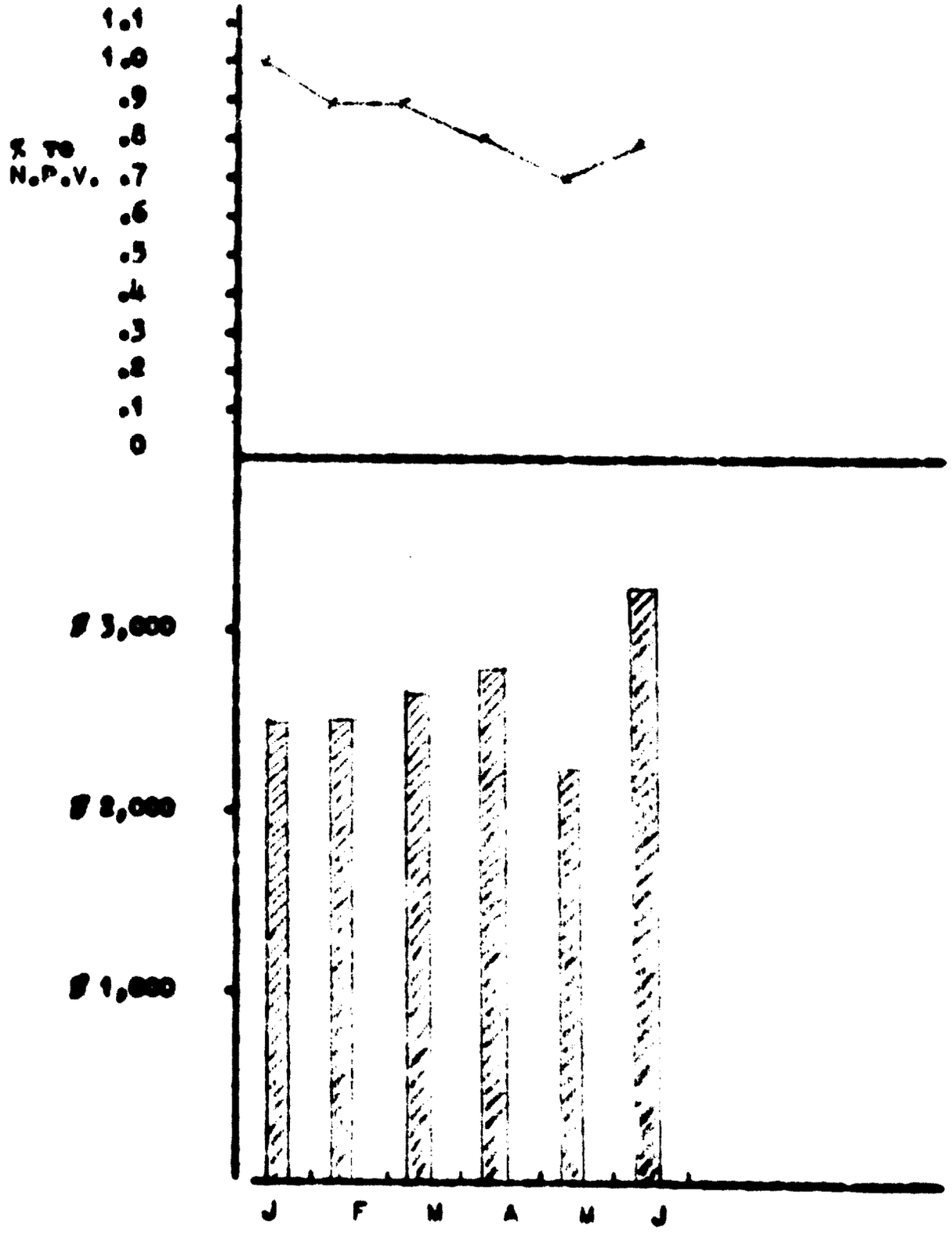
THE NET PRODUCTION VALUE FIGURE IS FOUND BY TAKING THE SALES FIGURE AND ADJUSTING FOR CHANGES IN WORK-IN-PROGRESS, AS FOLLOWS:-

	£
SALES FOR JANUARY 1969	300,000
ADD WORK-IN-PROGRESS AT JANUARY 31ST, 1969	1,500,000
	1,800,000
LESS WORK-IN-PROGRESS AT JANUARY 1ST, 1969	1,550,000
NET PRODUCTION VALUE FOR JANUARY, 1969	250,000

THIS NET PRODUCTION VALUE FIGURE IS PROBABLY THE MORE FAIR FIGURE TO USE AS IT OBVIATES THE INFLUENCES OF ANY LARGE INCREASES OR REDUCTIONS IN SALES DUE TO PRODUCTS COMING FROM OR GOING INTO WORK-IN-PROGRESS.

THE INFORMATION GIVEN IN THE STATISTICAL FORM CAN NOW BE EFFECTIVELY PRESENTED GRAPHICALLY, THUS:-

GRAPH SHOWING DIRECT MAINTENANCE COST TO NET PRODUCTION VALUE



CONTROL LINES MAY BE DRAWN ON THE GRAPHS AFTER MANAGEMENT HAVE ESTABLISHED WHAT THEY CONSIDER A FIAR AND REASONABLE STANDARD. THESE STANDARDS WILL, OF COURSE, VARY WITH THE AGE AND CONDITION OF THE PLANT AND EQUIPMENT. IT IS, THEREFORE, VERY DIFFICULT TO TAKE A STANDARD FOR A COMPANY EVEN IF THIS IS RELATED TO THEIR OWN TYPE OF INDUSTRY.

PROBABLY THE BEST CONTROL WHICH MAY BE POSSIBLE MAY BE TO WATCH THE TREND LINE AND ENSURE THAT THE SITUATION DOES NOT DETERIORATE.

THE NEXT CONTROL CAN COME FROM THE JOB ORDER COST CARDS WHICH HAS FACILITIES FOR COMPARING ACTUAL COSTS WITH ESTIMATES. THESE ESTIMATES MAY SEEM DIFFICULT TO PREPARE BUT IF SUFFICIENT HISTORICAL DATA IS AVAILABLE IT IS POSSIBLE TO PREPARE SYNTHETIC STANDARDS AND THESE, TOGETHER WITH OTHER PRACTICAL KNOWLEDGE AND EXPERIENCE, CAN RESULT IN REASONABLY ACCURATE ESTIMATES BEING PRODUCED. IT IS PROBABLY A FACT THAT EVEN A BAD ESTIMATE IS BETTER THAN NO ESTIMATE AT ALL. IF THESE ESTIMATES ARE AVAILABLE A SUMMARY CAN BE PRESENTED EACH MONTH OF THE JOBS FINISHED

AND COSTED, COMPARED AGAINST ESTIMATES AND THE VARIANCES NOTED, INVESTIGATED AND EXPLAINED.

A THIRD CONTROL WHICH IS OFTEN USED BY COMPANIES IS TO COMPARE DIRECT LABOUR HOURS AGAINST THE STANDARD LABOUR HOURS ALLOWED FOR EACH JOB. THESE STANDARDS MAY BE SET FROM:-

(I) ANALYSIS OF HISTORICAL DATA GIVING DETAILS OF TIMES TAKEN FROM WHEN THE JOB WAS PREVIOUSLY CARRIED OUT.

(II) BY BREAKING THE JOB DOWN INTO ITS VARIOUS ELEMENTS AND FINDING PREVIOUS STANDARDS FOR EACH ELEMENT, THUS BUILDING UP A SYNTHETIC TOTAL STANDARD FOR THE JOB- SOMETIMES NAMED THE "ANALYTICAL" SYSTEM, OR

(III) THE "COMPARATIVE" METHOD, ON THE BASIS OF THE UNIVERSAL MAINTENANCE STANDARDS (U.M.S.) SYSTEM, WHERE THE UNMEASURED JOB IS MATCHED WITH A CAREFULLY MEASURED SAMPLE AND THE AGGREGATE OF A NUMBER OF SUCH TIMES DERIVED IS TAKEN AS REALISTIC.

ONCE THESE STANDARDS HAVE BEEN SET IT IS A RELATIVELY SIMPLE MATTER TO EXTRACT THE ACTUAL TIMES TAKEN AND COMPARE THESE WITH THE STANDARDS, ACCORDING TO TRADE GROUPS AND TYPE OF MAINTENANCE WORK CARRIED. THE COST CONTROL SUMMARY MAY SHOW, FOR INSTANCE:-

M/INTENANCE COST PERFORMANCE SUMMARY

WEEK ENDING.....

TYPE OF W	STANDARD HOURS	ACTUAL HOURS	PERFORMANCE INDEX
MECHANICAL			
MILLWRIGHTS	1,350	1,300	104
PIPE FITTERS	350	490	112
ELECTRICAL			
TOTAL	8,750	7,290	120

MAINTENANCE CAN ALSO BE SPLIT INTO SEVERAL DIFFERENT TYPES, E.G.

(I) ROUTINE,

(II) REPETITIVE,

(III) NON-REPETITIVE,

AND A CONTROL REPORT CAN BE ISSUED TO ILLUSTRATE FREQUENCY AND PERFORMANCE IN EACH TYPE AND ACCORDING TO TRADE.

MAINTENANCE COST PERFORMANCE SUMMARY

WEEK ENDING.....

TRADE - MILLWRIGHT

	STANDARD HOURS	ACTUAL HOURS	PERFORMANCE INDEX
ROUTINE	150	130	115
REPETITIVE	800	670	118
NON-REPETITIVE	400	500	80
TOTAL	1,350	1,300	104

IN ORDER TO AVOID ANY EFFECTS OF SHORT PERIOD FLUCTUATIONS A 5 WEEK OR 7 WEEK MOVING AVERAGE IS GENERALLY TAKEN AND THIS ALSO SERVES TO ILLUSTRATE TRENDS WITH GREATER EMPHASIS.

IT CANNOT BE EMPHASISED TOO STRONGLY THAT THE RECORDING OF COST AND STATISTICAL DATA IS ONLY OF VALUE IF IT IS GOING TO BE READ, INVESTIGATED AND ACTED UPON. FOR INSTANCE, THE CHIEF ENGINEER SHOULD FIRST OF ALL DECIDE UPON THE EFFICIENCY LEVELS HE EXPECTS FROM HIS SUBORDINATES AND THEN HE CAN RELATE THIS TO THE PERFORMANCE INDEX. A GENERAL TARGET OF ACTUAL OPERATION AGAINST STANDARD IS IN THE REGION OF A 133 P.I. (PERFORMANCE INDEX) AND UNDER CORRECT INCENTIVE CONDITIONS AN AVERAGE OPERATOR WOULD BE EXPECTED TO ACHIEVE THIS FIGURE. A GREAT DEAL, HOWEVER, DEPENDS UPON THE ACCURACY OF THE STANDARDS SET, WHICH IN TURN DEPENDS UPON THE HISTORICAL DATA AVAILABLE AND MANAGEMENT TIME WHICH CAN BE USED TO ESTABLISH CONTROL FIGURES.

BY SUITABLE ANALYSIS IT SHOULD BE EASILY POSSIBLE TO FIND THE AREAS WHERE CLOSER INVESTIGATION IS NECESSARY. SHOULD THE RETURNS

IN ANY PARTICULAR DEPARTMENT, CRAFT OR OTHER AREA SHOW CONSISTENLY A POOR OR BELOW AVERAGE PERFORMANCE MANAGEMENT ATTENTION SHOULD BE POINTED TOWARDS THESE AREAS AND BY OTHER AVAILABLE MEANS (E.G. ACTIVITY SAMPLING) DECIDE WHETHER STANDARDS OR GENERAL WORK PERFORMANCE IS AT FAULT.

BUDGETARY CONTROL APPLIED TO MAINTENANCE COSTS

BUDGETARY CONTROL IS THE MAIN TECHNIQUE FOR PLANNING, CO-ORDINATING AND CONTROLLING THE OPERATION OF A COMPANY IN FINANCIAL TERMS. IN A WELL OPERATED SYSTEM THE TOTAL COST BUDGET FOR THE COMING PERIOD IS DETERMINED BY BUDGETING IN DETAIL FOR ALL THE COMPONENT OPERATIONS OF THE MAINTENANCE FUNCTION. CO-ORDINATION WITH THE DEPARTMENTS SERVED BY MAINTENANCE IS NECESSARY AND PLAYS AN IMPORTANT PART IN THE PREPARATION OF THE BUDGET.

WHERE THE SYSTEM IS NOT AS WELL DEVELOPED, THE BUDGET COST FOR MAINTENANCE TENDS TO BE GIVEN AS A LUMP SUM AND IS BASED PRINCIPALLY ON PAST EXPERIENCE, WITH PROBABLE ADJUSTMENTS IN THE LIGHT OF FUTURE OPERATIONAL PROSPECTS. THIS

SYSTEM CANNOT, HOWEVER, BE ADVISED AS WITHOUT THE DETAILED BUILD-UP, AN ADEQUATE BASIS FOR EFFECTIVE CONTROL CANNOT BE PROVIDED.

THE RESPONSIBILITY FOR PREPARING THE BUDGET FOR THE MAINTENANCE DEPARTMENT VARIES AMONG COMPANIES DEPENDING UPON WHETHER MAINTENANCE IS THE RESPONSIBILITY OF THE ENGINEERING OR OF THE PRODUCTION FUNCTION. IF IT IS RESPONSIBLE TO THE ENGINEERING FUNCTION, THE MAINTENANCE DEPARTMENT WILL PREPARE ITS OWN BUDGET, WHEREAS IF IT IS RESPONSIBLE TO THE PRODUCTION FUNCTION IT WILL GENERALLY BE PREPARED BY THAT FUNCTION.

IT IS CONSIDERED MORE SATISFACTORY, HOWEVER TO APPOINT A COMMITTEE CONSISTING OF PRODUCTION, MAINTENANCE AND ACCOUNTING PERSONNEL AND HAVE THEM JOINTLY PREPARE THE BUDGET. ANY DIFFERENCES OF OPINION WHICH CANNOT BE RESOLVED ARE REFERRED TO THE WORKS MANAGER OR PLANT ENGINEER WHO THEN MAKE THE FINAL DECISION. WHEN THIS BUDGET IS DECIDED UPON, IT IS ESSENTIAL TO IDENTIFY MOST CLEARLY THE PERSON RESPONSIBLE FOR CONTROLLING MAINTENANCE COSTS. CONTROL CANNOT BE STRONG UNTIL THIS RESPONSIBILITY IS KNOWN.

IN PRACTICE IT IS GENERALLY FOUND THAT MAINTENANCE COST BUDGETS CAN BE CLASSIFIED INTO THREE DIFFERENT TYPES, NAMELY:-

(I) FIXED BUDGETS IN WHICH A TOTAL AMOUNT OF MONEY IS ALLOCATED TO THE DEPARTMENT FOR A CLEARLY DEFINED PERIOD OF TIME.

(II) FLEXIBLE BUDGETS, IN WHICH IT IS RECOGNISED THAT MAINTENANCE WILL TEND TO FLUCTUATE WITH VOLUME OF OUTPUT.

(III) STEP BUDGETS WHERE COSTS ARE EXPECTED TO REMAIN CONSTANT WITH CERTAIN VOLUME OF OUTPUT AREAS. AT VARIOUS OUTPUT LEVELS THE COST BUDGET ALTERS TO DEAL WITH THAT VOLUME SITUATION.

EACH SYSTEM HAS ITS ADVANTAGES AND DISADVANTAGES AS PRODUCTION VOLUME OFTEN TENDS TO DETERMINE THE AMOUNT OF MAINTENANCE WORK CARRIED OUT. FOR INSTANCE, DURING TIMES OF HEAVY PRODUCTION REQUIREMENTS THERE IS A TENDENCY FOR MAINTENANCE WORK TO BE POSTPONED AND SIMILARLY

THERE MAY BE A CONCENTRATION ON MAINTENANCE WORK IN PERIODS OF DEPRESSION. BECAUSE OF THESE REASONS IT IS SOMETIMES ADVISABLE TO USE A PROJECT BUDGETING SYSTEM IN WHICH MONEY IS MADE AVAILABLE AGAINST WORK PLANNED AS SPECIFIC PROJECTS, WITH MINOR PROJECTS BEING ALLOWED FOR AS A SPECIAL ALLOWANCE IN THE MONTHLY BUDGETS. AS THIS METHOD MAY HAVE A MARKED EFFECT ON THE COMPANY'S OPERATING PROFITS, ESPECIALLY IF THE PROJECTS ARE VERY EXTENSIVE, TOTAL COSTS TO COVER A FULL OPERATIONAL CYCLE MAY BE CALCULATED AND WRITTEN OUT MONTH BY MONTH, THUS SPREADING THE COST LOAD.

ONCE AGAIN IT MUST BE REMEMBERED THAT THERE CAN NEVER BE ANY ONE HARD AND FAST RULE WHEN COMPILING A BUDGET FOR THE MAINTENANCE DEPARTMENT. A COMPANY HAS A MUCH BETTER CHANCE OF ACCURACY WHERE PREVENTIVE MAINTENANCE IS OPERATED BUT AGAIN THERE IS NO CERTAINTY THAT ABNORMAL BREAKDOWN MAY NOT OCCUR WITH CONSEQUENT HIGH EXPENSE.

THE MAINTENANCE DEPARTMENT ALSO HAS THE ADVANTAGE THAT ITS HIGHEST COST ITEM IS PROBABLY THE WAGES AND SALARIES PAID TO THE OPERATORS

AND THESE CAN BE FAIRLY REALISTICALLY ESTIMATED AND CONTROLLED. MOST OF THE MAJOR DIRECT MATERIALS FOR EXAMPLE, SPARE PARTS, WILL TEND TO BE PURCHASED AS REQUIRED AND THE ANCILLARY AND CONSUMABLE MATERIALS E.G. VEE BELTS, GREASE ETC. CAN BE ESTIMATED AGAINST VARYING LEVELS OF OUTPUT.

WHICHEVER SYSTEM IS USED, IT SHOULD BE REMEMBERED THAT ACUTAL COSTS SHOULD BE RECORDED AND REPORTED UPON IN THE SAME FRAME-WORK AS THE COSTS WERE COMPILED.

REDUCING THE COST OF MAINTENANCE

HAVING RECEIVED THE MAINTENANCE COST REPORTS AND FULL ANALYSIS FOR THE ACCOUNTING PERIOD IT IS THEN THE PROBLEM OF MANAGEMENT TO ATTEMPT TO REDUCE THE COST OF MAINTENANCE WITHOUT RISKING THE CHANCES OF PLANT BREAKDOWN AND CONSEQUENT EXCESSIVE LOSS OF OUTPUT.

THERE ARE TWO BASIC WAYS TO REDUCE THESE COSTS. FIRSTLY, IT MAY BE POSSIBLE TO REDUCE THE ABSOLUTE QUANTITY OF THE WORK REQUIRED TO BE DONE AND SECONDLY TO ANALYSE IN DETAIL THE WORK WHICH MUST BE DONE TO DECREASE, WHERE POSSIBLE, THE OVERALL COST OF OPERATION.

CAREFUL ANALYSIS OF EACH JOB MAY SHOW THAT WORK PROPOSED TO BE PERFORMED IS UNNECESSARY AND CONSEQUENTLY ALL SUCH REQUESTS SHOULD BE REFUSED. ANOTHER POINT TO WATCH FOR CONCERNS THE QUALITY OF WORKMANSHIP ON EACH JOB. THERE ARE VERY FEW INSTANCES ANYWHERE WHERE CHEAPNESS PAYS AND THIS IS THE SAME FOR POOR QUALITY LABOUR. WORK WHICH IS PROPERLY CARRIED OUT IN AN EXPERT AND PROFESSIONAL MANNER WILL FAR OUTLIVE ANY POOR AND INEXPERT WORK DONE. SIMILARLY, THE USE OF PROPER MATERIALS IS ESSENTIAL TO ENSURE THAT THE LATER TROUBLES WILL BE KEPT TO A MINIMUM. AT THE SAME TIME, CORRECT OPERATOR TRAINING AND ADEQUATE SUPERVISION WILL ENSURE THAT MACHINES AND EQUIPMENT ARE PROPERLY TREATED. MANY MACHINES ARE ABUSED THROUGH OPERATORS ON PIECE-WORK LIFTING THE SPEEDS AND FEEDS OF MACHINES IN ORDER TO ACHIEVE HIGH PIECE-WORK TIMES. MANAGEMENT SHOULD ALSO TAKE AN ACTIVE INTEREST IN DESIGN AND ENCOURAGE MAINTENANCE PERSONNEL TO GIVE ADVICE ON WHERE DESIGN CHANGES MAY REDUCE FUTURE MAINTENANCE COSTS. FOR EXAMPLE, SUITABLE ACTIONS WHICH COULD BE TAKEN AT THE DESIGN STAGE ARE:-

(1) WHEREVER POSSIBLE PARTS MOST LIKELY TO REQUIRE REGULAR MAINTENANCE SHOULD BE PLACED FOR AS EASY ACCESS AS POSSIBLE.

(2) WITH BUILDINGS, HAVE PERMANENT LADDERS AND HAND RAILS TO ENSURE EASY ACCESS TO ROOFS ETC.

(3) WITH PLANT AND EQUIPMENT, MOVING PARTS SHOULD BE KEPT TO A MINIMUM OF EXPOSURE TO REDUCE THE CHANCES OF DAMAGE CAUSED BY DUST AND GRIT.

(4) STANDARDISE WHEREVER POSSIBLE.

(5) USE SUB-ASSEMBLIES AND REPLACEABLE SEALED UNITS, WHICH IN TURN REDUCES MACHINE DOWN-TIME TO A MINIMUM, AND

(6) HAVE AUTOMATIC LUBRICATION SERVICES.

WHERE THE WORK TO BE DONE IS PROVED TO BE NECESSARY, COSTS CAN STILL BE REDUCED AND KEPT TO A MINIMUM BY INCREASING THE PRODUCTIVITY OF THE MAINTENANCE PERSONNEL THROUGH THE USE OF INCENTIVES AND OTHER MEANS. NON-PRODUCTIVE EFFORT SHOULD BE KEPT AS LOW AS PRACTICABLE BY ADEQUATE PLANNING AND CONTROL TECHNIQUES. THE USE OF BETTER METHODS AND

TOOLS TOGETHER WITH BETTER PROCEDURES CAN ALSO DO MUCH TO REDUCE COSTS. MACHINES AND MANPOWER SHOULD ALSO BE KEPT AT THE OPTIMUM OPERATING LEVEL.

PREVENTIVE MAINTENANCE

PREVENTIVE MAINTENANCE HAS BEEN DESCRIBED AS "ORDINARY MAINTENANCE CARRIED OUT BEFORE IT IS NEEDED". IT HAS MANY ADVANTAGES AND CAN MAKE A VALUABLE CONTRIBUTION TO THE OVERALL EFFICIENCY OF THE COMPANY, BUT ONCE AGAIN IT IS NOT THE "CURE-ALL" WHICH MANY OF ITS SUPPORTERS CLAIM IT TO BE.

THE OBJECTIVE OF PREVENTIVE MAINTENANCE IS TO KEEP PLANT AND EQUIPMENT IN GOOD CONDITION SO THAT BREAKDOWNS DO NOT OCCUR AND SO HELPS TO KEEP EMERGENCY REPAIRS DOWN TO A MINIMUM. IT COMPRISES MAINLY INSPECTION, LUBRICATION, ADJUSTMENTS AND OVERHAULS.

BECAUSE OF ITS VERY NATURE, PREVENTIVE MAINTENANCE CAN BE PROPERLY PLANNED AND STANDARD LABOUR HOURS MORE EASILY CALCULATED. IN THIS WAY MAINTENANCE WORK CAN BE BETTER SCHEDULED WITH CONSEQUENT BETTER UTILISATION OF MEN AND EQUIPMENT. FROM THE ACCOUNTANT'S POINT OF VIEW

IT CAN BE SAID TO REDUCE SOME COSTS BUT AT THE SAME TIME THE COST OF OPERATING THE SYSTEM MAY BE HIGHER THAN WHERE CORRECTIVE MAINTENANCE IS PRACTISED. A GREAT DEAL DEPENDS UPON THE TYPE OF PROCESSES CARRIED OUT BY THE COMPANY, FOR EXAMPLE, A CONTINUOUS PROCESS AGAINST INTERMITTENT OPERATION OR JOBBING WORK. COSTS MUST BE CAREFULLY CALCULATED AND COMPARISONS MADE TO SEE IF THE GROSS SAVINGS MADE OUTWEIGH THE EXTRA COST INVOLVED.

THERE IS STILL INSUFFICIENT EMPHASIS PLACED UPON THE COMPARATIVE COSTING OF PREVENTIVE MAINTENANCE WHICH CAN GIVE SAVINGS THROUGH:-

(I) DECREASING THE RISK OF SECONDARY DAMAGE TO PLANT AND EQUIPMENT.

(II) DECREASING THE RISK OF PLANT BREAKDOWN WITH RESULTANT LOSS OF PRODUCTION.

(III) DECREASING THE INCIDENCE OF OVERTIME WORKING BY MAINTENANCE PERSONEL.

(IV) ALLOWING FOR THE BETTER UTILISATION OF LABOUR AND LABOUR SKILLS BY SCHEDULING THE RIGHT MEN FOR THE RIGHT JOBS.

(v) GIVING BETTER MATERIAL UTILISATION AND STORES INVENTORY CONTROL, AGAIN THROUGH THE WORK BEING SCHEDULED.

(vi) KEEPING MACHINES OPERATING AT THEIR OPTIMUM CAPACITY WITH CONSEQUENT PROBABLY HIGHER PRODUCTION DUE TO THE BETTER UTILISATION OF FEEDS AND SPEEDS.

(vii) ENSURING THAT THE PLANT AND EQUIPMENT ARE CAPABLE OF TURNING OUT THE QUALITY OF WORK REQUIRED AND ESPECIALLY WHERE WORK OF CLOSE TOLERANCES IS INVOLVED.

AGAINST THESE SAVINGS THERE ARE THE EXTRA COSTS OF KEEPING RECORDS, SCHEDULING AND CONTROLLING THE SYSTEM. INSPECTION COSTS MAY ALSO BE HIGH IN COMPARISON TO OTHER MAINTENANCE SYSTEMS. THE PREVENTIVE MAINTENANCE SYSTEM MUST ALSO BE CAREFULLY CONTROLLED AND ESPECIALLY IN RELATION TO DISCARDING PLANT AND EQUIPMENT BEFORE THE END OF IT USEFUL LIFE. IT IS POSSIBLE TO GET A SITUATION WHERE THE EQUIPMENT IS PREMATURELY DIS-

CARDED BECAUSE IN THE OPINION OF THE MAINTENANCE INSPECTOR IT APPEARS TO BE READY FOR SCRAPPING, WHEREAS WITH CORRECTIVE MAINTENACE IT WOULD HAVE BEEN OPERATED UNTIL IT BROKE DOWN AND WAS NO LONGER USABLE.

AT THE SAME TIME, HOWEVER, THESE PREVENTIVE MAINTENANCE COSTS CAN BE KEPT TO A MINIMUM BY:-

(i) SIMPLIFYING THE WORK AND PROCEDURES,

(ii) ANALYSING THE COMPLETE MAINTENANCE CYCLE AND ESTABLISHING THE OPTIMUM INTERVAL FOR THE OPERATION, AND

(iii) USING, WHEREVER POSSIBLE, STANDARD PROCEDURES FOR THE RECORDING, SCHEDULING AND CONTROLLING OF THE SYSTEM.

IT IS DIFFICULT IN MANY CASES TO REACH ANY FIRM DECISIONS ON WHETHER PREVENTIVE OR CORRECTIVE MAINTENANCE SHOULD BE USED. THERE ARE, HOWEVER, SOME ANALYTICAL TECHNIQUES AVAILABLE WHICH CAN GIVE FAIRLY RELIABLE COMPARATIVE COSTS. IT IS POSSIBLE TO ESTIMATE THE ANNUAL COST OF EACH METHOD AND THE ULTIMATE DIFFERENCES IN TOTAL

ESTIMATED COST MAY BE SUFFICIENTLY LARGE TO GUIDE THE PLANT ENGINEER OR THE WORKS MANAGER IN HIS DECISION MAKING. IN SOME CASES, E.G. WHERE SEVERAL UNITS OF A SIMILAR NATURE ARE AVAILABLE, IT MAY BE POSSIBLE TO CARRY OUT AN EXERCISE USING BOTH PREVENTIVE AND CORRECTIVE MAINTENANCE AT DIFFERENT LEVELS AND, BY COMPARISON OF THE HISTORICAL DATA, REACH SOME FIRM CONCLUSIONS IN FORMULATING A MAINTENANCE POLICY.

MAINTENANCE ECONOMICS

UP TILL NOW THE FOLLOWING POINTS HAVE BEEN DISCUSSED AND ILLUSTRATED:-

(I) THE FUNCTIONS AND OBJECTIVES OF MAINTENANCE,

(II) THE ORGANISATION OF THE MAINTENANCE DEPARTMENT AND ITS RELATIONSHIP WITH OTHER DEPARTMENTS,

(III) ACCOUNTING FOR DIRECT MAINTENANCE EXPENDITURE,

(IV) THE ALLOCATION OF COSTS TO JOBS AND DEPARTMENTS,

(v) Cost reporting and performance against standards,

(vi) Budgetary Control,

(vii) Cost reduction techniques, and

(viii) Preventive Maintenance.

Having, therefore, decided upon the type of maintenance system to follow and the system of accountancy control to use, together with the control information considered necessary, the accountant must look further afield to find the true economics of maintenance. As already briefly stated, this economic analysis must compare the cost of direct maintenance against the hidden costs which will result if no, or insufficient maintenance is carried out. These indirect costs are:-

(i) The cost of downtime and lost production,

(ii) The cost of excessive deterioration resulting in premature obsolescence,

(iii) The cost of faulty and scrapped work, and

(IV) THE COST OF EXTRA FUEL AND POWER DUE TO PLANT INEFFICIENCY.

THE ECONOMICS OF DOWNTIME

AS PREVIOUSLY MENTIONED, THE MAIN AREA OF MANAGEMENT ATTENTION IN RELATIONTO MAINTENANCE IS ALMOST INVARIABLY THE COST OF LOST PRODUCTION WHEN THE PLANT BREAKS DOWN. AT THIS POINT MANAGEMENT AND PRODUCTION STAFF REGARD SUCH AN OCCURRENCE AS AN UNFORGIVEABLE CRIME AND CONSEQUENTLY DRAMATISE THE SITUATION. FREQUENT STATEMENTS ARE HEARD CONCERNING THE COST PER HOUR OR PER DAY TO THE COMPANY, DUE TO MACHINES STANDING IDLE AND UNABLE TO WORK BECAUSE OF BREAKDOWN. THESE STATEMENTS, HOWEVER, SHOULD BE TAKEN AT THEIR FACE VALUE AND IN RELATION TO THE TYPE OF WORK CARRIED OUT BY THE COMPANY. IN SOME CASES E.G. WHERE A CONTINUOUS PROCESS IS OPERATED (AS IN CHEMICAL WORKS, CEMENT AND COKE MANUFACTURE) THERE MAY BE SOME POINT IN THIS STATEMENT. IN MANY CASES, AN ANALYSIS OF THE OPERATION CYCLE MAY SHOW THAT NO WORK IS CARRIED OUT ON SATURDAY AFTERNOONS AND SUNDAYS. THE COST OF DOWNTIME IS, THEREFORE, ONLY HIGHER BY THE AMOUNT OF

OVERTIME ALLOWANCES PAID AND SUPERVISION REQUIRED TO MAKE UP THE LOST PRODUCTION. PRODUCTION PERSONNEL DO NOT, OF COURSE, CARE FOR THIS SITUATION AS THESE COSTS WOULD BE PLACED AGAINST THEIR OPERATION AND CONSEQUENTLY DIFFERENCES OF OPINION CAN ARISE AND UNFORTUNATE PRESSURES MADE ON THE MAINTENANCE FUNCTION.

AN ACUTE ACCOUNTANT CAN OR SHOULD BE ABLE TO COLLECT SUFFICIENT DATA TO ESTABLISH THE OPTIMUM MAINTENANCE DOWNTIME. AS ALREADY EXPLAINED, IT IS FAIRLY EASY TO ESTIMATE THE DIRECT MAINTENANCE COSTS AT VARYING LEVELS OF ACTIVITY AND THESE FIGURES WILL BE AVAILABLE WHERE A FLEXIBLE BUDGETARY CONTROL SYSTEM IS OPERATED. IT IS ONLY SLIGHTLY MORE DIFFICULT TO CALCULATE THE COST OF DOWNTIME AND, ONCE AGAIN, SHOULD PRESENT NO PROBLEM TO ANY COMPANY WITH A REASONABLE STANDARD OF ACCOUNTING EFFICIENCY.

DOWNTIME COSTS CAN BE FAIRLY QUICKLY ESTABLISHED BY CALCULATING THE OPERATING COSTS AT DIFFERENT LEVELS OF PRODUCTION ACTIVITY. AGAIN FROM THE BUDGETS AND ANY AVAILABLE HISTORICAL FIGURES IT MAY BE FOUND THAT THE TOTAL OPERATING COSTS PER YEAR ARE £ 240,000 AT 60%

ACTIVITY, $ 320,000 AT 80% ETC. FROM THESE TOTAL OPERATING COSTS THERE MUST BE SUBTRACTED THE COST OF DIRECT MAINTENANCE AND OPERATING MATERIALSCOSTS. AFTER THIS HAS BEEN CALCULATED A TABULAR COST STATEMENT CAN BE DRAWN UP, FOR EXAMPLE:-

LEVEL OF PRODUCTION ACTIVITY	MAINTENANCE COST	MATERIAL COST	OPERATING COST	TOTAL COST
%	DOLLARS PER YEAR			
60	30,000	90,000	120,000	240,000
80	40,000	120,000	160,000	320,000
90	45,000	135,000	180,000	360,000
95	50,000	142,000	190,000	382,000
97½	60,000	145,000	195,000	400,000
100	70,000	150,000	200,000	420,000

FROM THIS STATEMENT IT IS NOW POSSIBLE TO CALCULATE THE COST OF DOWNTIME BY SIMPLY SUBTRACTING THE OPERATING COST AT EACH LEVEL OF ACTIVITY FROM THE OPERATING COST AT 100%

ACTIVITY, I.E. AT 60% ACTIVITY THE DOWNTIME COST IS £ 200,000 LESS £ 120,000 = £ 80,000. THIS IN TURN CAN BE PRODUCED AS A TABULAR STATEMENT FROM WHICH A GRAPH SHOWING THE OPTIMUM SITUATION MAY BE CONSTRUCTED.

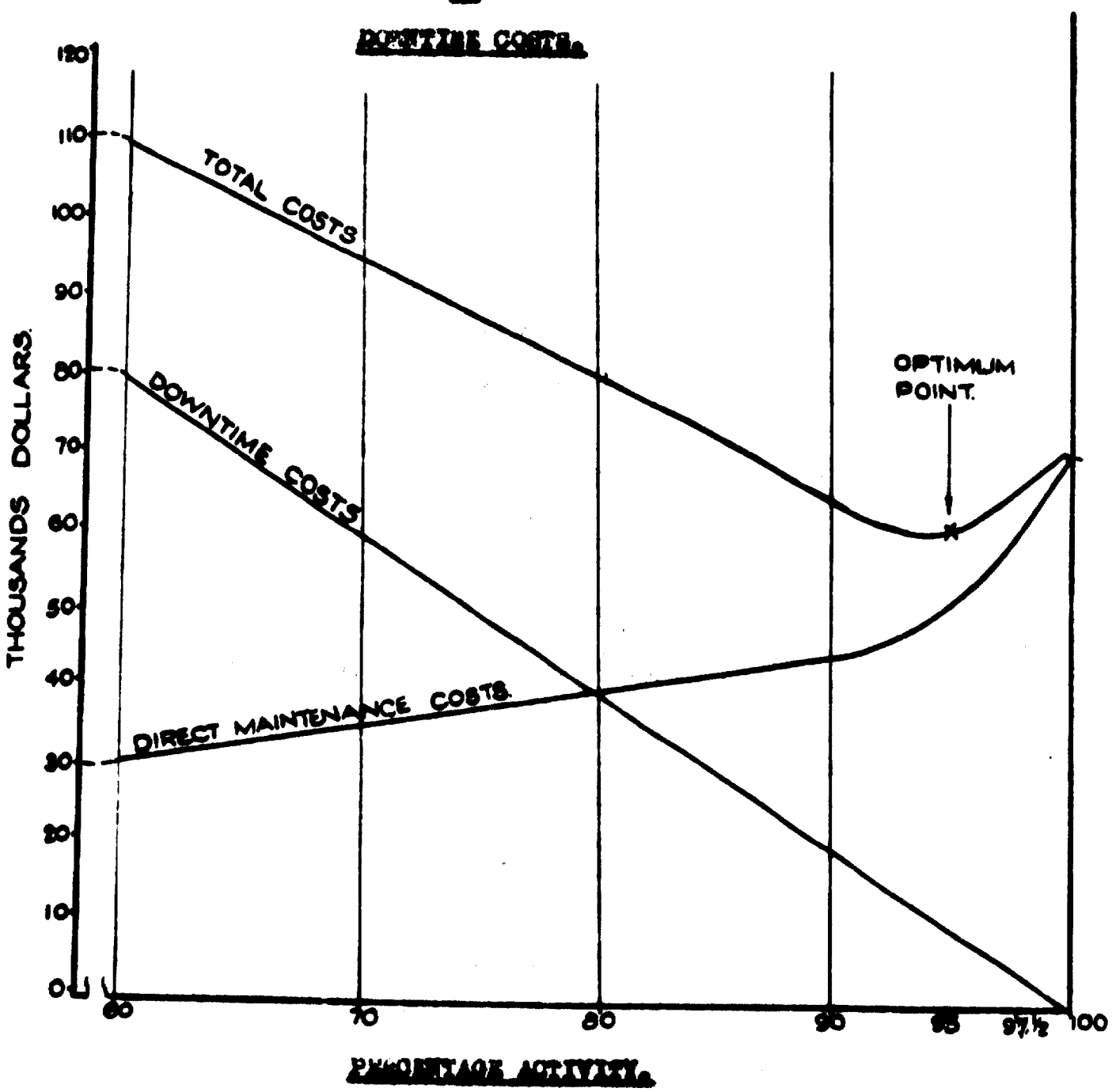
ACTIVITY LEVEL %	DOLLARS PER YEAR TOTAL		
	MAINTENANCE COST	DOWNTIME COST	TOTAL
60	30,000	80,000	110,000
80	40,000	40,000	80,000
90	45,000	20,000	65,000
95	50,000	10,000	60,000
97½	60,000	5,000	65,000
100	70,000	0	70,000

GRAPH SHOWING RELATIONSHIP OF

MAINTENANCE COSTS

TO

DOWNTIME COSTS.



FROM THIS GRAPH IT IS POSSIBLE TO REACH MANY CORRECT CONCLUSIONS. THE REAL COST OF MAINTENANCE CAN BE MUCH MORE EASILY SEEN, FOR EXAMPLE:-

(I) IN THIS ILLUSTRATION THE OPTIMUM POINT APPEARS AT 95% ACTIVITY. THAT IS, THAT UP TO THIS POINT THE COST OF DOWNTIME EXCEEDS THE DIRECT MAINTENANCE COST AND AFTER THIS POINT IS REACHED THE REVERSE OCCURS.

(II) IF THE PLANT CAN OPERATE AT 100% OF ITS CAPACITY, BUT HAD TO HAVE 3% OF ITS PRODUCTION TIME ON MAINTENANCE, THE GRAPH SHOWS THAT IN FACT THE COMPANY'S PROFITS ARE AT THEIR HIGHEST AT 95% ACTIVITY AND SO PROFIT HAS NOT BEEN LOST DUE TO THE MAINTENANCE TIME EXPENDED.

(III) THE IMPACT AND USEFULNESS OF DETERMINING THE OPTIMUM COST POINT IS EVEN MORE VALUABLE AND NECESSARY IF THIS POINT OCCURS AT A MUCH LOWER PERCENTAGE. IN PRACTICE IT

IS GENERALLY AGREED THAT FEW PRODUCTION LINES CAN JUSTIFY GREATER MECHANICAL AVAILABILITY FIGURES THAN BETWEEN 93% AND 95% I.E. A DOWNTIME OF BETWEEN 7% AND 5%.

The Economics of Premature Obsolescence

ACCOUNTANTS REDUCE THE BOOK VALUE OF THE CAPITAL ASSETS OF THEIR COMPANIES EACH YEAR BY AN AGREED PERCENTAGE DEPENDING UPON THE TYPE OF ASSET INVOLVED. THESE PERCENTAGES HAVE BEEN AGREED AFTER MANY INVESTIGATIONS, YEARS OF HISTORICAL EXPERIENCE AND DETAILED ANALYSIS OF STATISTICAL DATA. FOR EXAMPLE, BUILDINGS MAY BE REDUCED BY 5% OF THEIR RESIDUAL VALUE PER ANNUM, WHEREAS MACHINE TOOLS MAY BE 12½% AND AUTOMOBILES 25%. WHATEVER THE PERCENTAGE USED, THE OBJECT IS THAT THE ASSET SHOULD SHOW ONLY SCRAP VALUE IN THE BOOKS OF THE ACCOUNTANT AFTER ITS CALCULATED LIFE SPAN HAS PASSED. OF COURSE, IN PRACTICE, THIS DOES NOT OFTEN HAPPEN AS A MACHINE MAY BE SCRAPPED BEFORE THE END OF ITS CALCULATED USEFUL LIFE BECAUSE OF CHANGES IN PROCESSES AND THE NEED TO KEEP UP WITH COMPETITORS. SOMETIMES,

HOWEVER, PLANT AND EQUIPMENT BECOME OBSOLETE AND MUST BE SCRAPPED PURELY BECAUSE THE MAINTENANCE WORK CARRIED OUT UPON IT HAS BEEN LOW, POOR OR PERHAPS NON-EXISTENT.

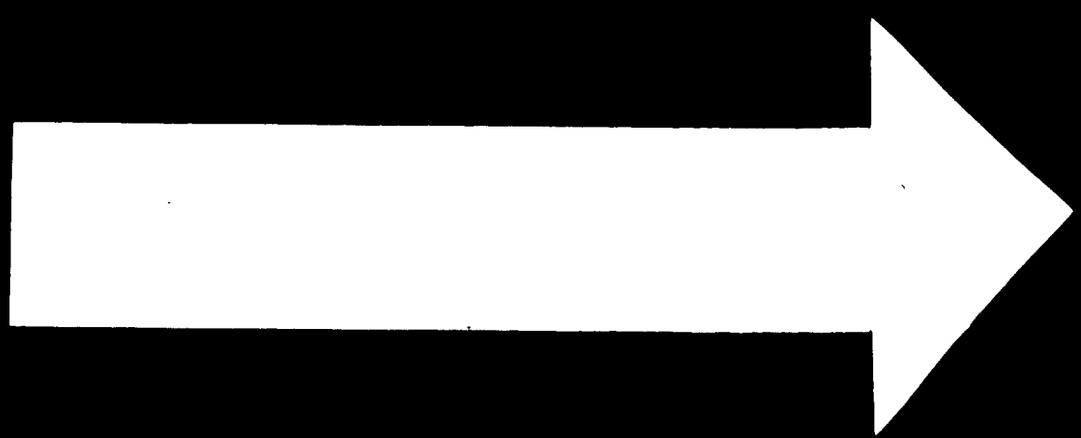
AN EASY TO UNDERSTAND AND GOOD EXAMPLE COULD BE AN AUTOMOBILE. IT CAN BE IMAGINED HOW RAPIDLY AN AUTOMOBILE WOULD DETERIORATE IF NO SERVICE WAS CARRIED OUT UPON IT, HOW QUICKLY THE BODYWORK WOULD RUST IF IT WAS NOT CLEANED AND POLISHED AND HOW ITS OPERATING MECHANICAL ABILITY WOULD BECOME USELESS IF ADEQUATE MAINTENANCE WAS NOT CARRIED OUT. SO, IF A NORMALLY MAINTAINED AUTOMOBILE COULD BE EXPECTED TO OPERATE FOR FOUR YEARS, THE POORLY MAINTAINED ONE WOULD PROBABLY ONLY HAVE AN OPERATING LIFE SPAN OF TWO YEARS.

IN THE SAME WAY THIS CAN HAPPEN TO BUILDINGS, PLANT AND EQUIPMENT IN A FACTORY UNLESS THE TRUE IMPORTANCE OF MAINTENANCE IS APPRECIATED. THE COSTS INVOLVED ARE, OF COURSE, VERY MANY MORE TIMES GREATER AND CREATE MUCH MORE DISTURBANCE AND FURTHER LOSS. IT CAN, HOWEVER, BE REALISED THAT IF THE COMPANY HAS ASSETS OF (SAY) TEN

MILLION DOLLARS AND THAT THESE ASSETS ARE EXPECTED TO LAST FOR TEN YEARS, THEN IF THEY ONLY LAST FOR EIGHT YEARS TWO MILLION DOLLARS HAVE BEEN LOST WHICH COULD HAVE BEEN SAVED BY EXPENDITURE ON MAINTENANCE AND AT PROBABLY ONLY A FRACTION OF THIS FIGURE.

The Economics of Faulty and Scrapped Work

IF A PIECE OF PLANT OR EQUIPMENT IS NOT MAINTAINED ADEQUATELY IT MAY NOT BE CAPABLE OF PRODUCING TO AN ACCEPTABLE COMMERCIAL QUALITY STANDARD. THIS RESULTS IN WORK BEING SCRAPPED AND GIVES LOWER PRODUCTION, LOWER SALES AND LESS PROFITS. EVEN IF THE PLANT IS NOT WORKING AT FULL CAPACITY THERE WILL BE CONSIDERABLE COSTS INVOLVED BY REPLACING THE SCRAPPED PRODUCTS. FOR EXAMPLE, IF THE DIRECT OPERATING COSTS (I.E. DIRECT OPERATOR TIME, DIRECT MATERIALS, FUEL AND POWER ETC.) ARE ONE MILLION DOLLARS PER YEAR AND THERE IS A 10% SCRAP RATE THEN A LOSS OCCURS OF 100,000 DOLLARS PER YEAR LESS THE RETURNABLE WASTE VALUE. THIS EXTRA COST COULD BE AVOIDED BY THE OPERATION OF A SENSIBLE ECONOMIC MAINTENANCE POLICY.



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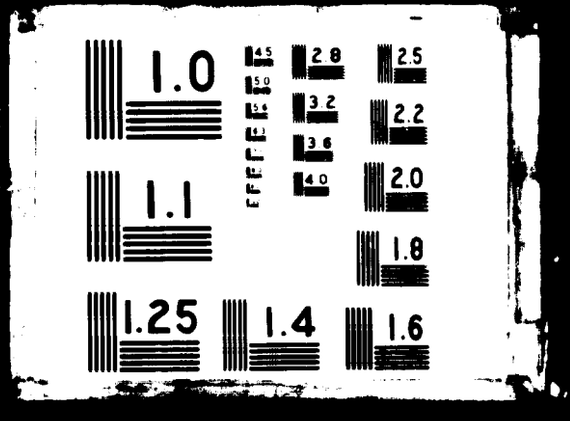

IN THE SAME WAY, FAULTY WORK WILL HAVE TO BE RECTIFIED TO BRING IT UP TO STANDARD. THIS TAKES UP TIME WHICH COULD HAVE BEEN UTILISED ON INCREASING PRODUCTION AND ANY WASTE OF THIS TIME TOGETHER WITH THE EXTRA MATERIALS, POWER AND FACILITIES USED IS AN EXTRA COST.

The Economics of Power Costs

IN A FACTORY HAVING A HIGH DEGREE OF MECHANISATION THE COST OF POWER E.G. ELECTRICITY AND COMPRESSED AIR, CAN BE QUITE CONSIDERABLE. THIS POWER HAS OFTEN TO BE CARRIED OVER LARGE AREAS AND RESULTANT LOSSES CAN OCCUR. THESE LOSSES CAN BE MINIMISED WITH CAREFUL AND ADEQUATE ATTENTION BEING GIVEN TO THE TRANSMISSION LINES TO AVOID LEAKAGES. AT THE SAME TIME MACHINES SHOULD BE MAINTAINED AT A SATISFACTORY LEVEL TO ENSURE THE OPTIMUM USE OF THIS POWER.

Summary and Conclusions

THE COST OF MAINTENANCE HAS NOT RECEIVED SUFFICIENT ATTENTION BY MANAGEMENT AND ACCOUNTANTS AND INDEED THIS IS EASILY SEEN BY THE PAUCITY OF TECHNICAL LITERATURE ON THE SUBJECT. THIS PAPER HAS SET OUT TO SHOW, IN PART, THE SIGNIFICANCE OF THE PROBLEM AND TO ILLUSTRATE WHAT THESE COSTS ARE AND HOW THEY CAN BE CONTROLLED. THE REAL COST OF MAINTENANCE MAY BE SAID TO BE EQUAL TO:-

(A) THE COST OF DIRECT MAINTENANCE, PLUS

(B) THE COST OF INDIRECT MAINTENANCE, WHICH INCLUDES:-

- (I) DOWNTIME COSTS
- (II) THE COST OF FAULTY AND SCRAPPED WORK,
- (III) THE EXTRA COST DUE TO POOR UTILISATION, AND
- (IV) THE COST OF PREMATURE OBSOLESCENCE.

IT MUST BE REALISED THAT ATTITUDES TOWARDS MAINTENANCE COSTING VARY SIGNIFICANTLY BETWEEN COMPANIES DEPENDING, FOR EXAMPLE, ON THE DEGREE

OF MECHANISATION, PLANT UTILISATION, AGE OF THE PLANT AND THE POLICY OF THE PARTICULAR COMPANY. GENERALLY FOR DIRECT MAINTENANCE COSTS AND RELEVANT MANAGEMENT ACCOUNTING STATISTICS, THE BASIC DATA NEEDED IS COMPARATIVELY SMALL AND IN EVEN POORLY MANAGED COMPANIES SHOULD BE AVAILABLE AND COVERS:-

(I) CORRECT TIME RECORDING FOR ALL MAINTENANCE LABOUR (TIME SHEETS).

(II) CORRECT RECORDING OF MATERIAL ISSUES (STORES REQUISITIONS).

(III) CORRECT RECORDING OF OVERHEAD (FINANCIAL ACCOUNTS), AND FROM THESE RECORDS A SUBSTANTIAL AMOUNT OF DATA CAN BE ASSEMBLED.

FROM THE ACTUAL COST AND STATISTICAL DATA EXTRACTED THE AREAS REQUIRING FURTHER INVESTIGATION SHOULD BE READILY SEEN BY:-

(I) COMPARISON AGAINST PRE-SET STANDARDS

(II) OBSERVATION OF ADVERSE TRENDS AND

(III) EXPERIENCE OF MANAGEMENT.

THROUGH THESE INVESTIGATIONS AND MANAGEMENT DISCUSSIONS DECISIONS CONCERNING FUTURE REMEDIAL ACTION SHOULD BE AGREED UPON. SHOULD OTHER COST REDUCTIONS BE NECESSARY CAREFUL CONSIDERATIONS WOULD BE GIVEN TO THE ABSOLUTE QUANTITY OF WORK REQUIRED TO BE DONE FOLLOWED BY CAREFUL ANALYSIS OF THIS WORK IN AN ATTEMPT TO FIND WHAT ECONOMIES CAN BE EFFECTED.

IN ANY DISCUSSION ON THE COST OF INDIRECT MAINTENANCE AGAIN IT MUST BE REALISED THAT THIS IS, IN ITSELF, A VAST SUBJECT WHICH COULD NOT POSSIBLY BE DEALT WITH IN ANY ONE PAPER. AS ALREADY POINTED OUT, CIRCUMSTANCES CAN AND DO VARY TO SUCH A LARGE DEGREE THAT ANYTHING MORE THAN A GENERALISATION OF POINTS ON THE SUBJECT WOULD ONLY TEND TO CONFUSE THE SITUATION. EACH COMPANY HAS ITS OWN PARTICULAR PROBLEMS BUT BY ADEQUATE COMMUNICATION BETWEEN THE MANAGER, THE ACCOUNTANT AND THE PLANT ENGINEER THERE IS NO DOUBT THAT REALISTIC CONCLUSIONS CAN BE REACHED. THESE DISCUSSIONS, OF COURSE, MUST TAKE PLACE ON THE HARD PLATFORM OF FACT AND POSSIBLY COVER THE AREAS ALREADY ILLUSTRATED, I.E.

(i) DOWNTIME AND LOST PRODUCTION

THIS INFORMATION CAN BE FOUND FROM A COMPARISON OF PRODUCTION ACHIEVEMENTS TO PLANNED OUTPUT WHERE A CORRECT PRODUCTION PLANNING AND CONTROL SYSTEM IS OPERATED. ADEQUATE PRODUCTION TIME BOOKING MUST BE AVAILABLE WHICH WILL GIVE DETAILS OF MACHINE BREAKDOWN, MACHINE UTILISATION AND MACHINE EFFECTIVENESS.

(ii) PREMATURE OBSOLESCENCE

FROM THE PLANT REGISTER (WHICH SHOULD BE MAINTAINED BY EVERY COMPANY) IT SHOULD BE SEEN AT WHAT STAGE OF TIME THE PLANT SHOULD BE CONSIDERED SCRAP ACCORDING TO NORMAL DEPRECIATION RATES. ANY PIECE OF PLANT OR EQUIPMENT SCRAPPED BEFORE ITS AGREED LIFE TIME SHOULD BE SURVEYED AND THE REASON FOR THIS PREMATURE OBSOLESCENCE REPORTED UPON.

(iii) FAULTY AND SCRAPPED WORK

BY THE USE OF CORRECT INSPECTION PROCEDURES THE CAUSE OF THE FAULTY OR SCRAPPED WORK CAN BE DETAILED AND

THE INCIDENCE OF PLANT RESPONSIBILITY DETERMINED.

(iv) Fuel and Power

THE EXTRA COST INCURRED DUE TO PLANT INEFFICIENCY MAY BE SLIGHTLY MORE DIFFICULT TO DETERMINE BUT AGAIN IT IS POSSIBLE BY INDIVIDUAL MEASUREMENT OF PLANT REQUIREMENTS AND MACHINE RUNNING TIMES.

WHEN THE TYPE OF MAINTENANCE SYSTEM TO BE PRACTISED BY A COMPANY IS CONSIDERED IT IS EQUALLY IMPOSSIBLE TO STATE THAT ONE SYSTEM IS BETTER THAN ANOTHER. ONCE AGAIN THIS DEPENDS UPON THE COMPANY, ITS DEGREE OF MECHANISATION AND TYPE OF OPERATION. IT MUST BE A DECISION BY THE MANAGEMENT AFTER HAVING THEIR ATTENTION BROUGHT TO THE METHODS AVAILABLE TOGETHER WITH INFORMATION ON THE POSSIBLE PHYSICAL AND COST ADVANTAGES AND DISADVANTAGES OF EACH METHOD.

TO CONCLUDE, ACCOUNTING FOR THE REAL COST OF MAINTENANCE IS A COMPLEX TASK AND IT IS MORE THAN PROBABLE THAT DIFFERENT MANAGEMENTS HAVE QUITE DIFFERENT APPROACHES TO THE SAME PROBLEMS.

THIS IS EQUALLY TRUE FOR MANY OTHER ACCOUNTING EXERCISES. INVARIABLY, HOWEVER, THE FINAL ANSWERS TEND TO BE FAIRLY CLOSE TO EACH OTHER AND ANY DIFFERENCES BETWEEN ALTERNATIVES MAY BE SUFFICIENT TO SHOW WHICH ACTION IS ECONOMICALLY THE BETTER. IT MUST BE REMEMBERED THAT ACCOUNTING AND STATISTICAL INFORMATION IS A RECORD AND INTERPRETATION OF WHAT HAS HAPPENED AND GIVES A BASIS FOR DISCUSSION ON THE FUTURE ACTION REQUIRED. IT IS NOT AN END IN ITSELF AND IT IS IMPERATIVE THAT FULL AND FRANK COMMUNICATIONS EXIST BETWEEN ALL MANAGEMENT CONCERNED IN ORDER THAT THE CORRECT SOLUTIONS BE REACHED.


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