1.0 Contents

2.0 US Patents

See appendix for abstracts of these patents

4,809,102.	Disk File with Air Filtration System.	Hatchett, MR Heath, JS	2/89
4,748,532.	Transformer Coupled Power Switching Circuit.	Commander, RD Fenton, BP Ramage, JG	5/88
4,748,532.	Disk File with In Hub Motor.	Commander, RD Ramage, JG Fenton, BP	5/88
4,743,995.	Integrated Injection Logic Output Circuit.	Castle, FE Hatchett, CP Hatchett, MR Heath, JS	5/88
4,740,720.		Newman, EL	4/88
4,660,117.	Disk Cartridge Having a Flexible Disk Storage Medium and a Disk File Including such a Cartridge.	Carey, PD Cutts, SJ Heath, JS White, DE Evans, DA	4/87
4,599,670.	Control of Relative Humidity in Machine Enc.	Bolton, IW	7/86.
4,594,622.	Track Following Servo System for a Disk File.	Wallis, CN	6/86.
4,578,723	Head Positioning System with Automatic Gain Ctrl.	Betts, AJ Elliot, PJ	3/86
4,553,320.	Rotor for a Dynamo Electric Machine and Method of Making Same.	Bryant-J, KC Dickie, HG Vaughan, EV	11/85.
4,511,938.	Magnetizable Recording Disk and Disk File Employing Servo Sector Head Positioning.	Betts, AJ	4/85.

4,412,165.	Sampled Servo Position Control System.	Case, WJ Wallis, CN	10/83.
4,408,238.	Magnetic Head Arm Assembly.	Hearn, AR	10/83.
4,398,167.	Limited Angle Electric Rotary Actuator.	Dickie, HG Hearn, AR Heath, JS	8/83.
4,401,933.	Motor Control System for a Single Phase Induction Motor.	Davy, JC Fenton, BP Ramage, JG	8/83.
4,297,734.	Sampled Data Servo Positioning System.	Laishley, WJ Taylor, JR	10/81
4,195,322.	Record Playback Head and Data Storage Apparatus	Cox, AR Pascual, R Rigbey, LJ	3/80
4,185,314.	Record Disk Cartridge Having Eject Spring within Cartridge.	Hatchett, MR Rigbey, LJ	1/80
4,167,269.	Flexible Record Disk Signal Storage Apparatus.	Hatchett, MR Rigbey, LJ	9/79
4,145,725.	Electromagnetic Actuator.	Wallis, CN	3/79
4,131,199.	Record Disk Cartridge.	Hatchett, MR Rigbey, LJ	12/78
4,120,505.	Stabilizing Backing Plate for a Flexible Disk Store.	Cox, AR Hatchett, MR Rigbey, LJ	10/78
4,103,314.	Motion Control System.	Case, WJP	7/78
4,115,823.	Track Following Servosystem for Data Storage Apparatus.	Commander, RD Gardner, PAE Taylor, JR	9/78
4,117,737.	Drive Belt Loading System.	Mulholland, PJ Thomas, CA	10/78
4,072,990.	Servo Positioning System for Data Storage Apparatus.	Case, WJP Duncan, R	2/78

4,068,269.	Positioning System for Data Storage Apparatus and Record Medium for Use Therewith.	Commander, RD Taylor, JR	1/78
4,054,931	Gas filtering arrangement for magnetic magnetic disk information storage apparatus.	I Bolton I George	10/77
3,936,876.	Rotatable Data Storage Apparatus with Track Selection Actuator Having Multiple Velocities.	Taylor, JR	2/76
3,939,438.	Phase Locked Oscillator.	Taylor, JR	2/76
3,849,800.	Magnetic Disk Apparatus.	Cuzner, DE Dodman, COR Heath, JS Rigbey, LJ Taylor, JR	11/74
3,839,734.	Air Turbulence Utilized to Clear Disk.	George, IC Luland, NW	10/74
3,635,608.	Magnetic Disk Assembly.	Crouch, HS Dickie, HG Metcalfe, AH Rigbey, LJ	2/72
3,731,177.	Disk File Head Movement Control System.	Commander, RD Dixon, JD	5/73
3,668,487.	Electromagnetic Actuated Detent Apparatus.	Cuzner, DE Rigbey, LJ Smith, GM	06/72
3,567,960.	Gating Circuit For Displaced Pulses.	Owen, CE Wallis, CN	03/71
3,508,117.	Circuit Assembly.	Cuzner, DE	04/70

3.0 UK Patents

See appendix for abstracts of these patents.

UK968013.	Address Mark Detector in Wopac.	Commander, RD	04/68
UK968018.	A Method of Applying a Force to a Read/ Write Head.	Cresswell, DJ Rigbey, LJ Lipscombe, JD	05/68
UK968004.	Disk Cartridge for DOLPHIN.	Rigbey, LJ Crouch, HS Dickie, HG Metcalfe, AH	05/68
UK968009.	A Method to Accurately Control the Speed of Step Motors.	Heath, JS	06/68
UK967010.	Gating Circuit.	Owen, CE Wallis, CN	06/68
UK969014.	Container for Magnetic Recording Disk.	Davy, JH Dickie, HG Metcalfe, AH Rigbey, LJ	11/69
UK969024.	Electromagnetic Actuator.	Cuzner, DE Rigbey, LJ Smith, GM	06/70
UK969025.	Fixed Flyback Principle in a Double Frequency Data Separator Using a Data Window Separation Technique.	Owen, CE	09/70
UK971001.	Disk File Head Movement Control System.	Commander, RD Dixon, JD	02/71
D221,605.	Container for Magnetic Recording Disk.	Davey, JC Dickie, HG Metcalfe, AH Rigbey, LJ	08/71

UK970003.	Magnetic Disk Apparatus.	Cuzner, DE	04/72
		Heath, JS	
		Rigbey, LJ	
		Crouch, HS	
		George, IC	
		Dodman, CO	
UK971008.	Data Storage Apparatus.	George, IC	11/72
		Luland, NW	
UK972005.	Improvements in Electric Digital Data Processing Systems.	Saunders, AG	02/73
UK971007.	Data Storage Apparatus.	Taylor, JR	06/73
UK973003.	A Reading and/or Reproducing Head Assembly for a Disk Store.	Bosier, MH	12/73
		Pollard, CA	
UK972001.	Data Storage Apparatus.	Saunders, AG	02/74
		Crouch, HS	
		Dodman, COR	
UK973004.	Improvements in or Relating to Phase Locked Oscillators.	Taylor, JR	07/74
UK973005.	Clean Gas System for Magnetic Disk File.	Bolton, IW	10/75
		George, IC	
UK974004.	Improvements in Servo Positioning Systems for Magnetic Disk Recording.	Martin, DH	09/75
UK974007.	Actuator Mechanism for Disk Storage Apparatus.	Rigbey, LJ	10/75
		Wallis, CN	
UK973011.	Data Storage Apparatus.	Case, WJP	10/75
		Commander, RD	
UK973006.	Data Storage Apparatus.	Commander, RD	10/75
		Taylor, JR	
UK974007	Printed circuit	Rigbey, LJ	
		Wallis, CN	
1,499,268	Servo Apparatus	Case WJP	06/76
UK975011.	Belt Drive Arrangement.	Mulholland, PJ	07/76
		Thomas, CA	
UK975014.	Disk File Access Method Using Sample Position Signal.	Case, WJP	10/76

UK975016.	Stiffening a Rotatable Disk.	Hatchett, MR	12/76
		Rigbey, LJ	
UK976014.	Controlled Surface Finish for Flexible Disk Stabilizing Plate.	Cox, AR	03/77
		Hatchett, MR	
		Rigbey, LJ	
UK976013.	Data Storage Apparatus.	Commander, RD	04/77
		Gardner, PAE	
UK976012.	Electromagnetic Actuator.	Wallis, CN	06/77
UK977017	Head profile for close flying flexible discs.	Rigbey, LJ	
		Cox, AR	
		Pascual, R	
UK977025	Cartridge loading mechanism	Hatchett, MR	
UK979001.	Control of relative humidity in machine enclosures.		01/79
UK987001.	Disk file employing dual filters.	G Dixon	01/87
		Gibbons, R	
		Bolton, I	
UK989022	D.C. motor driven centrifugal fan.	Gaunt, D	
		Bolton, I	
		Russell, DR	
UK990005	Multi unit electrical apparatus with forced air cooling.	Bolton, I	
		Castle, F	
		Gaunt, D	
UK990006	Data storage system with device dependent flow of cooling air.	Bolton, I	
		Gaunt, D	
		Humper, A	
		Gray, D	

4.0 UK Disclosures

UK869088.	Voice Coil Bounce Prevention.	Cuzner, DE Smith, GM Rigbey, LJ	05/69
UK869004.	Dolphin File Cartridge.	Metcalfe, AH Rigbey, LJ Davey, JC Dickie, HG	03/70
UK869033.	Design and Process for Producing an Advanced Disk Head Bulk Ferrite Type.	Vigar, JML Jones, AS Kington, BW Owen, CE Pascual, R Smith, DG	02/69
UK869174.	Dynamic Thermal Compensation of Magnetic Recording Head Position.	Davy, JC Heath, JS	10/69
UK875197	Algorithmic track capture and following method	Craft, DJ	
UK876101	Signal processing circuit for disc files	Taub, DM	
UK876153	Circuit for correcting pulse asymmetry	Taub, DM	
UK876182	Skewed axis actuator	Carmichael M	
UK876198	Head alignment checking device	Pascual, R	
UK876233	Data recovery for Miller-encoded recordings.	Taub, DM	
UK877058	Tool for handling flexible disc and hub assembly.	Cox, AR Holloway, JF	
UK877079	Improved alignment of interference microscope.	Pascual, R	
UK877080	Light interference fringe contour change decoding.	Pascual, R	
UK877081	Constant focus point microscope object alignment table.	Brew, TP Hatchett, MR Pascual, R	
UK877124	Disc handling tool	Cox, AR Holloway, JR	
UK877137	Glass-ferrite-sandwich recording head.	Farran, J	

UK877152	Capacitance probe and transparent head.	Carmichael, M	
		Feliss, NA	
UK877156	Fixed slotted platform for Sprat type disc file	Carmichael, M	
		Feliss, NA	
UK877159	Overlay device for disc defect mapping	Holloway, JF	
		Hatchett, MR	
UK877186	T2 code	Taub, DM	
UK877234	Magnetic surface defect overlay	Holloway, JF	
UK877252	Head stabliser setting tool	Carmichael, M	
		Feliss, NA	
UK877293	Stabilsed head with self compensating vacuum control	Holloway, JF	
		Rigbey, LJ	
		Saunders, MJ	
UK877299	Head cleaner in cartridge for flexible discs.	Rigbey, LJ	
		Brew, TP	
UK879004	Dual arm for rotary head positioner.	Bolton, I	
		....	
UK879094	Adjusting pressure in disc enclosure.	Bolton, I	
		....	
UK870143	Cooling of Redwing HDAs.	Bolton, I	
		....	
UK888007	Double banked fans.	Bolton, I	
		....	

5.0 People Working for or in Storage

Some names from this list may be missing as complete records were not maintained and this list was very hard work on list kept by Roger Ayres. However he left Storage in 1987 so the information after that date may be of inferior grade.

		Years In Storage -----	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Abbley	Liz	84-89																		x	x	x	x	x	x	
Allen	C	82-82																x								
Anderson	Andy	73-86							x	x	x	x	x	x	x	x	x	x		x	x					
Apperley	Norman	81-															x	x	x	x	x	x	x	x	x	x
Atkey	Pete	73-86							x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Atkinson	Bruce	82-88																x	x	x	x	x	x	x		
Avgherinos	Bob	81-82															x	x								
Ayres	Roger	73-86							x	x			x					x	x	x	x	x				
Bagwadia	Fil	77-84											x	x	x	x	x	-	x	x						
Bailey	Claire	89-																							x	x
Bailey	Nick	87-																					x	x	x	x
Baites	J	87-87																					x			
Baker	Roger	88-90																						x	x	x
Baker	R J	85-85																			x					
Baker	Peter J	67-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-
Baker	Pete	73-							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ball	Andrew	87-89																					+	+	+	
Banger	John	81-83															x	x	x			x				
Baker	C	85-85																			x					
Baker	Roger	85-89																			x			x	x	
Barnes	D	86-86																				+				
Basher	Ray	73-							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Beaman	K	84-84																		x	x					
Beer	Reg	82-																x	x	x	x	x	x	x	x	x
Betts	Alan	71-					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bevis	D	80-85														+		+		+	+	+				
Bishop	Nick	80-85														+	+	+	x	x	x					
Biddlecombe	James	88-																						x	x	x
Billington	Mark	81-88															x	x	x	x	x	x	x			
Black	Richard	87-90																					x	x	x	x
Bland	John	85-89																x		x	x	x	x	x		
Bloor	Margaret	82-82																x								
Blythin	Paul	73-89							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Bolton	Ivor	72-						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bond	John	82-86																x		x	x	x				
Bonson	Merv	67-71	x	x	x	x	x																			
Bosier	Maurice	73-							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Boswell	Graham	76-										+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Bowker	Terry	73-83							x	x	x	x	x	x	x	x	x	x	x							

		Years In Storage	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

Brew	Terry	75-77									+	+	+													
Brophy	Roy	73-							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brown	Val	84-85																		x	x					
Brown	W	85-85																			x					
Bryant-Jeffries	Keith	82-85																x		x	x					
Buck	Samantha	84-85																		x	x					
Burnley	Moira	82-85																x		x	x					
Bush	Mike	82-82																x								
Butterworth	Colin	85-																			x	x	x	x	x	x
Buurman	L	84-85																		-	x					
Callaghan	J	84-86																		x	x	x				
Cameron	Andrew	82-																x	x	x	x	x	x	x	x	x
Carey	John	73-							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Case	Bill	67-	x	x	x	x	x	x	x	x	x	x	x	-	-	x	x	x	x	x	x	x	x	x	x	x
Cass	Elfriede	82-																x	x	x	x	x	x	x	x	x
Castle	Frank	79-													x	x	x	x	x	x	x	x	x	x	x	
Cath	Roger	85-																			x	x	x	x	x	x
Catling	Robert	87-89																					x	x	x	
Challoner	Frank	82-																x	x	x	x	x	x	x	x	x
Chamberlain	Dave	79-													x	x	x	x	x	x	x	x	x	x	x	x
Chambers	Dave	77-82											x	x	x	x	x	x								
Chaplin	Russ	76-79										+	+	+	+											
Chapman	R	74-74								x																
Christmas	A	84-84																		+						
Clare	Don	84-85																		+	+					
Clark	Alan	82-85																x		x	x					
Clark	Peter	70-70											x													
Clauson	W	82-82																+								
Clayton	D	84-86																	x	x	x					
Codrai	Colin	82-																x	x	x	x	x	x	x	x	x
Coldicott	Tony	81-89															x	x	x	x	x	x	x	x	x	
Cole	R	84-86																		+		+				
Coles	Richard	72-						x	x	x	x	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x
Commander	Bob	67-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Conway	Jon	88-																								
Cook	A	84-85																		x	x					
Cook	R F	84-85																		x	x					
Cooke	Brian	68-85		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					
Cooper	Roger	81-															x	x	x	x	x	x	x	x	x	x
Cooper	John	85-85																			x					
Coombes	C	82-82																x								
Costabile	Bob	77-77											+													
Cowburn	Tony	89-																							x	x
Cox	Alan	75-83									x	x	x	x	x		x	x	x							
Craft	Dave	74-79								x	x	x	x	x	x											
Craggs	Steve	85-85																			x					
Cresswell	Derek	66-78	x	x	x	x	x	x	x	x	x	x	x	x												
Crocker	F	84-84																		x						
Crossland	Pete	82-																x	x	x	x	x	x	x	x	x
Crouch	Howard	67-85	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					
Crumplin	Pete	76-82										x	x	x	x	x	x	x								
Cruttenden	John	85-																			x	x	x	x	x	x
Culverhouse	Robin	82-85																x		x	x					
Cutts	Stan	81-															x	x	x	x	x	x	x	x	x	x
Cuzner	Dave	67-72	x	x	x	x	x	x																		

		Years In Storage	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

Dailey	Dan	73-87							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
Dale	Jim	74-85								x			x					x		x	x					
Davey	John	74-								x								x		x						
Davey	Martin	89-																							x	x
Davies	Ieuan	82-86																x		x	x	x				
Dew	Graham	84-85																		x	x					
Diaz	J	84-84																		+						
Dickie	Graham	73-							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Dickin	Frank	73-85							x	x	x	x	x	x	x			x		x	x					
Dicks	T N	85-85																			x					
Dixon	Gordon	82-																x	x	x	x	x	x	x	x	x
Dobson	Gaye	82-82																x								
Dodman	Charles	69-82		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
Dombey	Mark	89-																							x	x
Dorey	Juliet	83-84																	x	x						
Dossett	Roger	73-86							x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Downey	T	82-82																+								
Dunman	John	73-86							x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Dunn	Tony	77-86											x					x		x	x	x				
Durbin	Maurice	82-82																x								
Elggren	K	-																		+						
Ellingson	Gene AE	82-83																+								
Elliott	Peter	74-89								x			x					x		x	x	x	x	x	x	
Elliott	J E	84-																		x	x					
Elliott	J F	74-77								x			x													
Ellis	Shel	69-70																								
Evans	A	85-																		+	+					
Evans	Tony D	75-87									x	x	x		x	x	x	x	x	x	x	x	x			
Everett	Vic	87-																					x	x	x	x
Farran	John	75-									x	x	x	x	x			x	x	x	x	x	x	x	x	x
Fennell	John	74-87								x			x							x	x	x	x			
Fenton	Brian	82-85																x		x	x					
Ferrier	Jeff	85-86																			+	+				
Fletcher	Bill	67-		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Frankland	Mark	84-85																		x	x					
Francis	Huw	88-																						x	x	x
Fraser	George	73-86							x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Freeman	C	82-82																+								
Friesen	Bob	68-70		+	+	+																				
Frith	D	82-85																x		x	x					
Furniss	Steve	84-85																		x	x					
Galbreath	G	82-82																x								
Gallagher	K	82-84																+		+						
Gardiner	A	82-82																x								
Gardiner	Fred	68-83							x	x	x	x	x	x	x	x	x	x	x							
Gardner	A	84-86																		x	x	x				
Gardner	Peter	73-74							x	x																
Gardner	Tony	78-													x	x	x	x	x	x	x	x	x	x	x	x
George	Ian	68-85		x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	x	x		x			
Gibbs	Mike	85-																x	x	x	x	x	x	x	x	x
Giles	Chris	85-																			x	x	x	x	x	x
Gillard	Les	73-							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gillett	J	85-																				x				
Godwin	I	86-86																				+				
Golding	A J	82-84																+		+						

		Years In Storage	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

Goslin	J	74-74								x																
Graham	T A	82-85																x		x	x					
Grainger	Pete	85-																			x		x	x	x	x
Grainger	Paul	85-																			x		x			
Grandison	Pete	73-							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gray	Mandy	89-																							x	x
Greaves	Howard	87-88																					x	x		
Guenther	D	77-77											x													
Guest	John	71-73					+	+	+																	
Haddow	Brian	68-75		x	x	x	x	x	x	x	x															
Hall	Dave	87-																					x	x	x	x
Hamilton	Ian	88-																						x	x	x
Hamilton	J M	77-77											x													
Harding	Colin	77-77											x													
Hare	Les	85-																			x	x	x	x	x	x
Hardman	Pete	82-85																+		+	x					
Hardy	Paul	73-77							x	x			x													
Hartley	John	82-86																x	x	x	x	x				
Harwood	Alan	85-																x	x	x	x	x	x	x	x	x
Hatchett	Colin	73-87							x	x			x					x			x	x				
Hatchet	Mike	69-90			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Hatchett	Pete	71-86					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Hatt	Trevor	73-77							x	x			x													
Hawkins	Brian	68-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Hayes	Norman	73-85							x	x	x	x	x	x	x	x	x	x		x	x					
Hayward		85-85																			x					
Hearn	Colin	80-														x	x	x	x	x	x	x	x	x	x	x
Hearn	Tony	74-								x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-
Heath	John	68-		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-
Henderson	Ian	75-79									x	x	x	x	x											
Heneghan	Mike	85-																x		x	x					
Herbert	John	66-70	x	x	x	x	x																			
Herivel	W	87-																					x			
Helyar	Harry	67-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Heinzelman	G	82-82																+								
Higgs	Len	82-85																x			x					
Hill	Norman	81-89															x	x	x	x	x	x	x	x	x	
Hockley	Jack	-							x																	
Hodges	Nick	82-82																x								
Holloway	John	75-									x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Holmes	J J	73-73							x																	
Hooper	J	86-																				+				
Horn	Graham	73-84							x	x	x	x	x	x	x	x	x			x						
Houseman	Steve	74-87								x	x	x	x	x	x	x	x	x	x	x	x	x	x			
Hughes	Martin	73-78							x	x	x	x	x	x												
Hulme	Pete	86																				+				
Hunt	J	84-84																		+						
Ingram	Diane	79-81													x	x	x	x								
Ivinson	Paul	85-																x		x	x					
Jackson	Steve	89-																							x	x
James	Dave	82-82																+								
Jenkins	W	74-74								x																
Johnson	Eric	88-																						x	x	x
Johnson	Jeremy	87-89																					x	x	x	
Jones	Ivor	83-																	+	+	x	x	x	x	x	x

		Years In Storage	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Jones	Wyn	82-																x	x	x	x	x	x	x	x	x
Judd	Ian	86-																				x	x	x	x	x
Kahler	D	84-85																		+	+					
Karklys	R	82-82																+								
Kelsey	W	84-85																		+	+					
Kelway	Carolla	73-80							x	x	x	x	x	x	x	x										
King	Geof	72-						x	x	x													x	x	x	x
King	M	74-74								x																
Kirby	H	74-74								x																
Kirkman	Dave	87-																					x	x	x	x
Knight	Peter	82-82																x								
Krolak	Ray	88-89																						+	+	
Kvjatkovski	Vlad	82-89																x		x	x	x	x	x	x	
Laishley	Bill	73-							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lambell	Steve	-																								
Lambeth	Shaun	84-85																		+	+					
Lawler	John	77-											x	x	x	x	x	x	x	x	x	x	x	x	x	x
Leaper	M	74-74								x																
Learman	John	88-																						x	x	x
Leary	Steve	87-																					x	x	x	x
Legg	Steve	88-																						x	x	x
Leggett	Paul	84-87																		+	x	x	x	x		
Lennard	J	77-77											x													
Letellier		84-84																		+						
Lewry	Chris	84-84																		x	x					
Lipscombe	John	67-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Levine		77-78											+	+												
Llopis	Pedro	89-90																							+	+
Lloyd	G	84-85																		+	+					
Lowe	Cathy	82-82																x								
Luland	Norman	68-74		x	x	x	x	x	x																	
Lumsden	Judith	86-																				x				
MacHaffee	Maureen	74-74								x																
Mackenzie	I	74-74								x																
Maddock	Bob	87-																					x	x	x	x
March	L	73-73							x																	
Marsh	Peter	82-85																x		x	x					
Marshall	Bruce	87-																					x	x	x	x
Marshall	Stuart	82-84																x		x						
Martin	Dave	87-																					x	x	x	x
Martin	Derek	73-							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Martin	Gareth	82-85																x			x					
Martin	R	82-84																+		+						
Martinelli	Lou	84-85																		x	x					
Mathoulin	Ira	77-84											x	x	x	x	x	x		x						
Mattsen	D	85-85																			+					
Maxted	Harry	87-																					x	x	x	x
Mayes	Richard	81-87																x	x	x	x	x	x			
McBurney	N	84-85																		+	+					
McGuckian	Jack	79-													x	x	x	x	x	x	x	x	x	x	-	-
McGregor	D	84-84																		+						
McKee	Barry	84-86																		+	+	+				
McSloy	B	84-84																		+						
Meikle	Alan	82-84																x		x						
Mercer	Sue	84-86																		x	x	x				
Middleton	Brian	89-																							x	x

		Years In Storage	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

Miessler	Milan	73-83							x	x	x	x	x	x	x	x	x	x	x							
Miles	Mike	85-																			x	x	x	x	x	x
Millard	Paul	82-																x	x	x	x	x	x	x	x	x
Miller	Ira	73-74							x	x																
Miller	Simon	88-																						x	x	x
Milward	Dave	84-88																		x	x	x	x	x		
Mitchell	I	85-85																			x					
Morgan	Neil	88-																						x	x	x
Morgan	R	74-74								x																
Morgan	Rhyd	73-86							x	x	x	x	x	x	x	x	x	x	x	x	x					
Moseley	Maureen	85-																			x	x	x	x	x	x
Mulholland	Pat	72-82							x	x	x	x	x	x	x	x	x	x								
Mullins	Bill	68-		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Mulvaney	D	77-77											+													
Murphy	M	82-82																x								
Nash	Pete	82-																x	x	x	x	x	x	x	x	x
Nelson	R	82-84																+		+						
Newman	Eric	88-								x	x	x												x	x	x
Newman	John	83-89																	x	x	x	x	x	x	x	
Newmarch	Dave	-																								
Nicholas	Bob	84-																		+	x	x	x	x	x	x
Nixon	D	84-84																		+						
Noble	Bill	70-85				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					
O'Dowd	Noel	85-85																			x					
O'Niel	Fred	73-85							x	x	x	x	x	x	x	x	x	x		x	x					
O'Niel	Pat	72-82							x	x	x	x	x	x	x	x	x	x								
Ogilvie	Tom	89-																							x	x
Oliver	Yvonne	75-82											x					x								
Orchard	J R	82-82																x								
Palmer	Mike	83-																		x	x	x	x	x	x	x
Parsonage	John	84-85																		+	+					
Partner	Stan	84-84																		x						
Pascual	Rafe	-		x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Patchin	Ray	82-85																x		x	x					
Patel	R	85-85																			+					
Patten	Andy	73-85							x									x		x	x					
Patton	Albert	73-82							x									x								
Peach	Len	66-70?	x	x	x	x																				
Perry	Alan	87-																					x	x	x	x
Petherick	T	85-85																			x					
Petersen	Wes	-						+	+																	
Pidden	J	84-84																		x						
Piggott	Chris	86-																				x	x	x	x	x
Pinter	J	-																+								
Polwarth	Don	82-																x	x	x	x	x	x	x	x	x
Pond	Peter	-											x					x	x	x	x	x	x	x	x	
Postles	Colin	-																		x	x	x	x	x	x	x
Powell	G	-								x								x		x						
Prager	Edward	-																					x	x	x	x
Presly	G	85-																			+					
Purkiss	Alan	-								x			x													

		Years In Storage	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Quick	Merv	85-85						+	+	+	+										x	+	+			
Rahman	A	74-74								x																
Ralph	N	-																x		x	x					
Ramage	John	73-86							x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Rankin	Howard	85-																x	x	x	x	x	x	x	x	x
Ratcliffe	Chris	73-							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Read	D	84-85																		x	x					
Read	S	74-74								x																
Reed	Dave	84-84																			+					
Reed	L E	84-86																		+	+	+				
Rees	M	82-82																+								
Reeves	Mark	81-															x	x	x	x	x	x	x	x	x	x
Reid	G S	85-85																			+					
Richmond	E	84-85																		+	+					
Richter	G	82-84																+		+						
Rigbey	Leo	66-78	x	x	x	x	x	x	x	x	x	x	x	x												
Robinson	C	82-84																+		+						
Robinson	Derek	76-										x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rolls	Richard	82-																x	x	x	x	x	-	x	x	x
Roskell	John	84-85																		x	x					
Rutland	Jill	83-84																	x	x						
Sankey	Bob	86-																				+	+	+	+	+
Sangha	Harmel	86-																				x	x	x	x	x
Sansome	Paul	87-																					x	x	x	x
Sault	Steve	82-																x	x	x	x	x	x	x	x	x
Saunders	Alan	69-			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Saunders	Harvey	79-84													x	x	x	x	x	x						
Saunders	Mike	70-83				x	-	-	-	x	x	x	x					x	x							
Saunders	Ron	68-		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Savage	Colin	82-84																x		x						
Saverimuthu	Logan	-																								
Scrimshaw	D	84-84																		x						
Sears	John	71-					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sebborn	Dave	82-																x	x	x	x	x	x	x	x	x
Sergeant	M C D	84-85																		+	+					
Shah	Vinay	85-																			x	x	x	x	x	x
Shankland	Anne	84-85																		x	x					
Shankman	G S	84-85																		+	+					
Sheen	D	77-86											x									x				
Shidler	Karl	84-84																		+						
Shih	Alex	84-85																		+	+					
Short	Tony	84-																		x	x	x	x	x	x	x
Short	W A	85-86																			x	x				
Singh	R	74-74								x																
Skelly	J	73-73							x																	
Smillie	R	82-82																x								
Smith	Dave	77-				+	+	+	+	+	+	+	x	x	x	x	x	x	-	-	x	x	x	x	x	x
Smith	D J	85-85																			+					
Smith	Eric	82-																x	x	x	x	x	x	x	x	x
Smith	Ken	73-86							x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Smith	J	82-84																x		x						
Smith	P D	82-84																+		+						
Steel	John	84-86																		x	x	x				

		Years In Storage	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

Stubbens	Frank	84-85																		x	x					
Sung	Y	82-84																+		+						
Sykes	A	84-84																		+						
Symon	Alistair	89-																							x	x
Symonds	I K	82-82																x								
Szatkowski	Jan	87-																					x	x	x	x
Taub	Matt	75-77									+	+	+													
Taylor	John	68-		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-
Thiessen	D	82-82																x								
Thomas	Chris	84-85																		x	x					
Thomas	David	88-																						x	x	x
Thomas	Vince	87-90																					x	x	x	x
Thompson	S	82-82																+								
Till	R	84-85																		+	+					
To	Wallace	82-																x	x	x	x	x	x	x	x	x
Tobie	D	82-82																+								
Tomlin	John	88-																						x	x	x
Troke	Jim	67-78	x	x	x	x	x	x	x	x	x	x	x	x												
Trotter	V	75-75											x													
Underhill	Ann	85-																		x	x	x	x	x	x	x
Veal	John	73-86							x	x	x	x	x	x	x	x	x	x		x	x	x				
Venturi	Ron	87-																					x	x	x	x
Vigars	Jeff	82-84																x		x						
Vines	Terry	84-85																		x	x					
Vint	Ron	85-																			x	x	x	x	x	x
Wakeford	Nigel	78-												x	x	x	x	x	x	x	x	x	x	x	x	x
Walker	M	82-82																x								
Wallis	Chris	66-	x	x	x	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Wall	Frank	88-																						x	x	x
Ward	Chris	82-90																x	x	x	x	x	x	x	x	x
Watton	Robin	81-															x	x	x	x	x	x	x	x	x	x
Waugh	Robin	82-86																x		x	x	x				
Wenman	Mike	74-75										x	x													
West	E J W	72-85								x											x					
West	R	72-87								x													x			
Wharton	Colin	82-																x	x	x	x	x	x	x	x	x
Wheeler	W	82-82																+								
White	Dave	81-															x	x	x	x	x	x	x	x	x	-
White	Peter	73-73							x																	
White	John	74-								x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
White	J H	82-85																x		x	x					
Whitehill	R	82-84																+		+						
Whitfield	Gillian	88-																						x	x	x
Wilderspin	R	85-85																			x					
Wilks	Ron	73-81							x	x	x	x	x	x	x	x	x									
Williams	O	74-74								x																
Williams	Kevin	85-85																			x					

		Years In Storage	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Williams	Roy	82-82																x								
Williams	Vic	77-77											x													
Wilson	D	74-82								x								x								
Wong	David	84-																		x	x	x	x	x	x	x
Wortley	Chris	84-85																		x	x					
Wright	J	82-84																+		+						
Wright	K	82-84																+		+						
Wright	L A	85-85																			x					
Wright	Laurence	84-88																		x						
Wright	Peter	89-																							x	x
Wyatt	D	71-					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Yates	M	83-85																	+		+					
Young	Julian	71-																								
Young	Simon	79-80													x	x										

6.0 Appendix

6.1.1 Patent Abstracts

4,809,102.

A disk file of the kind employing a vented hub assembly and slotted spacers between disks to provide a passage for circulatory airflow employs a filter assembly extending circumferentially around the axial region of the hub assembly. The primary path for airflow is from a high pressure region at the periphery of the disks, through the filter assembly into the vented hub assembly and out again via the slotted spacers. A parallel leakage path between the filter itself and the hub assembly is limited by making the separation between a substantially planar surface of the filter assembly and the adjacent disk uniform and very small. Airflow rates through the filter are consequently enhanced.

4,748,532.

A power switching circuit for switching power repetitively to a load at a relatively low frequency employs a power switching device which is driven across an isolating transformer interface. The drive signals are high frequency pulse signals which are modulated with the low frequency switching information, the modulations being detected in the secondary circuit of the transformer. Such an arrangement affords isolated driving with fast switching edges and requires only a small transformer. Power for the detection circuit is derived by rectification of the high frequency signals induced in the transformer secondary.

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4,743,995.

A disk file comprises a disk stack subassembly and a head positioning actuator each mounted on opposite sides of a central box frame. The disk stack subassembly has a non-rotating central spindle and an in-hub electric motor whose stator is mounted on the spindle. The rotor of the motor is mounted internally of a hub supported for rotation about the spindle by two bearings at opposite ends of the spindle. A stack of disks is mounted externally on the hub. The box frame is open to one side and the opposite ends of the stationary spindle are located and fixed in the frame so that the disk stack subassembly spans the open side. Because of the symmetry and rigidity of the design, susceptibility to thermal or vibration induced misregistration is reduced. Finally a cover completes the enclosure.

4,740,720.

An I/2/L output circuit is described for supplying current to an output node of a plurality of I/2/L blocks in order to ascertain the logic condition at the output node. The output circuit includes a standard I/2/L gate with an input connection to the semiconductor region comprising both the lateral injector transistor collector electrode and the vertical switching transistor base electrode, and an output connection from the semiconductor region comprising one of the collectors electrodes of the switching transistor. The gate output being used to control two identical current sources one of which supplies current to the input of a simple current mirror having its output connected to the gate input. The other current source being connected to the output node of the logic blocks. The provision of a current feedback loop around the I/2/L gate in this way ensures that, upon stabilization, the current from the current source into the output node is very close in value to the internal injector current of the I/2/L gate.

4,660,117.
A disk cartridge file employs a cartridge which is a rigid enclosure containing a flexible information storage disk mounted on a drive hub. One wall of the cartridge comprises a central hub drive aperture and an arcuate radially extending access slot for a read/write transducer. In operation, the disk flies over the inner surface of the apertured wall on an air bearing. This surface is planar over a major portion including the access slot but has a smoothly contoured raised land bordering the slot on the downstream side thereof. When employed in combination with a transducer of the ring stabilized type which projects through the slot and penetrates into the normal path of the medium, the transducer is coupled with the medium in a stable closely spaced air bearing relationship. The raised land extends the range of penetration over which the transducer is coupled, particularly at the outer diameter of the disk.

4,599,670.
Relative humidity within a machine enclosure is controlled by means of a desiccant and a circulatory breather flow through the enclosure walls. The desiccant absorbs moisture during power off periods to keep the relative humidity down. During power on periods the enclosure temperature rises, which drives off the absorbed moisture from the desiccant. Operation of the machine also creates a pressure differential between two breather orifices in the enclosure walls so that there is a circulatory exchange of air between the enclosure and atmosphere. If the desiccant has absorbed a significant amount of moisture during power off periods, the moisture concentration within the enclosure will exceed that outside and there will be a net expulsion of moisture to partially recharge the desiccant.

4,594,622.
The performance of a track-following servo system for a disk file is improved by the feeding forward of a prediction of track eccentricity into the normal feedback control loop. The eccentricity related function is derived by combining functions of the position error signal and of the input signal to the head position actuator during at least one revolution of the disk. The eccentricity function is stored and the fed forward to the actuator during a subsequent revolution of the disk. The eccentricity function may be a track shape position signal formed from the difference of the PES and the double time integral of the actuator current. Alternatively it may be an actuator current profile formed from the difference between the actual current and the double time derivative of the PES.

4,578,723.
A head positioning system with automatic gain control for use in disk information storage apparatus employs multiphase radial position error signals derived from position reference information on the disk to control the position of a transducing head by means of a head positioning actuator. A variable gain amplifier amplifies the signals from the transducing head prior to their application to a position error signal generating means. The gain of the amplifier is controlled in a gain control loop by a gain function. The gain function is derived by combining the different phase position error signals to provide, at any position of the head, a measurement of the rate of change of the position error signals per track of displacement. This system affords gain control which is substantially independent of head width and limits variations in offtrack gain between heads.

4,554,559.
A print head assembly with interchangeable pluggable printed circuit print heads has means for automatically positioning a head during insertion with the aim of ensuring registration of printed circuit electrodes on the head with correspondingly positioned conductors on a body portion. The print heads are supplied as a variety of types all of which are interchangeable as a simple push-fit in the body portion. A clamp ensures that ohmic contact is established and maintained between the registering electrodes and conductors. Each head is also provided with a pattern of electrodes which serve to identify the head type. The pattern bridges selected additional conductors on the body portion and provides a decodable pattern of signals in response to an interrogate signal unique to heads of that type. One of these electrodes on the head shorts a control conductor on the body portion to one or other of two adjacent guard conductors, if lateral misregistration of the head within the recess exceeds a predetermined amount.

4,553,320.
A method of making a rotor, for a dynamo-electric machine, which has a number of arcuately formed rectangular loop coils arranged edgewise in a cylindrical configuration, employs injection molding. Molding material is injected between adjacent coils and penetrates between and around them to form an encapsulating framework. Entry of molding material into the central apertures of the coils is prevented by inserts. By directing the molding material inwardly, and spacing the coils slightly from the mold core, encapsulant also penetrates behind the coil faces to form a thin skin. By use of a sputter member, which may be an integral end cap, coil terminations can be led out of the mold cavity through apertures in the shutter to protect them from damage during the molding process.

4,511,938.
A magnetizable recording disk is divided into data and servo sectors. The servo sectors include position reference information comprising a circumferentially extending and radially repeated magnetization pattern. Each such pattern comprises at least three subsets of elements from each of which a different phase of radial position error signal, indicating displacement from a data track center line, can be derived. The subsets are radially offset from each other by less than the pitch of the data tracks and their individual elements each have a radial width greater than the pitch of a data track. By making the width of the individual element of the servo pattern greater than that of the data tracks and, necessarily, greater than the physical width of the electromagnetic transducing head for reading and writing information

on the disk, the contribution of neighboring elements to the signal sensed by the head via its fringing field is reduced. This results in a more linear position error signal in all regions where the head straddles the boundary between elements. A disk file comprising such a disk comprises, in addition to the electromagnetic transducing head, a head positioning actuator, position error signal generating means for generating the multiple phase position error signals and combining them into a composite signal and feedback means for feeding back the composite position error signal to control the actuator to correct for displacement of the head from a selected data track center line.

4,510,841.
A paper shear mechanism consists of a guillotine having a fixed blade and a pivoted blade. The cutting edge of the fixed blade is concavely curved so that paper to be cut as fed between the blades assumes a corresponding curvature and is given some longitudinal rigidity during the cutting operation. The pivoted blade is of composite structure to simplify the manufacturing process and thus reduce cost. Essentially, it includes a cutting section stamped from flexible sheet steel shim to provide a cutting edge with the desired nip angle. The flexible steel section is spot welded to a mild steel backing member with an elongated spring member sandwiched between the two. The spring member has a number of spring teeth which exert a force along the length of the flexible section to deflect its cutting edge laterally towards the fixed blade. By this means contact between the cutting edges is maintained along the length of a cut and relief between the facing surfaces of the two blades is provided. A sheet feeding apparatus with a correspondingly curved cross-section to the fixed blade feeds paper web to the shear mechanism. A single motor serves to feed paper during forward rotation and to operate the paper shear during reverse rotation.

4,508,204.
A chute for gravity feeding a plurality of like electrical components to a pick up station of a robotic controlled automatic assembly system comprises guide rails down which components slide with their pins extending between the rails. The rails are shaped to provide a downwardly inclined straight track leading into a horizontal track comprising the pick up station from which the components are taken by the robot. The transition form the inclined track (approximately 30 degrees to the horizontal) to the straight track, although smooth, is quite abrupt and ensures that the next component is successfully fed from the inclined to the horizontal section of the chute each time its predecessor is removed from the pick up station. Since the length of the horizontal track is such that only one component can be accommodated at a time, accurate positioning of he component in the pick up station for access by the robot is guaranteed.

4,412,165.
Servo records provided at intervals on a record medium are used in a sampled servo system to define data tracks on the medium. Asperities in the medium, or problems arising from the servo writing process can in some instances lead to mis-alignment of a servo path 33 defined by a servo sample with the corresponding desired data track. This causes non-zero position error signals to be produced even when the track following head is accurately positioned over the data track. The problem is solved by measuring the position error signals derived from each servo sample with the head constrained in the correct on-track position.

The value of each of these position error signals is then stored as a digital number forming part of a correcting byte in the data section immediately preceding the associated faulty sample. The correction byte also includes a flag bit which is set to demark the next servo sample if the error is so large as to be deemed uncorrectable. Thereafter, in use if the flag bit is unset, the servo system reads the digital number from the correction byte, and uses it to dynamically correct the position error signal from the associated faulty servo sample. If the flag bit is set, the position error signal from the previous sample is carried forward and used instead of the position error signal from the current sample.

4,408,238.
A cantilever magnetic head support arm assembly for a disk file comprises a flat beam structure and a means of damping the structure against out of plane vibrations. The damping means comprises a rigid sidebar extending along one longitudinal edge of the beam structure and a layer of compliant damping material connecting the beam structure and sidebar together. Relative motion between the beam structure and sidebar causes elastic shear deformation of the damping layer to absorb the energy of vibration.

4,398,167.
An electric rotary actuator for producing rotation through a limited angle comprises a rotor winding made of a plurality of thin loop coils arranged in a continuous cylindrical framework as part of a rotor shell. The rotor shell lies in an annular flux gap defined by a stator magnet assembly and a flux return means. Each pair of adjacent axially extending limbs of adjacent loop coils lies opposite to and cooperates with a respective stator pole face. This winding arrangement helps to optimize the torsional resonance characteristics of the rotating mass.

4,401,933.
A single phase induction motor control system employs power line assisted starting and runs at higher than power line frequency from an electronically generated inverter supply. This inverter supply is employed to provide an out of phase mains frequency signal to run winding during starting in order to create the rotating magnetic field needed to start the motor. After the motor has started, the power line supply is disconnected from the start winding and the inverter supply frequency is increased gradually to a final value corresponding to the desired operating speed.
provide the out of phase starting voltage and the run winding is optimized for running conditions.

4,297,734.
A sampled data servo positioning system employs an actuator to move a member between a current and a target position. Incremental position feedback is provided only at sampling times. The system employs a model responsive to a velocity related input signal to produce a continually available model incremental position signal. Phase comparing means indicates phase differences between the model and sampled position signals at the sampling times.
which a source of saturation control signals is connected to the actuator to cause maximum acceleration or deceleration thereof. In the first configuration, the model is forced to track the actuator motion by means of feedforward plus feedback control. The feed forward signal represents actuator performance while the feedback signal is the position signal phase difference. In the second operational

configuration, a velocity profile signal is applied to the model and the actuator is forced to track the model by means of feedforward plus feedback control. The feedback signal is again the position signal phase difference but the feedforward signal is a predetermined signal representing the desired actuator current to execute the velocity profile. The sampled data servo positioning system may be the access motion control system of a sector servo disk file.

4,280,767.
Printing apparatus, in particular for performing multicolor printing operations, has a ribbon shift mechanism for selectively interposing different transversely spaced portions of a print ribbon between a print head and platen. The print heat is of the impact type and probably, although not necessarily, of the type which moves along the platen to define a print row. When color printing is required, a ribbon having a plurality of longitudinally extending stripes of different colors transversely spaced across its width used. Selection of required portions or colors of the ribbon is performed by moving the head to pre-selected positions along the print row to engage, for example, a camming mechanism (including a cam and follower) which moves the shift mechanism the required amount to make the selection. Selection of the ribbon portion or color is by program control and in the case of color printing, the range of colors is increased by superimposed printing of the available colors on the print ribbon.

4,279,520.
A print mechanism for a wire printer has a robust single turn closed loop transformer secondary winding as the moving part for driving a print wire into and out of a print position. Each secondary winding threads a transformer core on which is wound a multi-turn primary winding. A stack of such secondary windings, arranged with print wires in a closely spaced print row across the stack is supported in a static magnetic field produced by a magnetic assembly. Energization of a selected primary winding induces a large current flow in its associated secondary winding which reacts with the static magnetic field to drive the associated print wire into the print position. In one embodiment, the stack of secondary windings are all mounted on a single pivot and each secondary winding swings about the pivot as a whole upon energization of its associated primary winding. In another embodiment each secondary winding of the stack is formed so as to be elastically deformable whereby the portion of the secondary winding carrying the print wire is deflected into the print position under energization of its associated primary winding.

4,208,681.
A disk, tape, etc., record member is contained in a cartridge or cassette. A cartridge type record player has a movable receptacle for receiving the cartridge. The receptacle has two stable and one momentary positions. A center stable position is a load position wherein the cartridge can be inserted into the receptacle. A second stable position, on one side of the center position, is a play position, wherein a transducer is in operative association with the second member. The third and momentary position on a second side of the center stable position causes a spontaneous ejection of the cartridge from the receptacle. Usually, from the eject position, the receptacle returns to the center stable position.

4,195,322.

In a recorder having a transducer with a gap which coacts with a flexible medium to record and/or reproduce data, an endless groove is positioned on the transducer to circumscribe the gap.

4,185,314.
A record disk cartridge has a single internal shutter for opening and closing a head access port adjacent a spindle access member in one wall. A further aperture allows the shutter to be actuated to an open position as the cartridge is moved into a playing position. A spring in the cartridge yieldably biases the shutter to a closed position. When the shutter is open, the spring in the cartridge is cocked to eject the cartridge from a player. Upon release, the spring acts to eject the cartridge.

4,167,269.
Flexible disk record storage apparatus has a chordally perturbed backing plate for inducing a dynamic stiffness in a flexible recording disk rotating immediately adjacent the plate. A head radially movably disposed between the chordal perturbations provides reliable recording and playback. A web portion of the backing plate has a predetermined flatness circumscribing a transducing location for enhancing recording and playback quality.

4,145,725.
An actuator comprising a transformer having a fixed primary winding on a magnetic core and a pivotally movable coil linked with the magnetic core and forming a secondary winding of the transformer. A permanent magnet generates a static magnetic field in which the coil is disposed. A transducer arm capable of pivotal movement is attached to the coil. When a current pulse is applied to the primary winding, a current is induced in the coil which reacts with the static magnetic field to cause pivotal movement of the coil and attached arm.

4,131,199.
A record disk cartridge has a single internal shutter for opening and closing a head access port adjacent a spindle access member in one wall. A further aperture allows the shutter to be actuated to an open position as the cartridge is moved into a playing position. The shutter also brakes the disk against movement when the cartridge apertures are closed. A magnetic coupling enables rotation of the disk inside the cartridge.

4,120,505.
A stabilizing backing plate for a rotating flexible record disk has a bearing surface with a smooth finish to prevent disk wear. A plurality of depressions in the backing plate trap air to prevent the flexible disk from adhering to the backing plate during start-up.

4,117,737. Drive Belt Loading System. October 1978.
A drive belt loading system for automatically loading and unloading a drive belt onto a pulley of a removable device employs a conical transfer means for automatically transferring the drive belt to the pulley upon tensioning of the belt. The transfer means is located below the device pulley so that upon slackening of the belt, the belt is automatically unloaded by dropping back onto the transfer means to

allow removal of the device. The system is applied to drive belt loading in a magnetic disk file employing a disk module with an external pulley.

4,103,314.
Positioning and motion control of two objects, for example, of a transducer and a disk record medium having tracks including pre-recorded servo information, is achieved in two modes of operation in the following manner.
closed servo loop and position error signals derived by the transducer are used to energize an actuator mechanism coupled to the transducer so as to maintain the transducer in the on-track position. During a track seek mode, the actuator is energized to cause the transducer to follow a desired velocity profile, at least a part of which is achieved with the transducer connected in a closed servo loop. The loop is fed with position error signals derived by the transducer sampled at times calculated to coincide with the on-tracks positions of a transducer following the desired velocity profile. The servo system responds as in track following mode to energize the actuator mechanism so as to reduce the instantaneous transducer position error from the true on-track positions during this part of the access operation with the overall effect of causing the transducer to follow the desired velocity profile more closely.

4,115,823.
A data storage apparatus, such as an accessing head magnetic disk file, includes at least one data disk surface and a servo disk surface. In operation, a continuous position signal having high frequency components is derived from the servo surface, which has a quadrature type servo signal prerecorded thereon. A circuit means modifies the derived position signal so that a substantially linear signal representing the displacement of the servo head from the servo track is obtained. A second position signal having a low frequency component is obtained from servo sector information registered on the data disk surface and together with the first position signal forms a hybrid position signal. This hybrid signal is used to control the movement of the data heads relative to the data tracks to ensure optimum transducing operation.

4,072,990.
Data track positioning information for data tracks on a stack of recording disks is provided by servo information pre-recorded on one surface of the stack. In addition, each data track on the remaining surfaces of the stack has servo information relative to that track prerecorded in sectors around the track. Track following operations are controlled in a closed loop servo system using on-track position information derived from the sectored servo tracks associated with the track being followed. The bandwidth of the position error signal derived from the sectored servo information is increased by adding high frequency components obtained from the continuous servo information on the servo surface. Track access operations are controlled using track crossing information derived from the pre-recorded servo information on the servo surface.

4,068,269.
A positioning system for data storage apparatus in which a magnetic transducer is positioned relative to data tracks on a moving record member by means of a closed loop servo system. Improved velocity control information is provided to the servo system by prerecorded servo tracks read by a single servo head forming part of the

closed loop system. Each servo track consists of a plurality of servo cells, alternate ones of which are laterally displaced by half a track width. A position reference signal is prerecorded in each cell at a point which is predetermined to permit the signal to be sensed by the single servo head independently of any other detectable signal. Accordingly, a position error signal derived from displaced cells is always 90 degrees out of phase with the position error signal derived from undisplaced cells. During a track access operation, when the servo head is moved from one track to another track, the displaced and undisplaced cells are sensed by the single servo head to provide two separate position error signals. Control circuits combine selected portions of the two position error signals to provide a composite signal of improved linearity from which the velocity of the head during the access operation can be ascertained directly and employed to perform control functions dependent on velocity.

3,939,438
In a phase locked oscillator (PLO), the frequency of a voltage controlled oscillator (VCO) is changed in response to error signals indicating the phase error between the individual pulses of a stream of input pulses and the output pulses of the PLO. The running of the PLO is temporarily interrupted whenever the phase error exceeds a predetermined amount, and is restarted in phase with the next input pulse from the stream of pulses. A residual part of the error signal causing the interruption is accumulated so that after each interruption the frequency of the oscillator is closer to the frequency of the input stream of pulses. The process is repeated as required until phase lock is achieved.

3,936,876
The invention relates to rotatable data storage apparatus of the type in which relative movement between a data transducer and a data storage medium is utilized to record data on and to read data from one or more parallel data tracks on the medium.

3,849,800
A magnetic disk apparatus including a sealed module which encloses magnetic disks, magnetic heads attached to head arm assemblies, an electromagnetic actuator for positioning the magnetic heads on the head arm assemblies, and a drive spindle on which the disks are seated. All control of the positioning of the head arm assembly, the operation of the electromagnetic actuator and the read write function being provided by electrical signals communicated between the file housing and the sealed module. A drive motor within the file housing is coupled to the enclosed spindle, which extends from the module while maintaining the module seal, for providing only rotary motion to the disks attached to the spindle.

3,839,734
In a data storage apparatus having a housing and an information storage member in the form of a magnetizable disk within the housing, the disk being so rotatable within the housing as to entrain air to flow therewith, the improvement characterized in having an air deflector blade mounted within the housing, the deflector blade being operable so as to intercept the path of air entrained by the disk as to create a region of turbulence in the air downstream of the deflector blade and to deflect air incident against the deflector blade to pass between the deflector blade and the disk surface into the turbulent region.

3,731,177
According to the present invention a movement control system comprises a motor for moving said body into a required position, a motor control unit for controlling the acceleration and deceleration of said motor, a position indicator unit producing positioning signals corresponding to movement of said body while accelerating toward said required position, and a calculating unit responsive to position data representing said required position and to said positioning signals to produce a control signal for said motor control unit to change from acceleration to deceleration in order to provide required speed/ position characteristics for the movement of said body.

3,668,487
or lead screw are selectively achieved by a detent apparatus, which includes an actuator element that is bidirectionally movable by a voice coil motor (VCM). A toothed detent wheel attached to the rotary drive shaft is engaged by detent pawls for locking. The detent wheel is released to allow rotation of the drive shaft by retraction of the actuator element, that is responsive to the VCM and that pulls the pawls out of engagement with the detent wheel. Stops limit the path of travel of the actuator element. A pulse generating circuit, in combination with a center tapped coil of the VCM, provides an inhibit pulse to minimize bounce of the movable actuator element and associated mechanical members.

3,635,608
A cartridge for a magnetic disk assembly includes a cover for enclosing a multiplicity of magnetic disks, the assembly having top, side, and bottom portions, wherein the side portion has an aperture for permitting the insertion of a magnetic transducer, the bottom portion has means for connecting the enclosed disk assembly to a drive unit and a removable base for covering the aperture in the side portion.

3,567,960
A gating circuit useful for separating data pulses from clock pulses in a double frequency detection system includes a signal generator that provides a sawtooth waveform having ramp portions of the same slope and a flyback interval of fixed magnitude. When the sawtooth signal is above a variable threshold, an input gate is enabled to allow the clock pulses to initiate flyback. The proportions of the sawtooth waveform above and below the threshold remain constant, so that early or late arrival of a clock pulse does not affect the gating of succeeding clock pulses. Thus, an output gate is made to operate to block clock pulses while passing data pulses.

UK968009.
A Method of Controlling Step Motors. February 1969.
This disclosure relates to a control method for stepping motors.

UK968013.
Address Mark Detector in Wopac. April 1968.
The data separator system proposed in disclosure No. UK867011 is being used in the DOLPHIN disk file and has been christened Wopac, after its creators. This disclosure covers the method presently used to detect the two missing clock bits. It includes a modification used to overcome problems in address mark detection which

are due to the compromise which has to be made in time constant values to suit both starting up and address mark requirements. Briefly, it consists of a threshold circuit which sets a threshold about one third of the way up the ramp. The fact that the ramp does not cross below this threshold when it flies back during an address mark is then detected.

UK968018.
A Method of Applying a Force to a Read/ Write Head. 05/68
In order to fly a head on a disk surface, it is necessary to apply a force to the head by means of a low mass device such as a spring. Since the flying height of the head is proportional to the applied force it is necessary to control the force very accurately. The method proposed here consists of a clock type spring which bears on the head and which is held at the other end on a rod which can be rotated. The stop which is also located on rod, can be rotated and locked onto the rod. The force required from the spring is achieved by rotating the stop against the spring and locking the stop in position. This operation is performed in a separate jig. With rod and spring assembly in position in the file the head is loaded by rotating the rod by a predetermined amount. This action first closes the head to the disk and further rotation takes the stop away from the spring thus applying the load to the head. The spring rate is low and so variations in the final gap between the stop, and the spring in the loaded position have only a small effect on the total force applied. This design has the advantage that variations from spring to spring are eliminated and the force exerted by the spring can be determined very accurately before it is placed in the file.

UK869004.
Dolphin File Cartridge. March 1970.
The cartridge housing is made up of three plastic mouldings- the top cover, shield and base. The top cover and shield are joined together to form the top which contains the disk and a mechanism for releasing the disk from the spindle which, unless engaged is used as a safe carrying handle. The top has cutouts for accessing the disk by the read/ write heads, sweeper brush and for air circulation.

UK869033.
Design and Process for Producing an Advanced Disk Head Bulk Ferrite Type. February 1969.
A single turn vertical read/ write head in which the magnetic circuit is formed entirely from bulk ferrite. A bulk ferrite substrate is produced with one surface polished to obtain a suitable surface finish. Onto this is deposited a nonmagnetic conducting layer, e.g., copper, of the appropriate thickness to form the gap. The conducting element is formed by etching the conducting layer. A second bulk ferrite substrate, suitably polished on one surface, is bonded in contact with the top surface of the conductor. The ferrite is then polished back to a line.

UK869088.
Voice Coil Bounce Prevention. May 1969.
In the DOLPHIN disk file the detent pawls are actuated by a voice coil driven yoke. In order to meet the timing requirements it is necessary to accelerate the voice coil and yoke very rapidly at the start of its stroke. This results in the coil and yoke assembly arriving at its end stop with a considerable velocity. Despite a variety of stop materials being evaluated the stored energy in the system results in severe

bounce, allowing the pawls to re-enter the region of the detent wheel, giving rise to access errors. The proposed solution consists of allowing the voice coil to hit its limit stop (a well defined point in the cycle) and then turning on a short duration high magnitude current pulse of such polarity that the coil and yoke are restrained from bouncing away from the stop position. The method has been evaluated and proved to be very effective.

UK869174.
Dynamic Thermal Compensation of Magnetic Recording Head Position. October 1969.
As the technology of magnetic recording heads and media has advanced, the amount of misregistration that can be tolerated between the read head element and a previously written track has decreased. With current development devices a tolerance of +/- 7.5-um (+/- 0.0003-inches) of total misregistration must be maintained.

UK967010.
Gating Circuit. June 1968.
A gating circuit useful for separating data pulses from clock pulses in a double frequency detection system includes a signal generator that provides a sawtooth waveform having a ramp of constant slope and a flyback interval of fixed magnitude. When the sawtooth signal is above a variable threshold, an input gate is enabled to allow the clock pulses to initiate flyback. The proportions of the sawtooth waveform above and below the threshold remain constant, so that early or late arrival of a clock pulse does not affect the gating of succeeding clock pulses. Thus, an output gate is made to operate to block clock pulses while passing data pulses.

UK969014.
Container for Magnetic Recording Disk. November 1969.
The ornamental design for a Magnetic Disk Container.

UK968004.
Magnetic Disk Assembly. March 1970.
A cartridge for a magnetic disk assembly includes a cover for enclosing a multiplicity of magnetic disks, the assembly having top, side, and bottom portions, wherein the side portion has an aperture for permitting the insertion of a magnetic transducer, the bottom portion has means for connecting the enclosed disk assembly to a drive unit and a removable base for covering the aperture in the side portion.

UK969024.
Electromagnetic Actuator. June 1970.
The bounce of a voice coil actuated member from a stop is inhibited by supplying a secondary pulse to the voice coil at the instant of bounce and in a direction such as to oppose the bounce. The actuating voice coil is center tapped (24) and one half (24 to 25) is used to drive the member into one stop and the other half (24 to 26) is used to drive the member in the opposite direction into a second stop. In each case the emf generated in the unused half of the coil, as a result of bounce, from a stop, is used to generate the inhibiting pulse at (time tfi to t|) which is supplied to the ot her half of the winding.

UK969025.
Fixed Flyback Principle in a Double Frequency Data Separator Using a Data Window Separation Technique. 10/70
A decoding circuit for decoding trains of pulses which have been coded to represent information by varying the intervals between pulses to be one of two lengths generates a sawtooth waveform in response to the input data. Long intervals are detected when the sawtooth drops below a reference level. The flybacks of the sawtooth are controlled to be one of two fixed magnitudes so that the circuit will still decode pulse displaced data correctly. Servo circuitry controls the ramp slope of the sawtooth so that it is matched with the frequency components of the input waveform.

UK971001.
Disk File Head Movement Control System. 02/71
A movement control system for controlling the movement of a body, which may be the read write head of a magnetic disk file data storage system, includes a motor for moving the body into a required position. A position indicator, which may include a disk rotated by the motor and cooperating with an electromagnetic system or an optical system, produce pulses corresponding to the rotation of the body and the movement of the body. A calculating unit is supplied with the pulses and data corresponding to the required position and includes one counter in a first version and two counters is a second version.

UK970003.
Magnetic Disk Apparatus. April 1972.
A magnetic disk apparatus including a sealed module which encloses magnetic disks, magnetic heads attached to head arm assemblies, an electromagnetic actuator for positioning the magnetic heads on the head arm assemblies, and a drive spindle on which the disks are seated. All control of the positioning of the head arm assembly, the operation of the electromagnetic actuator and the read write function being provided by electrical signals communicated between the file housing and the sealed module. A drive motor within the file housing is coupled to the enclosed spindle, which extends from the module while maintaining the module seal, for providing only rotary motion to the disks attached to the spindle.

UK971008.
Data Storage Apparatus. November 1972
The present invention relates to a data storage apparatus having a housing within which is disposed an information storage member in the form of a magnetizable disk.

UK972005.
Improvements in Electric Digital Data Processing Systems. February 1973.
Data Storage apparatus having a circuit for controlling a transducer positioning mechanism to remove a transducer flying above data tracks of a recording medium to a home position in event of failure of drive power to the medium. The circuit includes a capacitor which is normally held charged by the continuous supply of power to the motor but which discharges upon interruption of power to provide sufficient energy to remove the transducer before contact between the medium and transducer occurs.

UK971007.

Data Storage Apparatus. June 1973.

Track access mechanism for moving a transducer from track to track over a moving record surface is controlled in the following manner. The access mechanism is accelerated at the maximum rate attainable by the mechanism over a first number of tracks. Thereafter the transducer is driven at a constant velocity equal to the velocity attained as a result of the destination track, the transducer is retarded to bring it to rest over the destination track.

UK973003.

A Reading and/or Reproducing Head Assembly for a Disk Store. December 1973.

A recording and/or reproducing head assembly suitable for use in a disk file consists of a pivoted arm supporting a plurality of recording heads at one end. An electromagnetic actuator connected to the other end of the arm is operable to rotate the arm about the pivot to move the heads from one transducing position to another over recording surfaces of associated magnetic disks. The arm itself consists of a rigid cross braced frame work which does not enter the cylinder defined by the peripheries of the disks during access operations. The heads are mounted on supports which interleave the stack of disks so that the heads always remain inside the cylinder defined by the disks. The head supports are cranked to keep the average head skew at a minimum as the heads move in their arcuate paths across the disks during access operations.

UK972001.

Data Storage Apparatus. February 1974.

Magnetic head or heads are positioned over data tracks on a magnetic medium by means of a closed loop servo system deriving position information from servo tracks previously written on the medium surface. Each data track is associated with a corresponding servo track which, in addition to position information required to position the data heads accurately over the data tracks, contains clocking information for use by the data channel. Additional servo tracks are provided extending beyond the band of servo tracks associated with data tracks in a region known as the guard band region. These tracks also contain position and clocking information. However, the clocking information contained in the guard band is different from the clocking information contained in the servo tracks associated with the data area. The difference in the two types of clocking information is detected by circuitry and used to ensure that operations involving transfer of data are conducted only when the data heads are accurately positioned over the data tracks. The change in clocking information as the servo head moves from the guard band region to the data region is detected by the circuitry and is used to provide a reference for initial positioning of data heads at the start of track accessing operations and for repositioning the heads following the occurrence of a track accessing error.

UK973004.

Improvements in or Relating to Phase Locked Oscillator 07/74

A phase locked oscillator in which the frequency of a voltage controlled oscillator is changed in response to error signals indicating the phase error between the individual pulses of a stream of input pulses and the output pulses of the oscillator. The running of the oscillator is temporarily interrupted whenever the phase error exceeds a predetermined amount and is restarted in phase with the next input pulse from the stream of pulses. A residual part of the error signal causing the interruption is accumulated so that after each interruption the frequency of the oscillator is closer to the frequency of the input stream of pulses. The process is repeated as required until the phase lock is achieved.

UK973005.
Clean Gas System for Magnetic Disk File. 09/75
This invention relates to a clean gas system for a magnetic disk file.

UK974004.
Improvements in Servo Positioning Systems for Magnetic Disk Recording. September 1975.
This docket describes a circuit for the generation of an error signal for using in a disk drive. The error signal which is generated is not data dependent and is derived by doing a high speed multiplication of a data signal by itself and then a low speed division by data. This low speed division is done at a frequency higher than the required servo bandwidth of the position loop by using the value of data to control the gain of an amplifier in the servo signal path.

UK974007.
Actuator Mechanism for Disk Storage Apparatus. 10/75
An actuator mechanism for a disk file consists of a planar lamina triangular shaped substrate on which is formed a printed circuit conductive coil. The substrate is mounted for oscillatory motion about a pivot at the apex of the triangle and selected parts of the coil or substrate are positioned in the gaps of two C shaped magnets. An arm carrying a record and playback head extends from the substrate on the opposite side of the pivot to the coil. In use, the actuator is mounted adjacent a rotatable record disk so that movement of the substrate about its pivot moves the head across tracks on the disk. The position of the head over a selected track during read or playback operations and movement of the head between tracks during access operations is controlled by supplying current of appropriate magnitude and polarity to the coil.

UK973011.
Data Storage Apparatus. October 1975.
Data track position information for data tracks on a stack of recording disks is provided by servo information prerecorded on one surface of the stack. In addition, each data track on the remaining surfaces of the stack has servo information relative to that track prerecorded in sectors around the track. Track access operations are controlled using track crossing information derived from the prerecorded servo information on the servo surface and track following operations are controlled in a closed loop servo system using on track position information derived from the sectored servo tracks associated with the track being followed. The bandwidth of the position error signal derived from the sectored servo information is increased by adding high frequency components obtained from the continuous servo information on the servo surface.

UK973006.
Data Storage Apparatus. October 1975.
A data record and playback head is positioned relative to data tracks on a moving record member by means of a closed loop servo system. On track position information is provided by prerecorded servo tracks read by a servo head forming

part of the closed loop system. Each servo track consists of a plurality of servo cells alternate ones of which are laterally displaced by half a track width. Accordingly a position error signal derived from displaced cells is always 90 degrees out of phase with the position error signal derived from undisplaced cells. During a track following operation the on track position error signal is derived solely from the undisplaced servo cells. During a track access operation the position error signals from the displaced and undisplaced cells are combined to provide a composite signal of improved linearity from which the velocity of the head during the access operation can be ascertained directly.

UK975011. Belt Drive Arrangement. July 1976.
A belt transfer device in the form of a cone is located adjacent to a driven pulley. A drive belt is supported on a flange of a drive pulley and on the cone when in an inoperative position. The application of tension to the belt and rotation of the drive pulley causes transfer of the belt from the cone to the driven pulley. In the inoperative position the belt is out of contact with the driven pulley which if it is part of a portable equipment may be removed and replaced. The arrangement also has applications for locating a belt on an inaccessible pulley.

UK975014.
Disk File Access Method Using Sample Position Signal. October 1976.
Position and movement of a transducer over a record medium carrying prerecorded servo information is achieved during two modes of operation in the following manner- During track following mode the transducer is connected in a closed servo loop so that position error signals derived by the transducer are used to energize an actuator mechanism coupled to the transducer so as to maintain the transducer in the on track position. During track access mode the actuator is energized to cause the transducer to follow a desired velocity profile, at least a part of which is achieved with the transducer connected in a closed servo loop. This time however the loop is fed with position error signals derived by the transducer sampled at times calculated to coincide with the on track positions of a transducer following the desired velocity profile. The servo system responds as in track following mode to energize the actuator mechanism so as to reduce the instantaneous transducer position error from the true on track positions during this part of the access operation with the overall effect of causing the transducer to follow the desired velocity profile more closely. In the simplest case this closed loop control of an access operation is used to maintain the transducer at a constant access velocity.

UK976016.
Stiffening a Rotatable Disk. December 1976.
The flexible disk of a flexible disk file is provided with a stationary backing plate over which the disk rotates supported on an air bearing between it and the plate. The plate has a longitudinal slot extending in a radial direction with respect to the disk to permit access by a record/ playback head to the disk surface facing the plate. The backing plate is shaped in such a way that the rotating disk is continuously bent upwards about two chords on each side of a line through the head slot. The provision of these bends imparts stiffness to the disk in the vicinity of the head slot and stabilizes the flying characteristics of the disk.

UK976014.
Controlled Surface Finish for Flexible Disk Stabilizing Plate. March 1977.

A stabilizing backing plate for a rotating flexible record disk has a bearing surface with a smooth finish to prevent disk wear but provided with a plurality of depressions which trap air and prevent the flexible disk from adhering to the backing plate during start-up.

UK976013.
Data Storage Apparatus. April 1977.
Data storage apparatus of the type employing a stack of rotatable storage disks accessible by a plurality of data heads ganged for movement over the data surfaces. The position of a data head during track following operations over a selected data surface being controlled by a hybrid servo signal consisting of low frequency components of position information signals derived from servo sectors around the data track being followed added to which are high frequency components of continuous position information signals derived either from a dedicated servo surface forming part of the stack or from an external position transducer. The continuous position information being provided by a servo transducer, which is also ganged to the data heads, in the form of two cyclic quadrature signals (90 degrees out of phase with each other) each having portions which are linear and co-extensive over the whole range of head displacement. The apparatus including servo control circuits for detecting during data track following operations servo transducer displacement from the true on-track position (caused for example by temperature variations or mechanical vibrations) beyond the linear region of the corresponding one of the two quadrature signals supplying the high frequency components and, upon such detection, switching to an adjacent linear portion of the other signal, or the inverse of the other signal, to either of which has been added an appropriate d.c. offset so that the linear portion of this other signal becomes an effective extension of the linear portion of the continuous servo signal corresponding to the data track being followed. By this means the a.c. gain of the servo circuits is maintained constant thereby improving the servo loop performance.

UK976012.
Electromagnetic Actuator. June 1977.
An electromagnetic induction actuator for the transducer arm of a magnetic disc file is described which provides faster operation without increase in input power as compared to present voice coil actuators. The actuator consists of a transformer having a fixed primary winding on a magnetic core. An angularly movable coil is linked with the magnetic core forming a secondary winding of the transformer. A permanent magnet generates a static magnetic field which is coupled to the coil. One or more transducer arms capable of angular movement are attached to the coil. When a current pulse is applied to the primary winding, a current is induced in the coil which reacts with the static magnetic field to cause angular movement of the coil and attached arm.

3,567,960.
Gating Circuit For Displaced Pulses. March 1971.
A gating circuit useful for separating data pulses from clock pulses in a double frequency detection system includes a signal generator that provides a sawtooth waveform having ramp portions of the same slope and a flyback interval of fixed magnitude. When the sawtooth signal is above a variable threshold, an input gate is enabled to allow the clock pulses to initiate flyback. The proportions of the sawtooth waveform above and below the threshold remain constant, so that early or

late arrival of a clock pulse does not affect the gating of succeeding clock pulses. Thus, an output gate is made to operate to block clock pulses while passing data pulses.

D221,605.
Container for Magnetic Recording Disk. August 1971
An ornamental design for a container for magnetic recording disk.

3,635,608.
Magnetic Disk Assembly. January 1972.
A cartridge for a magnetic disk assembly includes a cover for enclosing a multiplicity of magnetic disks, the assembly having top, side, and bottom portions, wherein the side portion has an aperture for permitting the insertion of a magnetic transducer, the bottom portion has means for connecting the enclosed disk assembly to a drive unit and a removable base for covering the aperture in the side portion.

3,668,487.
Electromagnetic Actuated Detent Apparatus. June 1972
Locking and release for rotation of a threaded drive shaft or lead screw are selectively achieved by a detent apparatus, which includes an actuator element that is bidirectionally movable by a voice coil motor (VCM). A toothed detent wheel attached to the rotary drive shaft is engaged by detent pawls for locking. The detent wheel is released to allow rotation of the drive shaft by retraction of the actuator element, that is responsive to the VCM and that pulls the pawls out of engagement with the detent wheel. Stops limit the path of travel of the actuator element. A pulse generating circuit, in combination with a center tapped coil of the VCM, provides an inhibit pulse to minimize bounce of the movable actuator element and associated mechanical members.

3,731,177.
Disk File Head Movement Control System. May 1973
According to the present invention a movement control system comprises a motor for moving said body into a required position, a motor control unit for controlling the acceleration and deceleration of said motor, a position indicator unit producing positioning signals corresponding to movement of said body while accelerating toward said required position, and a calculating unit responsive to position data representing said required position and to said positioning signals to produce a control signal for said motor control unit to change from acceleration to deceleration in order to provide required speed/ position characteristics for the movement of said body.

3,839,734.
Air Turbulence Utilized to Clear Disk. October 1974
In a data storage apparatus having a housing and an information storage member in the form of a magnetizable disk within the housing, the disk being so rotatable within the housing as to entrain air to flow therewith, the improvement characterized in having an air deflector blade mounted within the housing, the deflector blade being operable so as to intercept the path of air entrained by the disk as to create a region of turbulence in the air downstream of the deflector blade and to deflect air incident against the deflector blade to pass between the deflector blade and the disk surface into the turbulent region.

3,849,800.
Magnetic Disk Apparatus. November 1974.
A magnetic disk apparatus including a sealed module which encloses magnetic disks, magnetic heads attached to head arm assemblies, an electromagnetic actuator for positioning the magnetic heads on the head arm assemblies, and a drive spindle on which the disks are seated. All control of the positioning of the head arm assembly, the operation of the electromagnetic actuator and the read write function being provided by electrical signals communicated between the file housing and the sealed module. A drive motor within the file housing is coupled to the enclosed spindle, which extends from the module while maintaining the module seal, for providing only rotary motion to the disks attached to the spindle.

3,936,876.
Rotatable Data Storage Apparatus with Track Selection Actuator Having Multiple Velocities. February 1976.
The invention relates to rotatable data storage apparatus of the type in which relative movement between a data transducer and a data storage medium is utilized to record data on and to read data from one or more parallel data tracks on the medium.

3,939,438.
Phase Locked Oscillator. February 1976.
In a phase locked oscillator (PLO), the frequency of a voltage controlled oscillator (VCO) is changed in response to error signals indicating the phase error between the individual pulses of a stream of input pulses and the output pulses of the PLO. The running of the PLO is temporarily interrupted whenever the phase error exceeds a predetermined amount, and is restarted in phase with the next input pulse from the stream of pulses. A residual part of the error signal causing the interruption is accumulated so that after each interruption the frequency of the oscillator is closer to the frequency of the input stream of pulses. The process is repeated as required until phase lock is achieved.

7.0 Interesting Developments

7.1.1 Spindle Grounding

Dolphin 1969

On Easter Monday we had to come in to PA (then called Product Test) because the Dolphin file was making many data errors. This meant that the test throughput was much reduced as for each error the 1130 computer, which was the controller, had to print out the error.

After much trial it was thought that the drive belt was making the DASD like a Van de Graf generator, the high voltage was then discharging from the discs to the heads. This discharge was causing the high error rates. It was thought that perhaps there should be a ground connection to the spindle. To verify this, Bon Friesen lay on his back below the drive with a grounded braid which he held onto the centre of the drive spindle. Immediately the errors stopped and this was how Storage at Hursley found the importance of spindle grounding. From that day every DASD which included a drive belt also had a spindle ground.

7.1.2 Golden Jumper

Dolphin 1970

The Dolphin File was mounted underneath the Multifunction Card Reader/Punch. The drive experienced a high error rate in 2 conditions -

1. When the Card Unit was performing punch operation, during which it was also printing on the top of the card.
2. When the whole System 3, in which it was mounted, was subjected to ESD.

We went to Rochester to examine the problems. The first thing we looked at was the Card punch problem.

We looked at all of the power wiring to the system which used FAP (Flat Aluminium Power) cables. We completely redesigned the distribution system, but we still had the problem. We found that the drivers for the print hammers were oscillating when activated. We told the Rochester people that they should redesign the drivers, but they said this could not be done as the last release had only just been done. A few months later they had to make a change as the drivers for the print hammers were burning out, which was not surprising with oscillating drivers. The high error rate caused by this problem was not looked at separately until we had investigated the ESD problem.

All the grounding of the front end of the data channel had been done by the correct method, ie. only one ground point for all of the system back at the main board which was remote from the preamplifier. We therefore tried the WRONG way and we put a 2″ from ground on the preamp card to the chassis adjacent to the preamplifier. After that the level of acceptable ESD was much increased. Who says the RIGHT way is always CORRECT.

8.0 Anecdotes

8.1.1 Servo Control (Dave Craft)

One anecdote I remember well concerned work I was doing related to stability of microprocessor-based arm control systems. We were breaking new ground on SPRAT and were having difficulty with our early digital control algorithms, due to excitation of the natural frequency of the actuator arm by the driver current steps produced by successive track-following algorithm calculations.

In those days, I tended to approach problems from first principles, and so I tackled the fundamental problem of applying torque change to a system which consisted of a mass attached to a shaft by a compliant arm. How could one in fact make ANY change to the torque applied to such a system without exciting its natural resonance ?

A mere day and night of intensive application of Newtonian Mechanics to this problem produced a brilliant solution, complete with equations. If it should be necessary to change the torque applied by an amount T, then alter it only by HALF this amount at first, increasing it to the FULL amount after EXACTLY ONE HALF THE ACTUATOR RESONANCE PERIOD. This results in no excitation of the primary actuator resonance whatsoever, and as such had an intellectual appeal of almost orgasmic elegance to yours truly.

Dashing off an Invention Disclosure, I sat back to await the world-wide fame and other honours a grateful profession would no doubt bestow upon me. In due course, an envelope arrived from U.K. Patents - my brilliant idea was already common knowlege, in of all places the construction industry ! High rise tower cranes typically have this problem when rotating the jib to deliver suspended loads from one point on the construction site to another, as the workers often simply do not appreciate a 15-ton hopper of concrete arriving at their pouring station swinging wildly, especially if a few hundred feet above ground level.

So, my brilliant contribution was consigned to the intellectual junkyard, so to speak, along with all the other lost causes I pursued so vigorously in my undistinguished career ...

9.0 Interesting stories during developments

9.1.1 Spindle grounding (Bill Case)

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The FAP (flat aluminium power) cables to the system were first examined. The power distribution system was completely redesigned, but the problem persisted. It was found that the drivers for the print hammers were oscillating when activated. The Rochester people were told that they should redesign the drivers, but they said this could not be done as the last release had only just been made. A few months later they had to make a change as the drivers for the print hammers were burning out, which was not surprising with oscillating drivers. The high error rate caused by this problem was not looked at separately until the ESD problem was investigated.

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9.1.3.1 Taylors's laws of servo development (John Taylor)

1. The differential signal into the servo channel is usually inverted.

   The probability of this happening varies from 50% when no thought is applied to 90% if a careful check is performed.

2. The technician who assembled the first actuator uses a 3-sigma method resulting in:

   - High force constant
   - Low friction
   - Complete absence of all problems predicted by the simulation.

3. TFA problems do not appear until just before release, no matter how much early hardware is evaluated.

4. Phase once lost can never be retrieved.

5. The total phase loss in a system is always greater than that lost by the sum of the individual parts.

6. The test equipment is initially incapable of exercising the file in the way that provokes most errors. This is only discovered during PA acceptance testing.

9.1.3.2 Other laws of servo development

1. Sources of vibration occur at frequencies where there is already a mechanical resonance.
   (A. R. Hearn, circa 1983)

2. Mechanical resonances, if reduced in one place, pop up in another, even worse, place.
   (Laishley/Baker, Discovered during solitary confinement on B7 lab, Hursley)

3. The more sophisticated the measuring instruments, the less confidence one has in the operation of the product.
   (Note for Managers justifying capital equipment.)

9.1.3.3 Wallis' first law of debugging (Chris Wallis)

- Consecutive malfunctions have identical symptoms, but different causes.
- Corollary
  If an error is found that completely accounts for a given malfunction, the malfunction still occurs after the error is corrected.

9.1.3.4 Wallis' maximum dubiety principle (Chris Wallis)

- An experiment designed to select one of two design approaches eliminates both and suggests a third, untried, approach.

  This procedure is not necessarily convergent during the development process!
- Corollary

  The design approach being evaluated now is never as attractive as the one you are going to look at next.

9.1.4 John Hartley's thought (John Hartley)

Why don't we get a man in to do the job.