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TESTS OF MOTORS IN
GRAIN ELEVATORS
AND FEED MILLS

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INTRODUCTION.

This thesis is for the purpose of determining the amount of power required to drive the various types of feed-mill and elevator machinery.

Little attention has been paid to motors used for this purpose. Such motors while small in size are often large in importance, for each one constitutes a fire hazard. Elevators and feed-mills are necessarily very dusty, and a spark or an overheated motor may cause an explosion or a fire. For this reason it is essential that no motor should be overloaded enough to cause it to overheat.

Tests were made under actual running conditions, but in some cases it was impossible to obtain very accurate or satisfactory results, due to the fact that certain machines are usually run in connection with other equipment, such as short elevators, line shafts, etc.

However, we trust that our efforts will prove of some value in determining the power required to drive various elevator and feed- mill machines.

SAGINAW MILLING COMPANY, SANDUSKY, MICH.

On April 14, 1921 the electric motors in the "Greeley" and "Bickle" elevators of the Saginaw Milling Company at Sandusky, Michigan were tested by R.A. Backus and R. M. Maitland for the purpose of determining why the specified fuses were not sufficient to carry the load. Found that several of the motors were heavily overloaded.

Conditions were investigated at the Gleaner's Elevator, a printing shop, and two meat markets, which comprise the total power load of the village. The lighting load is very small during the day.

At the Gleaner's Elevator fuses were replaced with fuse-wire or copper wire thruout, except at relays on 10 H.P. motor circuit. The motors in the printing shop and the two meat-markets, which are all 5 H.P., were started with single throw triple pole switches, and fused with 60 amp. fuses, except where copper wire was used.

The Power Plant, which is owned by the Village, is located about 100 feet from the Bickle Elevator, and is equipped with two generators of 30 Kw. and 85 Kw. capacity.

Character of service: 440 volt, 60 cycles, 3 phase.

The following tabulated data shows the results of the tests.

GREELEY ELEVATOR.

MOTOR #1.

2 H.P. Robbins and Myers 1150 r.p.m., 32 amps. 3.2 amp

Driving one elevator leg empty, 45' - 5 x 9" cups.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
472	2.5	15.5	1250	1.66	.612

Remarks:

The high starting current was instantaneous only.

MOTOR #2.

7.5 H.P. Robbins and Myers Type K 1150 r.p.m., 10 amps.

Driving one short elevator leg empty, and idler pulley on one #7 Monitor wheat cleaner.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
464	10.4	26.5	2400	3.16	.285

Running the elevator and wheat cleaner loaded.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
464	11.75		5100	6.8	.54

MOTOR #3.

7.5 H.P. Robbins and Myers type K 1150 r.p.m., 10 amps.

Driving one short elevator leg and #5 Monitor Grain Separator empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
458	9.0	24.25	3800	5.06	.534

Remarks:

We were unable to run this machinery loaded.

MOTOR #4.

1 H.P. Robbins and Myers type K 1150 r.p.m., 1.6 amps.

Driving one short elevator leg empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
476	2.5	7.5	550	.73	.267

Remarks:

This motor would undoubtedly be overloaded when

elevating grain.

MOTOR #5.

20 H.P. General Electric Type KT 1750 r.p.m., 24.5 amps.

Driving a Dreadnaught 20" Feed grinder empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
442	7.5		3030	4.04	.525

Running the above machine while grinding oats.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
438	13.21		9200	12.22	.92

Remarks:

This motor, together with the following 1 H.P. motor is on a separate circuit.

The exact starting current could not be determined as it was above 50 amperes and meters used were not of sufficient capacity.

MOTOR #6.

1 H.P. Fort Wayne Type MA, 1.75 amps. per phase, 1800 R.P.M.

Driving two short elevator legs and a shaker loaded with oats.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
442	1.0	6.0	487	.647	.683

BICKLE ELEVATOR.

MOTOR #1.

3 H.P. Robbins and Meyers Type K, 4.2 amps. per phase, 1150 R.P.M.

Driving two short elevators and #10 Clipper Seed Cleaner empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
478	2.5	21.75	1350	1.79	.510

Driving the above elevators and cleaner and idler pulley on Invincible bean picker.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
478	4.0		1400	1.86	.424

Driving elevators, seed cleaner, and bean picker all empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
478	4.5	22.0	1650	2.19	.444

MOTOR #2.

7.5 H.P. Robbins and Meyers Type K, 10 amps. per phase, 1150 R.P.M.

Driving fan on bean drier.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
448	13.0	21.5	7180	9.6	.733

Driving idler pulley on fan.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
452	9.0		2575	3.47	.365

Remarks:-

It is quite evident that this motor is overloaded while running fan.

MOTOR #3.

2 H.P. Robbins and Meyers, Type K, 1150 R.P.M.
3.2 amps. per phase.

Driving one elevator leg empty, 55' - 7 x 4½" cups.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
466	2.7	13.75	1200	1.6	.550

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	12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Remarks:

This motor is undoubtedly overloaded while elevating grain.

MOTOR #4.

2 H.P. Robbins and Meyers, Type K, 1150 R.P.M. 3.2 amps. per phase.

Driving one elevator leg empty, 55' - $4\frac{1}{2}$ x 7".

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
472	2.5	14.75	800	1.06	.333

Driving the above elevator loaded with beans.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
472	5.0		3000	4.0	.735

Remarks:

This motor is heavily overloaded when elevating beans.

This motor blew 6 amp. starting fuses, but started on 10 amp. fuses.

MOTOR # 5.

10 H.P. Robbins and Meyers, Type K, 1150 R.P.M. 14 amps. per phase.

Driving three short elevator legs empty, and idler pulley on #6 Monitor bean separator.

Volts	Av. amps.	Start. Amps.	Watts	H.P.	P.F.
456	11.75	40.75	3100	4.12	.335

Driving above elevators and #6 Monitor bean separator all empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
452	17.0		10300	13.7	.763

SUMMARY.

Tests show that several of the motors are heavily overloaded. They also show that several of these motors draw a very high starting current, due, no doubt, to the inertia of the machines which they start. Numerous readings of the voltage were taken and found to be 480 when no machines were running. There was a considerable drop when the various motors were started, but at no time did it drop more than 2 volts below normal, which is 440. This would show that the difficulty is not due to low voltage, but to overload.

On the 7.5 H.P. motor driving the coal conveyor there was no protection except the 150 amp. fuses at the entrance and located in the Bickle elevator.

Several of the low-voltage releases were repaired as they were not in working order.

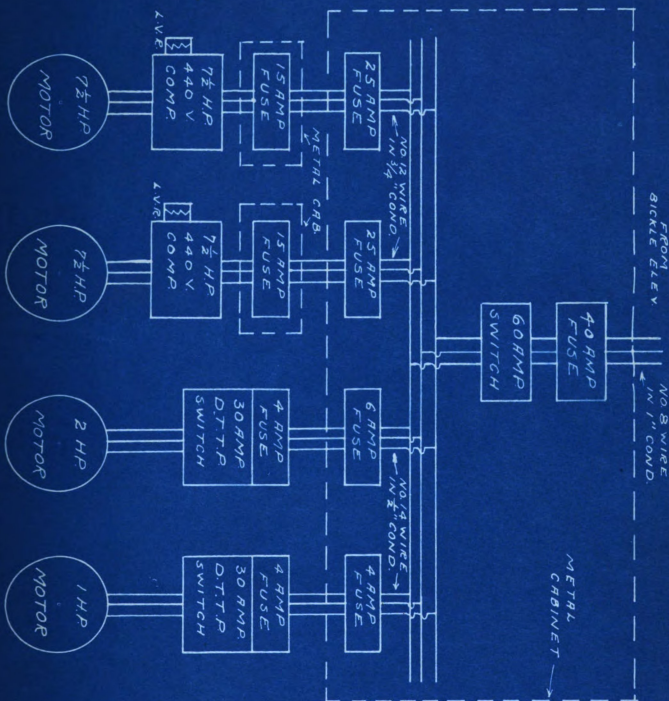
The following data gives the fuse sizes being used on the motors at the present time.

GREELEY ELEVATOR.

Motor size	Starting Fuse	Running Fuse
7.5 H.P.	Fuse Wire	30 amp.
2	Fuse Wire	60 amp.
1	Fuse Wire	15 amp.
7.5	30 amp.	30 amp.
20	60 amp.	30 amp. Relays
1	5 amp.	10 amp.

BICKLE ELEVATOR.

Motor Size	Starting Fuse	Running Fuse
10 H.P.	30 amp.	25 amp.
7.5	25 amp.	30 amp.
2	25 amp.	10 amp.
2	Fuse Wire	10 amp.
3	Copper Wire	15 amp.
7.5	No Fuses except the 150 amp. entrance fuses.	



GREELEY ELEV.

SAGINAW MILLING CO.

SANDUSKY, MICH.

MICHIGAN MILLERS' MUTUAL FIRE
INSURANCE COMPANY
ENGINEERING SERVICE DEPT.

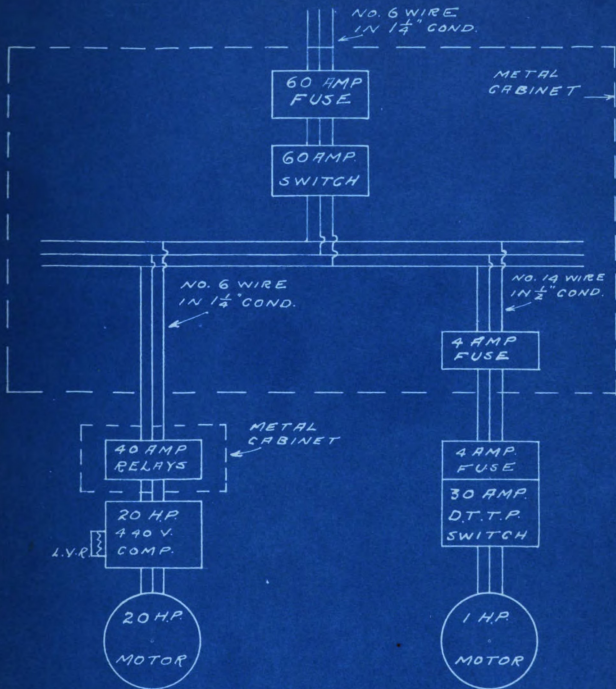
LANSING, MICH.

DATE 5-31-21

SCALE

R. A. B. - R. M. M.

PRINT NO.



GREELEY ELEV.

SAGINAW MILLING CO.

SANDUSKY, MICH.

MICHIGAN MILLERS' MUTUAL FIRE
INSURANCE COMPANY
ENGINEERING SERVICE DEPT.

LANSING, MICH.

DATE 5-31-21

SCALE

R.B. - P.M.M.

PRINT NO.

100

The following results were obtained at the Portland Farmer's Elevator Co., Portland, Michigan on April 23, 1921.

Character of service: 220 volt, 60 cycle, 2 phase current, supplied by the Municipal Power Plant.

MOTOR #1.

No nameplate, supposed to be 10 H.P.

Driving Clipper Cleaner #99-D loaded with oats, 3 short elevators loaded with oats, 1 elevator, 46'4" long, 30" head pulley, 5" x 9" cups, 9" canvas belt, known as #1, empty, and 1 elevator, 46'4" long, 20" head pulley, 4½" x 7" cups, 8" canvas belt, known as #2, loaded with oats.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
218	12.9		3500	4.7	.63

Driving 3 short elevators empty, and #1 empty, and #2 loaded with oats.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
224	12.5		2700	3.6	.48

Driving 3 short elevators empty, and #1 empty and #2 loaded with oats.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
224	12.3		2340	3.12	.41

Remarks:

Starting current very high due to the use of Fairbanks-Morse Induction Motor resistance starter.

MOTOR #2.

7.5 H.P., Fairbanks-Morse Type B, 17 amps., figures not discernible for speed.

Driving line shaft and 1 short elevator empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
218	7.0		1300	1.7	.41

Driving Clipper Clover-seed Cleaner #132 B, and 1 short elevator both empty.

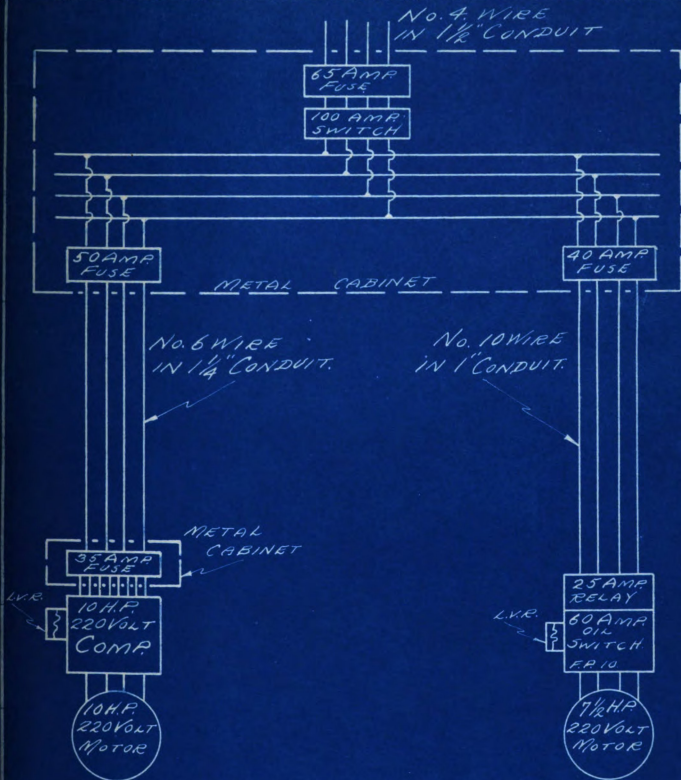
Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
216	8.0		1540	2.04	.43

Driving 20 hand bean pickers empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
216	8.0		1340	1.8	.39

Remarks:

Starting current very high due to the use of Fairbanks-Morse Induction Motor resistance starter.



PORTLAND FARMER'S ELEV. CO.

PORTLAND MICH.

MICHIGAN MILLERS' MUTUAL FIRE
INSURANCE COMPANY
ENGINEERING SERVICE DEPT.

LANSING, MICH.

DATE AUG. 15, 21

SCALE R.A.B.

PRINT NO.

The following results were obtained at the Portland Elevator Co., Portland, Michigan on April 23, 1921.

Character of service: 440 volt, 60 cycle, 3 phase current which is transformed, by means of the Scott connection, from the 2 phase current, supplied by the Municipal Power Plant.

MOTOR #1.

7.5 H.P. Western Electric, Type KT, 1200 R.P.M. 9.45 amps. per phase.

Driving 6 short elevator legs empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
436	5.5	25.5	1850	2.46	.45

Driving the above elevators and #19 Clipper cleaner all empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
432	6.5	27.5	3100	4.13	.64

Driving six elevators and #89 Clipper Cleaner, empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
432	7.0	28.5	3710	4.93	.71

Driving six elevators and #16 Clipper Cleaner, empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
430	6.0	27.5	2150	2.86	.48

MOTOR #2.

5 H.P. Westinghouse, Type CS, 850 R.P.M., 6.5 amps.

Driving 1 elevator leg 47'7" long, head pulley diam. 30" 7" canvas belt, 7" x 3½" cups, known as elevator #1, and

1 elevator leg 47'7" long, head pulley diam. 30", 10" canvas belt, 5 x 9" cups, known as elevator #2, both empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
420	4.0	27.0	600	.8	.20

Driving elevators #1 empty and #2 loaded with oats.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
430	3.75		1040	1.4	.373

Driving #1 loaded with beans and #2 loaded with oats.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
432	4.0		1200	1.6	.41

MOTOR #3.

3 H.P., Western Electric, Type KT, 1200 R.P.M., 4.4 amps.

Driving 1 short elevator leg and one two-decker Invincible bean cleaner #16862 both empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
424	2.75	12.0	330	.44	.16

Driving the above elevator empty and cleaner loaded.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
430	2.7	12.5	410	.55	.20

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and the role of the accounting department in ensuring the integrity of the financial statements. It also highlights the need for regular audits and the importance of transparency in financial reporting.

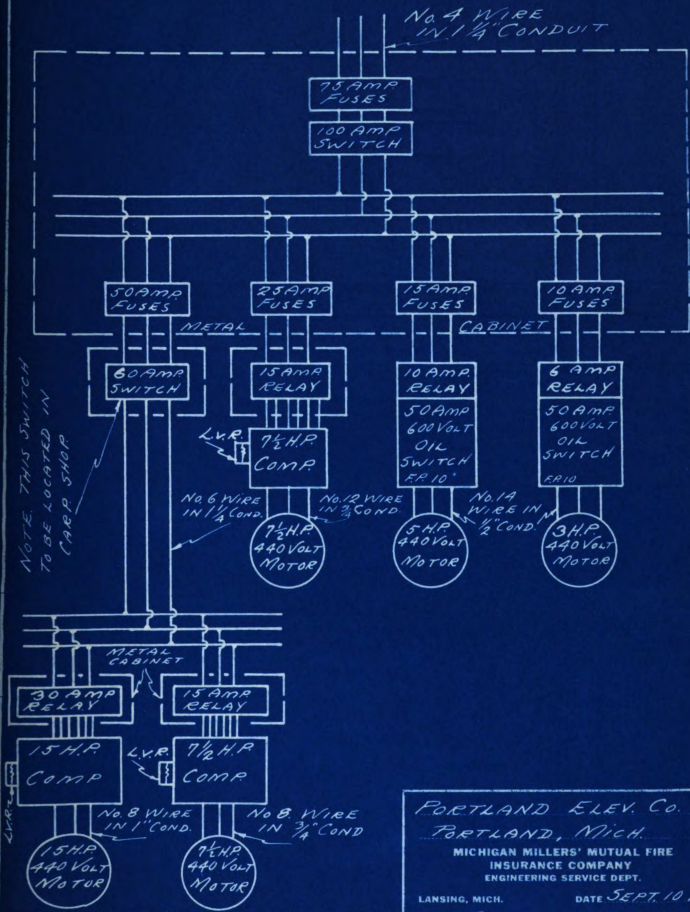
2. The second part of the document focuses on the implementation of internal controls to prevent fraud and ensure the accuracy of financial data. It outlines the key components of a robust internal control system, including segregation of duties, authorization procedures, and regular monitoring and evaluation.

3. The third part of the document addresses the challenges faced by organizations in managing their financial resources effectively. It discusses the importance of budgeting, forecasting, and financial analysis in making informed decisions and optimizing resource allocation.

4. The fourth part of the document explores the role of technology in modern accounting and finance. It highlights the benefits of using accounting software, data analytics, and automation to streamline processes, reduce errors, and improve the efficiency of financial reporting.

5. The fifth part of the document discusses the importance of ethical considerations in financial management. It emphasizes the need for integrity, honesty, and transparency in all financial transactions and the role of the accounting department in ensuring compliance with ethical standards and regulations.

6. The sixth part of the document provides a summary of the key points discussed and offers recommendations for organizations to improve their financial management practices. It stresses the importance of continuous learning, adaptation, and collaboration between different departments to achieve financial success.



PORTLAND ELEV. CO.

PORTLAND, MICH.

MICHIGAN MILLERS' MUTUAL FIRE
INSURANCE COMPANY
ENGINEERING SERVICE DEPT.

LANSING, MICH.

DATE SEPT. 10 '21

SCALE R.A.B.

PRINT NO.

DRIVING MONEY IN CARPENTER SHOP

The following results were obtained at the Owosso Elevator & Lumber Co's. Elevator, Owosso, Michigan, April 30th, 1921.

Character of service: 440 volt, 60 cycle, 3 phase, alternating current, supplied by the Consumers Power Co., Owosso, Mich.

MOTOR #1.

15 H.P., Western Electric, Type KT, 1715 R.P.M., 18.5 amps. per phase.

Driving elevator leg 34 feet long, 24" head pulley, 7" canvas belt, 4 x 7" cups, empty, known as Elevator #1 and one elevator leg 41 feet long, 24" head pulley, 8" canvas belt, 5 x 8" cups, empty, known as elevator #2, also two short elevator legs empty, and line shaft.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
474	7.5		3200	4.27	.52

Driving elevators #1 and #2 empty, two short elevator legs empty and Clipper Cleaner #8 D, empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
488	975		4790	6.37	.58

Driving elevator legs #1 and #2 empty, two short elevator legs empty and 30" blower fan for loading cars.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
486	15.1		10500	14.14	.86

Driving elevator #1 empty and elevator #2 loaded, two short elevator legs empty and line shaft.

Volts	Av.amps.	Start. amps.	Watts	H.P.	P.F.
489	8.5		3600	4.8	.51

Driving elevator #1 loaded, #2 empty, Clipper cleaner #8 D loaded, 2 short elevator legs empty.

Volts	Av.amps.	Start. amps.	Watts	H.P.	P.F.
488	10.25		4900	6.4	.58

MOTOR #2.

10 H.P. Fairbanks-Morse, Type B, 1800 R.P.M., 13 amps. per phase.

Driving elevator 35 feet long, 24" head pulley, 6" canvas belt $3\frac{1}{2}$ x 6 " cups, empty, known as elevator #1, and one elevator 40 feet long, 24" head pulley, $5\frac{1}{2}$ " canvas belt, $3\frac{1}{2}$ x 5" cups, empty, known as elevator #2, and two short elevator legs empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
486	8.5		1650	2.2	.23

Driving elevators #1 and #2 empty and two short elevators empty and Clipper cleaner #99 D empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
488	10		4900	6.5	.58

Driving elevators #1 and #2 empty, two short elevators empty and Gibbs bean picker empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
484	8.4		2600	3.46	.37

Driving elevators #1 and #2 empty, two short elevators empty and one elevator 40 feet long, 24" head pulley, 4" x 7" cups, chain drive, known as elevator #3, empty.

Volts	Av. amps.	Start. Amps.	Watts	H.P.	P.F.
480	8.4		2550	3.39	.36

Driving elevators #1, 2 and 3 empty, two short elevators empty and an elevator 34 feet long, 24" head pulley, 6" canvas belt, 6 x 3½" cups, empty, known as elevator #4.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
481	8.8		2730	3.63	.37

MOTOR #3.

7½ H.P. Fairbanks-Morse, Type B, 1800 R.P.M., 10 amps. per phase.

Driving Sprout & Waldron cob crusher empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
493	6		2040	2.78	.4

Running above crusher loaded.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
492	15		9800	13.2	.66

Remarks:

The load fluctuated considerably, consequently it was impossible to get very accurate results.

MOTOR #4.

7½ H.P. Fairbanks-Morse Type B, 1800 R.P.M., 10 amps. per phase.

Driving one long elevator loaded, one long elevator empty, one short elevator loaded, line shaft and corn sheller empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
488	5		2800	3.72	.66

Driving two long elevators and one short elevator empty.

Volts	Av. amps.	Start amps.	Watts	H.P.	P.F.
480	5.5		2450	3.28	.54

Driving two long elevators loaded, one short elevator empty, corn sheller empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
486	5.5		2600	3.48	.57

MOTORS #5 and #6.

Both motors alike, 10 H.P. Fairbanks-Morse, Type B, 1800 R.P.M. 13 amps. per phase.

Driving Hallstead 18" attrition mill empty.

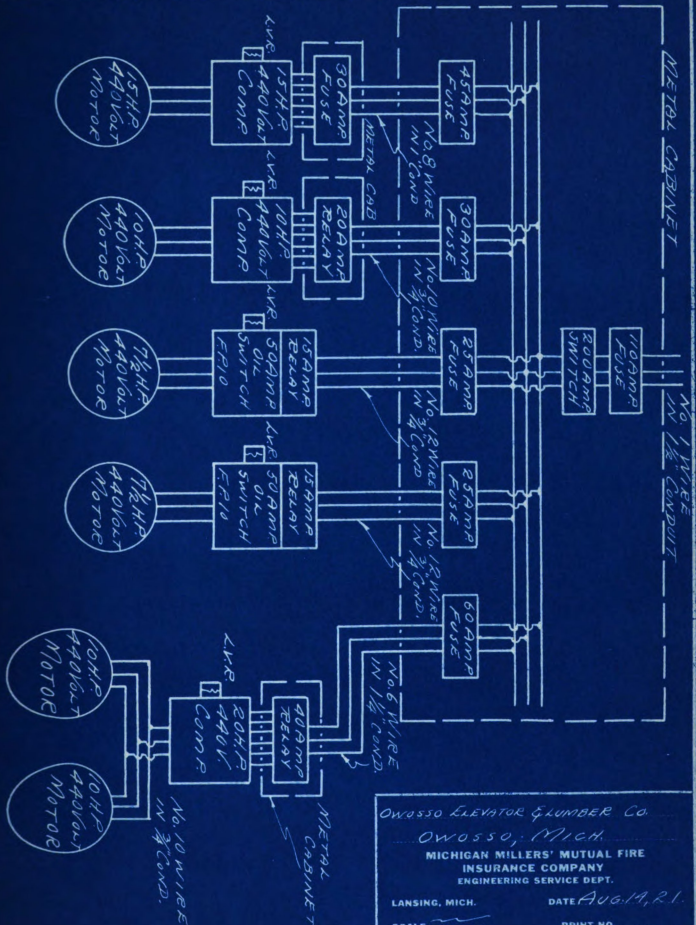
Volts	Av. amps.	Start.amps.	Watts	H.P.	P.F.
486	17.2		9100	12.1	.63

Driving the above mill loaded with corn and oats mixed.

Volts	Av.amps.	Start. amps.	Watts	H.P.	P.F.
480	27.6		17900	23.8	.78

Remarks:

Both motors were so hot that it was impossible to leave the bare hand on them.



The following results were obtained at the Cass Bean and Grain Co's. elevator, Bay City, (Salzburg), Michigan, May 7th, 1921.

Character of service: 220 volt, 60 cycle, 3 phase, supplied by the Consumers Power Co., Bay City, Michigan.

MOTOR #1.

7.5 H.P. Westinghouse, Type CF. 9.8 amps. per phase, 1130 R.P.M.

Driving Clipper Cleaner #8d, empty.

Volts	Av. amps.	Start. amps.	Watts	H.B.	P.F.
229	14.8		4100	5.97	.743

MOTOR #2.

5 H.P. 1130 R.P.M., 13 amps. per phase, Type CF, Westinghouse.

Driving Clipper Cleaner #99-D, empty.

Volts	Av. amps.	Start. amps.	Watts	H.B.	P.F.
240	13.3		4900	6.5	.89

MOTOR #3.

15 H.P., Fairbanks-Morse, 1200 R.P.M., Type H, Full load amp. 38.

Driving fan on Ellis dryer.

Volts	Av. amps.	Start. amps.	Watts	H.F.	P.F.
242	45		16450	21.6	.75

MOTOR #4.

3 H.P., Fairbanks-Morse Type H, 1130 R.P.M., 8.8 amps. per phase.

Driving Crippen blended action bean picker, empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
252	5		650	.86	.29

Driving the above machine loaded.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
248	5.2		730	.92	.33

MOTOR #5.

2 H.P. Westinhouse type CS, 1120 R.P.M. 5.8 amps.

Driving Oxford bean polisher #475, empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
250	5		1100	1.46	.51

Driving the above machine loaded.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
248	5		1300	1.73	.61

MOTOR #6.

1 H.P. Westinghouse, Type CSA, 1725 R.P.M., 2.5 amps.

Driving Giant bean picker loaded.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
248	1.85		750	1	.945

MOTOR #7.

2 H.P. Westinghouse, Type CS, 1120 R.P.M, 5.8 amps.

Driving elevator 61.5 feet long, 36" head pulley, 8 x 5 cups, 9" rubberoid canvas belt, empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
252	4.1	29	650	.87	.37

Driving the above elevator loaded with wheat.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
252	4.85		1300	1.75	.63

MOTOR #8.

1/2 H.P. Westinghouse, Type CSA, 1140 R.P.M., 1.75 amps.

Driving 16 hand bean pickers, empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
252	2.2	6	415	.55	.43

MOTOR #9.

30 H.P. Fairbanks-Morse Type B, 1200 R.P.M., 74 amps.

Driving Dreadnaught 24" Attrition Mill, Bryant Cob Crusher, corn sheller, and 3 short elevators, all empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
236	49.8		6600	8.76	.33

Driving attrition mill and 3 short elevators loaded with oats, other machines empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
236	64.5		17550	23.4	.67

Driving cob crusher loaded with cobs, other machines empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
232	54		8550	11.35	.39

Driving cob crusher and sheller loaded with corn on cobs, other machines empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
236	61.5		16050	21.3	.64

Driving attrition mill loaded with corn and crushed cobs all other machines empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
238	66		20100	26.7	.74

METAL CABINET

350,000 C.M. WIRE
IN 3" CONDUIT

300 AMP
FUSE

METAL
CABINET

7.00
CR

The following results were obtained at the Stockbridge Elevator Co's. Elevator, Jackson Michigan on May 14th, 1921.

Character of service: 440 volt, 60 cycle, 3 phase, supplied by the Consumers Power Co., Jackson, Michigan.

MOTOR #1.

3 H.P. General Electric, Type KT, 1200 R.P.M., 4.2 amps.

Drives fan on Clarage #9, Type CI car loader.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
482	6	25.5	4460	5.93	.89

MOTOR #2.

10 H.P. Wagner, Type 14 ZBW, 1730 R.P.M., 13 amps.

Driving Monarch #384 size 2 C Cracked Corn Separator and Sprout & Waldron #16 corn crusher, both machines empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
468	5	45.5	2800	4.05	.69

Driving above machines loaded with corn.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
460	4.5	45.5	1810	3.58	.51

Driving line shaft only.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
458	4		1200	1.61	.38

Driving the above machines empty and Crippen bean picker empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
460	5.5		2550	3.4	.58

MOTOR #3.

5 H.P. Western Electric Type KT, 1200 R.P.M., 6.6 amps.

Driving line shaft only.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
469	4	40	450	.6	.14

Driving Invincible 3 Deck Cleaner empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
464	4.5		600	.8	.17

Remarks:

This motor is also used to run freight elevator.

MOTOR #4.

3 H.P. Wagner, Type 11 PBP, 1750 R.P.M., 8 amps.

Driving an elevator leg 85'6", 33" head pulley, 11" canvas belt, 11 x 5 $\frac{1}{2}$ " cups, empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
486	1.95	27.5	690	.92	.42

Driving above elevator loaded with cracked corn.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
488	2.2		990	1.32	.54

MOTOR #5.

1 H.P. Robbins & Meyers Type K, 1750 R.P.M., 1.4 amps.

Driving Monarch aspirator #20, size 5 A, empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
490	1.4	6.5	690	.92	.59

MOTOR #6.

7.5 H.P. General Electric Type KT, 1200 R.P.M., 9.5 amps.

Driving fan on Hess Ideal Pneumatic dryer.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
488	9	31	6700	8.9	.99

MOTOR #7.

3 H.P. Western Electric, Type KT, 1800 R.P.M., 3.8 amps.

Driving elevator leg 79'6" long, 33" head pulley, 11" canvas belt, 5 x 11" cups. This elevator will be known as #1. Also elevator leg 85'6" long, 36" head pulley, 11" canvas belt, 5 x 11" cups. This elevator will be known as elevator #2.

Driving #1 and #2 empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
480	2.1		610	.81	.35

Driving #1 loaded and #2 empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
476	2.7		1350	1.8	.61

MOTOR #8.

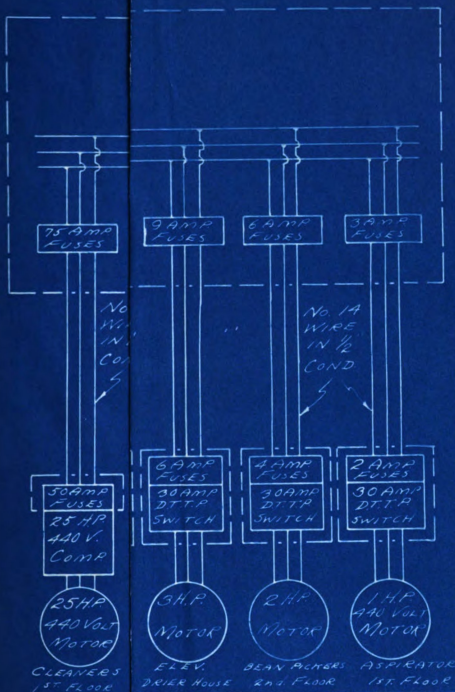
10 H.P. Fairbanks-Morse 1200 R.P.M., 14 amps. per phase.

Driving idler pulley only.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
476	6		1400	1.86	.283

Driving Wolf-Dawson Wheat Washer, #W288 empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
476	6.5		1800	2.4	.34



234

18.8

4400

5.85

.58

MOTOR #2.

5 H.P. Fairbanks-Morse Type B, 1800 R.P.M., 13 amps.
per phase.

The following results were obtained at the George F. Dimond Elevator Co., St. Johns, Michigan June 9th, 1921.

Character of Service; 220 volt, 60 cycle, 3 phase furnished by the Municipal Power Plants.

MOTOR #1.

10 H.P. Fairbanks-Morse, Type B, 1800 R.P.M., 24.4 amps. per phase.

Driving Clipper Cleaner #149 D, loaded with barley, and one elevator leg 44' long, 24" head pulley, known as #2 Elevator, and one elevator 44' long, 12" head pulley, elevator known as #1, both empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
230	18.2		4200	5.6	.58

Driving Elevator #1 empty and Elevator #2 loaded with barley.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
234	17		1951	2.59	.28

Driving elevators #1 and #2 empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
238	17.5		1700	2.26	.24

Driving cleaner and elevators both empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
234	18.8		4400	5.85	.58

MOTOR #2.

5 H.P. Fairbanks-Morse Type B, 1800 R.P.M., 13 amps. per phase.

Driving elevator leg 37' long, 16" head pulley, 8½" leather belt, 8 x 5 cups, known as elevator #1 and elevator leg 46' long, 16" head pulley, 8½" leather belt, 8 x 5" cups, known as elevator #2, both empty, and a line shaft with two short elevators, both empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
232	10		1800	2.4	.45

Driving the two long elevators, two short elevators and Clipper Cleaner #89, all empty.

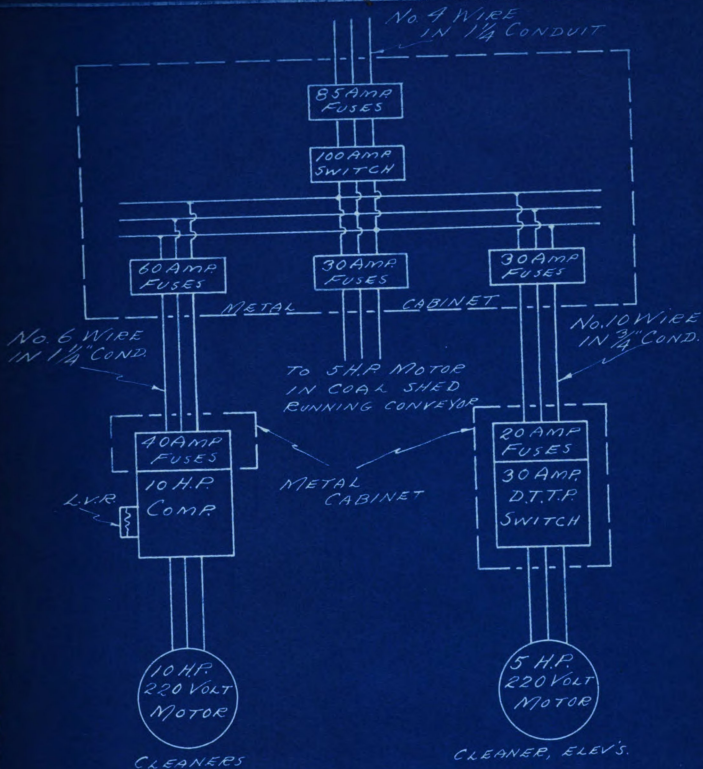
Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
224	11		2650	3.52	.62

Driving Oxford Bean Polisher #1L, two short, and the two long elevators, all empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
230	10.75		2500	3.33	.58

Driving Centrifugal Bean Picker, two short, and the two long elevators, all empty.

Volts	Av. amps.	Start. amps.	Watts	H.P.	P.F.
230	11.25		2750	3.65	.61



GEORGE F. DIMOND Co.
 ST. JOHNS, MICH.

MICHIGAN MILLERS' MUTUAL FIRE
 INSURANCE COMPANY
 ENGINEERING SERVICE DEPT.

LANSING, MICH.

DATE SEPT. 9, 21

SCALE R.A.B.

PRINT NO. 21

Grain Cleaners	Page	H.P.		Type Load	Other Machinery	Loaded
		Empty	Loaded			
Clipper						
No. 8 D	16	5.97			34'-4x7" cups	No
No. 8 D	12	6.37			41'-5x8" cups	No
					2 Short Elev.	
No. 10 Seed	3	1.79			2 Short Elev.	No
No. 16	10	2.86			6 Short Elev.	No
No. 19	10	4.13			6 Short Elev.	No
No. 89	10	4.93			6 Short Elev.	No
No. 89	23	3.52			37'-5x8" cups.	No
					46'-5x8" cups.	No
					2 Short Elev.	
No. 99 D	8	3.12			46'-5x9" cups	No
					46'-4½x7" cups	No
					3 Short Elev.	
No. 99 D	13	6.5			35'-3½x6" cups	No
					40'-6½x5" cups	No
					2 Short Elev.	
No. 99 D	16	6.5				
No. 132 B Clover Seed	9	2.04			1 Short	No
No. 149 D	22	5.85	5.6	Barley	44'-4x6" cups	No
					44'-4x6" cups	

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 3, 1862. It is a very important document, as it contains the President's annual message to Congress. The letter is written in a formal, dignified style, and it is one of the most important documents in the history of the United States. It is a document that has been read and studied by many generations of Americans, and it is a document that has shaped the course of our nation's history.

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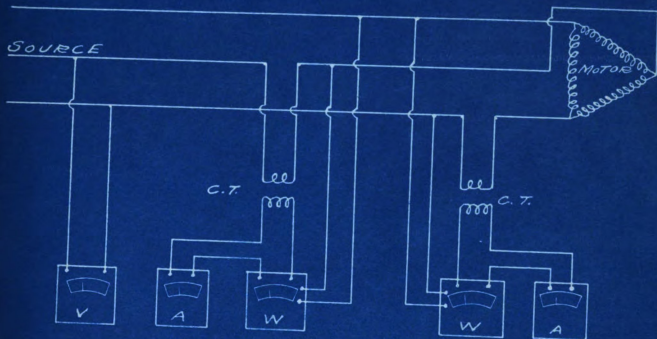
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Grain Cleaners	Page	H.P. Empty	H.P. Loaded	Type Load	Other Machinery	Loaded
Monitor						
No. 5 Grain	2	5.06			1 Short	No
No. 7 Wheat	2		6.8	Wheat	1 Short Elev.	Yes
Invincible 3 Deck	20	.8				
Bean Machinery						
Invincible 2 Deck Cleaner	11	.44	.55		1 Short Elev.	No
Invincible Bean Picker	4	2.19			2 Short Elev. 1 #10 Clipper Seed Cleaner	No
Monitor Bean Sep. No. 6	5	13.7			3 Short Elev.	No
Gibbs Picker	13	3.46			35' - 3 1/2 x 6" cups 40' - 3 1/2 x 5" cups 2 Short Elev.	No
Crippen Blended Action	17	.86	.92			
Giant Picker	17		1.00			
Oxford Polisher 475	17	146	1.73			
Oxford Polisher I L	23	3.33			37' - 5x8" cups 46' - 5x8" cups 2 Short Elev.	No

Bean Machinery	Page	H.P. Empty	H.P. Loaded	Type Load	Other Machinery	Loaded
Centrifugal Picker	23	3.65			37'-5x8" cups 46'-5x8" cups 2 Short Elev.	No
20 Hand Bean Pickers	9	1.8				
16 Hand Bean Pickers	18	.55				
Grinders, Crushers, Shellers.						
Dreadnaught 20"	3	4.04	12.22	Oats		
Dreadnaught 24"	18	8.76	23.4		Bryant Crusher Corn Sheller 3 Short Elev.	No
Dreadnaught 24"	18	No	11.35	Crusher		Yes
Dreadnaught 24"	18	No	21.3	Corn on cobs	Crusher and Sheller	Yes
Dreadnaught 24"	18		26.7	Corn	Crusher and Sheller	No
Halstead 18"	15	12.1	23.8	Corn & Oats		
Sprout & Waldron	14	2.78	13.2	Cobs		
Sprout & Waldron No. 16	19	4.05	3.58	Corn	Mon. Corn Sep. 384-2C	No
Sprout & Waldron No. 16	19	3.04			Crippen	No

Fans	Page	H.P. Empty	H.P. Loaded	Type Load	Other Machinery	Loaded
30" Loader	12		14.14		34'-4x7" cups 41'-5x8" cups 2 Short Elev.	No
Ellis Drier Fan	16		21.6			
Clarage Car Loader No. 9	19		5.93			
Pneumatic Drier "Hess"	21	8.9				
Bean Drier Fan	4	9.6				
Monarch Aspirator No. 20-5A	20	.92				
Wheat Washer						
Wolf Dawson # 288	21	2.4				
Elevators						
45'-5x9" cups	2	1.66				
1 Short	2	3.16			Idler Pulley	
1 Short	2	.73				
2 Short	3		.647	Oats	Shaker	Yes
55'-4½x7" cups	4	1.6				
55'-4½x7" cups	5	1.06	40	Beans		

Elevators	Page	H.P. Empty	H.P. Loaded	Type Load	Other Machinery	Loaded
3 Short	5	4.12			Idler Pulley	
1 Short	9	1.7			Line shaft	
6 Short	10	2.46				
47'-3½x7", 47'-5x9"	10	.8	1.5	Oats		
34'-4x7", 41'-5x8", 2 Short	12	4.27			Line Shaft	
34'-4x7" cups	12	4.8			41'-5x8" cups 2 Short Elev.	Yes
35'-3½x6" cups, 40'-3½x5" cups	13	2.2			2 Short Elev.	No
35'-3½x6", 40'-3½x5", 40'x4x7"	13	3.39			2 Short Elev.	No
35'-3½x6", 40'-3½x5" 40'-4x7", 34'-3½x6"	14	3.63			2 Short Elev.	No
61'-5x8" cups	17	.87	1.73	Wheat		
85'-5½x11" cups	20	.92	1.32	Cr.Corn		
79'-5x11" cups	21	.81	1.82		85'-5x11" cups	No
45'-5x9" cups	22	2.26			44'-4x5" cups	No
45'-5x9" cups		2.59		Barley	44'-4x5" cups	No
37'-5x8" cups, 46'-5x8" cups	23	2.4			2 Short Elev. Line Shaft	No



CONNECTION DIAGRAM FOR
THREE-PHASE POWER MEASUREMENT

A = AMMETER.
W = WATTMETER
C.T. = CURRENT TRANS.
V = VOLTMETER.

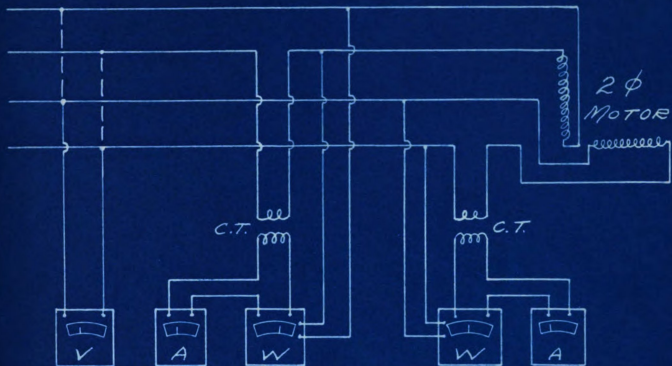
MICHIGAN MILLERS' MUTUAL FIRE
INSURANCE COMPANY
ENGINEERING SERVICE DEPT.

LANSING, MICH.

DATE

SCALE $\frac{1}{2}$ IN. = 1 FT.

PRINT NO.



CONNECTION DIAGRAM FOR

TWO-PHASE POWER MEASUREMENT

A = AMMETER
 W = WATTMETER
 C.T. = CURRENT TRANS.
 V = VOLTMETER.

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LANSING, MICH.

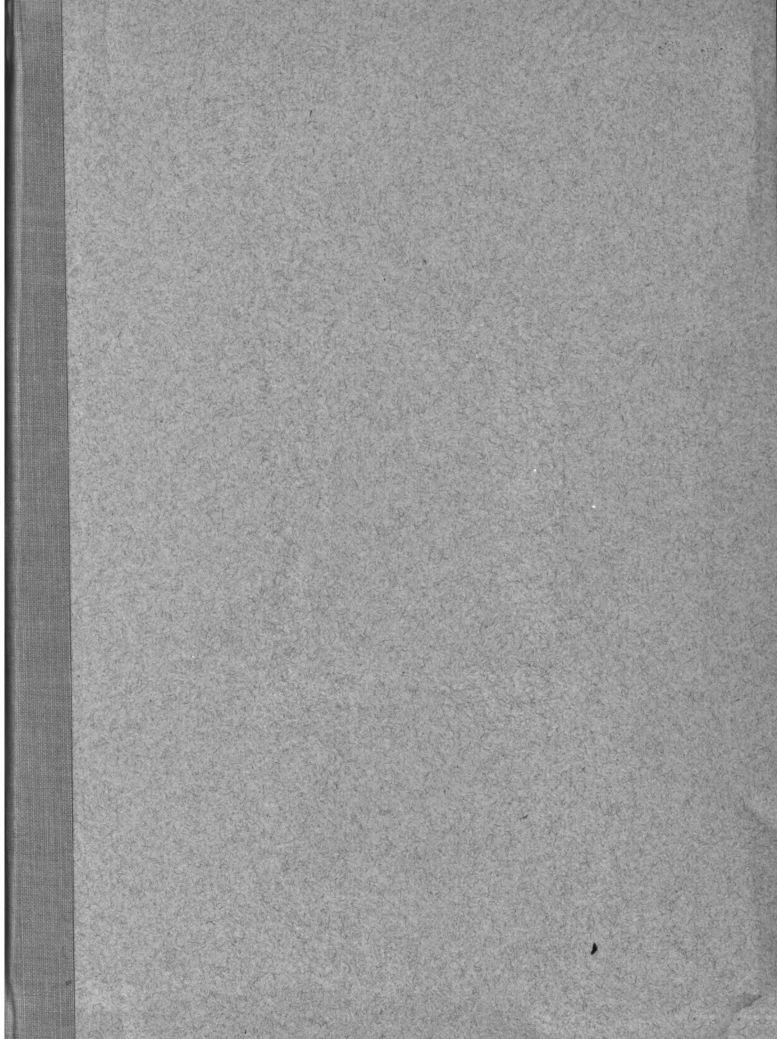
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