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INDUSTRIAL ACCIDENTS IN THE CALIFORNIA OIL FIELDS.

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Introduction\*\*

The progress of the "Safety First" movement in the oil fields of California during the past few years has been remarkably rapid. It has been generally conceded by those who have learned to value the life and limbs of their employees, that safety is essential to efficiency and no company that has a high accident rate can be considered an efficient organization. Accidents have a destructive effect on the morale of any body of workers and cause disorganizations and delays.

The increasing danger to life and limb involved in the drilling for and the production of oil and gas, has become so great that it is clearly evident that everything possible must be done to keep it within the narrowest possible limits.

There is a tendency toward carelessness, especially by men who are employed in hazardous occupations. This is brought about by the familiarity of the risk under which they are working, and in no industry is this more forcibly exemplified than in the oil fields. Men have performed the same or similar duties for many years and have worked around similar hazards and unprotected machinery until many have an entire disregard for the dangers surrounding them. Very often familiarity with a hazard occasions a contempt for that hazard which only too often results disastrously.

It is therefore evident that the employer and employee must work hand in hand to attain the desired end of reducing these avoidable accidents to a minimum, but it remains for the employer to take the initiative. His first duty is to provide adequate and effective safeguards and safety devices for all dangerous machinery and working places and thereby show evidence of his earnestness to lessen the hazards around which his employees are forced to work.

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\*\* List of tables is given at the back of this report.

The employee should feel that whatever is done in the way of providing safeguards is for his benefit, and unless his full and willing cooperation is given, safeguards alone will not assure the total prevention of accidents.

Practically every accident in the oil fields and especially at the derricks is a repetition of a similar accident occurring at the same or other parts of the field. Thoroughly acquainting the workmen with the hazards they are working under will tend to avoid a large proportion of the accidents and especially if they then use care and judgment in fulfilling their duties.

In the summer of 1923, the Bureau of Mines began a study of the causes of accidents in the oil fields and the means of preventing them. An intensive investigation was made of the accidents occurring to the employees of ten representative California oil companies during 1921 and 1922 and the results of the tabulation of these injuries are the foundation upon which the present work on safety in the oil fields will be carried on.

The engineers of the Bureau of Mines believe that a great deal of good can be accomplished by visiting the various oil fields, talking with the operators, superintendents, foremen and workmen regarding safety and safety appliances and disseminating information by means of sketches, photographs and safety bulletins. Suggestions and advice will be freely given as one of the general aims and purposes for which the Bureau of Mines was first established was to "increase safety in the mineral industries of the country."

#### Source and Scope of Statistics.

This report is the first of a series of papers on oil-field accidents and the means of preventing them, and is confined to a review of over 4000 accidents caused to the oil field employees of ten representative California oil companies during the years 1921 and 1922. The records of these accidents have been compiled from data taken from the accident reports sent by the operators to the Industrial Accident Commission of California. These data have been tabulated so as to show the cause and frequency of the accidents, part of workman's body affected, time in days lost and occupation of the injured.

It is hoped that this detailed review of the accidents enumerated here will be of assistance to the operators and officials of oil companies, in that it will show them the cause, frequency and severity of those accidents which are an almost daily occurrence in the oil fields. To the employee it points out the hazards he is working under and will tend to educate him to be more careful and to take greater precautions in his daily work.

From time to time other publications will be issued on safeguards and safety devices used in the oil fields.

## Salient Facts Brought out by this Investigation.

In all, 4108 tabulatable accidents causing disability lasting longer than the day of injury and resulting in a total loss of 274,829 days, occurred during the years 1921 and 1922 to the employees in the drilling and producing departments of the ten oil companies whose reports were available for this study. This number represents approximately two-thirds of all the lost time accidents met with in the oil fields of California during 1921 and 1922 and are fairly representative of the accidents occurring in the oil fields of California.

It is an interesting fact that 14.17 per cent of the accidents to oil workers, resulting in 29.38 per cent of all the time lost because of accidents were caused by the machinery at drilling and producing wells. A detailed survey shows that 39.34 per cent of the accidents causing 54.27 per cent of the total number of days lost through injuries were sustained by the drilling crews engaged in drilling operations. In terms of days lost, pumpers and oilers come next, though field roustabouts and laborers rank second as regards the number of accidents.

As a source of accidents, heavy lifting and straining closely follows the machinery at drilling and producing wells, though falls of persons caused the loss of more than four times as many days, due largely to the serious character of the accidents resulting from falls of workers from derricks and derrick ladders.

An average for the two years of slightly more than three per cent of the total days worked by the employees of nine out of the ten companies embodied in this report, were lost on account of injuries received during the course of employment. Assuming a conservative average wage of seven dollars a day for oil workers, this time in days lost, represents a gross loss of nearly one million dollars a year to the oil industry, and does not include the additional large amount lost through decreased work resulting from the disorganizing effect which accidents have on the workers.

### Statistical Study.

A classification of the 4108 accidents, in which a fatal accident has been taken as equivalent to 6,000 days\* lost time is given in Table 1. The causes of accidents have been divided into fifteen main divisions, each having one or more subtitles. In addition to showing for each division the total number of accidents and days lost with percentage of the total, the accidents listed have been further segregated to show the part of the body affected.

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\*Weighting recommended by the Committee on Statistics and Compensation Insurance Cost of the International Association of Industrial Accident Boards and Commissions,



Table 1. Accidents classified by Causes.

All Causes

Cause of Accident	Number of Accidents			Part of Body Affected								Time in Days lost.		
	Total of sub-title	Division total	Per cent of total accidents	Eye	Head	Face	Shoulder, Arms.	Hands, Fingers	Trunk, Back	Foot, Ankle, Toes.	Leg	Total of sub-title	Division Total	Per cent of total days lost
All causes.....	4108*			302	145	181	314	1102	801	898	365	274829		
Totals and percentages.....		4108*	100.00										274829	100.00
Heavy Lifting and Straining														
Heavy lifting and straining.....	493a						37	19	410	5	22	12368		
Totals and percentages.....		493a	12.00										12368	4.50
Dropping Objects or Materials														
Dropping objects... or materials...	225				2	2	2	41	4	161	13	3143		
Totals and percentages.....		225	5.48										3143	1.14
Stepping on Objects.														
Nails.....	109									109		725		
Miscellaneous.....	59								2	51	6	593		
Totals and percentages.....		168	4.09										1318	0.48
Running into or striking Objects														
Nails or wire.....	59			1		1	7	35	3	7	5	459		
Miscellaneous.....	147a			2	5	2	15	60	11	22	30	7867		
Totals and percentages.....		206a	5.02										8326	3.03

(\* ) includes 30 fatal accidents  
(a) includes one fatal accident.



Table 1. (Continued)

Struck by Moving Object														
Cause of Accident	Number of Accidents			Part of Body Affected								Time in Days lost.		
	Total of sub-title	Division total	Per cent of total accidents	Eye	Head	Face	Shoulder, Arms.	Hands, Fingers	Trunk, Back	Foot, Ankle, Toes	Leg	Total of subtitle	Division Total	Per cent of total days lost.
Caught between object and material.....	284													
Struck by.....	154b			5	3	3	13	189	5	53	18	6751		
Totals and percentages		438b	10.66										20662	7.52
Struck by Falling Objects														
From Derrick.....	112d			2	24	8	17	9	9	36	7	28356		
Tools and Materials.	245a			1	17	1	8	33	11	145	29	12199		
Totals and percentages.....		357e	8.69										40555	14.76
Falls of Persons														
Slipping and tripping.....	211				4	4	17	16	92	42	36	3602		
Into holes or unprotected places.	44					1	4	1	13	9	16	754		
From Derrick.....	28d				3	1	6	1	10	3	4	26429		
From Derrick Ladder..	10b				1		3		5		1	12126		
Off Ladders & Scaffolds	67				5	1	12	5	16	14	14	1445		
Off Trucks, Autos, etc.	61				2	3	12	8	17	13	6	1499		
Miscellaneous.....	33a				2	2	4	3	8	6	8	7217		
Totals and percentages .....		454f	11.05										53072	19.31

- (a) includes one fatal accident
- (b) includes two fatal accidents
- (d) includes four fatal accidents
- (e) includes five fatal accidents
- (f) included seven fatal accidents



Table 1, (Continued)

Hand Tools.														
Cause of Accident	Number of Accidents		Per cent of total accidents	Part of Body Affected								Time in Days Lost.		
	Total of subtitle	Division Total		Eye	Head	Face	Shoulder, Arms	Hands, Fingers.	Trunk Back.	Foot, Ankle, Toes	Leg	Total of subtitle	Division total	Per cent of total days lost.
Hammers, Hatchets, etc.	69			1	2	3	3	35	2	12	11	981		
Wrenches.....	40			1	2	2	9	17	8	1		794		
Tongs.....	34				1	1	4	12	7	6	3	125		
Jacks, Prys, Bars, etc..	60			1	7	4	4	16	7	15	6	877		
Miscellaneous.....	69			1	1	2	6	25	1	21	12	700		
Totals and percentages.....		272	6.62										3378	1.23
Autos, Trucks and Tractors														
Repairing.....	29			2	2		3	16	3	3		576		
Operating.....	72			1	3	5	16	23	15	4	5	2616		
Struck by.....	17a				1		5		4	6	1	633		
Miscellaneous.....	3									3		97		
Totals and percentages.....		121a	2.95										9622	3.51
Vehicles														
Plows, Scrapers.....	12							2	4	4	2	113		
Miscellaneous.....	5				1		2			2		74		
Totals and percentages.....		17	0.41										187	0.06

(a) includes one fatal accident.



Table 1 (Continued)

Burns														
Cause of Accident	Number of Accidents			Part of Body Affected								Time in Days lost.		
	Total of subtitle	Division total	Per cent of total Accidents	Eye	Head	Face	Shoulder, Arms,	Hands, Fingers	Trunk, Back	Foot, Ankle, Toes.	Leg	Total of subtitle	Division total	Per cent of total days Lost.
Gas and Oil.....	98a			2	2	65	6	16	1	1	5	7157		
Hot Metal.....	15			1		1	1	8		3	1	241		
Steam and Hot Water.	58				1	7	6	3	7	22	12	825		
Electric.....	3a							1	1		1	6078		
Acetylene.....	5			1		1		3				27		
Miscellaneous.....	36a			3		5	3	17	1	6	1	6531		
Totals and percentages.....		215c	5.23										20859	7.59

Flying Objects														
Cause of Accident	Total of subtitle	Division total	Per cent of total Accidents	Eye	Head	Face	Shoulder, Arms,	Hands, Fingers	Trunk, Back	Foot, Ankle, Toes.	Leg	Total of subtitle	Division total	Per cent of total days Lost.
Chips from Material..	117			107	1			5			1	6693		
Chips from Tools.....	12			5			2	2			3	985		
From Grinding Wheels..	15			10				4			1	323		
In Derrick from above.	64			64								1055		
Miscellaneous.....	89			78	4	3	2	1		1		2086		
Totals and percentages.....		297	7.23										11142	4.05

(a) includes one fatal accident  
(c) includes three fatal accidents



Table 1. (Continued)

## Machinery at Drilling and Producing Wells.

Cause of Accident	Number of Accidents.			Part of Body Affected							Time in Days lost.			
	Total of Subtitle	Division Total	Per cent of total accidents	Eye	Head	Face	Shoulder, Arms.	Hands, Fingers.	Trunk, Back.	Foot, Ankle, Toes	Leg	Total of subtitle	Division total	Per cent of total days lost.
Draw-works														
Drum.....	5a				2			2	1		1	6133		
Sprockets.....	6							4	1		1	271		
Chains.....	22a			1		3	3	4	2	3	6	7377		
Shaft.....	5				2			1			2	1437		
Cathead.....	12				1		4	5			2	1194		
Clutch, etc.....	28					3	1	6	3	1	14	436		
Rotary Engine														
Flywheel.....	3a				1					2		6026		
Sprocket.....	0											0		
Eccentric.....	1									1		20		
Miscellaneous.....	3							1		2		120		
Rotary Table														
Shaft, Gears, Sprockets	3							1		1	1	29		
Miscellaneous.....	2							2				253		
Pumps.....	5				1			3	1			258		
Calf Wheel														
Sprocket, Chain...	2							2				25		
Miscellaneous...	2							1	1			644		
Bull Wheel														
Wheel, Pegs, Shaft.	10a				1		1	4	3	1		6381		
Rope.....	9			1	1	2	1	2	2			63		
Band Wheel														
Shaft, Belt.....	0											0		
Miscellaneous.....	1							1				10		
Standard Engine														
Flywheel.....	3a							2	1			6039		
Pulley, Belt.....	4						2	2				37		
Miscellaneous.....	8							6		1	1	339		
Pitman.....	9						2	6		1		2067		
Walking Beam														
Fell from.....	1						1					66		
Struck by.....	2						1	1				27		



Table 1. (Continued)

## Machinery at Drilling and Producing Wells. (Continued)

Cause of Accident	Number of Accidents			Part of Body Affected							Time in Days lost.			
	Total of subtitle	Division total	Per cent of total accidents	Eye	Head	Face	Shoulder, Arms.	Hands, Fingers	Trunk, Back	Foot, Ankle, Toes	Leg	Total of subtitle	Division total	Per cent of total days lost.
Stuffing box, Grip, Polish Rod etc.	27				1	1		21	1	2	1	2224		
Gas Engine.														
Flywheel.....	5						1		1	2	1	294		
Gears, Clutch...	10			2				6	1		1	419		
Cranking.....	13a			2	1			1	5	1	3	6209		
Miscellaneous..	2							2				14		
Motor														
Palley, Shaft, Gears....	4						1	3				1834		
Miscellaneous..	0											0		
Travelling Blocks														
Struck by.....	5			1				2	1	1		101		
Caught in.....	26							26				2490		
Miscellaneous..	2							2				31		
Levers.....	34a			2	10	3	6	7	4		2	6472		
Crown Blocks														
Caught in.....	7							6	1			55		
Miscellaneous..	0											0		
Elevators														
Falling.....	26a			2	1	2	7	1	8		5	6809		
Struck by.....	54			2	5	6	30	1	8		2	1707		
Caught in.....	31						31					2935		
Breaking of lines														
Casing line...	3			1		1					1	8		
Sand line.....	4a			1	1	1		1				6109		
Cat line.....	4			3				1				69		
Tongs and Wrenches														
Struck by.....	134			1	16	19	24	11	47	9	17	2580		
Caught in.....	30							30				271		
Struck by falling*...	9				1			1		7		246		
Rotary Hose.....	3			1	1					1		91		
Sand Reel.....	2									2		9		
Totals and percentages...	582g		14.7									80728		29.3

(a) includes one fatal accident (g) includes nine fatal accidents.

\*Due to the breaking of the hold up line. -9-

Table 1. (Continued)

Other Machinery.

Cause of Accident	Number of Accidents.		Part of Body Affected									Time in Days lost		
	Total of subtitle	Division total	Per cent of total accidents	Eye	Head	Face	Shoulder, Arms,	Hands, Fingers	Trunk, Back	Foot, Ankle, Toes	Leg	Total of subtitle	Division total	Per cent of total days lost
Shop.....	34						3	24	2	3	2	57		
Compressor Plant..	10			1				5	1	1	2	550		
Absorption Plant...	0											0		
Dehydrating Plant..	0											0		
Pumping Plant.....	3							3				315		
Pumping Power Plant.	1							1				3		
Miscellaneous.....	3							3				42		
Totals and percentages.....		51	1.24										1677	0.61

Miscellaneous

Gas Explosion.....	7			2	5							70		
Boiler Explosion...	0											0		
Horse, Mule, Insect and Poison Oak.....	27				1	2	2	5	10	2	5	209		
Splinters.....	49			1	1	1	43			2	1	419		
Wickers.....	105			2		6	96				1	744		
Gassed.....	93								9			6089		
Horse-play.....	2						1		1			8		
Miscellaneous.....	13			1			11			1		253		
Totals and percentages.....		213	5.16										7792	2.83

(a) includes one fatal accident.

Causes of Injuries and Extent of Disability.

The injuries from various causes tabulated in Table 2 have been classified into three main groups, fatal, permanent partial disability and temporary disability. As no accidents of a permanent total disability occurred to the employees of the ten companies embodied in this classification, this heading has been omitted from the table. Permanent partial disability includes all accidents resulting in the loss of one foot, leg, hand, eye, one or more fingers, one or more toes, any dislocation where ligaments are severed or any other injury known in surgery to be permanent partial disability. The duration of disability for accidents of this latter type is taken as the period for which compensation is payable under the laws of the State of California.

Those injuries tabulated as temporary disabilities have been subdivided into three classifications according to the duration of the injury.

The days lost through an injury of a temporary disability are based on the actual number of days lost.

Table 2. Summary of Data regarding Causes and Number of Injuries, by Extent of Disability and Total Days lost resulting from each Class of Injuries.

	Number of Injuries						Severity of Injuries	
	Total	Deaths	Permanent Partial Disability	Temporary Disability			Total days lost	Per cent of total days lost
				15 days or over	8 to 14 days	1 to 7 days		
All Causes	4108	30	129	1048	722	2179	274829	100.00
Heavy lifting and straining	493	1	1	137	103	251	12368	4.50
Dropping objects or material	228		4	59	34	128	3143	1.14
Stepping on objects	168			19	28	121	1318	0.48
Running into or striking objects	206	1	1	38	45	121	8326	3.03
Struck by moving object	438	2	11	127	75	223	20662	7.52
Struck by falling object	357	5	19	111	63	159	40555	14.76
Falls of persons	454	7	11	128	94	214	53072	19.31
Hand Tools	272		2	60	47	163	3378	1.23
Autos, Trucks, Etc.	121	1	3	53	19	45	9622	3.50
Vehicles	17			5	5	7	187	0.07
Burns	215	3		59	56	97	20859	7.59
Machinery at well	582	9	50	186	85	252	80728	29.37
Other Machinery	51		7	18	5	21	1677	0.61
Flying objects	297		20	24	31	222	11142	4.05
Miscellaneous Causes	212	1		24	32	155	7792	2.84

The Part of the Body Affected.

Table 3 shows the number of accidents and the days lost classified as to the part of the body affected. It may be noted that the hands and fingers received the largest number of injuries but that those sustained by the trunk and back result in the most time lost and are by far the more serious.

Referring to Table 1, it will be seen that over one-half of the accidents resulting in injuries to the trunk and back are caused by straining or heavy lifting, and that heavy lifting and straining caused more accidents than any other single cause listed in the entire classification.

Table 3. Summary of Data regarding the Part of the Body Affected.

Part of Body Affected.	Number of Accidents	Per cent of total Accidents	Days Lost	Per cent of total days lost
All Parts.....	4108	100.00	274829	100.00
Eye .....	302	7.35	11648	4.24
Head.....	145	3.53	51303	18.67
Face.....	181	4.41	1582	0.58
Shoulder, Arms.....	314	7.64	9312	3.39
Hands, Fingers.....	1102	26.83	38766	14.11
Trunk, Back.....	801	19.50	124985	45.46
Foot, Ankle, Toes.....	898	21.86	14569	5.30
Leg.....	365	8.88	22664	8.25

Average Number of Days Lost per Accident.

No apparent relation seems to exist between the number of accidents and the resulting days lost. It is evident that the seriousness of one cause as compared to another, can not properly be gauged by the relation of the frequency of their accidents, nor will a comparison of the days lost without taking into account the number of accidents, give a true standing of one cause as regards another.

As the average loss of time in days per injury gives a true index of the severity of the various causes, Table 4 has been prepared.

Table 4. Summary of Data regarding the Average Number of Days Lost Per Accident by Causes.

Cause of Accident.	Number of Accidents	Days Lost	Average Number of Days Lost per Accident
All Causes.....	4108	274829	65.8
Stepping on Objects.....	168	1318	7.8
Vehicles.....	17	187	11.0
Hand Tools.....	272	3378	12.4
Dropping Objects or Materials.....	225	3143	14.0
Heavy Lifting and Straining..	493	12368	25.1
Other Machinery.....	51	1677	32.8
Miscellaneous.....	212	7792	36.7
Flying Objects.....	297	11142	37.7
Running into or striking objects.....	206	8326	40.4
Struck by Moving Object.....	438	20662	47.1
Autos, Trucks and Tractors...	121	9622	79.5
Burns.....	215	20859	97.4
Struck by Falling Objects....	357	40555	113.9
Falls of Persons.....	454	53072	117.1
Machinery at Drilling and Producing Well.....	582	80728	138.8

Classification of Oil Field Labor.

The classification of accidents and resulting days lost according to the occupation of the injured is essential for the study of accident prevention. An absolutely correct analysis is impossible because complete details of many accidents are lacking and because in many cases a man who is reported as injured may at the time be temporarily engaged in work of a nature far removed from that of his regular occupation. Instances may be cited where entire drilling crews are temporarily given work ordinarily done by roustabout or common labor, while the well at which they have been working is standing cemented, or, at times roustabouts have been temporarily loaned to the drilling crews to help out in a shortage in the drilling ranks. Whenever possible however, the accidents have been classified as to the kind of work regardless of the regular occupation or pay roll rating of the injured at the time of such accident.

An analysis of oil-field labor follows in which the employees have been classified into twelve divisions, and from this classification and the data given in Table 1, the summary in Table 5 has been compiled.

1. Drilling Crews:
  - (Relay Drillers
  - (Derrickmen
  - (Cathead Men
  - (Helpers
  - (Cable Tool Drillers
  - (Tool Dressers
  - (Circulator Men
2. Producing Crews (Well Pullers and Helpers  
(Well Cleaners and Helpers
3. Rig Builders and Helpers.
4. Engineers and Firemen
5. Pumpers and Oilers (Gaugers)
6. Teamsters (Helpers and Stablemen)
7. Truck and Tractor Drivers (Drivers:  
(Swampers  
(Helpers
8. Roustabouts and Laborers (Common and semi-skilled labor  
(Yardmen
9. Garagemen. (Mechanics and Helpers
10. Craftsmen
  - (Carpenters and Helpers
  - (Painters and Helpers
  - (Electricians and Helpers
  - (Plumbers and Helpers
  - (Tinsmiths and Helpers
  - (Brickmasons and Helpers
11. Shopmen
  - (Machinists and Helpers
  - (Blacksmiths and Helpers.
  - (Welders and Helpers
  - (Boiler Makers and Helpers
  - (Gas Engine Repairmen and Helpers.
12. Miscellaneous
  - (Cooks.
  - (Waiters.
  - (Warehousemen
  - (Clerks
  - (Watchmen
  - (Janitors
  - (Miscellaneous

Table 5. Summary of Data regarding Accidents and Days Lost Classified as to Occupation of Injured.

Occupation	Number of Accidents	Per cent of Total Accidents	Time in days lost	Per cent of total days lost.
All Occupations.....	4108	100.00	274829	100.00
Drilling Crews.....	1616	39.34	149139	54.27
Producing Crews.....	518	12.61	27125	9.87
Rig Builders.....	76	1.85	7411	2.70
Engineers and Firemen....	55	1.34	1672	0.61
Pumpers and Oilers	147	3.58	36234	13.19
Teamsters.....	83	2.02	1165	0.42
Truck and Tractor Drivers.	213	5.18	4743	1.73
Roustabouts and Laborers.	806	19.62	18418	6.70
Garagemen.....	40	0.97	622	0.22
Craftsmen.....	123	3.00	10594	3.85
Shopmen.....	354	8.61	10747	3.91
Miscellaneous.....	77	1.88	6959	2.53

Accidents Caused by the Machinery at Drilling and Producing Wells.

From the preceding tables there can be no doubt as to the hazards exposed to those whose duties bring them within the range of the derrick. Table 1 shows that 14.17 per cent of all the accidents, resulting in 29.38 per cent of all of the lost time are due directly to the machinery at drilling and producing wells.

It is but natural then that the study of accident prevention and mechanical safety appliances should begin at this point.

The 582 well machinery accidents (Table 4) occasioning 80,728 days disability have been grouped in Table 6 into 21 classifications and the data expressed in per cent of total machinery accidents and per cent of total days lost as a result of these accidents.

Table 6. Summary of Data regarding the Accidents Caused by the Machinery at Drilling and Producing Wells.

Part	Number of Accidents	Per cent of total Accidents	Time in days lost	Per cent of total days lost
All Machinery.....	582	100.00	80728	100.00
Draw Works.....	79	13.57	17348	21.49
Rotary Engine.....	7	1.20	6166	7.64
Rotary Table.....	5	0.86	282	0.35
Pumps.....	5	0.86	258	0.32
Calf Wheel.....	4	0.68	669	0.83
Bull Wheel.....	19	3.26	6443	7.98
Band wheel.....	1	0.17	10	0.01
Standard Engine.....	15	2.61	6415	7.95
Pitman.....	9	1.55	2067	2.56
Walking Beam.....	3	0.51	93	0.11
Stuffing Box, Grip, Polish Rod..	27	4.64	2224	2.75
Gas Engine.....	30	5.15	6936	8.59
Motor.....	4	0.68	1834	2.27
Travelling Blocks.....	33	5.67	2622	3.25
Levers.....	34	5.84	6472	8.02
Crown Blocks.....	7	1.20	55	0.07
Elevators.....	111	19.07	11451	14.19
Lines.....	11	1.91	6186	7.66
Tongs, Tubing Wrenches.....	173	29.72	3097	3.84
Rotary Hose.....	3	0.51	91	0.11
Sand Reel.....	2	0.34	9	0.01

Details Relating to Labor Statistics and Accidents.

Figures which show a comparison between the accidents and time lost and the number of employees exposed to these hazards are of vital importance to those interested in safety work. Nine out of the ten companies embodied in this statistical review, furnished figures showing the average number of men employed by them during the years 1921 and 1922. The three following tables are a summary of statistics of these nine California oil companies. In Table 7a fatal accident has been considered as equivalent to 6000 days lost and this figure enters into the severity rate and the average days lost per accident.

As there are some companies who do not employ this arbitrary figure for a fatality, but consider a fatal accident as separate from those causing loss of time, Table 7a has been compiled. This method is open to criticism because a true comparison of the severity rates or the days lost per accident cannot be made unless a fatal accident is arbitrarily assumed as being equivalent to a certain number of days lost.

Though the record of the total number of men killed in the California oil fields during the years 1921 and 1922 is available, accurate data as to the total number of men employed in the entire industry could not be obtained. Statistics showing the number killed per 1000 employed are therefore not available. The data in Table 8, giving the number of men employed and total number of fatal accidents occurring to the employees of the nine companies whose labor statistics were obtainable is valuable in showing the number of men killed per 1000 employed in the drilling and producing departments of these companies.

Table 7. Summary of Accidents and Labor Statistics compiled from the Labor Returns of 9 Representative California Oil Companies.

	Average Number of Employees	Number of Accidents	Time in days lost	Accidents per 100 Employees	Severity Rate <sup>a</sup>	Average days lost per Accident
1921.....	11719	1883 <sup>b</sup>	158,633	16.1	13.5	84.2
1922.....	12798	2080 <sup>c</sup>	107,783	16.3	8.4	51.8
Average..	12258.5	1982.5	133,208	16.2	10.9	67.2

- a The "Severity Rate" is the number of days lost due to accidents per full time worker.
- b Includes 19 fatal accidents.
- c Includes 10 fatal accidents.

Table 7a. Summary of Accidents and Labor Statistics compiled from the Labor Returns of 9 Representative California Oil Companies. (Fatalities excluded).

	Average Number of Employees	Number of Accidents	Time in days lost	Accidents per 100 Employees	Severity Rate	Average days lost per Accident
1921.....	11719	1864	44,633	15.9	3.8	23.9
1922.....	12798	2070	47,783	16.2	3.7	23.1
Average..	12258.5	1966.5	46,208	16.0	3.8	23.5

Table 8. Summary of Fatal Accidents and Labor Statistics compiled from the Labor Returns of 9 Representative California Oil Companies.

	Number of Men Employed	Number Killed	
		Total	Per 1000 Employees
1921.....	11719	19	1.6
1922.....	12798	10	0.8
Average....	12258.5	14.5	1.2

List of Fatal Accidents in the California Oil Fields in 1921 and 1922.

All the fatal accidents occurring in the California oil fields during the years 1921 and 1922 showing the occupation of the injured and the details regarding the cause of the fatality have been tabulated below. In all cases the description is that furnished by the companies when reporting the accident to the Industrial Accident Commission of California. It is hoped that through a careful consideration of the accidents enumerated, that thought and consideration will be taken to prevent wherever possible a re-occurrence of a similar accident.

Table 9. Fatalities in the California Oil Fields During year 1921.

Rotary Helper	Dead pin fell out of crown of derrick.
Well Puller	Pulling bailer out of hole, line broke, hit on head with line.
Roustabout	Struck by telegraph pole projecting from truck.
Rotary Helper	Collapse of rotary hoisting drum brake flange.
Rotary Helper	Kicked flywheel of engine, foot got caught and dragged him between flywheel and brace.
Derrickman	Fell from oil derrick.
Tool Dresser	In derrick when it caught fire, severely burned.
Rig Builder	Erecting derrick, beam from oil rig fell on him.
Rotary Helper	While pulling out drill pipe, rope became entangled in cathead and broke. Knocked him under rotary chain (not guarded). Leg had to be amputated. Gangrene set in and proved fatal.
Pumper	Struck by flywheel while oiling engine.
Pumper	Caught by bullwheel pegs.
Rotary Helper	Fractured leg. Died after operation.
Electrician	Failed to pull switch on main line. Current turned on. Electrocuted.
Pumper	Struck by lever on neck, severing wind pipe and thrown against flywheel.
Derrickman	Elevator rope broke while pulling casing and elevator fell on his head killing him instantly.
Foreman	Starting gas engine with bar. Hit on head by bar.
Derrickman	Climbing derrick, fell 80 feet, struck head on ladder.

Table 9. (Continued)

Derrickman	As he started to move sheave, cat line hook gave way and struck him on the skull.
Engineer	Oiling engine. Gas engine flywheel not guarded.
Engineer	Hand crushed in gas engine compressor. Blood poison.
Well Puller	Struck by auto truck while on way to telephone instructions regarding work.
Engineer	Cylinder head blew off and struck him in groin and arm.
Derrickman	Sheave fell from crown block, crushed chest.
Tool Dresser	Standing in mud. Electric shock from touching iron motor house.
Oiler	Backfire of gas engine. Burned.
Gang Pusher	Explosion of Boiler.
Total 26	

Table 10. Fatalities in the California Oil Fields during year 1922.

Well Puller	Piece of rigging fell and hit him.
Mechanic	Lacerated palm. Erysipelas resulting in death.
Well Puller	Fell from oil derrick.
Driller	Clothing caught on pump shaft carrying him into machinery.
Derrickman	Fell from derrick.
Pumper	Slipped and fell while going through door of pump house and struck shoulder.
Derrickman	Fell from ladder of oil derrick.
Pumper	Burned. (Cause not known).
Driller	Struck by boiler rolling over on him, crushing him.
Derrickman	Fell from derrick 110 feet.
Pumper	Heavy wrench slipped and struck him on head.
Tool Dresser	Jumped from moving car, injured side, leg and shoulder.

Table 10. (Continued)

Driller	Derrick collapsed under which he was working, crushed under falling pipe and skull fractured.
Derrickman	Fell from kelly board 50 feet, fractured skull.
Rotary Helper	Pulled travelling block against crown block resulted in cutting casing line. Travelling block and other equipment fell and hit him.
Derrickman	Rotary table fell on his head.
Derrickman	Lost balance while tightening nut, fell from double board 40 feet, fractured skull.
Not known	Pipe fell from rack.
Welder	Gas trap was being raised by sand line. Trap swung to one side and struck his chest.
Derrickman	Lost balance and fell from 28-foot level of oil derrick. Broke neck.
Rotary Helper	Struck by smoke stack. House was being moved, when guy wires came in contact with house the stack was pulled over.
Driller	Chain slipped off engine sprocket causing reverse lever at duplex steam engine to fly forward and strike him.
Pumper	Explosion of tank car by ignition. Burned.
Rotary Helper	Elevator fell and struck him on head.
Rotary Helper	Working on derrick floor. Piece 2" x 6" -3' fell out of derrick and hit his head.
Derrickman	Breaking down pipe. Kelly was lifted from pipe and fell. He was thrown from kelly board 28 feet. Not wearing life belt.
Tool Dresser	Driving stake with heavy sledge when fatal attack came.
Tank Inspector	Fell 32 feet from roof to floor of oil tank.
Derrickman	Caught on bull rope, thrown into the air probably against dog on wheel.
Cat Head Man	Replacing key in sprocket, wind pipe severed.
Tool Dresser	Hook on jerk line broke, let casing tongs fly around and strike him.

Table 10. (Continued)

Driller	Hook on jerk line broke, let casing tongs fly around and strike him.
Tool Dresser	Caught in cable and whirled about 5 feet from chain.
Welder	Explosion of boiler on which he was working at well.
Total	34

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