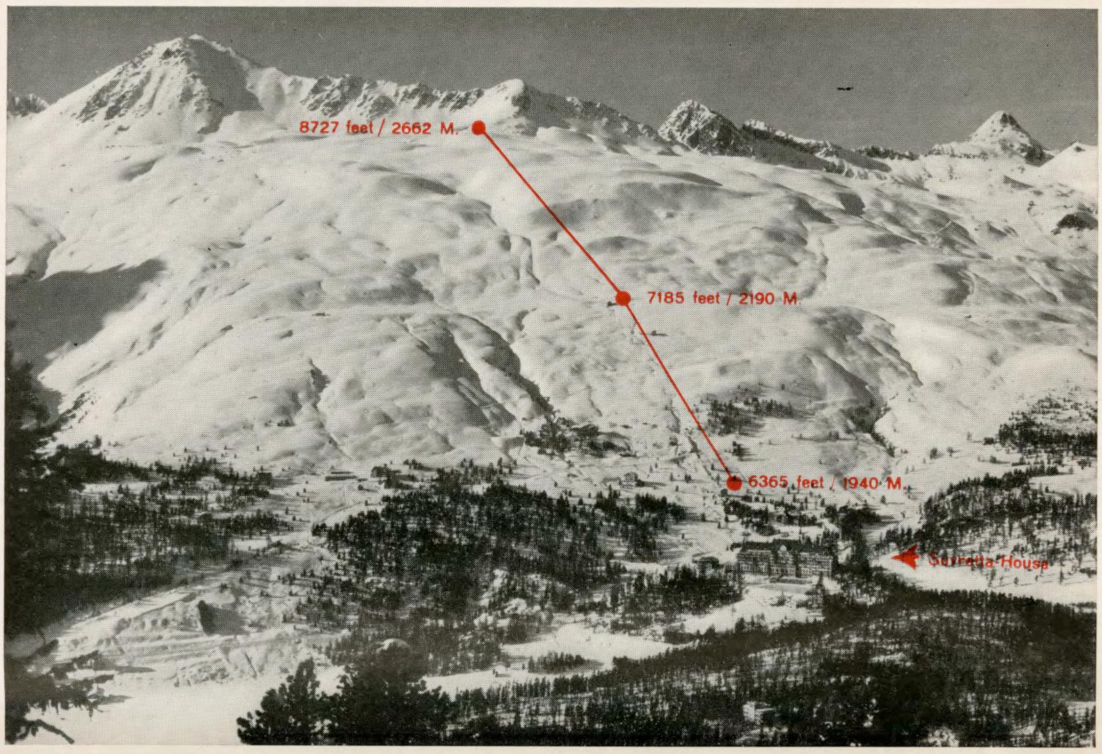
E. CONSTAM · ZURICH SWITZERLAND

TELEPHONE 41205 · CABLE ADDRESS: CONSTAMGULL



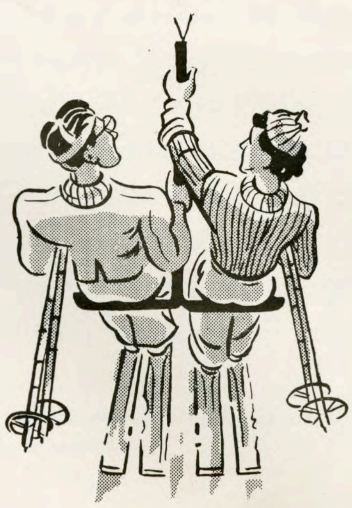
PATENTED

AERIAL TRAMWAYS

for Passenger Transportation

American Patent 2087232 Canadian Patent 357229 Further Patents applied for

IN WINTER



IN SUMMER

on the same tramway

INTRODUCTION

The *first modern Ski-Lift in the world* was built 1934 at Davos Switzerland (see page 4). As skiing has become the national wintersport in many countries an active demand has been created for this new means of transportation.

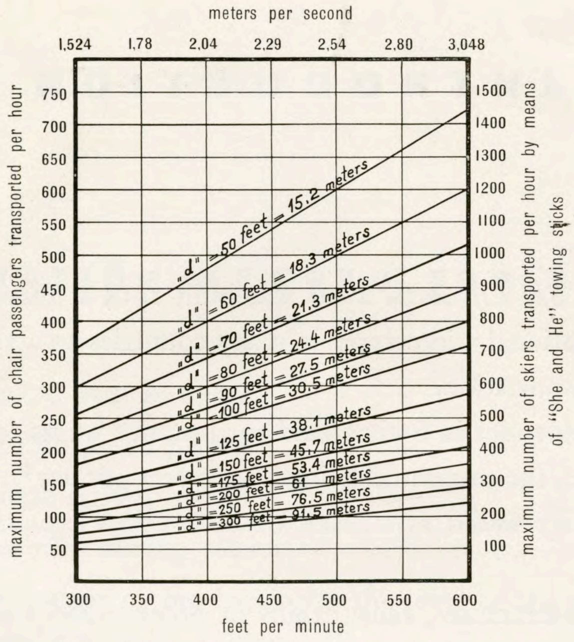
The average week-ender in Switzerland for instance wants to cover on sunday a vertical descent of 5000 to 8000 feet, the maximum being 26 200 feet per day*). Few skiers could afford this frenzy were not the *fares very modest* as a result of *low overhead expense*, upkeep, and low running expense.

There are no substructures, rails, cabins or other vehicles of considerable concentrated weight, the locomotion of which would necessitate powerful traction by expensive machinery, although the elevational track might not be steep except over a short distance. Easily one after the other — not in bunches — the passengers are hauled up over the steep part of the slope. The snow bears the weight of the passenger, the aerial cable has only to drag him. This is the first reason why at *comparative transportation-capacity the Ski-Lift is lower in cost*, *upkeep and running expense than the aerial tramway*, an already old proposition. The second reason is the higher speed of the Ski-Lift, as with its latest development the starting on and giving up of the haulage is definitely easier for the skier with the skis on than the sitting on and getting up from the circulating aerial chairs. The third reason is the Ski-Lifts immunity to wind and blizzard, snow-digging being indeed annoying on such plants because of the expense and the receipts lost meanwhile. *In summer the Ski-Lift is easily transformed into an aerial chair tramway* of reduced but still sufficient output as explained below in detail. The towing-outfit is screwed off from the hangers suspended on the aerial cable and aerial chairs are screwed on. The speed is reduced, and the aerial cable is lowered in order to avoid the aerial chairs circulating at undue height above the ground.

On all such plants the traffic in summer differs widely from the traffic in winter. Excursionists and sightseers ascend the slope but once a day, whilst the skiers ascend repeatedly for the purpose of multiple downhill runs. Therefore a reduced transportation-capacity in summer will cope with the demand although the total receipt in summer when the season and the days are longer may exceed the receipt of the winter-season.

According to the following diagram a Ski-Lift with "She and He" towing-sticks spaced at "d" = 60 feet and circulating at a speed of 500 feet per minute can haul 1000 skiers per hour. The same plant in summer, equipped with aerial chairs ("d" = 60 feet again) and circulating at a reduced speed of 350 feet per minute will carry 350 passengers per hour. This is still a considerable output, exceeding the transportation-capacity of, for example, an aerial passenger cableway, 1 ½ miles long, equipped with two reversible cabins each for 35 passengers. At comparative length the over-

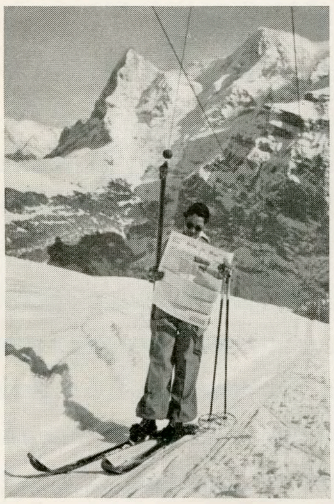
*) The explorer Mr. A. Roch of Geneva when training on Ski-Lift No. 6 (see page 4) for the ascension of Mt. Dunagiri and other summits in the Himalaya.



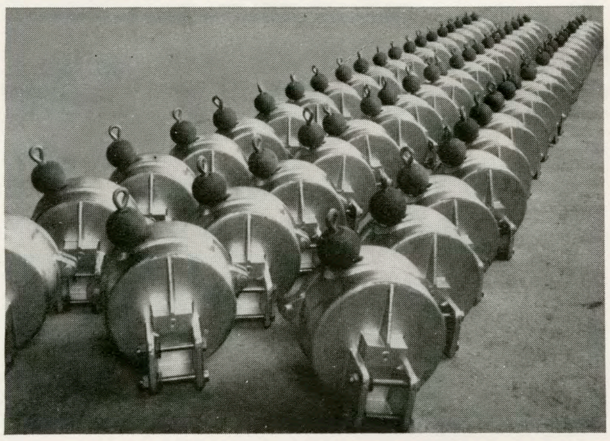
"d" is the distance between the individual hangers suspended at the aerial cable

head of the latter plant costs at least five times more than the Ski-Lift, upkeep and running expense being also higher. Before turning to the existing plants let us briefly resume the outstanding patented features as follows:

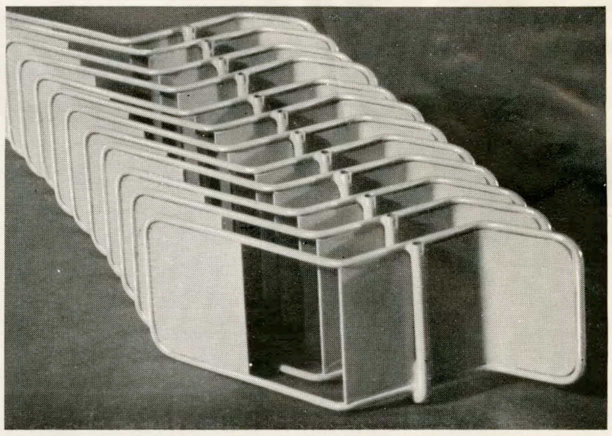
1. *The skiers* leaning gently back against the supports of the towing-sticks *ascend the steepest and roughest of slopes at considerable speed with great ease in a perfectly relaxed position**). Both "Jay-sticks" for one single skier and "She and He-sticks" designed for pairs of skiers are used, single riders feeling quite as comfortable on the latter as on the jay-sticks. She and He-sticks make the ascent of the slope more sociable and entertaining, halve the number of towing-outfits — for a given output and speed — and double the free space for skiers who cross the track on the downhill run. Subways are therefore necessary only where the Ski-Lift crosses frequented public roads or railways.



*) 60%, 61%, 64%, 70% and 72% of linear inclination have been realized, even 80% and 82%. On the two latter plants however it once happened that a skier having fallen slipped down the slope when icy. Since then, on the rare occasions when ice has formed again it has been broken with pick and shovel where the inclination exceeds 75%.



A set of spring-loaded hoists



A set of aerial chairs

2. Light spring-loaded hoists of considerable lift or stroke, mounted in tight casings, are inserted between the aerial cable and the individual towing-outfits and provide the *necessary elasticity* so that:
   a) the height at which the aerial cable circulates above the track may vary widely, its slavish guiding along the elevational line of the individual plant by means of numerous pillars and rollers being dispensed with. *Few pillars, large spans, little ground levelling, immunity against blizzards;*
   b) towing-outfits abandoned by the skiers rise automatically to the aerial cable, circulate round the sheave of the upper terminal and travel back to the lower terminal;
   c) the skiers start on the haulage without jerk although the aerial cable circulates with the considerable speed of 500 or more feet per minute.
3. *Easy transformation for summer traffic.* Aerial chairs, each for one passenger, are screwed to the hangers instead of the spring-loaded hoists and towing-sticks, speed reduced, cable lowered and nets stretched underneath the circulating chairs wherever the ground is stony.

Arriving at the finish

PATENTED SKI-LIFTS BUILT BY MR. CONSTAM AND HIS LICENSEES

			Feet Length	Feet Rise
*)	1.	Davos-Bolgen	980	196
**)	2.	Davos-Strela I	1990	740
**)	3.	Davos-Strela II	4150	780
	4.	St. Moritz I	2620	820
**)	5.	St. Moritz II	4600	1542
***)	6.	Arosa I	2980	960
***)	7.	Arosa II	4100	1055
	8.	Muerren	3950	1505
***)	9.	Klosters	2350	550
	10.	Pontresina	1220	310
	11.	La Dole	2480	605
***)	12.	Oberiberg	3950	1360
	13.	Frohnalpstock	4880	1500
	14.	Lauberhorn	5000	1500
	15.	Zermatt	4800	1600
	16.	Braunwald	3000	1000
	17.	Chaux-de-Fonds	1000	300
	18.	Megeve	1800	435
	19.	Mt. Genevre	1320	395
	20.	Beuil	870	375
**)	21.	Mt. Joux	2990	790
**)	22.	Col de Voza	3800	745
	23.	Carroz Arraches	5350	1820
	24.	Piz Ronce	2050	560
	25.	Garmisch	6550	1970
	26.	Walsertal	4800	640
	27.	Hindelang	2640	960
**)	28.	Zuersersee	4810	1540
	29.	Lech	4100	1150
	30.	St. Anton	2300	1100
	31.	Kitzbuehel I	2300	650
**)	32.	Kitzbuehel II	2500	950
	33.	Seefeld	700	150
	34.	Are	1280	394

IN AMERICA

			Feet Length	Feet Rise
	35.	Rutland, Vt.	2650	650
	36.	Franconia, N. H.	2300	720
	37.	Manchester, Vt.	2450	575
	38.	Ogden, Utah	4850	1290
	39.	Reno, Nev.	1850	670
	40.	Strawberry, Cal.	1740	417
**)	41.	Winterpark, Colo.	750	173
	42.	Camp Hale, Colo.	6150	1100
	43.	Mt. Tremblant, P. Q.	3428	730

PLANTS BUILT BY THIRD PARTIES AND OPERATING UNDER CONSTAM LICENSE

		Feet Length	Feet Rise
44.	Oslo	980	263
45.	Zuers-Kirche	1280	326
46.	La Gourette	980	196

IN AMERICA

		Feet Length	Feet Rise
47.	East Dorset, Vt.	3150	610
48.	Plymouth, N. H.	1970	655
49.	Intervale, N. H.	1640	556
50.	Lake George, N. Y.	2620	850
51.	Soda Springs, Cal.	910	305
52.	Winterpark, Colo.	3200	750
53.	Wausau, Wis.	3260	980

Remarks
*) First modern Ski-Lift in the world.
**) Subsequent Ski-Lift built at the same resort.
***) Equipped with intermediary station.

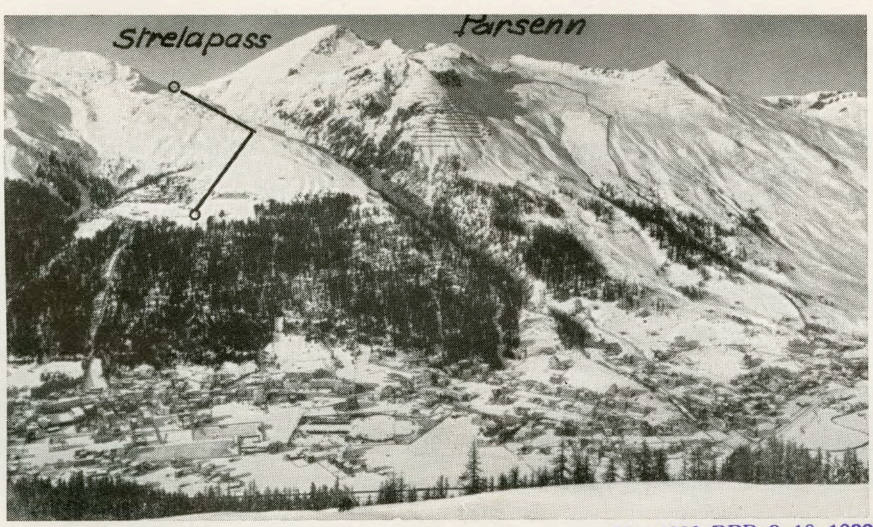
Swiss ski-school at Davos

°) Time-checking at the Swiss ski-school at Davos has prooved that the pupil was on the downhill run only 6½ minutes per hour, the bulk of the time being absorbed by tiresome reascending of the practice slopes. Since erection of Ski-Lift No. 1 the average pupil is 26 minutes per hour on the descent and learns in 3 days what previously took 5 days.

14 of the above installations were built on practice slopes, 20 give access to notable descents. 9 plants start from railway stations, 1 from a cog wheel mountain-railway, 3 from funiculars, 2 from aerial passenger cableways with reversible cabins, 4 from electrical railtramways, 6 from public buslines, 4 from private buslines and 5 only are not connected with other means of communication. 5 plants cross rivulets, 4 cross public roads, 6 electrical power-lines and 7 well frequented ski descents. 1 crosses an avalanchy ravine. 4 plants have intermediary stations. 5 plants are equipped with structural steel pillars, all other with wooden pillars.

Although it is easier to obtain the necessary adhesion between the driving sheave and the aerial cable when driving the plant at its upper terminal, the drive at the lower terminal is often preferred for economical and practical reasons: the motor and the delicate machinery are at the lower terminal in most cases more easily accessible than at the upper terminal. Less machinery to be transported to the top of the slope to which often no road leads. No electrical power-line to be built to top of mountain. If there is no electrical power available and the plant has to be driven by an internal combustion engine, no fuel oil has to be transported to the upper terminal. Less staff, because the mechanic also sells the tickets at the lower station.

When working with the aerial chairs in summer one of the staff must be permanently present at the upper terminal helping the passengers off the chairs. On the contrary, in winter many plants work without permanent staff at the upper terminal, the latter being equipped with an automatic stop: Some feet ahead of the finish a rope is stretched out transversely to the direction of the haulage. In the rare event of a skier not abandoning his towing-stick in due time he comes against the rope whereby a switch shuts an electrical circuit bringing the plant to a stop. The circuit runs through a blizzard-proof low-tension line mounted on insulators fixed at the heads of the pillars and extending from the driving terminal to the other terminal. As the line is under a tension of 36 volts only, it is harmless to staff ascending the pillars when greasing the overhead rollers and as the line works with continuous current, the telephones (equipped with condensers) are linked to the same line. The low-tension continuous current is produced by a small metallic rectifier or by a little dynamo. When the circuit is shut the main switch of the plants electrical motor opens or in the case



Ski-Lift extending a funicular

Electrical motor on the way to upper terminal

of an internal combustion engine a frictional clutch is thrown out. As soon as the skier who caused the disturbance leaves the automatic stop, the latter's switch opens again by itself and the plant can be restarted. When desired, a portable telephone and a stop-switch can be linked to the line at any pillar. This has been used for time-checking during ski-races.

Intermediary stations of a simple and cheap design have been installed for the following purposes:

The lower part of the slope being densely wooded or extremely steep or covered with uneven or with little snow or being icy during the morning through shadow, many skiers will prefer to remain on the upper part before coming back at lunchtime.

On very large plants covering a distance of 1 ½ or more miles during cold weather skiers may wish to interrupt the journey and warm up in a heated shelter before going on.

An intermediary station consists simply of a shelter erected at a level spot on the track. The cable is so much lowered there that one can grasp and use the empty towing-sticks under the supervision of a ticketman. When there is no such need (good weather) the cable is raised again and the ticketman withdrawn.

Ski-Lift extending a public busline

Huge span, 918 feet long

Provisional intermediary station

NEW PLANTS

The rapid growth of the Ski-Lifts and the seasonal character of this line of business called for *standardisation* as a means for functional reliability, short terms of delivery, erection and spare-part service.

The three *models I, II and III* described below in detail meet the requirements of all snow conditions. Model I is designed for places which at times have abundant snow and is of course higher in cost than model II the latter being designed for places with less snow. Model III is the lowest in cost and recommendable only for places with little snow.

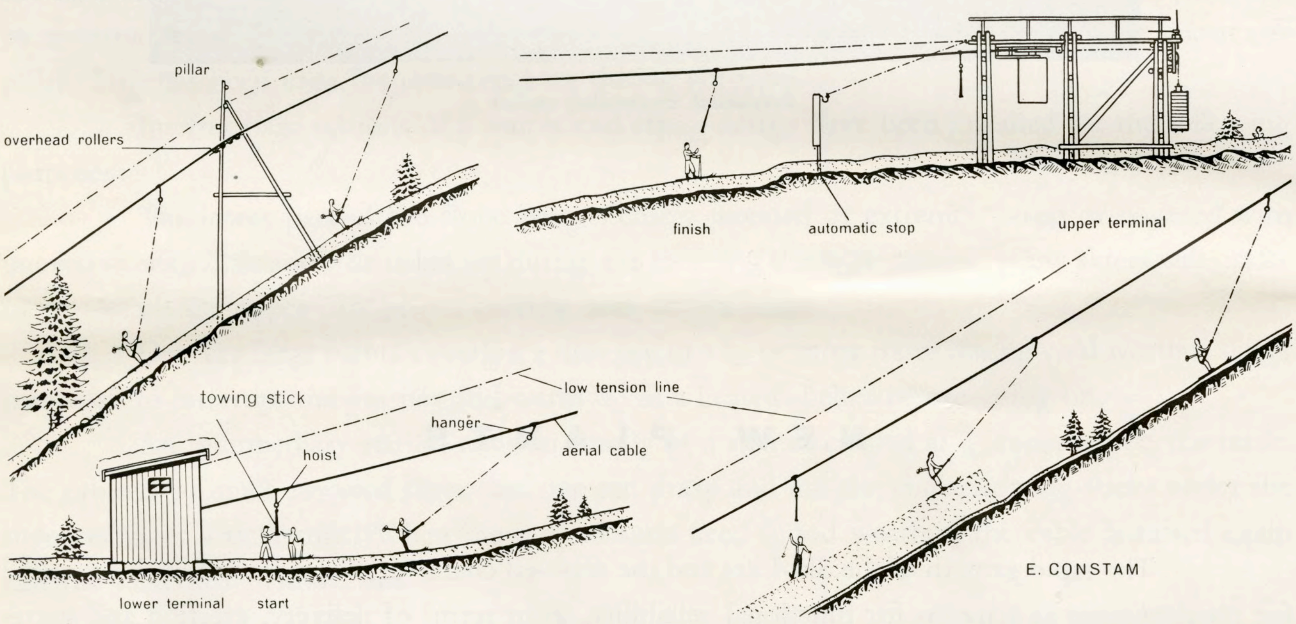
Each of the three models can be delivered in *5 different sizes* according to varying lengths, heights and transportation-capacities, the smaller sizes being of course lower in price than the bigger ones.

The following figures are intended to give an idea of a *huge* projected *plant:* Inclined length 2 miles, vertical distance 3300 feet. Whole plant in one single section (as being the most economical solution of the problem) driven by a 200 hp electrical motor at the upper terminal. Ride lasting 21 minutes in winter and 31 minutes in summer. Transportation-capacity 400 skiers per hour in winter and 140 passengers per hour in summer.

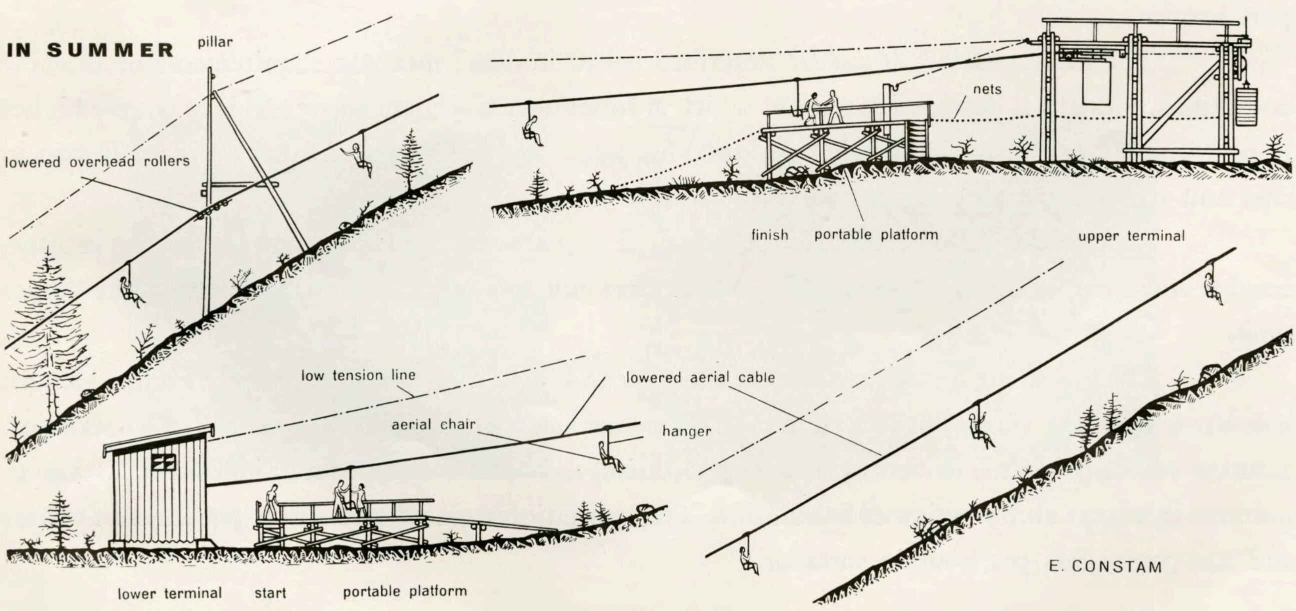
MODEL I

is illustrated below and has given satisfaction under severest conditions: stormy summit at St. Moritz 8727 feet above sea level, 7700 feet at Davos-Strela and 6700 feet at Mürren. The aerial cable circulating at a height of 23 to 33 feet above the ground, the empty towing- outfits travel so high that skiers holding no tickets cannot grasp them even when the snow is deep. In summer the cable is lowered so that the aerial chairs circulate at a height of $6\frac{1}{2}$ to 13 feet above the ground. Nets are stretched underneath the chairs where the ground is stony. The speed is reduced to about 2/3 of what it is in winter for the reasons given in the introduction of this pamphlet. The aerial cable is lowered at the opening of the summer season and relifted in fall by two men only, the pillars being designed for this. Mixed exploitation in winter by interposing aerial chairs between the towing-sticks is not recommended as the chairs would circulate too high.

IN WINTER



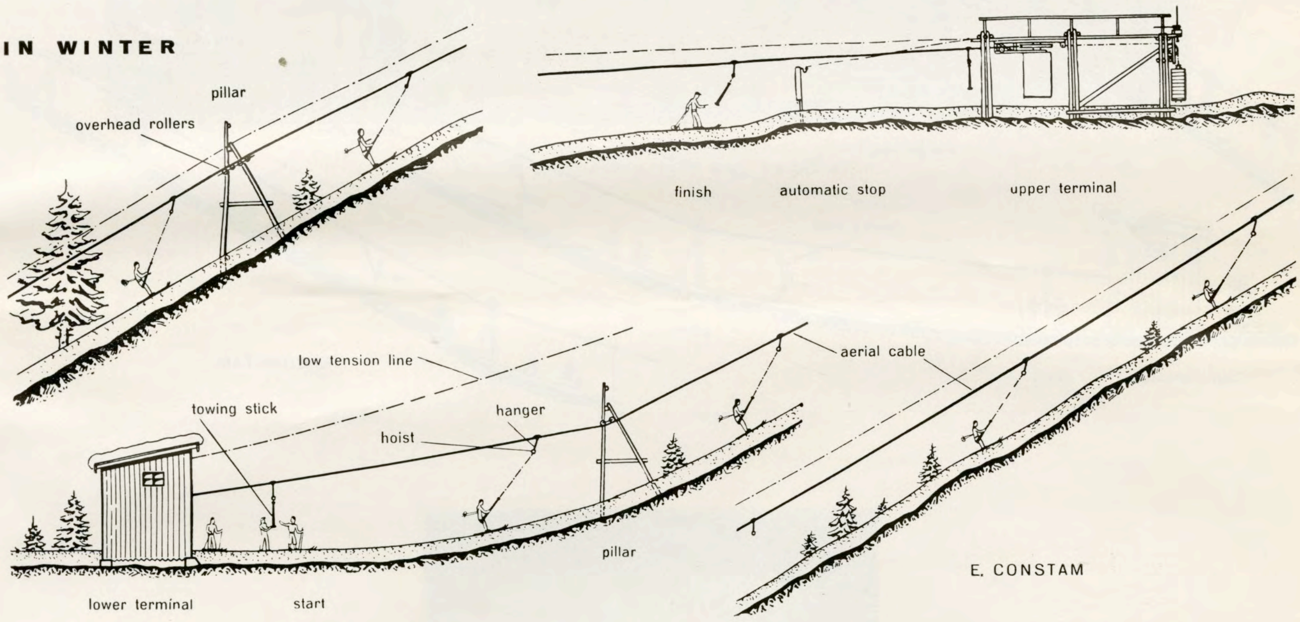
IN SUMMER



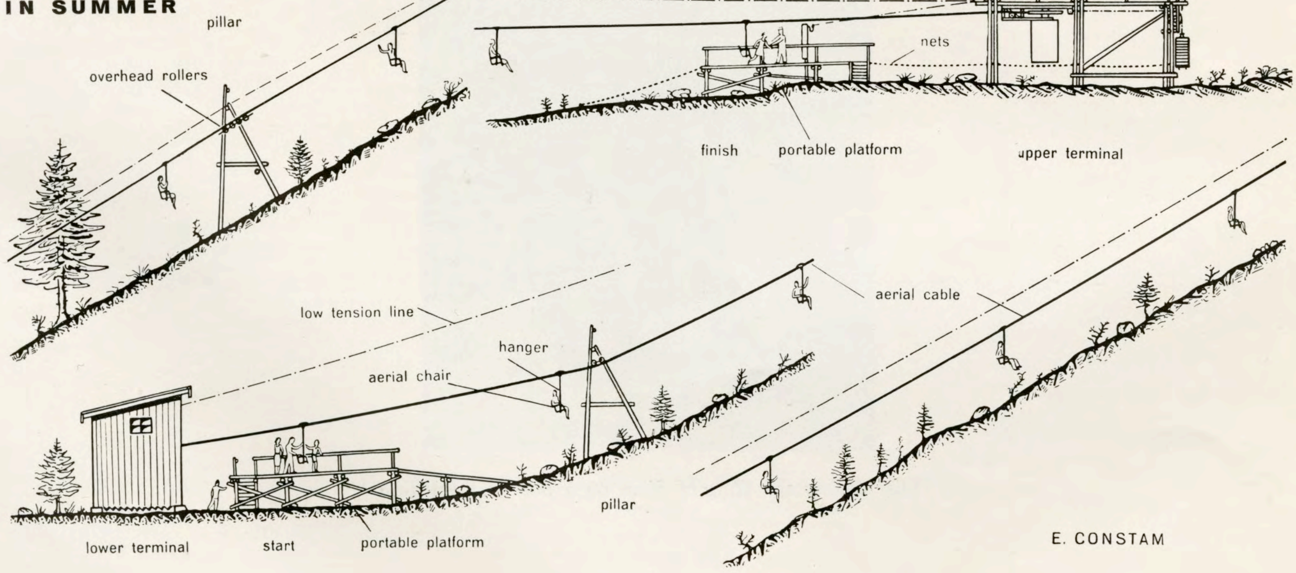
MODEL II

is illustrated below and is designed for places with not more than about 4 feet of snow. The aerial cable circulates summer and winter at the same height of 13 to 20 feet above the ground. In summer the aerial chairs circulate at a height of 6½ to 13 feet above the ground, speed being reduced and nets stretched as described above with model I. The spring-loaded hoists have less stroke than their sisters of model I. The towing-sticks are detachably hooked into rings fastened at the lifting ropes of the hoists, the staff forwarding sticks only to skiers holding tickets. Empty hangers and hoists circulate without towing-sticks; otherwise skiers not holding tickets could grasp and use them. The towing-sticks which have been used by the skiers rise at the finish to the aerial cable, circulate round the sheave of the upper terminal and travel back to the start where they are unhooked by the staff. This additional labour is an economical disadvantage of model II in comparison to model I; the advantages being the smaller overhead expense because of the lower pillars and the hoists with less stroke. Another advantage is the possibility of mixed exploitation in winter with aerial chairs interposed between the towing-sticks at however the risk that a chair might collide with a skier crossing or standing on the track.

IN WINTER

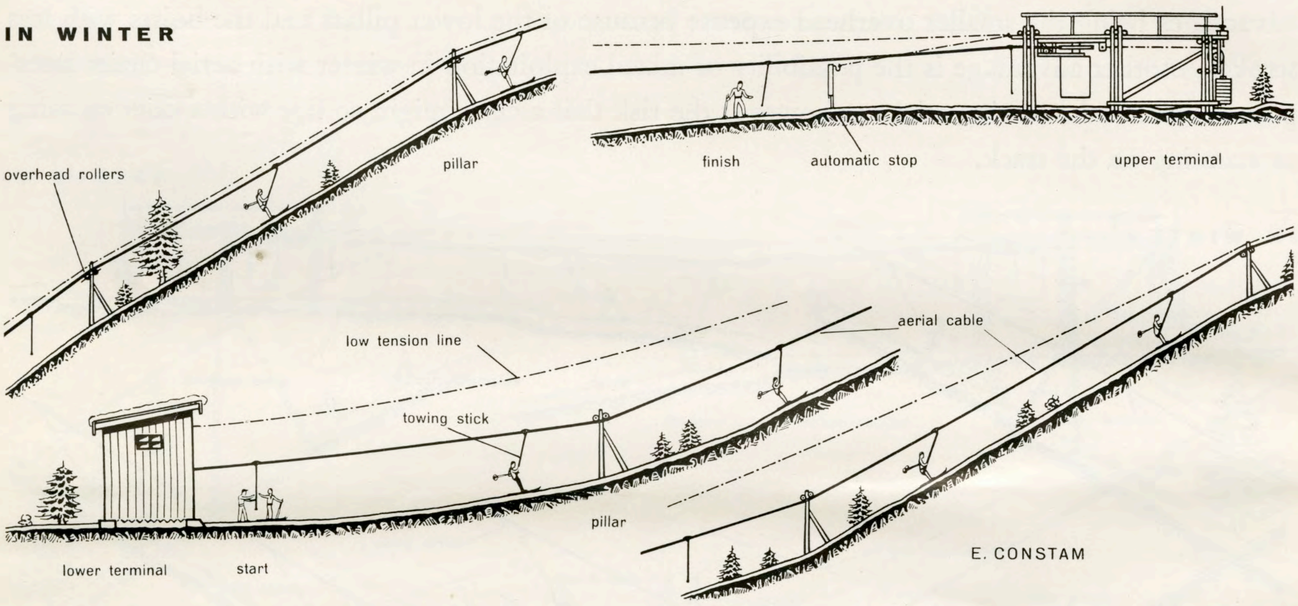


IN SUMMER



is illustrated below and represents the cheapest solution of the problem but to be recommended only at places with poor snow conditions. Numerous low pillars guide the aerial cable along the elevational line of the track. The towing-sticks are fastened directly to the endless wire cable, their length being adjustable within certain limits according to the varying depth of the snow so that the supports of the sticks neither drag on the track nor are they raised too high to be comfortable. It is usual with model III to issue daily tickets. Otherwise it is necessary to erect fences along both sides of the plant to prevent skiers without tickets hanging on. This of course cuts the skiing slope in two parts. Aerial chairs are not used on model III, as the aerial cable circulates to low. It can however be done if necessary.

IN WINTER



His Majesty the King of Siam on a She- and He-stick

Length 3960, ascent 1360 feet, 10 pillars

Late Mr. Douglas Fairbanks for the first time on a jay-stick

INFORMATION NEEDED FOR TENDERS

1. Customers full mail address?
2. Location of proposed plant?
3. Name of next railway station?
4. Distance of next railway station?
5. Is a resort, village or inn located at the level of the upper or of the lower terminal, and at what distance there from?
6. Horizontal distance between terminals?
7. Vertical ascent between terminals?
8. Send a topographical map if possible?
9. Does the proposed track run straight, or how many angle stations are required?
10. Does the proposed track cross railways, public roads, rivulets, power lines or forests?
11. Maximum number of passengers to be transported per hour
    a) in winter?
    b) in summer?
12. Is electrical power available at the upper or at the lower or at both terminals?
13. At what distance from the terminal?
14. How many kilowatts are available?
15. Tension and character of electrical power, cc, ac?

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